
AN ALTERNATIVE MODEL FOR UNDERGRADUATE THESIS INSTRUCTION: USING COLLABORATIVE FULL-SCALE DESIGN EXERCISES TO SUPPLEMENT INDIVIDUAL RESEARCH PROJECTS

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INTRODUCTION

This paper examines a pilot undergraduate thesis studio that synthetically combined three course typologies – studio, workshop, and seminar – into a rich and investigatory environment. Design explorations, material prototyping, and theoretical frameworks were pursued simultaneously towards the completion of a comprehensive thesis design project. Desired learning outcomes for the studio included: working and thinking in a contemporary manner (collectively, projective, atmospheric, diagrammatic), establishing an architectural agenda (an interest, topic, position, approach), ability to test design performance using full-scale models and to make necessary design adjustments (prototyping, installations, information feedback loops, digital fabrication), to design with consideration of an event (implicit or explicit activity, programmatic relationships, movement or flows), and the ability to produce affective environments (atmosphere, affects, materials of sensation, spatial experience). This paper focuses on the unique aspect of the course: the use of collaborative full-scale design exercises to supplement individual research projects.

While the requirements for an architectural thesis vary from school to school, a thesis typically denotes independent student work that includes a research topic, a proposal or position on the research topic, and the proposal's realization as a conceptual project. The thesis duration typically extends over an academic year and is divided into two parts: thesis preparation (prep) and thesis project. Although the work is independent, the student is typically linked with a faculty advisor with relevant topical expertise or interest. In this example, each thesis advisor oversees student theses in a "studio" course typology. Each advisor presents an initial prospectus that outlines their studio's umbrella theme(s) or ethos, and students select the advisor that best fits their topic or interest. Students are able to develop their independent thesis (both the prep and the project) within a familiar studio environment and surrounded by others investigating similar research topics. The overlapping subject matter amongst student theses provides an opportunity for pedagogic experimentation via collaborative exercises that supplement the students' individual thesis prep and project development.

In this pilot thesis studio, the collaborative exercises were strategically scheduled during the first half of the course to assist students in developing their thesis prep, and one exercise at the end of the

course to collectively exhibit the student thesis projects. The collaborative exercises were envisioned as skill and knowledge building workshops that could stimulate and cultivate topical aspects in the students' individual theses. Each exercise had specific desired learned outcomes, and varied in scope and duration. The workshops ran parallel to the theses development and were an opportunity for students to engage in a verbal discourse, in a collaborative design charrette, and in the physical act of making, all through an exercise that was centered on their thesis topic but not on their specific thesis. Following the workshops, students would pollinate their individual theses with the lessons learned. Although each workshop had unique outcomes, the exercises' collaborative aspect provided three fundamental categorical opportunities: knowledge/research, design, and production. Collaborative activities pooled together the students' multiple research threads to expand the topical range of possibilities, and promote different viewpoints and approaches; this exposure bolstered the students' knowledge/research on the subject matter. Collaborative activities required individual compromise, which led to collective hybrid outcomes; this practice enriched the students' design skills on the topic. Collaborative activities allowed for expanded scope and complexity of production due to increased manpower and multiple skill sets.

In all academic courses, the medium and working scale of conceptual design exercises needs to be carefully considered and linked to the subject matter of the investigation. For design investigations centered on materials, material effects, atmosphere, perception, and sensation, the conceptual rendering (drawing or image) has been the primary medium for establishing design intent. In these conceptual renderings, the atmosphere is often explicit but the materiality is not. Subsequent design development consists of creating a physical substance that will realize the atmospheric qualities of the conceptual rendering. In this topical line of study, full-scale (1:1) modeling exercises can serve as an alternative medium for design investigations, conjoining conceptual renderings and design development into a synthetic process. Full-scale exercises prompt students to be explicit about the material substance and aesthetic performance of their design proposals. Full-scale modeling establishes a 3D material and/or immaterial substance as the design intent. In these conceptual full-scale exercises the materials are not abstract or representative of another material, such as the common architectural use of basswood and cardboard in scalar models, but are the project's in-

tended materials: specifically selected to generate the design intent. With this critical step the development of tectonics and geometric forms becomes linked with a material and the material's specific attributes. Although the materials used in these exercises are often not common materials of building construction, the process of coupling materials and tectonics is transferable and can be later employed in future building construction projects. Full-scale modeling cultivates an alternative design process – one that integrates production techniques and strategies into the creative process towards the realization of the material tectonic and its resultant material effect – and empowers students with the skills necessary to formulate a particular spatial experience within their projects. As a pedagogical tool, full-scale exercises foster: a physical and conceptual material sensibility, an understanding of how material assemblies perform perceptually, an understanding of how material assemblies engage/respond to its environment, an understanding of material processes, and an ability to employ material effects.

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The alternative thesis instructional model presented here is the “Affective Environments” studio 2009-2010. Affective environments was the studio's umbrella topic or collective design agenda; with individual student theses pursuing the creation of charged and active spaces in which the occupants are not passive recipients of information but are actively contributing to the production of affects. In this pursuit the thesis studio shifted its interest away from the standard production of (architectural) objects and towards the production of (architectural) atmospheres and effects. Focused on the production of atmospheres and architectural effects, the studio adopted an alternative design process that utilized full-scale concept models or installations, with real or intended materials and environmental conditions. The alternative design process oscillated between material studies and digital representations; this process conjoined visualization and realization into a synthetic process and engaged the contemporary discourse on the role of representation (literal verses non-literal). The pedagogic aim was to encourage students to be explicit about their design intentions and learn how to realize or manufacture their projective representations. The production of immaterial atmosphere was realized as the primal byproduct of a material assembly; full-scale exercises enabled students to test, develop, and experience the material assembly's qualities and sensory affects.

Collaborative full-scale design exercises were introduced during thesis prep to supplement the students' individual research projects. These full-scale exercises cultivated an awareness and ability to construct a spatial experience that emphasizes materiality, perception, and atmosphere. The course included two types of collaborative full-scale exercises – studio installations and small group material effects prototypes – that complemented the students' individual full-scale material effects prototypes.

The first full-scale design exercise *Curating the Surface* was a series of collaborative studio installations (approx. 400 sq. ft.) that

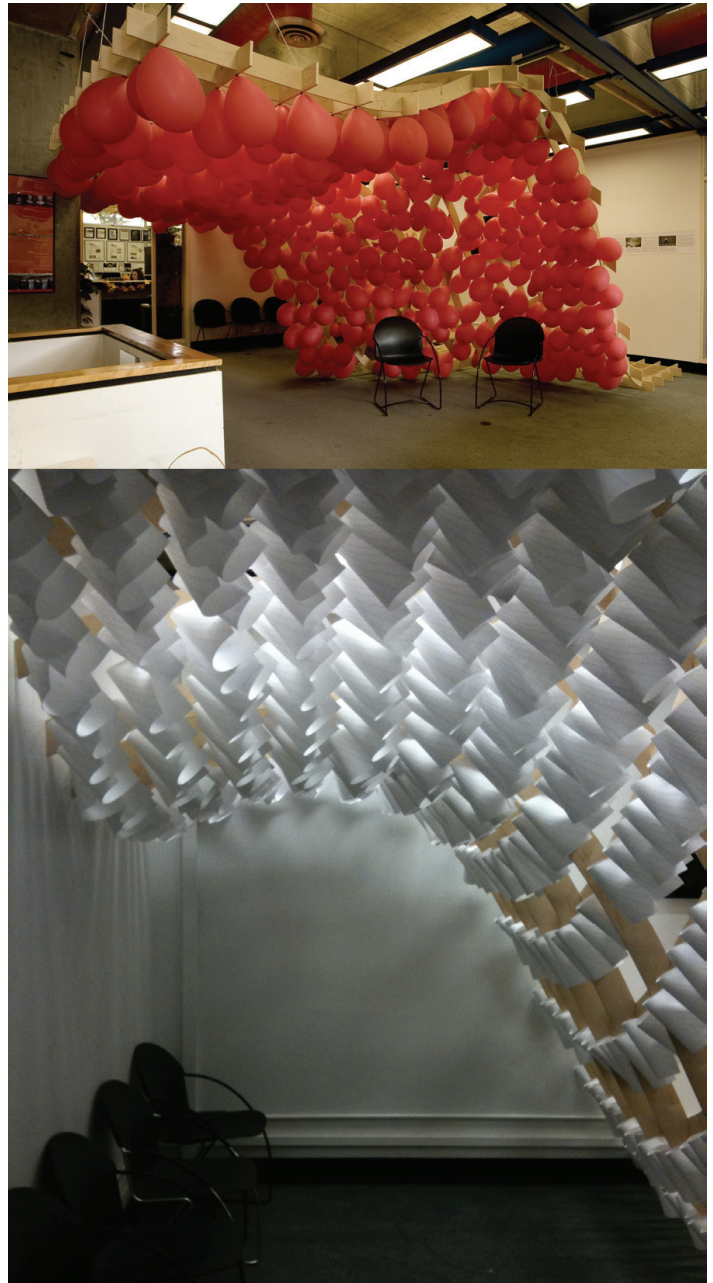


Figure 1. *Curating the Surface, Meat* (top) and *Paper Light Scoops* (bottom).

explored the use of surface treatments and material qualities to produce atmospheric environments.¹ The exercise utilized a lattice structure as an armature onto which new surfaces could be applied. For each installation or version in the series, students collaborated to develop unique material-tectonic units that were aggregated over the lattice to form a surface. The qualitative differences between versions demonstrated the influence of material effects in determining spatial atmosphere. The version titled *Meat* deployed a field of red colored balloons – as surface – to diffract the overhead fluorescent lights and produce a red glowing effect. The version titled *Paper Light Scoops* captured the white glow from overhead fluorescent

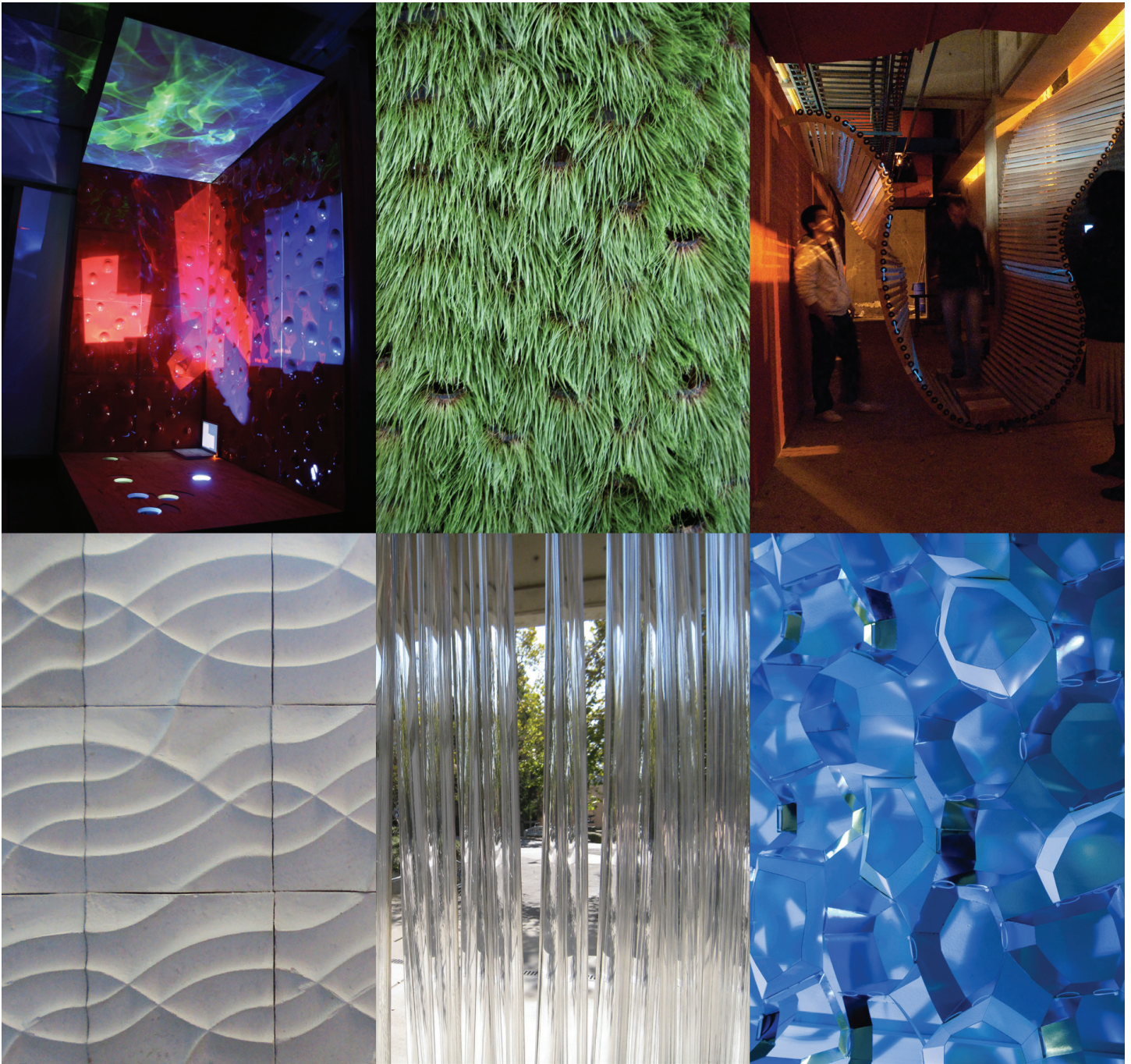


Figure 2. Material-Effects Prototypes (from top left) *Intangible*, *It Felt Natural*, *Cascade Flux*, *Plastered*, *Refractive Forest*, and *Polymorph*.

lights with translucent sheets of white paper. The exercise yielded many lessons including the size of the repeated unit, use of everyday objects or stock material, and the importance of the environmental context. In *Meat* we found that the size of the unit relative to the overall surface inhibited one from perceiving the surface first rather than the unit; a smaller unit would have been more successful in de-contextualizing the object so that the object's qualities are first perceived. In *Paper Light Scoops*, the size of the unit relative to the

overall surface was small enough for the unit as an object to visually dissolve into the surface. The cupped shape of the light scoop was able to de-contextualize the planar letter-size paper and the irregular pattern of the backlit lighting dematerialized the light scoop.

The second exercise *Material Effects Prototypes* was a series of small group installations (approx. 25 sq. ft. each) that were each positioned as a material effect prototype. The exercise began with

students presenting their in-progress material research for their individual thesis projects and then self-segregating into small groups with a common sub-topic to design and develop a material prototype. The prototypes were an opportunity for students to realize a quick but substantial representation of their thesis material research sub-topic. The exercise served as a model for their individual research methodology, and the prototypes served as accessible case studies.

The following six material-effects prototypes – *Intangible*, *It Felt Natural*, *Cascade Flux*, *Plastered*, *Refractive Forest*, *Polymorph* – demonstrate the diverse interest under the studio umbrella topic, and a variety of materials and processes used to produce architectural effects. Also highlighted are the lessons learned from each prototype following the case study analysis.

Intangible investigated the capacity for spectral light to take on physical, spatial qualities. The students' goal was to cultivate an ability to produce wispy light patterns as a secondary or resultant effect from simple digitally projected images. Through the use of reformed glossy plastic, simple projected images were bent and refracted into ethereal wisps. Although the light patterns appear complex, they were simply produced by subtle deformations in the plastic. Through this exercise, students learned how a material and its formation could become a generator for producing secondary effects.

It Felt Natural cultivated a living texture by growing rye grass on synthetic felt. The final product was a draping grass curtain bolstered by a simple wooden armature. Grass was able to root over the course of 3-4 days, penetrating the felt and creating a new texture on both sides of the surface: matted roots on one side, and fluffy grass on the other. Through this exercise, students learned how to capitalize on the inherent qualities of two materials, and develop a new synthetic material effect.

Cascade Flux explored the interactivity of a user, and their movement through space. This prototype produced a dynamic space characterized by a cascade effect of light ribbons. The lighting effects were set to an algorithm that was triggered by pedestrian movement through the space and yielded an intermittently glowing envelope. Through this exercise, students learned how to engage the audience in an affective exchange by linking motion sensors to light controls. Frosted plastic tubes filled with electroluminescent wires became the material unit that formed the project's undulating ruled surface geometry.

Plastered produced a dramatic textural effect through the employment of sharp surface undulations that enhanced the interplay of light, shade and shadow across a surface. Through this exercise, students learned how to optimize a design for mass production by developing reusable formwork and rotatable panels. The reusable formwork generated multiple pattern combinations, and provided localized difference within the composition.

Refractive Forest produced a screening effect by creating a field of light refracted perspectives that distorted the environment beyond. This prototype investigated the use of water as a lens for light refraction to produce light shadows and to obscure views. Although each unit was standardized and produced the same effect, their collective arrangement produced varied spatial densities throughout the installation, which generated unique distortion effects from every vantage point. Through this exercise, students learned how a unit's effect can be intensified through aggregation and localized difference.

Polymorph investigated the use of a tessellated pattern to produce a motion effect with a static object. A unit comprising six components was flipped increasingly to achieve a gradation of reflectivity. The component's faceted form and material reflectivity captured the artificial light irregularly to give the static wall an appearance of movement as one passed through the walking space. Through this exercise, students learned how the combination of multiple tile components could provide controllable textural variation for the overall composition.

The third exercise *Fog Bank* was a studio installation completed at the end of the students' thesis prep. *Fog Bank* was designed and fabricated on campus, then installed in a small gallery (approx. 400 sq. ft.) over 200 miles away in San Francisco. The collaborative full-scale exercise was an opportunity to produce a larger immersive environment where the material effects generated an atmospheric condition. *Fog Bank* investigated affective environments through multiple means: textural variation, light and shade, blurring, reflectivity, and varying opacity. *Fog Bank's* visual intent was a non-literal representation of the city's legendary weather condition that defines its atmospheric identity. The exercise's initial brainstorming utilized the previous workshop's material effect prototypes as a platform for the installation's concept design, specifically the material sensibility from working with plastic tubing. The surface of the installation was composed of cylindrical plastic tubes clustered together into tectonic units, which were uniquely positioned to form a figured shape. Together, the tubes created a highly animated effect, alternately shimmering with light or distorting it to create an atmosphere diffused throughout the space at once tangible yet ethereal.

The installation's visual intent was realized through the material's ability to reflect light, similar to water-based fog. The installation had two atmospheric conditions. Daylight conditions via the skylight, which produced a frosted glow affect. And evening conditions with artificial lights, which yielded a soft purple and magenta haze. The desired architectural effect was optimized through the tectonic unit, minimizing material waste and maximizing resources. Digital fabrication equipment was not used to cut or shape individual pieces but to construct custom jigs to assist in hand tooling: the method used to accurately and efficiently cut-to-size the installation's 26,000 plastic tube pieces. The exercise yielded many lessons but two stand out. First, students learned how to conjoin visualization and realization into a synthetic process: with the initial visualization exercise establishing the design objective for the project, and the material investigations focused on the project's goals. Second,

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students were able to employ material effects as a design mechanism towards the creation of a spatial atmosphere.

The fourth exercise *Poker Face* was a studio installation and the final exhibition of the students' individual thesis projects. *Poker Face* took a typical thesis exhibition and turned it into an affective environment, with emphasis placed on the spatial experience and the sensations engendered by the installation's material effects. *Poker Face* presented each student as a singular entity and as a component of a larger field (approx. 1800 sq. ft.). The field was composed of three hundred double-sided posters. Each poster with two distinct sides: one focused on the individual person plus the installation's effect and the other on student's thesis ideas or proposals. *Poker Face* physically presented this body of work in specific ways to encourage an active engagement between the audience, the student's ideas, and the material installation itself. First, the work was presented as a spatial matrix of ideas with each poster representing a complete or singular idea within the thesis project. The field of posters was delicately hung from above so that each poster appeared to be suspended in air. The undulating shape of the installation, produced through the varying vertical displacement of the posters, created distinct pockets of space. Second, to engage

the matrix of ideas the audience must immerse oneself within the poster field and experience the installation. The orientation of the double-sided posters obfuscated the reading of the ideas from a passive position outside the field, encouraging participation. The inwardly exposed poster face contains the thesis content whereas the outwardly exposed face was designed to produce an atmospheric effect, saturating the space with a vibrant color wash. The outward face's color gradient was punctuated by silhouette figures that linked the poster's thesis content to an individual. Third, the installation relied upon the audience's movement through the field to produce a kinetic effect. The dense spacing of posters restricted one's movement between posters making it difficult to navigate through the field without inadvertently bumping adjacent posters. This accidental bumping set the posters in motion, softly swaying and producing a blur effect. Through the collaborative full-scale exercise, students learned how to link the production of atmosphere to the spatial experience. The unit's material effects produced an illusive image of the installation, best described as an aurora effect. *Poker Face* embodied the studio's umbrella theme – affective environments – in creating a charged and active space in which



Figure 3. *Fog Bank* studio installation.



Figure 4. *Poker Face* studio installation.



Figure 5. Final Project Outcomes (from top), Matt Kendall, Keith Houchin, and Patrick Delorey.

the occupants were not passive recipients of information but are actively contributing to the production of affects.

SYNTHESIS

The collaborative full-scale exercises had an operative role in promoting the studio's umbrella topic and cultivating the students' awareness and ability to construct a spatial experience that emphasizes materiality, perception, and atmosphere. In order to illustrate the continuous thread of development from introductory collaborative full-scale exercises to final thesis project outcomes, I highlight the work of three students – Matt Kendall, Keith Houchin, Patrick Delorey – and their individual design research, material-effects prototypes, contribution to the studio installations, and final thesis project outcomes. In each case, the student's architectural interest began to take material form in a group research project – the material-effects prototypes – with Matt animating material surfaces with light and motion, Keith examining the spectacle via a screening effect, and

Patrick studying interactive materials/environments. All three were team leaders for our studio installations: Matt developed the undulating surface geometry for the exercise *Curating the Surface*; Patrick and Keith applied their material knowledge of plastic cylindrical tubing gained from their respective material-effects prototypes to lead the design of the studio installation *Fog Bank*.

For the final project outcomes, Matt utilized his project's surface geometry and materiality to capture the dynamic pedestrian movement of the Shibuya Scramble in *Catalytic Dynamism: Harnessing A Movement Based Atmosphere*; Keith's boardwalk theatre blurred the distinction between performer and audience by employing spatial organization and an articulated screen wall façade to embrace the public's fascination with the spectacle in *Embracing Spectacle*; Patrick established temporal atmospheric conditions within localized spaces, where spatial atmospheres respond to the diurnal changes (in both time and space) of: programmatic relationships, audiences, events, weather and other external forces in *Affective Interaction*. The link

between students' final project outcomes and the collaborative full-scale exercises demonstrate the ends or gains of using collaborative full-scale exercises to supplement individual research projects. The studio course typology was instrumental for this endeavor insofar as the overlapping subject matter amongst student theses provided an opportunity for pedagogic experimentation with collaborative exercises to supplement the students' individual thesis prep and project development. The studio's umbrella theme – affective environments – led to design investigations centered on materials, material effects, atmosphere, perception, and sensation; for these topical studies the use of full-scale (1:1) modeling exercises was essential. Full-scale exercises prompted students to be explicit about the material substance and aesthetic performance of their design proposals. By conjoining the full-scale exercises with the thesis projects, the design-research experiments operated in a supportive role and were tied to the goals of the students' specific projects. Beginning the material investigations with a clear definition of project goal(s) led to varied production techniques and strategies between student projects inasmuch as their selection of a tool, technique, or method was concept based towards achieving a desired affect. In this alternative model for undergraduate thesis instruction, the collaborative full-scale design exercises provided students with an applied understanding of how a material and its associated systems of assembly could be intertwined in the creative process to generate the performance and experience of architecture.

ENDNOTES

- 1 The title of this exercise was inspired by Sylvia Lavin's insightful analysis on the curation of effects via the surface to produce mood and atmosphere. See Sylvia Lavin, "The Temporary Contemporary" in *Perspecta*, Vol. 34 (2003), pp. 128-135.