Design ecologies, locating and amplifying individual motivations in a collaborative research environment

Nicole Koltick, Drexel University

Abstract

Design practice exists as a complex and varied ecology of practitioners, methodologies and outcomes, one that harbors varying internal biases, tangents and conceptual stances. As designers interface with outside practitioners in science, engineering and theory, they are confronted with both problems and opportunities from these external domains that can appear quite foreign in both approach and outcome. Design process and its resultant biases are distinct and yet malleable and these unique aspects should be emphasized when confronting and collaborating with outside disciplines. In acknowledging our own disciplinary and project specific values, we must remain mindful of the risk of ceding authority to more pragmatic or quantifiable concerns from collaborators outside of the design discipline. Negotiating these collaborations requires a careful attention to communication, methodologies and how project goals are defined and articulated. In analyzing the procedures, methodology and resulting projects from an interdisciplinary design led research group, this paper will offer insight into the nature of interdisciplinary conversations and translations within the context of design education and offer examples of design-led collaborative research. This paper will argue that identifying, amplifying and communicating the conceptual, aesthetic, intellectual and emotional goals of a project is a crucial component to fruitful design-led research collaboration.

Keywords

transdisciplinary education; collaborative design research; computation in design; speculative design

Introduction

Design ecologies are defined in this paper as a rich and multivalent space which is comprised of a multitude of design related disciplines, practitioners, methodologies, approaches and outcomes. This paper uses the recently formed Design Futures Lab as a case study for examining how individual motivations and disciplinary biases can be leveraged and amplified in the context of a collaborative research setting. The lab is a newly formed Master's Research Group housed in a graduate Interior Architecture + Design Program. Last year there were 6 third year graduate students pursuing yearlong thesis projects within the collaborative framework of the lab. The final projects produced were a series of future prototypes for domestic life which will be discussed in more detail below. Each student pursued a term of directed research on an individual topic before entering a 6 month design development phase. Their topics aligned with the general interests of the lab and included synthetic biology, the impact of technology on communicating emotional subtlety, detrimental effects of technology, mechanics of memory, the role of sensors in our environment and methods of ambient communication. The topics held particular resonance for each student and this core interest was maintained throughout the project. Students were expected to synthetize their core research topic and findings with the interests of the lab in exploring speculative prototypes for inhabitation. The lab specifically seeks to examine and advocate for novelty in design processes, narratives and aesthetics. A particular focus is given to the potential of a design investigation to have evocative and unexpected emotional resonance. Students were continually challenged to locate their specific attachment to the project and to define their underlying biases, feelings and beliefs about the larger social, conceptual and philosophical

implications. With these motivations being clearly defined and examined, students develop confidence in their core investment of the project. Only after we have identified and clarified this "seed" motivation are students able to proceed to collaboration and further design ideation.

After locating and defining the core research interest and underlying motivations a series of outside collaborators were identified and cultivated from disciplines including computer science, biology, biomedical engineering and electrical engineering. Through a series of structured discussions and later through targeted collaboration, the lab is able to model and facilitate collaborative working relationships for students. One important focus in structuring the yearlong process is enabling students to pursue and develop a fairly vague initial topic and interest into a cohesive and realized final object, experience or environment. In a very intensive project research, design and development process students are continually exposed to procedures, methodologies and dialogues outside of their field. The lab model seeks to explicitly encourage and expand these conversations and collaborations in the pursuit of novel design narratives and artefacts. There are multiple checkpoints along the way in the form of structured presentations, design critiques and required written documents which challenge students to revise, refine and advocate for their core motivations in the project.

Within this space the individual design researcher inhabits a territory through which they develop and refine a series of trajectories related to design motivations, interests, theoretical and intellectual goals and potential collaboration opportunities. The "ill-defined niche" can be considered a space of opportunity in design ecologies (Murray, 2012). This paper will argue for the merits of assessing, defining and delineating the particular motivational characteristics of a given designer's niche space. This activity seems in contrast to prevailing wisdom about collaborative dynamics in terms of finding common ground. Researchers from a variety of disciplines have examined the collaborative dynamics of interdisciplinary teams (Thomson Klein, 2004, Stokols, et al., 2008, Gray, 2008). Some of the problems arise from individual approaches to divisions of labor and an unrelenting focus on "usable" results. (Pohl, 2005) What this paper argues for is a careful attention to the dynamics of collaboration and vigilance in asserting and advocating for the specific designer led positions and motivations in a given project. This privileging of concerns including things such as the realm of the aesthetic can be met with challenges to its perceived value or utility in a given project (Hekkert, 2006). This paper is not advocating for a hierarchy of one set of design related values over any other, but rather it is encouraging designers engaged in trans-disciplinary collaborative research investigations and educational environments to examine these existing values and ensure that these concerns are advocated for to ensure that designer input is not relegated to extraneous or superfluous realms in both the process or output.

In a pedagogical setting, this process of determining, clarifying and advocating for one's specific niche in a given project can be integrated and modelled in a collaborative design-led research experience. The lab explores applied design research through a variety of procedural approaches: exploration of novel form through digital fabrication, enhanced interaction scenarios employing new responsive technologies, pursuit of material innovations and user-centered narratives to envision speculative futures. Students were exposed to a diversity of vantage points from the outset of their initial research. The ability to synthesize this information and to develop novel design narratives out of these disparate threads was a core focus of the initial research work. The operations of modelling and synthesis have been identified with design culture as distinct from the disciplinary approaches of art or science (Cross, 2006). The lab sought to further encourage synthesis of divergent information and approaches through a series of structured conversations. This involved discussing students' research in progress with invited groups of scientists and engineers. While this type of interdisciplinary collaboration is becoming increasingly common, some researchers point out, there is a tendency for designers to adopt the methodology of their scientific collaborators and less the other way around (Koskinen, et.al, 2011). In structuring the lab and the interactions with outside collaborators it was a primary goal that student researchers would lead the design narrative and investigations. Repeated exposure to trans-disciplinary collaborators forced students to develop comfort and eventual confidence in asserting their design-led narratives and arguing for their specific design speculations.

In structuring conversations and working relationships with potential collaborators, cultivating a diverse group of individuals who shared some key commonalities as well as interesting specialized differences was an important metric. The commonalities included an interest in complexity and systems, sensitivity to core concepts of ecology and biology, interest or research into various facets of computation and a desire to discuss and explore these concepts on conceptual terms. Another selection criteria for involvement pertained to an awareness and interest in emerging developments across science and technology. Collaborators were also selected on the basis of a shared appreciation or sensitivity to design practices. In terms of immediate or visible benefit to our collaborators as a result of the experience this is not easily quantifiable. In conversation many relayed their enjoyment of the process and the novelty they found in terms of our working methodologies. I would speculate here that the effects produced for outside disciplines in collaborating with the lab manifest as more latent effects. These effects may be a result of seeing their research and methodologies deployed in new ways, leading them to visualize or reconceptualise their work from a different standpoint. The willingness of the collaborators to participate extensively with little material gain or publishable results, leads me to believe that the experience is mutually beneficial albeit in very different ways.

Methodology

In facilitating design-led collaborations it is crucial to pay careful attention to how a trans-disciplinary process of research should be structured from the initial idea gathering and synthesis phase through to completion of full scale prototyped artifacts. There is the potential to inhibit or support the awareness of individual niche positions within the broader design ecology. The yearlong lab experience was divided into a two distinct phases: initial research and design development and production. The initial design ideation and creative synthesis phase was an area of important focus, as it was vital that projects originated from trans-disciplinary research conversations. These conversations have the ability to become adversarial on the basis of perceived threats to competence, territory or approach. Strategies to overcome this may include overt attention to these dynamics. There exists an opportunity to discover the fractured and heterogeneous nature of one's own field and for all participants to approach the collaboration with the intent of enriching rather than defending their own position (Kumar Giri, 2002). In the case of the lab a concerted effort was made to communicate clearly the motivations of the lab as well as discussing with potential collaborators the pedagogical aims of the structured interactions. In this way involvement from collaborators was understood to be in service of pedagogical and collaborative goals. This clarification at the outset is necessary in this structured educational experience.

Research Processes

Students began initial research in the summer prior to joining the lab. Students each had a general topic and interest which they explored through self-directed research with some minimal feedback. Leading up to the fall term student were provided with a comprehensive collaborative reading list and a set of directives. This list was read by all student members of the lab and the directives involved the development of a point of view towards their broad subject matter they had been reviewing. Students were asked to synthesize their previous research with the texts from the group reading list and begin to locate a critical conceptual position to their work. The use of narrative was encouraged as a means to help generate and locate this position. Students were encouraged to identify and develop threads of information that held resonance for them and begin to assemble and reassemble these threads in a search for a position towards their topic. In the fall term, students pursued an intensive research synthesis process and engaged in weekly trans-disciplinary group discussions with invited collaborators. Students would present short 10 minute PowerPoint presentations describing the state of their position and then a free form conversation would follow among students and collaborators. Students would include case studies, precedent and selected information from their research. The underlying similarities in process and design ideation across disciplines made this initial conversational phase of the collaboration quite productive with surprisingly few difficulties in facilitating open-ended narrative development from the outset.

In surveying research on the creative process in design one finds a variety of attempts to quantify the process through diagrams, theories and various experimental setups. Precedent research on the topic reveals a prevalence of analogies and attempts to quantify this process in biological and other analogous terms. One particularly novel approach, proposed by Maher and Poon (1996), posited that Genetic Algorithms could provide insight into the way design solutions co-evolved in response to design problems. By identifying both the design problem space and the design solution space as co-evolving actors in a design exploration the design process itself can be abstracted, simplified and simulated. The use of biological analogies is not a new approach in describing design process. This process has been increasingly understood over the years to be highly nuanced and very sensitive to context (Edelson, 2002). The description of process has been successively refined but a sizable gap still remains. This gap may fall under the description of intuition, fuzziness or any number of romanticized evocative terms but this aspect of process in relation to creative insight is found in other disciplines as well. It is useful to consider other disciplinary approaches to ideation and decision making when contemplating collaborative design.

Scientific creativity and the process of decision making in science share a number of similarities with the processes used by designers during both ideation and production. Scientific disciplines make extensive use of the hypothesis. This can be understood as a story, a way to make sense of certain facts or intuitions. The hypothesis is also quite loose, relying on data to refine the story or redirect the plot (Grobstein, 2005). This comparison to storytelling emphasizes the provisional and non-deterministic features of this process in scientific experimental procedures. This "quasi-random combinatorial" is similar in description to findings on design process by design researchers (Simonton, 2003). Each individual working in a given field shares a subset of ideas and also obtains novel or unique ideas or information owing to their specific interactions, background, training and interests. Exposure to additional sources or ideas under the requisite conditions can produce novel findings, but the required pieces must be in place either through information, technique or context (Simonton, 2003). This finding is similarly enforced by controlled design research experiments (Dorst & Cross, 2001). This attempt to quantify the factors contributing to creativity as well as the decision making involved in design challenges produced results that seem consistent with our intuitive understanding of "creativity." The lab sought to leverage the distribution of novel information and random combinatorial adjacencies through encouraging a diverse exchange of ideas and exposure to a wide range of information. This diversity came from the initial research sources that students pursued and was later amplified through interactions with collaborators from outside disciplines.

Design Narratives

Broadly, procedures of information gathering in the early stages of the creative process can involve review of precedent in design, scientific research and experiential and experimental data collection. Working with these diverse threads of information, however, requires some method for moving from the broad and somewhat messy overview of data which is needed to set the stage for a stochastic process of creative discovery towards a more refined model or hypothesis. In the Lab, the students were encouraged to develop design hypotheses in narrative form, translating and combining multiple threads of information into a cohesive narrative of possible experience in the near future. This closely modeled the procedure of hypothesis generating used in scientific research, and our scientific collaborators seemed to quickly grasp the underlying similarity of these creative methods across fields. Writing was used as a means to encourage and refine students' attenuated sensitivity to their own evolving positions. All students reviewed similar readings providing a broad overview of key concepts and precedent in ecology, algorithmic design, tangible interaction, digital fabrication, critical and speculative design practices, as well as contemporary philosophy and theory relating to objects. In addition to collective readings, students also pursued individual research into more specialized areas relating to their topics. Students were required to research and synthesize information from three distinct domains: Design Case Studies, Scientific Research and Philosophy and Theory. This research was presented in weekly lab meetings at which students would discuss their findings with the group as well as outside collaborators including evolutionary biologists, biomedical engineers and computer scientists.

The idea of an evolutionary search was used as a procedural analogy for this broad multi-disciplinary research process. Students were encouraged to cast a wide and divergent net in their

information gathering and research processes in an attempt to increase their chances of stumbling upon novel or productive adjacencies in their information. Similarly, their exposure to outside practitioners in other disciplines was conceived as an important part of their research experience. In reformulating their presentations and hypotheses through subsequent iterations after receiving feedback from scientists, engineers and other collaborators, students uncovered a number of new directions and opportunities. Working with diverse data sets and information from a variety of sources, the students approached their design hypotheses and explorations with a robust toolkit of ideas and techniques from which to formulate their problems and responses. This process required a thorough and committed encouragement of individual reflection refinement and re-assertion of a position each week. Students could easily find themselves directed on any number of tangents arising from these structured conversations. It was therefore necessary to insist upon a thoughtful deliberation and a re-development of the narrative each week. This act of deliberation and exploration through writing differs from writing that merely narrates or recites known information. Here writing was used as a method for the generation of additional insight. This was a process meant to privilege and encourage “knowledge transforming” over simple “knowledge telling” (Galbraith & Hallam 2006).

Conceptual Coherence

The progression from information gathering to problem formation and ultimately to a design response is a crucial bottleneck. Students initially struggled with the procedural synthesis required to combine such disparate threads and categories of information. Most students tended to jump very quickly to neat conclusions that arose from preconceived notions. There exists a recurring issue of indeterminism in the design problem space dealing with “ill-structured” problems (Goldschmidt, 1997). Goldschmidt argues that “coherence and completion are, therefore, utmost goals and to achieve coherence and completion, all components and elements of a design must reach 'good fit', therefore, one may describe the process of designing as one in which the designer tries to generate only such figures and concepts that can be linked to one another (1997). The pursuit of a perceived good fit may in fact lead students to overly prescribed and pre-determined solutions. A greater danger lies in the student acquiescing either consciously or less so to the perceived goals and disciplinary aims of collaborators external to design disciplines. The pursuit of coherence rather than completion may privilege a much more nuanced set of relationships and a more operational term than completion. (Thomson Klein, 2004). Achieving a degree of completion is understandably challenging when confronting a truly thorough, diverse and fertile accumulation of research from multiple disciplines, sources and types. Coherence would allow for a transition and translation between disparate agendas, attitudes and outcomes. Yet defining conceptual coherence is problematic and it is highly dependent on the specific perspectives of contributing participants (Murphy & Medin, 1985)

The collaborators helped to challenge students’ preconceived notions, and in early conversations they showed a good deal of latitude and creativity in thinking as they were exposed to novel findings from the students. This process exposed the collaborators to new procedures and insights, and the collaborators in turn provided students with additional directions for research or suggestions of precedent to review. The development of a speculative design narrative required students to incorporate and respond to these conversations, as well as to delve into the emotional subtext of their research, engaging the subtle nuance that lurks beneath the surface of human interaction. This required an act of translation on their part, synthesizing subtext, aspirations and experiential influences in order to speculate on potential tangents to human experience. In developing a speculative narrative an a priori design assumption is unproductive. General attitudes and a variety of resonant information are helpful but these threads need to be combined in a freeform, exploratory and undirected search. Galbraith & Hallam elaborate that, “in order, therefore, to capture their implicit disposition towards the topic, the writer has to formulate ideas dispositionally, free from external constraints. The crucial claim for present purposes is that, when novel content is formulated by this process, it will, because it is generated as a dispositional response to preceding ideas, be conceptually coherent with those ideas” (2006). This requires that students sustain a delicate balance between recognizing threads which are interesting and meaningful and then be able to approach these threads from a non-judgmental position. Later these threads are deployed both in conversational form and then later through progressive exploratory writing sessions which slowly move towards coherence of a variety of parts. This work

happened progressively and was facilitated through conversation, focused writing and multiple refinements over the term. By the end of the term, students had developed a proposal that outlined the major findings of their research and began to outline their speculative design narrative. This work prepared them to begin exploring the design development of their ideas and transition into a collaborative production phase.

Collaborative production

In transitioning to the design development phase, it becomes even more crucial to assert a strong conceptual stance towards the work. At this phase other disciplines were relied upon to weigh in on the feasibility and plausibility of a given design narrative. In this phase of negotiating the collaboration there was a clear experiential hierarchy between expert and student. Yet the goal of the lab is to exploit and explore methodologies across disciplines. Therefore our interest was not in soliciting conventional wisdom or disciplinary norms but rather in encouraging all parties involved to focus on underlying conceptual, experiential and aesthetic intentions. By retaining a focus on the particular design niche that each student had begun to assert, these intentions could be re-stated and emphasized in conversations relating to practicalities and design development discussions. Particularly in assessing notions of feasibility and plausibility, students could easily fall prey to assumptions and biases from collaborators outside of the discipline. For this reason it was important that students developed an extensive familiarity with the current state of the fields they were engaging. Students engaged with a variety of current and seminal scientific papers that provided them with a more refined sense of what might be plausible, both scientifically and technologically. A thorough literature review of relevant external disciplines supplemented by recommendations from collaborators provided designers with their own intrinsic ability to assess plausibility without relying on preconceived disciplinary biases. Ideas of plausibility varied quite a bit between collaborators and across disciplines. Students' design-driven assessments of the plausibility of a given concept often diverged from the opinions of some of the scientists and engineers with whom they were interacting.

In discussions related to design development issues of practicality, economics, desirability and feasibility were weighted quite differently across disciplines. However, one area of trans-disciplinary overlap that suggested a common language was in the realm of computation and programming. All of the projects in the lab engaged issues of tangible interaction and therefore all needed to interface with collaborators on issues of coding and hardware. The rise in computational literacy paired with increased usage of digital modeling, programming and fabrication techniques has the potential to serve as a common foundation for approaching trans-disciplinary collaboration (von Mammen & Taron 2012). Technology has the potential to perform as a boundary object and serve different yet simultaneous functions across disciplines (Marshall and Pengelly, 2006). In the lab, novel deployment and explorations of computation were a common thread that was negotiated through the projects in varying ways. This commonality allowed the lab to capitalize on the skill set and expertise of specific collaborators in combination with the design agendas and computational methodologies of individual students. The translations that occurred between disciplines originated in conversation form and expanded through collaborative design and prototyping of the projects. This model of design-led trans-disciplinary collaboration resulted in a series of compelling full scale design prototypes that speculate on near future implications of science and technology in our environments. The methodology employed and the resulting projects offer insight into the nature of trans-disciplinary dialogues, demonstrating that the crossover between varying internal dialects can produce emergent design outcomes.

In framing design speculations, some measure of plausibility is useful in defining certain constraints. While students were encouraged to propose novel deployments of existing technologies by hacking, as well as to develop and invent new methods to pursue their speculative narratives, discussions of plausibility came to the forefront as students neared the end of their research and writing phase. Through a series of round table discussions with students and collaborators, the plausibility of various design ideas was thoroughly debated at several stages. Collaborators from different disciplines approached these discussions with their own disciplinary biases and thoughts on plausibility, which turned out to be a fairly subjective concept. However, the technological insights of collaborators regarding the complexity and feasibility of certain aspects of the projects were incredibly useful in the end. The lab required that students pursue full scale

prototypes of at least some portion of their proposal, and this requirement led to a productive narrowing in scope, in most cases strengthening the final project.

Design Prototyping

The lab worked with several main collaborators in the design prototyping phase. One of these was a computer scientist and evolutionary biologist currently developing computational methods for the analysis of collective behavior in animal groups. Another was an electrical engineering student with a broad skill set in physical computing. I served as the main advisor to each student and provided feedback on all aspects of the projects including aesthetics, generative design processes, material experimentation, interaction and the philosophical and theoretical implications of the work. The lab also exposes students to a variety of novel computational techniques for both form generation and design fabrication through a series of seminars and workshops. Students prepared detailed diagrams outlining the nature of the interactions they envisioned in preparing to meet with their collaborators. They also began some initial interaction prototypes investigating various sensors while pursuing material and formal investigations. Their early familiarity with these skills and processes afforded them more time to investigate and develop the more complex technical aspects of their projects including coding and electronics. Students also had a fairly broad sense of what was feasible in terms of material and formal investigations. This allowed them to quickly engage with the prototyping of their ideas and to refine the initial tests into full scale interactive prototypes.

All students had a certain affinity for algorithmic design processes and digital fabrication processes. This work was initially explored through a special elective seminar I developed and taught which all students were required to take before joining the lab. This seminar explored novel approaches to form generation, and utilized digital fabrication tools including the CNC router and 3D printer. Thus, all students in the lab had encountered and pursued experimental approaches to computational design and fabrication through formal and material investigations in coursework that served as a prerequisite to participation in the lab. Students were also given primers in basic programming using Processing, as well as workshops with core physical computing concepts and basic initial prototyping. This comfort in exploring novel procedural approaches to generating formal outcomes yielded work in the lab that displayed a high level of sensitivity to the aesthetics of interaction, including careful attention to issues of materiality, tactility and form.

Synthetic futures

The resulting projects from the lab display a diverse yet cohesive array of interactive objects and environments. The projects share a consistent approach to exploring formal and material outcomes through pursuit of generative computational design methods. All of the projects also pursued some method of interaction through various sensing mechanisms. Novel interaction aesthetics are explored through an integrated synthesis of the diverse research tangents. Students have a tendency to focus narrowly on one facet of the design problem, and one of the primary goals in this phase was to continue to emphasize a focus and commitment to the underlying core conceptual values that were defined and developed in the initial phases of research. By emphasizing a return to these values in tandem with problem solving and engineering of the project in physical form, I feel these projects retained the rich underlying conceptual intent. Specifically students were encouraged to revisit and refine their interaction narratives and think carefully about how these interactions would be best expressed, materially, spatially and aesthetically. One particularly successful project from the lab explored the potential implications of synthetic biology on our interior environments (figs. 1-4). This project involved a thorough review of current and emerging technology and theory relating to synthetic biology. The final project featured a series of three future domestic surfaces: a wall, a floor and a countertop. In a near-future scenario, these surfaces would utilize swarms of synthetically-derived bacterial strains to serve a variety of support tasks in the home.

One of our key collaborators was trained as a computer scientist and is currently pursuing a Ph.D. in Ecology and Evolutionary Biology. He brought an incredible knowledge of computational modeling and a thorough understanding and sensitivity to the collective behavior of swarms including bacteria. While this collaborator was able to provide general with coding issues, he also

provided very specialized expertise related to his own research into collective behavior and swarm intelligence. He worked closely on the project from initial biological inspiration and research into programming and fine tuning the final bacterial swarm simulations. This exploration utilized Processing, a Kinect sensor and a projection to simulate a future synthetic wall surface which would be interactive, allowing a user to modulate openings through tactile interface with light attractive bacteria. This working relationship was very smooth with very little conflict; this was a collaborator who understood that issues of aesthetics and form were just as important as understanding the underlying biological system. This project also required additional physical computing collaboration. This project was unique in that the student formed an alliance with a local community hackerspace and members of the community provided assistance in creating a large sheet of bacterial cellulose. This is an experimental material which is made by fermenting bacteria, and then harvesting the sheet like substance and drying it out. The use of a bacterial substrate for a bacterial simulation was a nice material addition to the project and a novel collaboration effort between the University and the community hackerspace. This project highlights the focus that is placed on material experimentation and process in the lab. This novelty was incorporated into the existing design speculation and added depth to the interaction. This collaborator has worked with artists in the past and he finds the experience of collaborating on creative projects to be refreshing. Again there are no immediately quantifiable benefits to his own research, but even this descriptor of “refreshing” indicates to me that the experience is providing new input and vantage points to the collaborator which may manifest in a variety of ways in their own work at a later point.

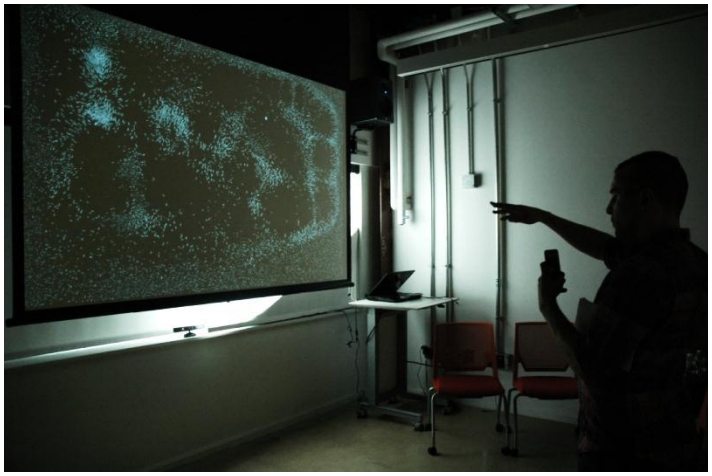

Figure 1: Speculative Interactive Bacterial Wall Surface In Development, June 2013. Photograph by Author

Figure 2: Living Skin Interactive Bacterial Wall Surface, July 2013. Photograph by Author

Figure 3: Living Skin Interactive Bacterial Wall Surface, July 2013. Photograph by Author

Figure 4: Living Skin Bacterial Cellulose Surface samples, July 2013. Photograph by Author

Sculpted Interactive Terrain

Two other projects from the lab displayed a similar synthesis between technology, design and science while preserving the initial focus on novel aesthetic, material and interaction outcomes. The SIT (Sculpted Interactive Terrain) is an interactive sleep surface (fig. 5-6). This piece displayed a very impressive final outcome in terms of behavior, resolution and materiality. This project required custom programming and communication between various hardware and software components. An array of responsive sensors was embedded into a custom poured silicone surface, allowing the surface to sense the presence of a user by weight and touch, rising in response around an occupant. The bed has potential health applications as well as lifestyle implications for issues such as snoring, SIDS or bedridden occupants. This project posits a narrative of inhabitation that is highly plausible and yet highly evocative as well. It is a product of extensive design, computation and engineering but its overall aesthetic and interactive presence feels very well synthesized. This student was able to retain her original motivation and intent in the final outcome and delivered a fully functioning prototype that explores a nuanced tactility in interaction.

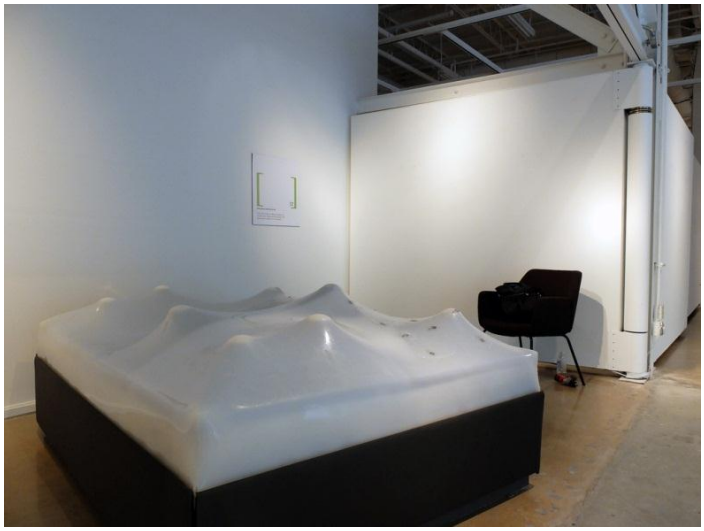

Figure 5: [SIT] Sculpted Interactive Terrain, July 2013. Photograph by Author

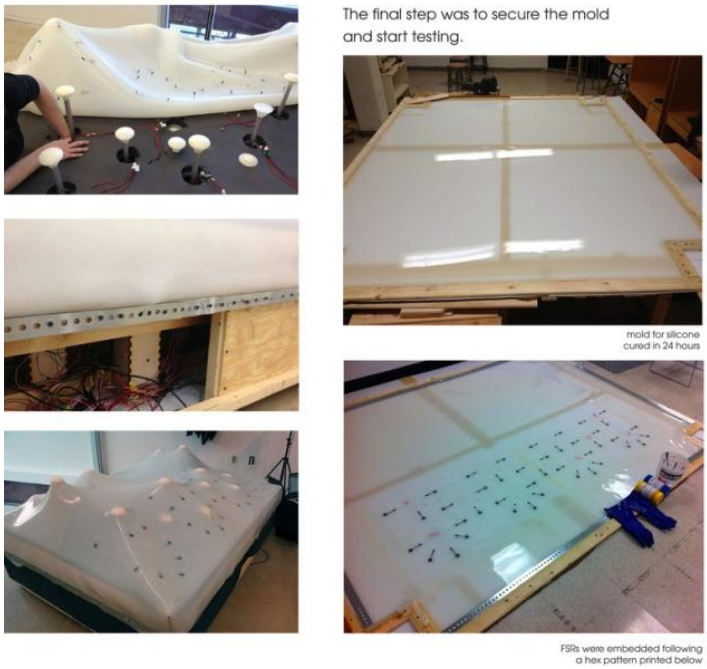

Figure 6: Custom Poured Silicone Surface Embedded With Sensors, July 2013. Photograph by Author

S(c)ent Message

A third project, S(c)ent Message posited a novel interaction based around the sense of smell, exploring formal outcomes in addition to prototyping a working scent communication device (figs.7-9). The resultant piece allows a user to transmit a variety of emotionally correlated scent messages to another occupant within an environment. This project incorporated wireless communication systems, hacked scent delivery devices, and custom designed scent delivery form and control. This project also posited very specific user interaction and the interface with the device and spatial installation reveal a carefully calibrated approach to the design narrative. When assessed as a whole, all of the projects in the lab synthesize a variety of disciplinary research insights, working processes and novel experimentation into materiality and form. In each project despite an intensive

development process that required revision and synthesis of multiple levels of information and technique, the projects retain a cohesive focus in their exploration of novel scenarios for interaction with our environments in the near future.

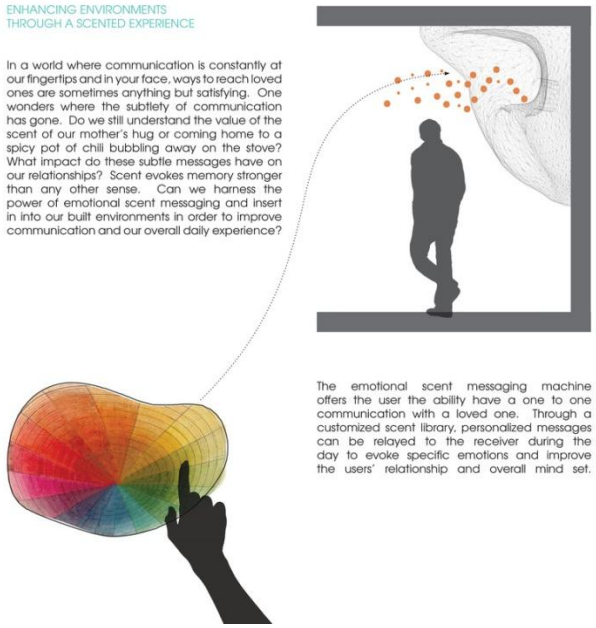

Figure 7: S(c)ent Message, July 2013. Figure by Student, Laura Nejman

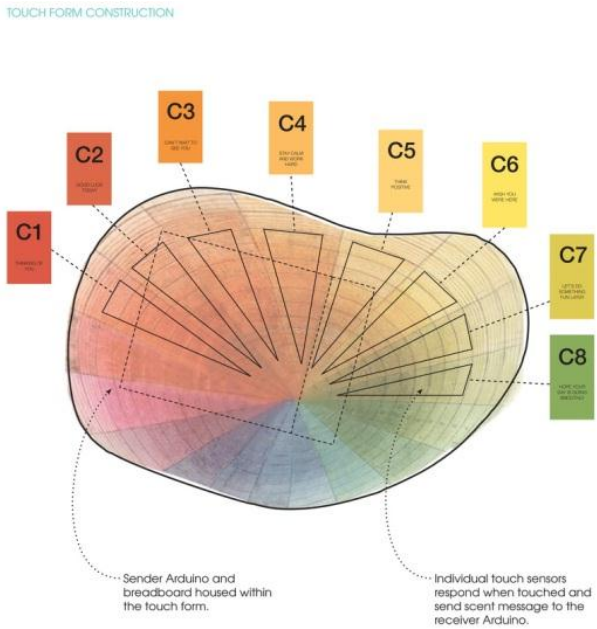

Figure 8: S(c)ent Message, July 2013. Figure by Student, Laura Nejman

Figure 9: S(c)ent Message, July 2013. Photograph by Author

Conclusion

In summary, the work produced in the lab this year has demonstrated a diverse yet cohesive set of responses to issues of spatial interaction and emotional amplification in our environments. Each student had a particular interest, perspective and motivation that was explored and amplified through a carefully structured set of interactions and collaborations. The lab benefitted from initiating collaborations very early in the design research process, with collaborators from outside disciplines participating in design ideation conversations, and thereby establishing investment in proposals at an early stage. One universal language that all projects engaged was that of programming. The interpretation and implementation of coding varied between disciplines, but served as a common operational language through which to investigate aesthetic nuance. The lab's focus on innovation in materiality and form generation was further enhanced through the interaction scenarios developed by the students, and insights and skills from our collaborators. The novel formal and interactive outcomes from the lab display the benefits of a research process that seeks to leverage information, methodologies and expertise across disciplines. By structuring an educational experience where unexpected disciplinary adjacencies may emerge, individual design motivations can be acknowledged, integrated and facilitated to great benefit.

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Nicole Koltick
An Assistant Professor in Architecture + Interiors at Drexel University and a principal in the design research practice lutz/koltick. Nicole is the director of the Design Futures Lab where she leads a graduate research group in critical design practices and speculative proposals focused on three main areas of inquiry; tangible interaction in the built environment, the incorporation of novel advancements in science and computation into our built environments and new models for ambient communication.