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A Polydisciplinary Journey: From Coffee to Prototype

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Abstract: *Multidisciplinary research and access to multidisciplinary learning experiences are recognized as critical to our time. However, most universities are not structured to accommodate co-teaching, cross-linking of courses between majors or colleges, or other curricular methods of bringing people of dissimilar backgrounds together. While faculty are pushing these limitations around the world, it is often done outside of institutional structures, and may require an act of magnanimity. In addition to infrastructural hurdles, disciplinary specificity can make communication and collaboration as challenging as speaking different languages. This paper presents an approach to overcoming these difficulties from a social beginning resulting in extracurricular research teams with leaders and members from various disciplines, including architecture, architectural engineering, mechanical engineering, environmental engineering, computer science, industrial manufacturing engineering, and landscape architecture. Teams may consist of professors with Ph.D.'s down to undergraduate students. An example socialization-to-multidisciplinary research process is demonstrated by an architectural research and design project. The example project will also illustrate the use of analog simulation and computation as a communication tool between various disciplines, allowing verification of design ideas through the simple fundamentals of science.*

Keywords: multidisciplinary, indoor air quality, undergraduate research, interdisciplinary, professional learning community

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Finding Synergies

As an architect and professor of architecture, I am interested in the design of buildings, or building sub-components that improve performance in regard to energy, comfort, and human health. This interest extends beyond speculative design proposals, to the extension of these ideas into testable full-scale prototypes, and eventually into building applications. The prototypes are not just meant to demonstrate the aesthetic qualities of the system, nor the material qualities. The prototypes are meant as learning tools and verification machines. Each prototype is put to test to validate theoretical models. From my own experience as a licensed architect, I'd argue that a background in architecture does not provide adequate qualifications or the experience needed to generate theoretical models and physical experiments. Architects are trained to collaborate. This makes us reliant on those in the engineering and sciences who are fully equipped to calculate performance expectations and to test hypothesis. Those in the engineering and sciences benefit from collaboration with designers as they sometimes lack new applications to test in the classroom. Under the right circumstances, a perfect blend of designer meets scientist can be mutually beneficially and incredibly productive. David Edwards eloquently elaborates upon this theme in his book *The Lab: Creativity and Culture*:

> We dream, and realize dreams, through a creative process that mixes to ways of thinking—aesthetic and analytical—which we often encourage and exploit in very different settings. Through aesthetic thinking, we embrace uncertainty and complexity, we induce, follow intuition, and draw inspiration from images and sounds. This process especially thrives in artistic environments, like theatre companies or design studios. Through analytical thinking, we simplify a complex world, reduce its challenges to resolvable problems, and pursue the logic of equations. This process thrives in scientific environments, like a pharmaceutical company or a bank. The aesthetic process is the substance of hypothesis generation, while the analytical process is the substance of hypothesis testing. (Edwards 2010, p 4)

The question is no longer whether or not we should break disciplinary boundaries in order to more comprehensively address the endemic questions of our decade relating to environment, resources, health, and sustainability. The question has shifted from why to how. This question is not easily answered due to obstacles at every turn. Through my desire to co-teach with faculty from other departments within my university, or even to co-teach with colleagues from within my same department, I have found institutional barriers in terms of compensation, space, and enrolment. Time and time again when I come across successful models of co-teaching, I soon learn that the faculty members are essentially donating their time, and in rarer cases the students are not receiving academic credit in the most deserving way. Both faculty and students recognize the value of these collaborative experiences, and are hungry for them to the point where compensation and credit are moot. If the universities are slow to adapt to the needs of faculty and students, and inevitably, to the needs of the job market, how then can we still have viable multidisciplinary experiences? How can faculty be adequately compensated for their time? How can multidisciplinary research move-forward in a timely manner without holistic support?

I have found one possible way forward in this labyrinth of closed doors. This solution is within the university, and even within the university do's-and-don'ts, yet is also a distinct co-curricular mode of working. The long-term hope is still that classes can be taught with experts from various disciplines to a student population equally as diverse, and that this co-mingling would result in a sum-greater-than-the-parts education. The aspiration is still that faculty are gainfully employed without an unreasonable extra workload in order to pursue a dream, in the sense that David Edwards described in the previous quote. The aspiration is also that students are able to leverage their multidisciplinary experiences into viable senior projects, projects that receive academic credit, and eventually into jobs. The aspiration would extend beyond the university to the business and industrial world where youthful minds raised in a collaborative process would guide decision-making through their inherently wide lens.

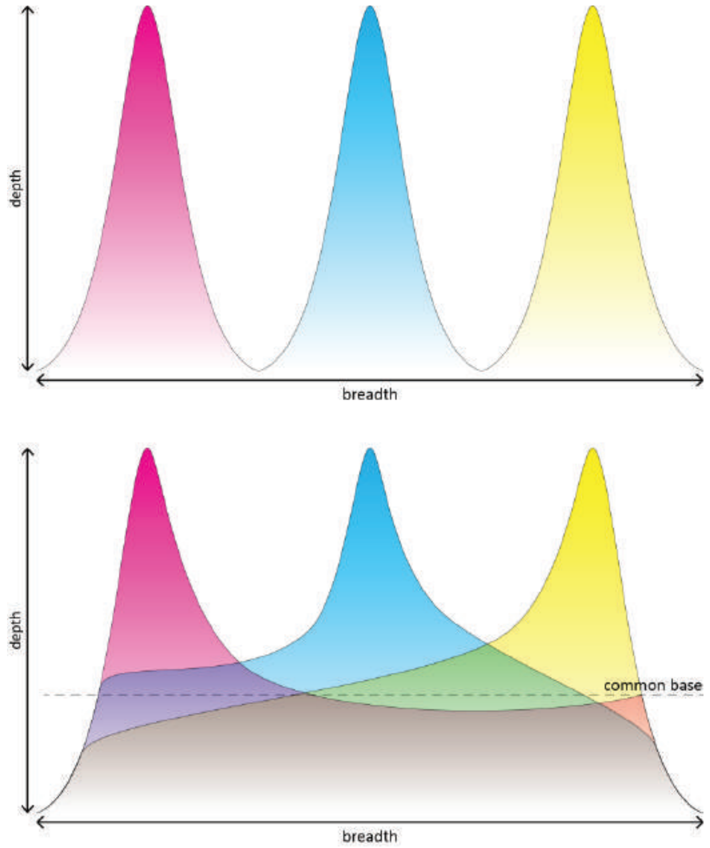

Figure 52: The top diagram represents the current educational model where individuals increase in depth of knowledge in a particular topic, yet remain isolated from other knowledge areas. The bottom diagram represents a model where individuals or teams would have both breadth and depth and would share a common base of knowledge that spanned across disciplines. This common base could include mathematics and language (which general education courses already address) but it could also include the arts, music and food (with a greater potential for a social foundation). Diagram developed in collaboration with Clare Olsen.

Until universities can develop a financially sustainable method to bring people together, an approach that takes both faculty and students beyond the classroom structure has proven effective. The Center for Architecture, Science, and Ecology (CASE) will be used as an example of an innovative new model of education that successfully erodes disciplinary silos. I would put CASE under the artscience laboratory umbrella defined by David Edwards that "improve the dialog between creators and the public around the creative process while erasing conventional boundaries between art and science (Edwards 2010, p.7-8)."

The Center for Architecture, Science, and Ecology (CASE)

Figure 53: The Integrated Concentrating Solar Façade (ICSF) system designed by researchers at CASE with support of NYSERDA, NYSTAR, and U.S. DOE. Source: www.case.rpi.edu

As a graduate student at the Center for Architecture, Science, and Ecology (CASE) in New York City, my fellow classmates and I would often ruminate that the greatest innovation to come from CASE is CASE itself. This comment is not meant to degrade the significance of the research being conducted at CASE. Notable research projects include the Integrated Concentrating Solar Façade shown in Figure 2 and the Biological Active Modular Phytoremediation System (BI-AMPS). Instead, the comment is meant to acknowledge the brilliance of CASE as an institutional construct. First, CASE is a joint venture between Rensselaer Polytechnic Institute (RPI) located in Troy, New York, and the Manhattan based architecture, engineering, and urban design super firm Skidmore, Owings, & Merrell (SOM). In their own words, CASE's mission reads:

> A new academic-industrial alliance is required to accelerate a more aggressively experimental process that leads to development of new systems that produce a paradigm shift in the way that our future cities metabolize energy, water, and resources. The Center for Architecture Science and Ecology (CASE) is addressing the need for accelerated innovation of Built Ecologies through the development of next-generation building systems. A multi-institutional and professional research collaboration co-hosted by Rensselaer Polytechnic Institute and Skidmore, Owings & Merrill LLP, CASE is pushing the boundaries of environmental performance in urban building systems on a global scale, through actual building projects as research test beds.
>
> Buildings account for over a third of the total energy consumption in the United States, and nearly 40% of U.S. carbon production. As new construction projects increase exponentially in emerging global economies, it becomes urgent to

> accelerate the pace of architectural innovation, and to press the implementation of sustainable material and energy technology.
>
> This progress cannot be accomplished solely within any traditional discipline of architecture, engineering, or environmental science, but requires collaborative solutions that meet social and environmental needs head on. By providing a setting that supports the immediate need for innovation, CASE is able to incorporate next-generation architectural technologies into new building projects (http://www.case.rpi.edu/CASE.html).

The first significant CASE innovation is that CASE is an educational laboratory, yet is co-sponsored by an educational institution and a private corporation. In these challenging economic times, it is admirable that both sides of this partnership are continually willing to take the fiscal risk necessary to pursue a co-dependent endeavour. Their innovation is based on trust, transparent communication and the shared belief in a common mission. In addition to shared ethics and common desires to use resources more effectively, RPI and SOM share the belief that both education and practice are enriched through blending. SOM keeps the graduate students and research endeavours rooted in practicalities such as budget, schedules, and manufacturability, while RPI keeps SOM innovative and critical.

The second innovation is that employees of the firm work directly with the students, and the students work directly on SOM projects for short intense periods of time. SOM key experts in buildings sciences coexist in a common workspace with both undergraduate and graduate design and built-ecologies students. These are experts in computer programming and energy performance and simulation who would engage in constant dialog and friendship with the students. Conversely, many students choose to participate in a semester or yearlong practicum, in which they work full-time for SOM yet act as a liaison between the practice and the research team. While it may seem to be a minor point, friendship will repeatedly be put forth as vital to the success of these otherwise unnatural collaborations. One should not gloss over the significance of friendship due to its' apparent academic irrelevance. We are here to discuss serious research, are we not? Exactly, and in a world and institutional system full of limitations, boundaries, and hurdles, what we have as our primary tool for progress is each other. The best way to get people to take a risk and invest in you is if they care about you. It's not just about the work. Care for the work is not sufficient. Care for the person is essential.

When Alexis de Tocqueville was asked to determine the reasons for the success of democracy in the United States, he concluded that the American social capital—"the ways our lives are made more productive by social ties" (Putnam 2000, p. 19)—resulted in healthy local associations that lead to supportive and productive communities (Cox 2004, p. 5). While this is a gross simplification of a confluence of a multitude of factors, it is worth noting that the coffeehouse, the front stoop, and the weekend group picnic are historically recognized social structures that lead to success. From these informal networks come more structured intellectual networks, such as societies or salons, yet they still have a foot firmly planted in the social. In the case of CASE, experts and novices sat together, ate together, drank together, and all members of this community were students of each other. In particular projects, one individual would take leadership, but then another task would allow the roles to reverse creating a harmonious nurturing in both depth and breadth.

The final CASE innovation to evaluate is community diversity. The faculty and students are chosen from a variety of disciplines and experience backgrounds. The director of CASE, Anna Dyson, has a background in art history, while the Assistant Director, Jason Vollen, is an architect with extensive experience in ceramics. Professor Peter Randolph Hazard Stark, who has an undergraduate degree in aeronautical engineering, and a Ph.D. in theoretical physics, teaches the building technology and prototyping courses. An SOM environmental engineer teaches energy modelling workshops. Students have undergraduate degrees in architecture, structural engineering, mechanical engineering, music, and ecology. This diverse population leads to rich discussions and unique approaches to problem solving. CASE is a model of education that produces students prepared to face, and perhaps author the next 20 years of design methodologies, and design pedagogy.

Over CASE's short life of approximately six years, graduates have already gone-on to tenure-track teaching positions at universities around the United States including Cal State Berkeley, California Polytechnic State University, University of Florida in Miami, and Auburn University. CASE's profound educational model is disseminating as their graduates spread out and become curriculum makers. It is only a matter of time before we see this type of educational model emulated in architecture programs around the country.

The Social Laboratory

Assuming that you agree with me that friendship is fundamental to successful interdisciplinary research, and to the progress of research, then the next question would be how to develop these relationships within a university structure. Teaching can be quite isolating. Unless you happen to meet someone at a university event or through a point-of-contact, it can be extremely difficult to reach beyond disciplinary silos even for the simple act of making a friend, let alone the act of building a committed research team. The following two sections will demonstrate two means by which ideas and collaborations are born from a social structure. The first example uses historical England and America to show how drunken conversation and open minds and mouths lead to many of the most profound inventions of all time. The second example, a much more humble one at that, will document a multidisciplinary professional learning community convened at California Polytechnic State University.

The Club of Honest Whigs

In Steven Johnson's book titled *The Invention of Air* the importance of the English coffeehouse in bolstering academic dialog is remembered and praised. Every two weeks a group of male thinkers would gather at the London Coffee House located rather ironically in St. Paul's churchyard—a bustling urban space anchored by religion and challenged by the sometimes-heretical ideas of the coffeehouse debaters known as The Club of Honest Whigs. This type of lively, sometimes substance induced, exchange of scientific, political, religious and philosophical thoughts does not have a direct parallel in modern society. In Johnson's words, "The late-night bender at an industry conference probably comes the closest: the sharing of essential, potentially lucrative information while stimulated by the chemical cocktail of caffeine, alcohol, and nicotine" (Johnson, 2008, pp.17-18). (Johnson 2008)

The protagonist of Johnson's biography, Joseph Priestley, approaches the Honest Whigs in December of 1965 to pitch a book idea (p.18). Priestly wants to write a book documenting all of the scientific discoveries and subsequent gadgetry related to electricity. He wants to write this book in lay language as a tome for the curious masses, not as a highbrow esoteric scholarly work. In short, "Priestley wanted to tell them a story" (p.29). That night at the London Coffee House Priestly met Benjamin Franklin, John Canton (member of the Royal Society and leading Electrician), and Richard Price (Welsh moral philosopher and mathematician), who became life-long friends. The "Electricians" as they were called, opened up their libraries, notebooks, and letters to Priestly within days of their first encounter. Over the next year, Priestly worked fastidiously researching these documents and generating his own original work, which was shared back-and-forth between the Honest Whigs. I suppose you could say this work was peer-reviewed as the Electricians read and commented on drafts.

The History and Present State of Electricity, with Original Experiments was published in 1767 and further solidified Priestley's standing with the Electricians from the coffeehouse. Over the next few years, the book sold "well enough to support five English editions, and was subsequently translated into both French and German" (p.34). Priestley's book was the principle text on electricity for the next hundred years. The book included two sections geared specifically toward young aspiring science minded individuals: "Practical maxims for the use of young electricians" and "A description of the most entertaining experiments performed by electricity" (p.35). Priestley encouraged people to join in the sciences instead of creating a schism between the experts whose stories are told in the book, and the readers. In Priestley's own words, "…[T]he interests of science have suffered by the excessive admiration and wonder with which several first rate philosophers are considered; and…an opinion of the greater equality of mankind in point of genius would be of real service in the present age" (p.36).

The Invention of Air follows its' own advice. After studying the likes of Benjamin Franklin and Joseph Priestley in great detail, Steven Johnson may have been transformed in his approach to knowledge and knowledge dissemination. In the Author's Note, Johnson writes:

> So this is a history book about the Enlightenment and the American Revolution that travels from the carbon cycle of the planet itself, to the chemistry of gunpowder, to the emergence of the coffeehouse in European culture, to the emotional dynamics of two friends compelled by history to betray each other. To answer the question of why some ideas change the world, you have to borrow tools from chemistry, social history, media theory, ecosystem science, geology. The connective sensibility runs against the grain of our specialized intellectual culture, but it would have been the second nature to Priestley, Franklin, Jefferson, Adams, and their peers. Those are our [American] roots. This book is an attempt to return to them. (p.xx)

Steven Johnson and Joseph Priestley are given as examples of successes derived from a place that betrays the specializations and isolating structures often found in modern universities. This paper is calling for a shirking of what is recognized as "scholarly" in order to create supportive and nurturing environments for progressive research.

The Material Innovations Laboratory

As an architect and a graduate of CASE, I carry with me a research agenda that has collaboration imbedded in its' nature. I used to believe this was novel or abnormal in modern academic practices, but as many know, it is actually historic and primal. Before there were silos, there were richly layered people with expertise in a number of fields. Moving away from this thickness in both depth and breadth may have contributed to our current economic and climate troubles. Collaborative cross-disciplinary sustainable relationships are essential to my success as a professor and scholar who is not stymied by the institutional hurdles discussed in the introduction. Through California Polytechnic State University's Center for Teaching and Learning (CTL), I was introduced to professional learning communities (PLCs) as a networking method. While a professional learning community is not the same as an English coffeehouse, I would challenge Johnson, and say that this may be the closest thing we have, at least within the institution. The CTL defines PLCs as:

> A faculty and/or professional staff group who engage in an active, extended program of study that is defined either by the needs of a particular group or by the imperatives of a particular topic. In addition to study, group members commit to self-reflection and peer feedback in an effort to improve teaching and learning. A PLC typically consists of 6-10 participants with either one or two additional facilitators (Call for Proposals: Professional Learning Communities, CTL).

Learning communities have been shown to benefit both students and faculty. The difference between a classroom full of students and a learning community is the focus on relationships. The difference between a research team and a faculty learning community is the focus on a multidisciplinary composition and on creating community—the social aspects that allow time for hanging-out off campus, including family and guests, and looking for opportunities to have fun together. While learning communities do have guidelines, such as meeting over at least a 6-month period, a membership of six to fifteen, and a common cohort-based or topic-based theme; there is also a lot of room for generating content and activities on-the-fly. There is room for the random agenda that would have surely emerged in the Coffee House.

Mark Cabrinha, Ph.D., is a professor of architecture at Cal Poly with expertise in digital fabrication and material assemblies. He established a loose structure that he called the Material Innovations Laboratory (MIL) and was in the process of defining the scope of this laboratory when our paths intersected. I was ruminating about the value of a PLC, and how much a group of faculty with similar interests would benefit our collective research, when Dr. Cabrinha introduced me to the MIL. It turned out that we needed each other. I needed Dr. Cabrinha to articulate the nature of a collective group that could fit within newly established curricular and pedagogical goals of the architecture department. Mark needed me to organize an agenda and give this group structure and funds. Together with professor Clare Olsen, we successfully responded to the CTL call and launched the MIL PLC with five architecture professors, an architectural engineering professor, a landscape architecture professor, a computer science professor, and an environmental engineering professor.

How did we find these willing participants to join the MIL PLC? Well, in the tradition of our ancestors, we had coffee. The process of creating this PLC proved both challenging and extremely effective at what I will call flash networking. The three founding members of the MIL PLC sat-down and generated a list of architecture friendlies. First, identify people with an interest and dedication to similar research agendas. This may be easier said than done. As new faculty at an institution, knowing whom to look for, how to look for them, and what to look for can all be unknowns. We started locally. Start with coffee with the department chair and other faculty in your own department. Ask them who they've worked with, who they know, and how to approach those people. This is the first tier of coffee dates.

In my experience, the first tier did not become members of the professional learning community. As one can imagine, many of these individuals were already working collaboratively across the campus, and were already well established in a trajectory. The first-tier was still incredibly valuable to meet, socialize with, and as a resource for the second-tier. From each coffee date, names were recommended as people on campus with similar interests. Several names came-up multiple times. These people were the next to receive a cold-email or cold-call inviting them to a 30 minute coffee date at the library café. At one of the early coffee dates, five members of the architecture faculty joined with one professor from materials engineering. She recommended to us to reduce the number of people at the coffee date so that she didn't feel like she was on trial. Even this critical feedback was a valuable part of the learning process and we restructured the coffee meetings to be more casual with only 3 to 4 people meeting at a time. The lesson was to keep it informal, keep it social, and allow the general conversation to take precedence over the request to join the learning community. Even if our guest decided not to join the group now, having them as an advisor and ally in the future should not be squandered. In this case, we asked for the short-game, but we ultimately were playing the long-game.

In is important to pause here and note that the method for introducing ourselves and pitching this learning community was coffee meetings at the library. The library was specifically chosen as neutral territory, but also because it's a hub of student, faculty, and staff activity. The second floor café is surrounded by various study spaces that are rarely vacant. Here we had informal conversations about aspirations and shared interests, and the format allowed people to easily walk away having only invested the price of a cup of coffee. The format also allowed people to be energized by the surroundings and agree to take a time-intensive risk with a group of loosely connected individuals. The risk turned out to be worthwhile.

Three of the five initiating members of this working group were new professors and we are eager to get to know other faculty and contribute to the scholarship of the University. Having taught and studied at premiere institutions throughout the country, each of the three new faculty were drawn to Cal Poly in part because of the institutional access to synergistic disciplines that could foster cross-disciplinary collaboration. The PLC helped us to forge relationships and solidify our collective scholarship and pedagogical goals, which directly aligned to Cal Poly's Strategic Plan and Vision to "develop and inspire whole-system thinkers to serve California and help solve global challenges". Clare Olsen and myself described the MIL PLC with the following paragraph:

> Developing our research as a team implementing whole systems thinking will elevate the investigations and allow us to crosscheck the objectives and outcomes of our research against the values and limitations of our respective fields. With work that aspires to address climate responsiveness and efficiency, and aims to progress toward high-performance ecological design, it is difficult, if not impossible to tackle this research effectively without partnerships. As a result, this

> collaboration is fundamental to our teaching and scholarship goals. Without collaboration, our work will remain generative in concept and not application. As part of Cal Poly's learn-by-doing agenda, students become skilled at both contributing ideas and testing them. This pedagogical agenda is critical in preparing students to make meaningful contributions to the profession (MIL PLC grant application).

The agenda for the MIL PLC included facility tours of respective labs and shops owned by each department represented, pecha kucha presentations by each member indicating their research interests and general curiosities, readings, meals together, and even making things. The two readings were from *Cradle to Cradle: Remaking the Way we Make Things* by William McDonough and Michael Braungart, and *The Lab: Creativity and Culture* by David Edwards. Incidentally, McDonough and Braungart met at a party, decided almost immediately to collaborate, and subsequently wrote a book, created an organization, and have made a considerable global impact. The members of the MIL PLC had brown-bag lunch discussion where we each brought our passions and biases to the table. Members of the group had differing thoughts and opinions leading to a healthy academic dialog that is not always possible in the classroom.

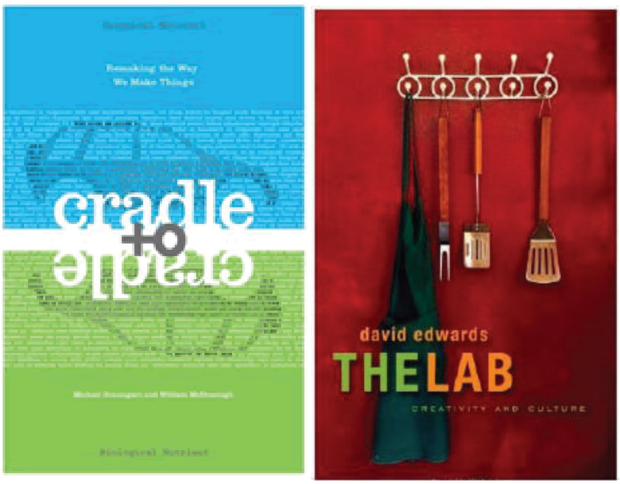

Figure 54: MIL PLC reading discussion books. The <u>*Cradle to Cradle*</u> *conversation focused on the role of materials in resource consumption (McDonough and Braungart 2002), and* <u>*The Lab*</u> *looked at the collaboration between the arts and sciences as a productive collaboration for innovation and public engagement (Edwards 2010).*

The most significant outcome of the learning community was friendship. In a world of overwhelmingly busy schedules, and unrealistic expectations for faculty performance, these friendships became invaluable. There are two reasons why the social aspects of the PLC were important. First, we were able to stretch our minds in a hospitable environment knowing that the others cared about us and supported us, and that the dialog was in no way confrontational. Second, a group of people who care for each other are more likely to agree to help with collective research even if it means delaying a personal project. Friendship allowed the group to prioritize the collective over the individual.

Make Things

It is my research philosophy that one must make things—prototypes, simulations, and experiments—to fully understand his or her own thinking. Making allows the teachers to become the students. Having a group of friends with various expertise will allow the making of ever more sophisticated and didactic prototypes. My own research into air quality and the related design implications for improving human health has lead to a number of analog simulations and experiments conducted collaboratively in order to demonstrate assumptions and design performance. Returning briefly to Joseph Priestley, one of the significant outcomes of his meeting with the Honest Whigs was the encouragement to conduct his own experiments (Johnson 2008, p.29). As a result, Priestley “launched himself into a rapid and turbulent river of experiments, developing a style of investigation that would shape the rest of his career—more exploratory than systematic, shuffling through countless variations of materials and equipment test subjects” (p.31). In his naïve and chaotic approach, Priestley was able to make a substantial contribution to the world of knowledge in a number of significant ways. As I have done along my own research path, Priestley went from the coffeehouse to the workbench, from making friends to making things.

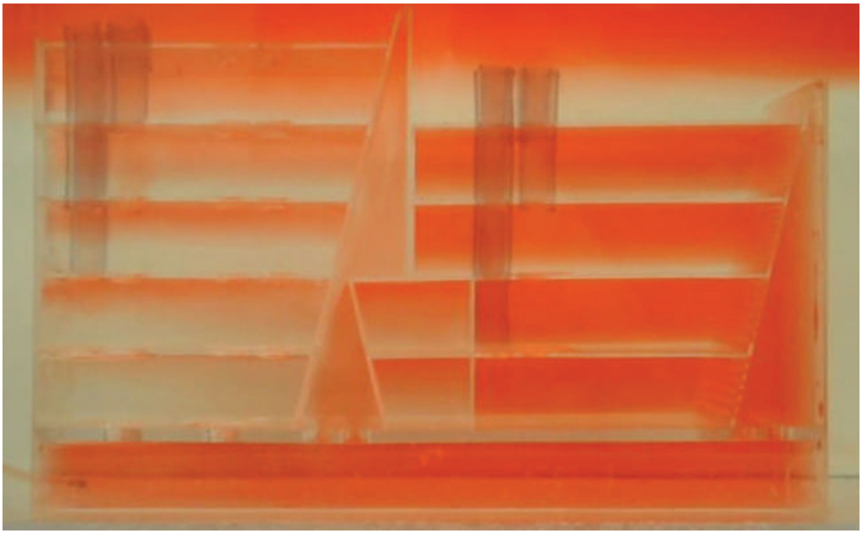

Figure 55: An analog fluid dynamics simulation illustrating the stack effect, nicknamed ALVS (analog liquid ventilation simulation). The red water represents buoyant air (warm air) moving through the building section and exiting through chimneys to the exterior.

In 2009-10, I worked with a small team of undergraduate students from Rensselaer Polytechnic Institute (RPI) to design a family of wall modules that pre-filter outdoor air before it is brought inside. We established performance goals for our walls, but as our team was made-up of only architecture students, our abilities to verify our hypothesis were limited by our lack of exposure to fluid dynamics and experimental frameworks. While we couldn’t, without considerable effort, self-teach fluid dynamics in our short timeframe, we could make models. We could make videos and drawings, and we could use these tools to explain our concepts through analog simulations. The image shown in Figure 55 is a photograph of one of these simulations. An acrylic tank was built and an acrylic section model of a portion of our building was built to fit within the tank. The tank was filled with salt water, and red-dyed tap water was filled into the bottom chamber of the sectional model. Time-lapse photography and video were used to capture the vertical movement of the less dense fluid as it moved through the building eventually escaping through chimneys into the tank. This model simulated the stack effect that would be induced by solar chimneys and create ventilation in the building.

Figure 56: Experiment testing particle removal efficiency of an 3D printed module. The collaborative research team consists of faculty and students from environmental engineering, mechanical engineering, and architecture.

In 2012-13, I was able to build off the MIL PLC relationships to create an undergraduate student research team. This team followed the same basic working methods as the architecture team did two years earlier. We made prototypes, theoretical models, and analog simulations to demonstrate behaviour as shown in Figure 56. The team consisted of students from architecture, environmental engineering, and mechanical engineering. Together we have successfully proved a design idea as a viable building system and are moving forward with industry partnerships, and further grants.

In just one short year, I have been able to move my research far beyond the expectations for this duration. It all started with coffee in the library, and through a generous grant to create a social group that bantered about our common interests. As a result of these fortuitous events, I have a wonderful and productive team of undergraduate student researchers who will soon have patents under their names and will have hands-on research experience to aid them in their future endeavours beyond the university. This type of experience is rare for an undergraduate architecture student to leave the university with. The engineering students tell me it's rare for them too.

Seriously Less Serious

"In the artscience lab model, art and design ideas would move from education on the one side to social and cultural change on the other, with public dialog taking place in between, through cultural exhibition instead of academic publication" (Edwards

2010, p.11). The method of highly educated scholars operating in locked laboratories struggling to protect their intellectual property cannot be our only method of researching at academic institutions. This paper proposes a social method of developing research teams that freely share information and criticism in pursuit of new knowledge. Both methods have the same goal. One is just a lot friendlier, and frankly much less isolating to both the researchers and the larger community. Architects are often criticized for not properly protecting our innovations. We go straight from idea to public presentation and often directly to the Internet. The images spread quickly. In this way, the designer has very little chance to protect their ideas and retain sole authorship of them. Some may argue that designers should behave more like scientists or engineers in carefully protecting their work until the legal system can protect it for them. And while I understand the financial and institutional need to be original, I think the sciences and engineering fields could learn a lot from the ways of the designers.

While the promise of this paper, to provide a model of successfully working with multidisciplinary teams within the university is still a work-in-progress. There are a number of conclusions that can be made from the experiences explored above. First, be open. Be open to relationships, open to expertise, and open to novice energy. Second, be giving. Until the universities devise adequate compensation for working beyond disciplinary boundaries with teams that don't properly fit into a high-efficiency lecture hall, it is up to the professors and students to develop these situations. This will take generosity, but the returns are likely worth the investment. Third, when in doubt, physically try it. With uninhibited shameless determination, make something and document it. Without a doubt you will learn something. I always do. Even if it was not the thing I expected to learn. The last conclusion I would make is to publish for the academy and for your peers, but publish for the public too. Exhibit, blog, tweet, write, and do it in an inclusive way that invites others to the table. Buck the arrogance that believes only those with Ph.D's and Post-Docs can innovate. Collectively we can be better.

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