Studio Exercises: Bridging the Ethical and Aesthetic

RAY KINOSHITA MANN
University of Massachusetts Amherst

NAOMI DARLING
Mount Holyoke College and UMass Amherst

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This paper will focus specifically on a pedagogy that emphasizes making as a critical method for integrating and translating learning about cultures, sites, and pressing sustainability issues into three-dimensional material form. We will describe our work in crafting two closely curated making exercises. We sought to integrate enough technical content without becoming overwhelming for the student, while considering how to transition from the knowledge embodied in lectures into learning embedded through making with one's hands.

Four premises underlie our teaching and these exercises: 1. Culture, broadly defined, is central to an ethical practice, and critical to achieving sustainability and equity goals. 2. Sustainable architecture has as much to do with controlling and using gradients of spatial enclosure and tempering as it does with sharply dividing tempered interior climates from the exterior. 3. Structural thinking fully integrated into design is an essential facet of sustainable architecture. 4. We seek to rehabilitate beauty. The role of an intelligent beauty that inspires the best in us is only becoming more important.

The overarching topic in the fall of 2022 was material flows as we examined waste streams on our own campus as a prelude to creating a student-centered recycling/re-use hub. The projects described in this paper are two preliminary short making exercises upcycling waste to make a vessel and to develop a site forces model in anticipation of the culminating building design. We believe that making and working with tangible materials must remain central to the training of architects as we strive to bridge the ethics of working within a changing climate with the aesthetic.

> The choice between ethical and aesthetic is not between good and evil, it is the choice whether or not to choose in terms of good and evil
>
> —MacIntyre in Hagan, *Taking Shape,* p. 40

INTRODUCTION

For the past eight years, we have been collaboratively teaching an undergraduate senior studio which was initially conceived through a Mellon Bridging Grant to bridge between the pre-professional 4-year (B.S.) program in architecture at a large public university and a liberal arts undergraduate major in architectural studies. Each year, as we prepare to launch our students into the profession or on to graduate school, the focus of our studio has been to provide students with the broader systems-thinking context in which we as design professional must operate –and the social and ethical responsibility that comes with being the designers and architects of the built environment. This paper will focus specifically on a pedagogy that emphasizes making as a critical method for integrating and translating learning about cultures, sites, and pressing sustainability issues into three-dimensional material form.

We will describe our work in crafting a series of closely curated making exercises. We sought to integrate enough technical content without becoming overwhelming for the student, while considering how to transition from the knowledge embodied in lectures into learning embedded through making with one's hands. We will begin by describing several premises that we have evolved over the eight-year period of curriculum development, and the reasoning behind them. This will be followed by a literature review that frames our thinking and provides the basis for logical argumentation. We will then describe in detail the exercises themselves along with the resulting work, and conclude with a discussion about the student learning efficacy and outcomes, as well as the further work needed to more precisely evaluate impact.

The challenges architecture students currently face are daunting. As the climate crisis continues to accelerate, there

is much more content and technical know-how that must be internalized alongside the fundamentals of space making and design communication--all within an academic schedule that remains unchanged or even further compressed in duration. At a time when students are still trying to gain visual/spatial literacy and a degree of sound decision-making over the basics of spatial and material control, they are being asked to integrate hosts of weighty concerns that are, within the relatively static spatial context of the academic setting, quite intangible. For instance, solar position may be straightforward to comprehend as a geometric phenomenon, but to truly understand the dynamics of solar radiation throughout the day, the year, in interaction with weather—and the myriad of potentials and limitations on how it may be used to reduce our carbon footprint while bringing beauty to a space through the use of inspiring daylight—is to ask a lot. Add to that at least a dozen other considerations, and it's no wonder our students are overwhelmed! Consequently, as a short-hand way to provide linkages between sustainability knowledge and its potential architectural manifestations, we have developed four premises that we articulate from the outset to our students:

Premise 1: We see culture, broadly defined, as being central to an ethical practice, and critical to achieving sustainability and equity goals. Sustainability is as much impacted by understanding and thoughtfully helping to shape of patterns of human behavior and values as it is by knowing how to design enclosures that minimize carbon footprint and/or energy and resource consumption. As discussed in a previous paper (Darling N., Mann R., 2018), this premise was inspired by Barbara Allen's Performative Regionalism (Allen, B. 2007) as a more culturally-rooted and behavior-based redirection to Kenneth Frampton's more form-based Critical Regionalism (Frampton, K. 1983), as an avenue for how culture can operate generatively in architectural production.

Premise 2: Sustainable architecture has as much to do with controlling and using gradients of spatial enclosure and tempering as it does with sharply dividing tempered interior climates from the exterior. Liotta and Belfiore's book Patterns and Layering promulgates Kengo Kuma's hypothesis that a more spatially-layered approach to both inhabitation and tectonics provides a methodology not only to understand the climate-responsive architecture of Japan, but a generalizable approach towards a more sustainable architecture worldwide (Liotta, S., Belfiore, M. 2012).

Premise 3: Structural thinking fully integrated into design is an essential facet of sustainable architecture. While structural knowledge may seem off-topic for a studio prioritizing sustainability, we have found that our students are not only hungry for (though initially intimidated by) greater structural integration, but that structural literacy is crucial for navigating sustainability challenges from skillful adaptive re-use to increasingly amplifying forces from weather. Structural thinking also allows us to use materials more creatively and cleverly in order to make more out of less, both in terms of support and meaning. Authors Mark Cruvellier, Bjorn Sandaker and Luben Dimcheff draw a direct connection between structure and culture in their 2017 book Model Perspectives: Structure, Architecture and Culture, (Cruvellier M., Dimcheff L., Sandaker B., 2016), while others encourage the investigation of structure in the studio as "play" (Ilkovič, J., Ilkovičová, Ľ. 2015, 287 and Whitehead, R 2019). Both instructors are practicing academics with more than the average structural engineering background (for architects). This lets us dip comfortably into structural instruction, particularly from a design perspective. Calculation is used very lightly, however, with a greater emphasis on developing students' structural intuition.

Premise 4: Finally, it is important to state that an underlying goal of our pedagogy is that we seek to rehabilitate beauty. It is easy to lose sight of beauty with all of the concurrent demands on our design processes--but if anything, we see the role of an intelligent beauty increasing in importance, a beauty that inspires the best in us while supporting—not overriding—our other values.

LITERATURE REVIEW:

While few design educators in 2023 would dispute that "Mainstreaming sustainability is essential in design education to adapt to contemporary global challenges and industrial changes" (Grover R., Emmitt S., Copping A. 2020, 1), fully integrating sustainability approaches into the studio education environment continues to be challenging. Fundamentally "the studio experience is rarely fully integrated due to disconnections between the various learning environments and teaching staff often differing between the studio and technical studies in terms of skills and pedagogical objectives." (Schiano-Phan R., Goncalves J., Vallejo J. 2022, 3). Others have noted "the restricted capacity of students to apply environmental knowledge throughout the entire design process, leading to its application for answering specific design questions only." (Natanian J., Aleksandrowicz, O., 2018, 365.) In other words, the students are typically unable to convincingly enact their sustainability learning throughout their design work.

While this "gap" in curriculum delivery is quite familiar to those who have witnessed such tensions within their own institutions, other more hidden factors are also at work: One study's findings "…show that although students exhibited motivation for sustainability, implicit architectural values (with the program or studio) undermined holistic approaches to sustainability." (Grover R., Emmitt S., Copping A. 2020, 1). It is easy to forget how strongly students are motivated to please their instructors and peers, and are therefore quick to pick up on what pleases or displeases them. We try to be mindful of our own lapses, when delight in form may start to take over functionality/

performativity, while at the same time recognizing that such moments can invite useful discussions.

Another finding is that "In many cases the complexity of the design project was seen as a barrier to examining sustainable design themes." (Grover R., Emmitt S., Copping A. 2020, 6). Particularly at the upper levels, there are likely few of us who have substantively backed away from ambitious building programs to compensate for the increasing burdens placed on our students. Our anxiety to secure their futures has tended towards the opposite. In this studio, we worked to moderate the overall program size and number of components, while providing a detailed narrative-style brief that situated program needs within an ideological, behavioral and thermal conditioning context.

Some of the challenges of sustainability integration come from still unresolved aspects of "traditional" studio teaching, where "… there is generally a lack of explicit definition of the requisite knowledge of design, and a neglect of attention to thinking in design as a legitimate pedagogical content. (Oxman, R. 2001, 270). Part of the problem is that both predominant "traditional" models—the disciple being guided by, or emulating the "master" –or the student largely setting their own interpretations and agendas relative to the studio prompt—are specific and implicit at the expense of the generic and explicit. "Designing is conceived as a complex, personal, creative and open-ended skill—an implicit activity. In teaching, however, it is essential to make explicit." (Van Dooren, E., Boshuizan, E., et al., 2013, 54) Instructors are often unable to articulate what is implicit within their own processes, but it would be of greater help to their students if they did so. Absent such an ethos of disciplinary discipline, "The emphasis on independent and "discovery" learning in the studio may make the acquisition of particular values and skills (such as sustainability learning) unreliable (Grover R., Emmitt S., Copping A. 2020, 2). Understanding that students inevitably feel the impulse to focus on developing their own generative abilities, particularly for building designs, we identified the potential of other collaborative and individual studio exercises in research and making as avenues for a more open, less vested frame of mind.

Architectural pedagogy also continues to be unresolved in terms of digital vs. analog learning. While the digital has created opportunities in form-generation, computation, information processing and reality emulation beyond our wildest dreams, it still cannot touch, feel and learn as our hands do. Post-pandemic, the year's lack of hand work in a studio environment clearly inhibited students' development as designers. Pioneering architectural educator Donald Schon's words continue to resonate: "Doing extends thinking in the tests, moves, probes of experimental action, and reflection feeds on doing and its results" (Schon, D., 1983, 280) Others also argue that "The sketches and models function as an external and extended memory, needed in a complex and interwoven process with all kinds of (provisional) decisions and implications…they are embodied cognition" (Van Dooren, E., Boshuizan, E., et al., 2013, 68). These notions raise a potential avenue—is there a way to use making to enhance cognition in relationship to sustainability knowledge?

While papers reviewed largely conclude that, "The gap in the integrated studio can be effectively overcome if a strong link can be created between the didactic inputs of the taught modules and the demands of the brief proposed in the design studio environment," and that, "lecturers involved in teaching of the principles and the analytic/quantitative tools must also be present in the design studio, or at least the skills shared by the studio instructors (Schiano-Phan R., Goncalves J., Vallejo J. 2022, 23). Others more pessimistically caution that, "…it remains unclear how suitable the existing pedagogy of the design studio is to enable a critical understanding of sustainable design, or whether it may be operationalized to do so." (Grover R., Emmitt S., Copping A. 2020, 3). In our view, what we do in the studio can't and shouldn't replace lecture learning, but the methods we have developed seem to enhance integration and greater fluidity in design.

DESIGN EXERCISE 1 –UPCYCLED VESSEL

In our most recent iteration of the studio in the fall of 2022, the overarching topic was material flows as we examined waste streams on our own campus as a prelude to creating a student-centered recycling/re-use hub. As before, we challenged students to design not just a building but systems of use – and to understand that those systems must be integral to the cultures in which they are produced and consumed. After an initial self-reflective research phase of collecting and categorizing one's own waste for a week, students were asked to: "construct a vessel with an 'interior' and an 'exterior.' The interior need not be completely contained but there should be, though the construction, a demarcation of space. The vessel must be at least 12" and no more than 36" in one dimension."

Further, we wanted students to consider the lifecycle trajectory of the materials they were working with including extraction and material origins. A student now can find out a great deal about the carbon footprint and chain of custody of a piece of wood or plastic, but they may not know that it can split in particular ways or be weak some directions and strong in others. We find there is nothing more instructive than trying to make something out of materials themselves. Students were required to choose 2 or 3 types of trash to work with, with at least two of different material origins – meaning, for example, they could not pick two paper-based products or two plastic based products. Finally, we recommended that students consider the structural and behavioral properties of the materials and to pick some items that would lend themselves to transformation so that the original identity of the trash would not limit their creativity.

Figure 1. Upcycled Vessels. Top Left: Aigerim Khamar, Bottom Left: Charlotte Hambucken, Right: Klil Loeb

Working with their found materials – their "trash" – students were able to combine both materiality and prior manipulation. The projects that the students developed in which the materials were particularized into smaller components - processed back to a more fundamental materiality - that were then reused to assemble a larger vessel demonstrated striking transformations. In Figure 1, we can see colored pencils that were broken but revealed the colored lead and stitched together with dental floss, a cereal box cut into cardboard strips and woven with strands of plastic bags, and an assembly of copper wire, plastic and paper napkins all knotted together. Other projects seen in Figure 2 chose to integrate aspects of its prior manipulation – for example, a project with aluminum cans cut into strips woven together but that reused the molded top and bottom of the can, or an assembly that maintained the perimeter of the takeout containers from the dining commons. All of these projects were able to effect a transformation in order to bring out the possible and exciting in what initially seemed unpromising. Beauty, while hard to define, could be recognized in these projects that reworked a waste material to yield something that excites our senses or changes our perspective.

After manipulating their materials to make a vessel, students were asked to overlay a force diagram onto a photo of their project. While students may have strong intuition about what can hold things together or make them stand up, they had not previously been introduced to structural concepts or the language of analysis. By being forced to consider what is acting in tension or compression, where the load paths transferred the forces to the table, students couldn't fall back on known diagrams for post and beam structures or trusses, but really had to analyze the form that they had created. In this sense, working with materials with inherent structural characteristics in a world with gravity can teach lessons that are increasingly elusive in our digital age.

DESIGN EXERCISE 2 – SITE FORCES

Over the last number of years, we have transformed our site analysis assignment into a site-forces making project that has forced our students to confront the materiality of making with conveying information three-dimensionally. Why conflate site analysis, essentially an information-gathering exercise, with making? Time is a real issue—with ever-increasing requirements, the leisure of separated subject matter is harder to come by. In addition, while students may be adept at making things, they may not have had to convey specific information

Figure 2. Upcycled Vessels. Left: Addi Kessler, Right: Tyler Cashton

through making. Translation of knowledge into design is one of the hardest things that we do. As architects, we are constantly faced with translating knowledge about our clients, our sites, materials, structure, the codes, etc. etc. etc. into a cohesive project design. This exercise gives students an opportunity to develop an expression of meaning through form. Here, rather than trying to find some personal meaning as a driver, the task of expressing site parameters - pleasant vs. objectionable sound, the intensity of light, access for service vs. the visitor, become real information that is helpful to communicate on a site plan. Site forces are also often present in gradients (sound, traffic flow) and change in intensity and direction with time and the seasons (daylight, wind and natural breezes). One has to address this differentiation and, in our experience, for most students, it is not enough to read a chart! Making takes time, and taking the time to connect back to the essential value of "craft" while physically spatializing their chosen site forces gives students time to slow down and really spend time thinking about their chosen site forces as they begin to design their projects. Students come away with a greater awareness of climatic and other forces, both seen and unseen. By forcing their visibility and tangibility, invisible forces become more "real" and harder to ignore. Designing FOR a site, finely attuned to the sun and wind, noise, vegetation and water flows, is also a fundamental starting point for any sustainable architecture.

In the Fall of 2022, in keeping with the theme of material flows, we asked students to each pick four "forces" that act on their site (students were able to choose between 1 of 4 sites selected by the class on different parts of campus) and to choose a single waste/upcycled material to construct each analyzed expression of the particular force. Students were challenged to spatially interweave the forces so that they are interacting with each other in a spatially rich way to reflect the complexities within our built environments. We wanted students to think about how the forces influence each other – for example a busy street with lots of traffic might also be very loud and therefore attract fewer (or more) pedestrians, or a sunny spot sheltered from the wind might naturally become a place for pedestrians to slow down and hang out. We prompted students to create "a 3-dimensionalized construction of an analytic "plan view" of the site and general area around it, at a standard scale between 1/16" = 1'-0" and 1/8" = 1'-0". … With the skills and techniques that you have furthered from the earlier making exercise, your goal is to build something not just informative, but also explorative of elegance and expressiveness of materiality, layering, repetition, rhythm, gradients, knotting, clumping, structurality, interaction with light and shadow, and craft."

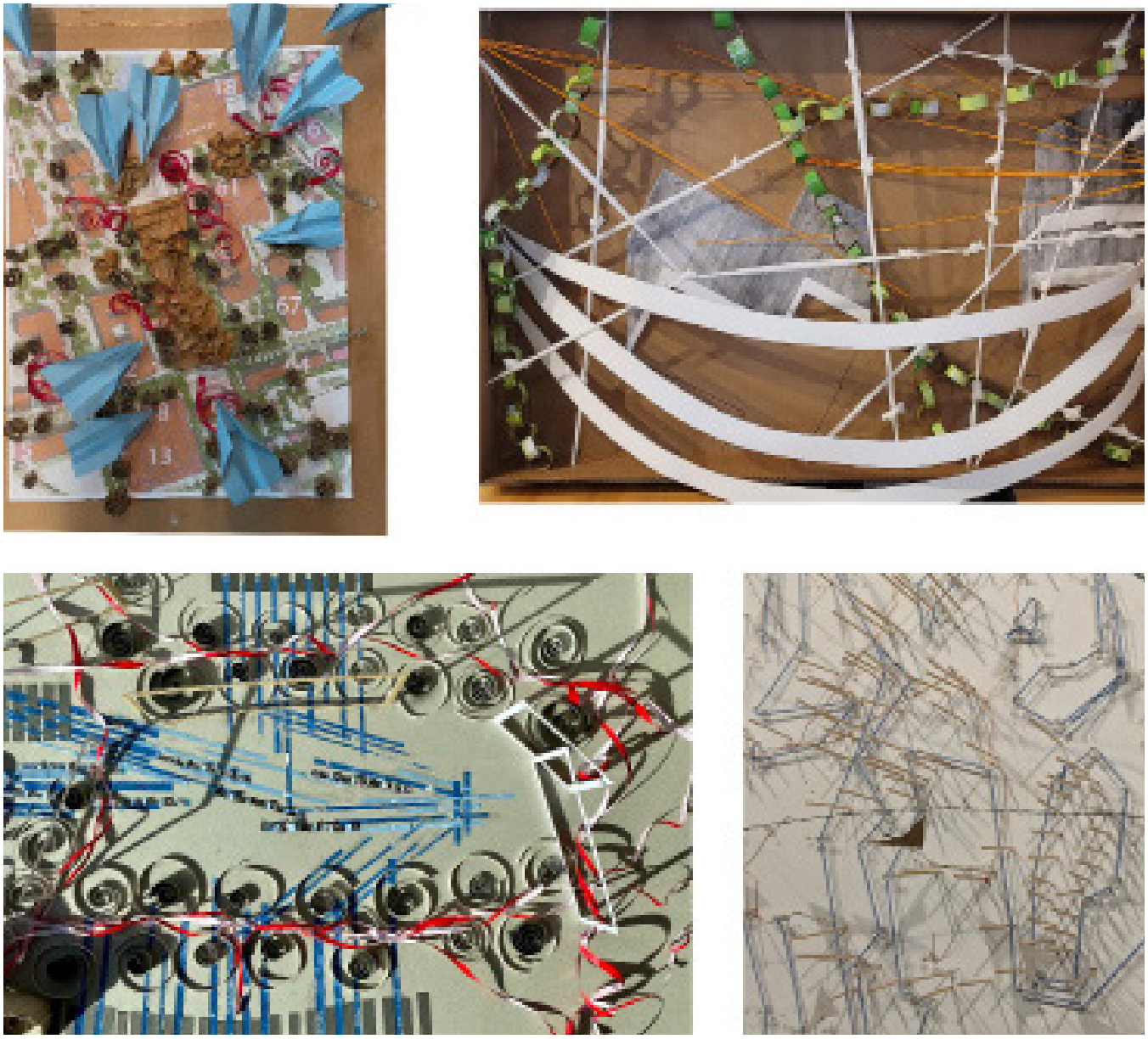

Figure 3. Site Forces. Top Left: Brianna Pappas, Top Right: Rebecca Shay, Bottom Left: Lucy Hawkins, Bottom Right: Hannah Zhao

The project was assigned on a Wednesday, and initially, we gave the students one week to complete the assignment. Five days in, on the Monday before the due date, it became clear that the students would not be able to do their best work within the time allotted and so we made the decision to extend the deadline by five days from a Wednesday to the following Monday (we only meet 2x per week on M/W) – giving the students a total of 12 days -understanding the making with the level of craft that we were looking for does take time. At the final review, we were very pleased with the level of analysis translated into spatial making and interaction between site forces that the projects demonstrated.

The projects that we felt best fulfilled the assignment criteria were those that successfully wove together the different site forces along the z axis. The submissions had different levels of abstraction. At one end of the spectrum, in figure 3, top left, a student overlaid the site forces on an actual plan of the site and represented the wind, direction and strength, as blue paper airplanes. In this example, the red ribbon represented sounds, the bronze and silver wire represented pedestrian and vehicular traffic, and the crumbled carboard represented vegetation. In another more abstract example (figure 4), the student repurposed the broken colored pencils for pedestrian and vehicular flow, used zip ties to represent a sun-path diagram, broken sticks and yogurt containers to represent topography and laser-cut cardboard patterns to represent vegetation. As can be seen in the side view, this project considered the forces quite dynamically in the z dimension which interestingly translated to broad scale dynamic site circulation in the final project. A few other examples in figure 3 show the extent of overshadowing (top right), framed views (bottom left), and water systems including the invisible sewage system and water distribution system both underground (bottom right).

All of these projects make visible the invisible, and forced students to spatialize materially how these site forces overlay and work together in the third dimension.

Figure 4. Site Forces. Aigerim Khamar

REFLECTION:

As one might imagine, students find our lessons both exciting and challenging when presented with so many overlaid objectives but also entirely unlike anything they have previously done. From a pedagogical perspective, the ways in which learning is embodied through making, alongside more conventional techniques such as lectures on daylight and structures, is in our view more deeply embedded via the challenge and time spent in developing a physical manifestation of a piece of information. Students also felt freer and enjoyed the process of intensively making something that is closely related to, but not in itself, the program-based architectural product. Many students commented that the exploratory nature of the making was something they hadn't done since first year and so appreciated the time dedicated to these smaller exploratory hands-on making exercises.

How does the making inform the jump into building design? There were several factors that seemed to aid students in carrying their embodied learning into their building design process: how the student continued to use their vessel or site forces study moving forward and the modeling methods and materials that the student used in developing study models - the more analogous to the making assignments, the more likelihood that the awareness was translated into the final product. For example, for the site forces project shown above, the student directly overlaid a program on her site forces model and used that as

Figure 5. Final Renders - UMass Student Recycle/Transfer Hub: Top: Aigerim Khamar, Bottom: Hannah Zhao

she developed her building. As can be seen in the final render, the dynamic site circulation retains the energy of her site forces model. In a second example, the modeling technique of using wire translated into a dynamic skin enclosure. These two projects, as well as many others, through their physical modeling techniques extending from the earlier exercises, were able to envision the construction as layered, with a frame and skin, filtering between inside and outside. Moving forward, we could integrate these successful methods into the assignment brief so that all students carry the successes from the analytical making exercises forward into their building designs and are less likely to fall back on more conventional methods.

CONCLUSION:

In conclusion, we believe that making and working with tangible materials must remain central to the training of architects as we strive to bridge the ethics of working within a changing climate with the aesthetic. We felt that the upcycled vessel and site forces projects using waste materials were successful and students were pleased with their outcomes, but a more detailed study of process and results as well as targeted feedback from students could prove enlightening. Finally, we work with the students in the final year of their undergraduate study and felt the need for greater coordination with our colleagues at UMass to create a consistent ethos and vocabulary across different levels of the program as well as to layer in specific learning related to sustainability strategies and structures so that they have more of a foundation coming into their senior year studio.

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