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INTRODUCTION

THE CASE FOR CASE STUDIES

in design education and design practice

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It's no secret that the practice and study of design has changed enormously in the last decade. While designers have consistently taken up the challenge of responding to cultural shifts, the first decade of the twenty-first century has brought with it unprecedented rates and combinations of change in financial structures, consumer patterns, climate change, technological hegemony, and political strife in countries whose citizens have experienced oppression for several generations. Designers are scrambling to respond to these cultural upheavals and design education is perpetually shifting to prepare students for a profession in flux. As educators, we are left asking: What are enduring qualities of an effective and successful designer? How can designers work more sustainably? How can individuals in the design community learn from each other?

In order to build a body of information that designers can rely on to answer these questions, we must increasingly turn to case study practices to explain the design process, record visual process and iteration, cite sources to create bibliographical reference, describe collaboration, and articulate material exploration. Where are we going? Where are we coming from? Why change now?

Although the practice of design has changed, the nature of designing has not. The challenge to make knowledge visible, and the task of mediating between two entities—the client and the target audience—have always been two chief concerns of designers. However, how we acquire knowledge and information to undertake these two tasks has changed—designers must now determine how to ask the right questions to make decisions about their work, and they must learn how to look at the world critically.

The practice of design has changed from observing culture and responding to that observation to participating in cultural activities and allowing design to emerge from that experience. Design practice has evolved from the theory that 'form follows function' to the concept that form follows process, reasoning, and critical thinking (among other things). Formerly in professional design practice and design education, it was common practice to problem-solve around market research or make assumptions about target markets based on age, economic status, and consumer behaviour. The end result—the solution to the 'problem' or 'design opportunity'—often addressed issues of form, material exploration, and functionality. Designers and design students looked at factors including target markets, audience, shelf life, and materials to create commodity-driven design work. We are now learning to design for behaviour, technology, and semiotics (because our post-modern world expects subtext in almost everything we say and do) to create culturally embedded design. Function now becomes a condition of contextually situated design.

THE PRACTICE OF DESIGN HAS CHANGED FROM OBSERVING CULTURE AND RESPONDING TO THAT OBSERVATION TO PARTICIPATING IN CULTURAL ACTIVITIES AND ALLOWING DESIGN TO EMERGE FROM THAT EXPERIENCE.

In this climate, case studies help designers articulate what we do best. In order to move away from the historical perception of design as an applied art, designers need to showcase the thinking and process that are the drivers of form. There is no one single way to be successful in this. The dialogue around design has increased significantly in the past ten years: design journals, online magazines, and blogs have already made a profound impact on the way we discuss design and the way designers share ideas.

WHY ARE CASE STUDIES IMPORTANT FOR DESIGNERS?

Designers are often rewarded for the end result of their project, where many days, weeks, or months of work culminate in a visual or physical object. The refined version of the work is what is usually published, while the story of the project often dissipates. Writing a case study requires the designer to isolate and articulate the design process and communicates the contributions of the client, co-creator, and the research partner. Case studies transform the convergent and divergent choices that designers form throughout their project development into tangible design thinking. They illustrate the intricacies of the design process and provide information access for other designers to learn from. It is this transparency of information that allows designers to better understand each other, and allows the client to value the refined version that much more.

While sharing information with other designers may not be the most compelling reason for professional designers to write case studies of their work, the practice of writing and sharing case studies lead to accountability in areas of ethics and sustainability which benefits the professional as a whole.

William Cupid, photography

WHY ARE CASE STUDIES IMPORTANT FOR DESIGN STUDENTS?

Designers and design students need to capture the many voices that contribute to the creation of design work as a commitment to life-long learning and sharing of ideas. This requires an atmosphere of respect for the design process, for collaboration, and for open source learning.

Writing case studies enables students to work theoretically, to build upon and create new ideas, and to challenge existing theories published by design professionals, design scholars, or other design students. While some professionals may believe it is impractical to explain the design process of projects in great detail, articulation of design processes facilitates an understanding of complexities for students and contributes to building their intuition as practicing designers. Case studies provide an opportunity for students to express the interdisciplinary nature of design studies, and are instrumental in open source and peer-to-peer learning.

Open source learning is not a new concept. MIT OpenCourseware has been sharing resources and knowledge for ten years, and the term 'open-source' has been in the lexicon of software developers since the early 1980s. The freedom to develop, publish, share, and rewrite existing information (then to publish and share again) are fundamental principles of open source knowledge. For students, taking part

CASE STUDIES IN DESIGN NOT ONLY CALL ATTENTION AND DEVELOP A SYSTEMATIC WAY OF LOOKING AT THE DESIGN PROCESS... THEY HIGHLIGHT NEW TERRITORIES IN DESIGN, SUCH AS THE USE OF CO-CREATION.

in open source learning by writing a case study means that they can contribute to a brain trust—a collection of knowledge that expands to form various levels of expertise, and which is available to anyone. Restricting access to case study content and information for the sake of competitiveness is antithetical to learning. In order for case studies and published design research to become truly open-sourced, they must be published and referred to for any purpose; fellow designers and design students must be free to study case studies and to use them as a jumping off point for their own projects. In order to learn from each other, designers and design students must be free to distribute copies to of case studies to each other without hindrance.

WHAT'S NEXT?

If professional designers and design students disclose more about their critical thinking and the practice of design, and if this leads to more collective learning and citing of other designers' projects as references, then designers will be able to develop methods and nomenclature that are most suitable to the design process and not borrowed from other science and social science disciplines. Designers writing case studies, open sourcing them, and learning from other published work will establish design research on its own terms. As a result, clients and research

partners will be able to understand design in a comprehensive way that helps their work at research and development stages, rather than using design simply to assist in the marketing and deployment of information or products. This process establishes the credibility of designers to their clients, and to each other in the design community.

Case studies in design not only call attention to and develop a systematic way of looking at the design process, they highlight new territories in design, such as the use of co-creation or participatory methodologies, issues of sustainability, use of technology, development of visual and tactile forms, and new design practices. Case studies also allow designers to examine ethics more carefully and more often by describing how and why they addressed specific issues.

Finally, and perhaps most importantly, case studies allow Canadian designers to share and reflect on their work, and to express what makes the work uniquely Canadian. There is no real defining text or source for Canadian designers to learn about each other historically, and while this may seem inconsequential in the larger scheme of things, this lack of information that identifies Canadian design as noteworthy means that design education in Canada struggles for recognition—for their students and for the institutions themselves. Developing and contributing to a body of knowledge that is distinctly Canadian in form, methods, ethics, behaviour, language, and technology would be invaluable to both students studying design and to practicing designers.

SUSTAINABILITY

CASE STUDY: POWERTECH

Service oriented strategies for sustainability

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This morning, I spent two dollars on a coffee and put 834 grams of carbon into the atmosphere. That's 417 grams per dollar, according to US carbon intensity data (US Energy). In our resource-based economy, it should come as no surprise that this can be measured, and certainly no surprise that our spending habits have a negative impact on the environment (Jackson, 2009) (This is averaged information. In specific terms, a dollar spent on gasoline for my car would likely have greater carbon per dollar than a dollar spent repairing the soles of my shoes.). But still, it is fascinating to see this correlation. If there were time to work it out, we could probably determine a numerical relationship between dollars and averaged environmental toxicity, dollars and biodiversity loss, dollars and... but I am getting ahead of myself.

The real question is what to do about it. There are many eco-design strategies we can employ to reduce the resource intensity of each dollar, from light-weighting, to using recycled materials, sourcing from local suppliers, and designing products for longevity (Belletire, St. Pierre, & White, 2007). But these approaches alone are not enough to mitigate the problems we are facing (WBCSD, 2008). Service-oriented strategies, on the other hand, have the potential to offer greater environmental gains. For example, a company that collects discarded computers to reassemble them into low-cost electronics shifts economic

value to a service instead of a resource[1]. This creates economic activity that is divorced from resource extraction, which is one way to keep the economy healthy while slowing down resource dependence. Equally important, service-oriented strategies can support environmentally positive behaviour change in ways that designers have only begun to explore.

The underlying premise of service-oriented strategies is that people don't necessarily need to own a product—what they really need is the service that the product provides. Watching the movie is the desire, not necessarily owning the DVD. Getting to a doctor's appointment is what is critical, not owning the car. These needs can be met through services (online movie streaming), or product-service systems (car-sharing).

THERE ARE MANY ECO-DESIGN STRATEGIES WE CAN EMPLOY TO REDUCE THE RESOURCE INTENSITY OF EACH DOLLAR.

Most of the literature on service-oriented strategies categorizes the practice as either Service Design or Product Service Systems (PSS). Hugh Dubberly and Shelley Evenson define Services Design as design of activities or events that form a product through an interaction between the customer, any mediating technology, and representatives of the service organization (Evenson & Dubberly, 2007). An example of pure service design is the IDEO-designed Keep The
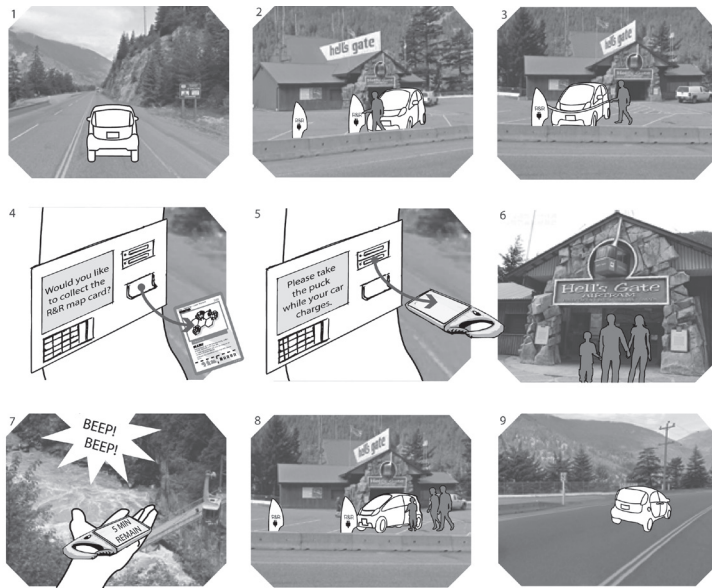
Figure 1. Details of the system are carefully developed to support new patterns of behaviour

Change project, a savings plan for Bank of America™ Visa® holders where every purchase can be rounded up to the nearest dollar, and the 'change' is deposited into a new savings plan (IDEO.com). The designed product in this case is intangible. On the other hand, PSSs are defined as having an object or product at the center of their

A GOOD CAR–SHARING PROGRAM NECESSITATES THAT WE ACQUIRE NEW HABITS AND ACCEPT SOME INCONVENIENCES IN THE CAUSE OF SUSTAINABILITY. THESE SMALL BEHAVIOUR CHANGES HINT AT THE POTENTIAL FOR SERVICE–ORIENTED STRATEGIES TO PROMOTE EVEN MORE SIGNIFICANT CHANGES.

service. An MP3 player exemplifies this—one needs to have the product in order to access the downloadable music service. Service Design and PSSs bracket a spectrum of possibilities that range from the intangible to product-centric. All along this spectrum there is potential to dematerialize the physicality of purchases and, as a result, reduce the resource intensity of each dollar spent. But where this becomes exciting is in the behaviour change that a service can command—a good car-sharing program, for instance, necessitates that we acquire new habits and accept some inconveniences in the cause of sustainability. These small behaviour changes hint at the potential for service-oriented strategies to promote even more significant changes.

Ursula Tischner, author, researcher, and PSS advocate points out that while PSSs have the potential to leapfrog to drastically reduced environmental impacts, simply designing a PSS is not necessarily an automatic environmental gain (Tischner, 2008). There are enormous challenges when designing something with the complexity of a PSS. Only by playing out the scenarios of all of the branches of the system and examining the consequences, can one be sure that the benefit really

exists. We can understand this by taking a look at the case study of the Rest + Recharge project by Amanda Klassen (see page 12 – 15).

The Rest + Recharge project is a complex service system designed to supply electricity to recharge an electric vehicle (EV) throughout a road trip. Consumers can (but don't necessarily) own the vehicle. Charging an EV is very different from refueling with gasoline because the fastest EV charging system takes roughly 30 minutes, and the range of a typical EV is 160 km. The design challenge is then to enable a road trip where one must stop every 1.5 hours and wait there for half an hour before starting on the next leg of the journey. The design students involved in the project (Chiu, Klassen, & Tomlinson) covered key aspects of service design processes. They detailed the total customer journey and conducted extensive ethnography as part of the design process (Fig. 1 and 2). After researching existing infrastructure, they proposed that the Rest + Recharge system could piggy-back on rest stops that are already well distributed along the Trans-Canada highway. Finally, they collaborated with a business student to propose a business plan for the system.

So far, so good. But to Tischner's point, this system could either be a great benefit to the environment, or not. The environmental benefits can only be assured if there is follow-through on features of the system that may be difficult to control. Here are the factors of the Rest + Recharge proposal would that determine it's environmental performance:

1. Reduce energy consumption: This proposal depends on the availability of low-carbon or no-carbon power sources. Because clean energy supply is limited, a system needs to do more than simply replace one source of energy with another. The greater goal is to achieve an overall reduction in energy usage.

Figure 2. Mapping the audience experience and existing infrastructure that can support traveling long distances in an electric vehicle

2. Traveling less: Given the pace and rhythm of the experience that this team has designed, travel could become a kinder, gentler, and slower journey. This offers subtle encouragement to enjoy traveling a shorter distance. The overall carbon output, however, can remain the same or even increase if people assume that because an activity is less damaging, they can do it faster or more often (rebound effect) (UNEP, 2001).

3. Buying local: Dollars spent locally are less prone to hidden carbon costs (Jackson, 2009). In this proposal, commercial opportunities at rest stops are intended to expose visitors to local experiences and products. This only works if the product being sold is Chilliwack corn rather than Starbucks™coffee. Ensuring that local retailers dominate each stop would probably involve long-term local government controls, demanding initial buy-in from all stakeholders.

4. Experiencing nature: A walk to see a waterfall is probably one of the less resource-intensive ways to spend time, feed the soul, and perhaps engender greater commitment to the environment. The system sets the conditions to encourage this to happen, but cannot force it.

WE CAN NO LONGER IGNORE THE FACT THAT OUR ENERGY AND RESOURCE CONSUMPTION MUST BE RATCHETED BACK MORE SIGNIFICANTLY THAN WE FIND COMFORTABLE.

The ideals listed in the above points will sound intuitive and obvious to many. It is easy to agree with reducing energy consumption, nourishing local economies and cultural diversity, and re-establishing personal connections with nature. The challenge is to develop the system so that even the least motivated citizen finds it relatively convenient to make the behaviour changes that lead to these environmental benefits—and that is where the hard work of service design is.

Fortunately, the students who worked on this project were supported by an enlightened sponsor: Powertech Labs, a leading clean energy consulting and testing company. Strategist Mari Nurminen understands the challenges in realizing more environmentally sustainable services. She and her colleagues at Powertech also recognize that the changes brought by these services are only the beginning of the substantial changes we need to make to the way that we live. The projects developed in the fall of 2010 envision ways to support a shift from gasoline to EV travel, but the paradigm shift that will allow us and other species to thrive on this planet must go much further than that. "Radical changes are needed in the way we produce, consume and socially interact" (Ceschin, Vezzoli, & Zhuang, 2010).

We can no longer ignore the fact that our energy and resource consumption must be ratcheted back more significantly than we find comfortable. Economist Tim Jackson frames it as the need to reduce carbon intensity from 417 grams per dollar to 6 grams per dollar (Jackson, 2009). Designer Ezio Manzini simply states that we must reduce our consumption by 90% (Manzini, 2006). Both see a service based economy as our best route through this unimaginable degree of change. As John Thackara says, the first question is "what might life in a sustainable world be like?" followed by "how can design help us get there?" (Thackara, 2010) Service design strategies offer some important methods for designers to help all of us get there, and to help us get there more enjoyably.

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FOOTNOTES

1. Examples of this in Vancouver are Free Geek for computers (http://freegeekvancouver.org/) , and Our Community Bikes for bicycles (http://www.pedalpower.org/?q=our_community_ bikes).d0a819d3-7c8d-4a58-868a-67fcab5cd299

REST + RECHARGE:
LONG DISTANCE TRAVEL USING ELECTRIC VEHICLES ACROSS CANADA

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ABSTRACT

Rest + Recharge is a collaboration between Emily Carr University of Art + Design students Amanda Klassen, Ada Chiu and Kevin Tsuyuki Tomlinson, and Powertech, a company specializing in clean energy consulting, testing, and solutions.

Electric vehicles (EV) can be recharged from a standard wall socket (120 Volt); they are generally viewed as a transportation solution for shorter urban trips rather than longer excursions. This perception of limitation is a major barrier to adoption. However, interurban travel can be viable through level three 'fast' charging, a 500 Volt DC high-current charging, which allows users to recharge EV batteries in less than 30 minutes. This project proposes a network of fast charging stations that transform existing rest stop infrastructure into 'rest and recharge' stops. This solution transforms and broadens the type of travel that is possible for electric vehicle drivers, and enables users to positively experience recharging times while engaging with the environment and communities that they are passing through (Fig. 1).
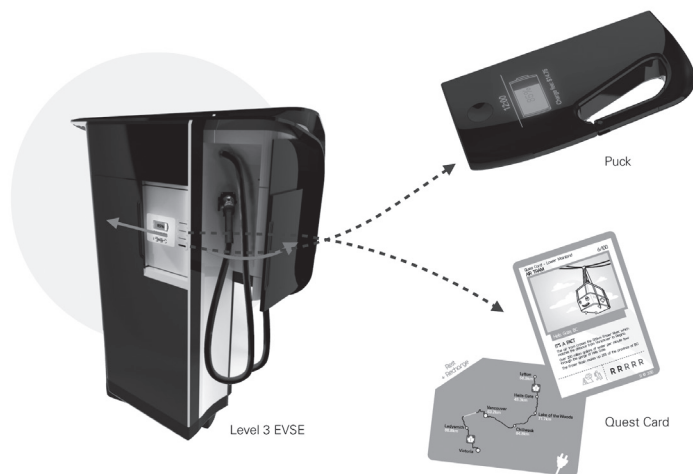
Figure 1. Rest + Recharge system components: EVSE, Puck, and Quest cards

KEYWORDS

Electric vehicles, EVSE, sustainability, long distance travel, Trans-Canada highway, industrial design

INTRODUCTION

Background Information › The Trans-Canada highway is the longest road ever constructed; unfortunately, electric vehicles (EV) face serious limitations for interurban travel. We need a system that allows for long-distance travel and uses short-range technology to help facilitate the switch from petroleum to a cleaner energy source. The problem of potentially long wait times to receive full charges should be addressed

RESEARCH QUESTION

Maybe extended wait times are not a problem—maybe it is how we wait. Can we design a charging system for the EV that allows interurban travel—without the burden of waiting? We cannot guarantee everyone will have a positive experience waiting, but we can design objects that act as positive "emotional levers," by understanding both the user and the environment (Forlizzi, DiSalvo, & Hamilton, 2003).

COMPONENTS

EVSE › A CHAdeMO standardized Electric Vehicle Supply Equipment (EVSE) or charging unit placed anywhere on the Trans-Canada highway will need to withstand weather extremes in every region of Canada. As it stands, none of the existing CHAdeMO EVSEs fall within acceptable temperature ranges

As the locations proposed tend to be primarily rest areas, it was important to help users manage their time efficiently; walking distance from a given location back to the charging station was converted to walking time.

METHODOLOGY

Client Briefing › Over a two-month period we met with professionals from Powertech—two engineers, a product developer and a marketing manager—who provided crucial background information and technical expertise. We also met with Rob Inkster, Associate Vice President, Research and Industry Liaison at Emily Carr, Brian Beck of the City of Vancouver Sustainability Group, and the art director of Whitebox Studios, Greg Corrigan. Each meeting informed our concept and influenced our design direction.

Research Summary › A literature review became extraordinarily important during our ideation and early conceptual development phases. Statistics Canada was used to find patterns in Canadian demographics that were relevant to this project—such as salary scales and spending habits (Statistics Canada, 2010). This information helped us re-frame the design problem in terms of affordability, accessibility, and desirability. Reviewing of CHAdeMO protocol standards for designing EVSEs provided essential guidelines for the prototyping and testing stages.

Figure 2. William, co-designer, reading a Quest card prototype

(CHAdeMO Association, 2003). The concept discussed in this paper also considers features such as a payment system for non-physical money; an intuitive touch-screen interface with LED indicators, and a sleek design that entices support for EV technology, a design language that is appropriate to EV technology and the principles behind green energy sources.

Quest Cards › A map and information card (Fig. 2), identifying all nearby charging stations and distances, would be available at each station. This navigational tool could also be educational, providing information on agriculture, the region's history, and local recreational services (Readers Digest, 2001). The cards could be collectible and serially numbered; design features such as the 'R' rating (= rarity) would communicate that the card is unique and produced in a limited quantity. Flipping over the Quest card would reveal a map with all the Rest + Recharge stops in a 300 km radius; connecting the complete set of issued cards would create a map of the Trans-Canada highway. The playful aspect of the informational cards could help children to cope better with extended travel time.

Puck › The puck was designed as a time management device dispensed from the charger and it could be pocketed or clipped onto the user's pant loop. With an energy efficient OLED display, the device would provide a live feed of the charge status, current charges (including overtime charges) and current time. This would allow the user to leave their car while it charges and take advantage of the activities in the area.

CAN WE DESIGN A SYSTEM FOR ELECTRIC VEHICLES THAT ALLOWS INTERURBAN TRAVEL —WITHOUT THE BURDEN OF WAITING?

Research also included the review of a collection of articles relevant to the technologies developed at Powertech and a tour of the company's facilities. This provided insight into the company's most current innovations.

Precedence research on EV rest stops in countries pursuing EV technology brought us to the Japanese Expressway case. The Ebina SA rest stop along the Tomei highway is built around a shopping mall and other services including dining and sightseeing (Ebina SA, 2010). While this scale is not expected for Canada, it provided a successful example of economic activity at rest stop locations.
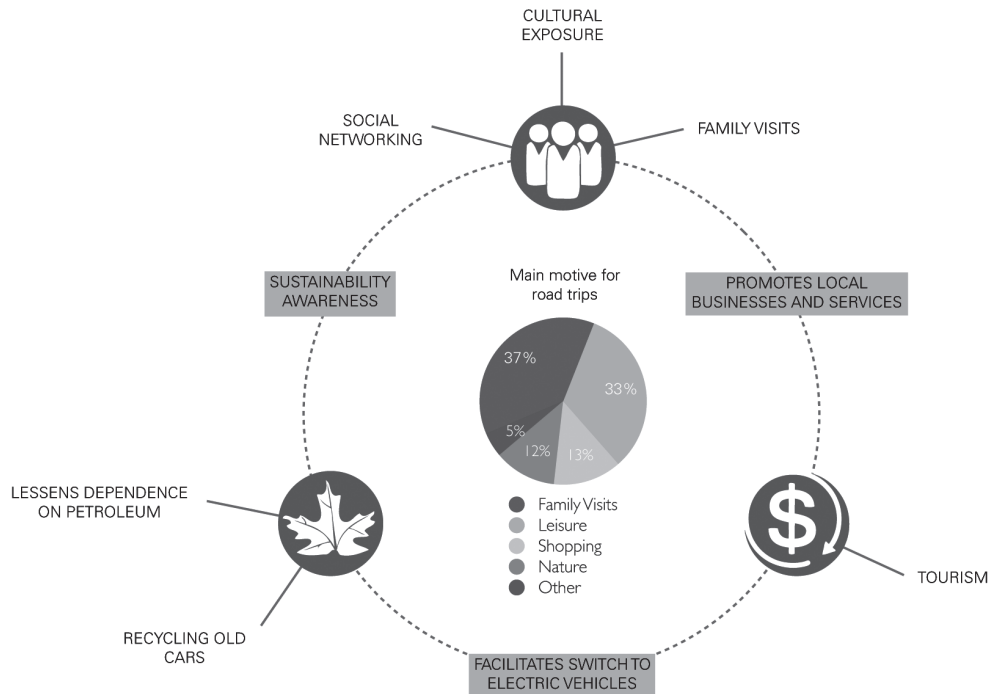
Figure 3. Benefits Diagram

PEOPLE NEED THE CONFIDENCE THAT AN ELECTRIC VEHICLE CAN GO THE DISTANCE BEFORE THEY MAKE THIS TECHNOLOGY SWITCH. OUR CONCEPT LESSENS THE DEPENDENCY ON PETROLEUM, EASILY PROVIDING ECOLOGICAL BENEFITS.

Precedence research on EV rest stops in countries pursuing EV technology brought us to the Japanese Expressway case. The Ebina SA rest stop along the Tomei highway is built around a shopping mall and other services including dining and sightseeing (Ebina SA, 2010). While this scale is not expected for Canada, it provided a successful example of economic activity at rest stop locations.

Clean Motion Survey › In the early stages of our research, and following approval from the University's Research Ethics Board, we developed an online survey of thirteen questions to collect potential user data using the online tool SurveyMonkey™. A total of 98 participants completed the survey; a significant number of respondents were middle-aged adults. The collected data included information on road trip frequency, average distance travelled and the driver's main motivation for road trips.

Prototype Testing › Full scale models of EVSE, Puck and the Quest card were produced for testing—three adult participants were observed while role-playing different scenarios. Prototyping and testing the items multiple times allowed the design team to refine the design and provide important information on ergonomic functions.

Co-Designer › William, age eight, was our co-designer from a local day care. He was presented with the collection of Quest cards and was immediately engaged. After reading the quick regional facts, he informed us that he preferred non-fictional facts over fictional, i.e., he was not interested in the imaginary profiles on the Pokemon® cards. Flipping over the card I watched him trace his finger over the segment of

the Trans-Canada highway and he instantly understood the indications for nearby EV charging stations. William's engagement and his request to keep the cards reassured us that the visual language and information selection was appropriate for children as an educational tool.

Anecdotal Review › The EV can only travel 160 km at maximum before it must stop to recharge; the fastest way to recharge would be via level three charging, which would take approximately 25 minutes (variable depending on current battery status among other factors)(Coloumb Tech, 2010). The design team chose a scenic urban space in the False Creek area to set up a Rest + Recharge station and conducted a role-play testing session with user Adina, age 33.

Adina imagined she was driving an EV from Vancouver, BC to Kamloops, BC, a typical highway on Trans-Canada route. Her first stop is just before Chilliwack, BC (~100 km). The chargers were designed to be instantly recognized—six feet high with an illuminating plug icon on the front surface. Pulling up to the first available parking spot next to a charger, she turns off the car and hops out to set up the charge. On the charger's touch screen interface, Adina first makes the language selection (English, French, etc.) and then follows the directions to insert and remove her credit or debit card to release the nozzle. After plugging in the nozzle to power the battery, she is prompted to

Figure 4. Puck prototype

take the puck to keep track of the charging time. Next on the interface, the local Quest card is offered for purchase at a cost of $2.00; Adina purchases the card. The recreation legend indicates that there is a nature path nearby, and she ventures out for the remaining rest period. Ten minutes remain for a full charge and the puck vibrates and emits a chiming tone. Adina glances at the puck and presses the single button to navigate through the interface. Discovering she is only a two-minute walking distance from the car—she continues reading a book until the remaining time on the puck indicates two minutes. Once the puck is returned, the car is unlocked and the nozzle returned to its casing unit. Prior to departure, Adina scans the back of the card to locate the next rest location.

BENEFITS

Our survey results provided helpful information for the design of our benefits diagram. The diagram illustrated the social, ecological and economic benefits (Fig. 3).

Social Benefits › From the data collected in our 'Clean Motion' survey it was determined that family visits are the main motivation and reason for road trips. People need the confidence that an electric vehicle can go the distance to visit their family before they will make this technology switch. Our concept lessens the dependency on petroleum, and offers a direct and positive ecological impact.

Data collected from our 'Clean Motion' survey indicated that on average, people leave their city of residence, by vehicle, four times a year. The average distance travelled each trip is approximately 400 km each way, totaling 3,200 km per year travelled specifically during road trips. Family visits were identified as the main motivation for road trip travel. Shopping and leisure ranked second, accounting for 46% of trips, with cross border or cross Canada destinations. Rest + Recharge stations could expand to provide additional services as revenue streams for local communities.

REFLECTIONS

Brian Beck of the City of Vancouver indicates that 15% of the Greater Vancouver population will become EV owners by 2020. However, only one level three charger exists in the entire country today. He also stated that the Nissan LEAF™, a major competitor in the EV market, wouldn't be available in Canada until 2015. It is evident that a large-scale adoption of EVs will not be rapid as we transition from gas-fueled vehicles.

Our feasibility diagram roughly outlines how such a system could be implemented: following analysis and verification of the rest stops by Powertech, people who are interested in conducting business on the provincially-owned rest stops could do so by investing in the purchase of an EVSE. There are many government incentive programs offering millions of dollars in funding towards clean transportation awareness and systems development (Transport Canada, 2010).

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Fig 1. Ada Chiu, Amanda Klassen, Kevin Tsuyuki Tomlinson, 2010

Fig 2. Amanda Klassen, 2010

Fig 3. Ada Chiu, Amanda Klassen, 2010

Fig 4. Amanda Klassen, Kevin Tsuyuki Tomlinson, 2010

PULSE™ ENERGY ON RE-EDUCATING YOUR MARKET

INTERVIEWER: HAIG ARMEN

Interviewees: Kara Pecknold, MAA 2009 graduate from the design stream, &
Chris Stone, principal of SeaStone Designs. February 16th, 2011.

THE BACK STORY

What does energy consumption look like? Or, for that matter, what does energy conservation look like? If you've ridden in a Prius™ taxi, you might have seen a dashboard display as a response to these questions. If you haven't, then the concept is likely an abstraction. Or, if you've participated in any of the Earth Hour Campaigns, you're likely able to visualize what turning off the power for an hour looks like; an action that is both a symbolic and practical act of energy literacy.

So what is energy literacy? What can we learn from our buildings in terms of how they are managed? How do we achieve energy effectiveness and efficiencies in the artificial world where the built environment consumes 75% of the world's electricity while emitting 33% of all greenhouse gases? What do the leading clean-technology companies have to offer facility managers in the way of solutions?

Pulse™ is both the name of a company and a powerful web-based, energy management software for facility or operation managers, and employees in commercial and institutional settings. Pulse™ monitors, displays and analyzes energy consumption per square foot per day, per week, and per month. The system is also designed to compare individual buildings against high performers and industry standards. The software collects data from a building's meter and sends real time data to Pulse™, which can then parse the data into a number of ways to achieve efficiencies of between 15 to 25 per cent. "The success of Pulse™ Energy's monitoring technology rests on the supposition that, if people can see their energy usage in real time, then they will want to reduce it because they've come to realize how easy it is to save money" (Saxifrage, 2011). A high profile example was their Venue Energy Tracker used by vanoc and BC Hydro to enable energy savings of 10 to 20 per cent at the 2010 Vancouver Winter Olympics™.

As a world leader in clean energy technology, Pulse™ promotes literacy through energy webinars and newsletters. However, as ceo Helliwell has stated "the biggest hurdle… (he says)… is capturing the attention of senior management to address the energy efficiency of their buildings" (McCarthy, 2011).

Against this backdrop, the University, in partnership with Olivelife Creative (Kara Pecknold), and Lift Studios (Haig Armen and Chris Stone), developed a design research participatory workshop to orient Pulse™ stakeholders to the opportunity of integrating design research practices into their entrepreneurial portfolio. At the outset the goals were: "to develop a practice of research with Pulses™' clients to ensure that the software was providing the requisite tools needed for energy management teams, and to gain some insights into the overall customer experience to guide future software developments" (Pecknold & Stone, 2010).
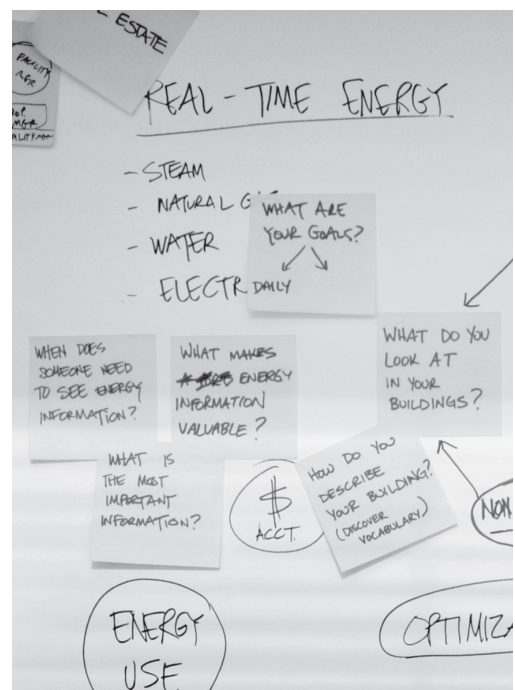

Figure 1. Participatory workshop, fall 2010

THE CHALLENGES AND THE OPPORTUNITIES OF TRYING TO INTEGRATE DESIGN RESEARCH INTO AN ORGANIZATIONAL CULTURE, A CULTURE LOOKING TO ADVANCE ENERGY LITERACY GLOBALLY.

To create a common working language for stakeholders, energy management roles were grouped by affinities into one of three categories: DECISION MAKER, KNOWLEDGE WORKER, and/or ACTION WORKER, presented in Venn diagram format. A triangle was used to represent the organization and was superimposed onto the Venn diagram.

What follows is a conversation between the facilitators of the workshop as they discuss the challenges and the opportunities of trying to integrate design research into an organizational culture, a culture looking to advance energy literacy globally at the residential and commercial levels.

THE CONVERSATION

KARA: I'm Kara Pecknold, graduate of Emily Carr University's masters program; I graduated in 2009 from the design stream. My practice involves design research and teaching. I have developed a course on teaching people how to look at social change and how to apply design process to that. I teach non-designers about design, about how designers think and how it applies to business or design in critical social scenarios.

Figure 2. Participatory workshop, fall 2010

CHRIS: My name is Chris Stone, principal of SeaStone Designs. I was Director of User Experience at Lift Studios when the Pulse™ Energy project came up. Prior to that I was the Senior Interaction Designer at Pulse™ Energy. Pulse™ Energy is a Vancouver-based company that's been around for about three years now; it provides software for visualizing energy consumption in commercial and institutional buildings like UBC campus. Their goal is to help people understand how buildings behave, to track any anomalies, and to proactively address them.

We'd identified that design research was a discipline that needed to be injected into the overall thinking process and product management at Pulse™. Kara was brought in to create a framework for not only applying the short term effect of design research, but also for creating a repeatable process by which design research could be woven into the core of the company's decision-making processes.

Pulse™ had done a lot of market research on identifying viable opportunities to validate the business model in terms of core values and clients, and in terms of risks and benefits. The challenge was to think in terms of sharing a vocabulary, and documentation, and technology. You have to understand what the real infrastructure looks like before you can build any software. As deBono (2010) might observe when wearing the Black Hat from his Six Thinking Hats® technique (the logical negative response), proposing a business anthropology or ethnographic research strategy to a client can present a difficult terrain to navigate. Often clients assume that these strategies add to the bottom line when in fact, over time, the return on investment is realized when monetized as part of the business plan.

KARA: We went through a timeline of objectives. We wanted to cover the internal, and I, as an outsider, really needed to truly understand energy, energy consumption and the system. So that, in and of itself, was a learning process, and so was processing the data gathered from internal interviews.
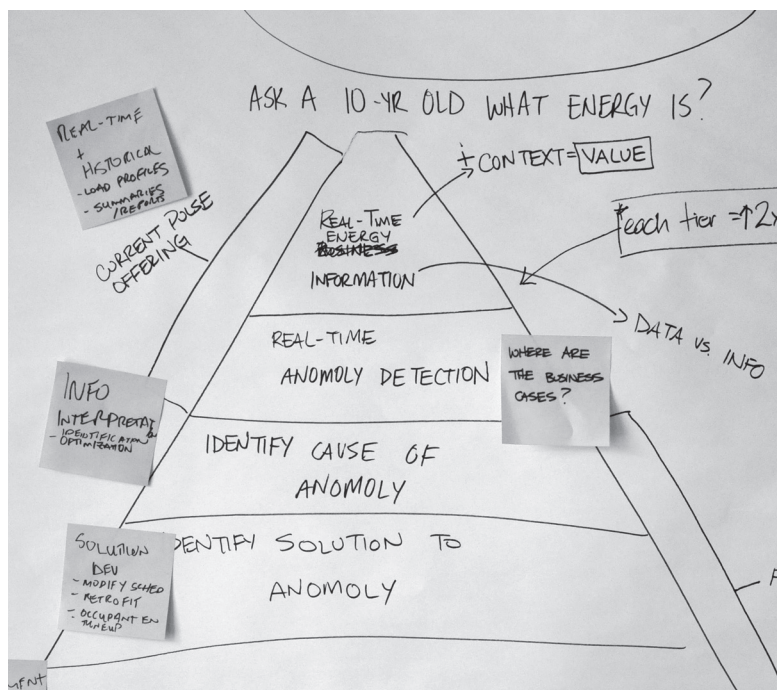
CHRIS: We also commandeered a room with lots of walls—Post It® Notes and sharpies were purchased. We started brainstorming, drawing out our thoughts, and visualizing the design challenge.

KARA: In starting our process with Pulse™ I'd put together a presentation of my background and what we were proposing as a real asset to the company. Skepticism was vocalized quite clearly in that first meeting; I wasn't from the software sector and wasn't building software, so how could I possibly understand what they needed?

CHRIS: Largely what we do in User Experience, Interaction Design and Service Design is a rigorous human-centred methodology that is not driven by subject matter. That is the benefit of being in design research: not being tied to any core subject matter because if you are, you become biased. Of course, the bias in Interaction Design is always the end user.

DECIDING ON TOOLS AND METHODOLOGY

KARA: For our initial internal interview phase, I developed a set of common questions and a few unique questions in collaboration with Chris to understand the field to then develop a methodology to apply to the client. You simply can't avoid that stage; you can't just toss a methodology out there.

CHRIS: We quickly identified that there wasn't a common understanding of the energy field language, and so we tried to capture that in the internal interview process with key stakeholders.

Our core methods were the interview process and context mapping or theming feedback using coloured Post-It® Notes and pens. Through an iterative cycle of mapping we started noticing patterns and themes (Fig. 1-3).

KARA: This kind of methodology development is the fuzzy front end in design, where you prefigure a methodology to figure out next steps such as: What is the best way to connect to such a diverse client base?

CHRIS: For the workshop we had to identify all the potential clients so we worked with the sales team to identify the background of each one. We next organized them by sector: healthcare, education, commerce or industrial. We wanted to have as broad a spectrum as possible to arrive at a telling set of data to inform the development of personas and mental models.

KARA: Defining the problem space took the greatest amount of effort. That gap between what you think "it" is and what "it" ends up being is one of the most difficult spaces to navigate. It cannot be quantified. Further, it is very hard for clients to wait for an "Ah-Ha" moment because it's the messiest of times; it's cumbersome and it doesn't feel tangible.

CHRIS: There is actually two stages to synthesis. There's the research and synthesis that has to happen before you even begin to define the audience and the most appropriate methods to meet their needs. Then there's the synthesis that happens once you've actually executed the methods. You reflect back; it's a full cycle.

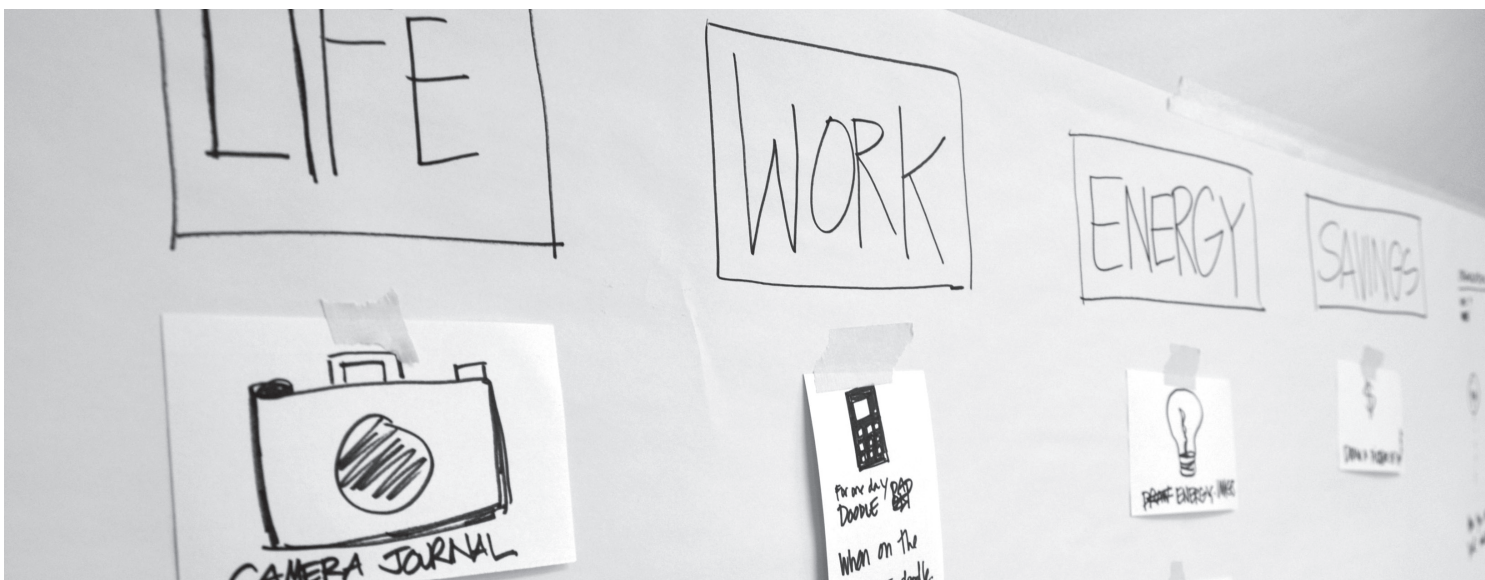**THERE'S AN EMERGING INTEREST AND BUZZ BEING GENERATED AROUND DESIGN RESEARCH.**

Figure 3. Participatory workshop, fall 2010

IF DESIGN RESEARCH IS ONLY HOUSED WITHIN
AN ACADEMIC SETTING AND IT SITS ON PAPER,
THAT'S FINE, THAT'S ONE ASPECT OF IT. BUT
WHAT REALLY HAS A LOT OF IMPACT IS WHEN
YOU CONNECT DESIGN RESEARCH TO INDUSTRY.

ITERATIVE VISUALIZING – LOOKING FOR THE OPTIMUM PULSE™ FIT

KARA: Having a repeatable framework was key; a basic Venn diagram was laid over top of a triangle. Each point of the triangle showed a place in the system.

CHRIS: It was a simple triad of decision maker [executive], knowledge worker [manager] and action worker [employee]. These are the people who are issuing directives or implementing actions to respond to a particular facet of the system, or who respond to energy anomalies such as a boiler breaking or the HVAC system running out of control.

Stakeholders were given coloured Post It® Notes to identify themselves in the system rather than having us assign them to a category such as "you're an energy manager and you're an operations person." It was more of a facilitation exercise than it was co-design. However, once they were able to self identify it got them immediately engaged in the process.

IN THE FLOW

CHRIS: We were searching for whatever it was that made up their infrastructure: shared vocabulary, frequently engaged technology (computer-email-mobile phone), types of documents that would get exchanged, and, most importantly, the people involved. The exercise prior to that had them establishing all their goals as individuals and as an organization, and prioritizing them in terms of importance, and then across time or frequency as markers for specific information.

Our goal was to unearth how Pulse™ operated as a learning organization, as an environment that's interconnected. We were looking for statements that supported that. However, a lot of the statements that came up were from the second level discussion questions. These turned out to be almost more useful than our primary questions.

KARA: If design research is only housed within an academic setting and it sits on paper, that's fine, that's one aspect of it. But what really has a lot of impact is when you connect design research to industry.

CHRIS: There's an emerging interest and buzz being generated around design research. However, there is often a sense of disappointment on the part of clients when it is explained to them. It is not a product; it is a process.

KARA: We weren't synthesizing and going "here's what you can do to the software," because we didn't have enough content. We ended up changing gears to "here's a case-study and here's a toolkit" because our real motivation was to say "the only real way that this is going to work for your company is to create a sense of value around design research." And the best way we know to do that is to say, "now repeat what we just did with other clients." We presented the work and some of the people listening to our presentation were nodding "Yes," almost like a sign of relief, going "I've always thought this and now you've validated it."

CHRIS: As a team, we persevered in a very challenging situation: we had to come up with a very compelling deliverable that changed the way people were thinking about this problem. We were aiming to change the culture of the company around thinking more deeply about their decision-making processes, how they were selling the product, positioning it, designing, and distributing it.

LEARNING AND LEADING CHANGE

KARA: For me the experience was satisfying because I felt that not only were we doing design research about software, we were also doing design research about a company in the hope of embedding the value of design research into their business model.

Since the workshop, we've had some conversations with people at Pulse™ asking us "Would you teach me how to do this?" For me the satisfaction is that someone on the interaction or development team would want to keep going because that is what ultimately impacts the design. That was the design solution.

CHRIS: The crown jewel for this entire thing for me was when someone came up to me and said "I don't see how as a company we can move forward without this being at the centre of our decision-making about our product."

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Fig 1. H. Armen, K.Pecknold, C. Stone, & K. Whistler

Fig 2. H. Armen, K.Pecknold, C. Stone, & K. Whistler

Fig3. H. Armen, K.Pecknold, C. Stone, & K. Whistler

WELL BEING

CASE STUDY: O2 MOBILITY BACKPACK

A case study on ergonomic design

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ABSTRACT

This paper documents the development of an oxygen (O2) tank carrier for adults dependent on medical oxygen, addressing the users need for comfort and safety while promoting active lifestyle choices. O2 Moba integrates two ergonomic functions: a comfortable backpack for a d-type cylinder and an adjustable rolling system ensuring improved mobility and product longevity. Usability trials were conducted with four participants; they were asked to perform in scenarios designed to simulate critical tasks. The scenarios included placing the oxygen tank into the main compartment, threading the nasal cannula, placing O2 Moba on as a backpack and adjusting for comfort, converting the backpack into the rolling system and pushing and pulling O2 Moba in a trial course. Three measures were taken: force exerted on shoulders and hips, a mixed questionnaire, and timed performance. The purpose of the study was to identify how effective O2 Moba was at meeting its design objectives and to recommend further improvements.

KEYWORDS

O2 Moba, industrial design, ergonomic oxygen carriers, ergonomic design

INTRODUCTION

Statistics from The Lung Association™ British Columbia report that chronic obstructive pulmonary disease (COPD) affects 4.8 % of women and 3.9% of men. Studies show that pulmonary rehabilitation in the form of exercise improves breathing muscle strength which is key to managing COPD symptoms. Active adults can participate in light to moderate cardiovascular exercise on a regular basis to strengthen pulmonary muscles despite their reliance on medical oxygen.

Market research shows that cylinder bags and carts available today are geared towards the elderly or for use in emergency health services. Mobile oxygen users seek comfortable product alternatives to shoulder carriers (Fig. 2) and oxygen carts. This user group includes active adults affected by respiratory disease within the age range of 30 to 70, and their mobility is paramount to their sense of independence and self-esteem.

O2 Moba (Fig. 1 and Fig. 3) is a system designed to promote active well being for users with this profile. O2 Moba integrates two ergonomic functions; a comfortable backpack for a d-type cylinder and a lightweight adjustable rolling system to address the user's need for improved mobility and product longevity. Moreover, O2 Moba addressed the stigmas associated with respiratory disease and the burden of lugging around industrial medical equipment by incorporating an athletic aesthetic.

O2 Moba was designed by Diane Espiritu, as her final undergraduate project for the Industrial Design program at Emily Carr University of Art + Design. Along with Claire Kim (Emily Carr) and Jason Leong (Simon Fraser University), the team of students conducted user trials to test the proposed objectives of the design under the supervision of their instructor Anne-Kristina Arnold in her 3D Concentration: Human Fit course.

User Trial Objectives › The purpose of the study was to find out how effective O2 Moba was at meeting it's design objectives, to identify areas of the design that need improvement and to recommend further ergonomic design criteria. The team wanted to investigate the following questions: does O2 Moba improve the

users' daily experience carrying an oxygen tank so the user can spend more time outdoors? Is it easy to use and easy to learn? Does it make daily activities more efficient and comfortable by reducing the time it takes to complete critical tasks such as loading the cylinder into the carrier? Does wearing O2 Moba aid in reducing the strain and fatigue associated with carrying an oxygen tank by distributing the weight evenly onto the shoulders and hips? Are there any potential pinch points that have been created in the harness or any other potential injury risks?

O2 MOBA ADDRESSED THE STIGMAS ASSOCIATED WITH RESPIRATORY DISEASE… BY INCORPORATING AN ATHLETIC AESTHETIC.

METHODOLOGY

Our ergonomic design included the following methods: an ethical review process, co-creation to gain insight into the concerns of the users, research and consultation with professionals in the field of respiratory health, soft product design prototyping, ergonomics, and user trials. Empathy exercises were conducted to understand the physical demands of the users carrying O2 equipment. Market research established the percentage of the population to be accommodated and their corresponding critical dimensions to identify the needs and physical constraints of primary users. Identification and analysis of critical tasks performed by users informed both the design of the prototype and usability trial design. Vigorous prototyping occurred early in the design process to arrive at a functional prototype.

Figure 1. Working Prototype of O2 Moba

Product Description › O2 Moba is categorized as a soft product, medical assistive device that functions as a backpack and a rolling push and pull carrier for a d-type oxygen cylinder. The backpack is constructed with water resistant nylon for its outer shell and lined with cork upholstery to provide lightweight insulation between the tank and the user's body. The O2 cylinder fits into an aluminum chassis that is secured at the base of the backpack; this is also where the shock absorbent 80 mm wheels, brakes and telescoping handle are secured. The harness consists of two shoulder straps connected by a sternum strap and a hip belt to aid in distributing the weight evenly over the shoulders and the hips. There are two small stash pockets accessible on the exterior of the bag. Two alternative openings allow for the nasal cannula to be threaded. The opening on the side panel is to be used when the bag is worn on the back allowing the user to thread the cannula over either shoulder; the opening on the front top center is used when O2 Moba is converted into the rolling system. Openings can be used interchangeably depending on the user's preference. Releasing and pulling up the handle from the side of the backpack converts it into the rolling system.

Percentage of Population to be Accommodated › O2 Moba aims to accommodate 90% of the population of men and women from the 5th percentile woman to the 95th percentile woman in need of ergonomic oxygen mobility backpacks; this involved integrating a range adjustment for design features. These percentiles contained the smallest and largest critical dimensions of interest.

Subjects › Four participants were recruited for the usability trials. Participants 1 and 2 were oxygen dependent females; participant 1 was within the age range of 50 to 59, participant 2 was in the age range of 60 to 69. Participants 3 and 4 are non-oxygen dependent males, participant 3 was within the age range of 20 to 29 and participant 4 was within the age range of 30 to 39. To test the range of body types that O2 Moba fit comfortably, the oxygen users in the study represented the 'outliers' of our target group falling into the 5th and 95th percentiles of our normal population. Each of the 2 female subjects had maximum and minimum critical dimensions and strength limitations according to the average North American anthropometric tables.

Usability Trail Design › The following critical tasks were identified:

1.0   Placing a full O2 tank into the main compartment of O2 Moba

1.1   Threading the nasal cannula into a hole from the interior to the outside of the bag, through the loop on the shoulder strap and zipping the bag up (this is a personal safely issue)

1.2   Placing the bag on their back and adjusting the straps and hip belt to fit

2.0   Converting the bag into the rolling system (new task)

2.1.0 Pushing O2 Moba through the trial course simulating exterior obstacles (new task)

2.1.1 Pulling O2 Moba through the trial course simulating exterior obstacles

Before the initiation of the trial, evaluators determined how much pressure the subjects could withstand on their shoulders and hips. A live demonstration of the tasks was presented before the subjects were asked to perform them. Participants were

Figure 2 (left). Uncomfortable Shoulder Carrier
Figure 3 (right). Working Prototype on User

that the back panel cannula exit be located directly under the regulator to discourage kinks to the oxygen delivery line. Participants one and two noted that there could be a hook on the telescoping handle for the cannula when O2 Moba is being pushed or pulled. Side pocket zippers could be lengthened to accommodate larger hands. Boning should be moved from the zipper hood to the top panel where it attaches to the back panel to allow users better access to zipper while maintaining the shape of the bag. A colour code system with matching colour buckles could reduce confusion as to where they attach. Graphic instructions on the back panel could help users to see how to convert from backpack to roller. The padding should be designed in such a way as to communicate that there is only one correct way to connect it. The telescoping quick release mechanism should be reconsidered since users had some difficulty locking it.

The following are the team's concluding remarks on the improvements that can be integrated into future usability trials. During the demonstration of the conversion of O2 Moba from the backpack to the roller, subjects should be shown how to adjust the handle so that it is high enough to reach the hand at a neutral position when the bag is tipped towards the user in the active position to push or pull. The simulated obstacle course tested the handling of O2 Moba in a supermarket environment and not the ability of the user to navigate the physical exterior environment; it would be beneficial to conduct a usability trial with a constructed exterior environment simulating a city block. Subjects stepped on the line of the obstacle course that was meant to represent a wall or physical object; the use of physical walls or boundaries would be beneficial. The team used an Almedic Aneroid Sphygmomanometer blood pressure mete to measure pressure exerted onto the shoulders and hips; using actual force sensors would result in more accurate readings.

The designer should never lose sight of whom they are designing for. Usability trials allowed us to gather insight into a variety of critical elements, many of which were unanticipated and had not been accounted for in the design planning. O2 Moba was designed to be pushed, making it an ergonomic alternative to pulling a load. However, the team found that half of the subjects preferred pulling to pushing. The positive aspect of this contradiction is that O2 Moba can be pushed or pulled comfortably depending on the user's preference.

asked to go through the tasks twice. The evaluators recorded the time of their first trial to completion as well as any error they may have encountered. The subjects were then asked to perform the task a second time and to 'think aloud' to voice their thought processes, which were recorded by evaluators. The participants were also asked to fill out short questionnaires to obtain more specific information.

MEASURES

Objective Measure › Force on shoulders and hips. The team used an Almedic Sphygmomanometer (blood pressure cuff) to measure the amount of pressure exerted onto the shoulders and hips of the participants. Evaluators placed pressure on the shoulders and then on the hips of each subject in increments of 10 mmHg while the subjects were continually asked if they would be able to withstand that amount of pressure for at least an hour. The final portion of the testing involved obtaining the actual value of pressure that O2 Moba created. This value was then compared to the subjective reports from participants.

Subjective Measure: Questionnaire › People's perceptions give a deeper understanding of design concerns. The questionnaire had a short introduction and asked relevant information about the tasks the subjects had performed, including Likert Scale ratings on their experience with the O2 Moba, forced questions pertaining to design features, and a rating of body part discomfort after the trial.

Performance Measure: Timed Trials and Errors in Scenario › The trials were timed to completion and it was noted if the subject successfully completed the task, partially completed the task or failed to complete the task. Errors for tasks 1.0, 1.1, 1.2, 2.0 were recorded as either; fail (subject does not complete task), partial success (subject is able to complete task however they miss a step, must redo a step or completed the task in a different order). Errors for task 2.1.1 and 2.1.2 included pushing or pulling O2 Moba outside the delineated path. Talk-out-loud trials were not timed as the time to talk increased the length of the task. The video recording of all the trails were later observed and compared to the data recorded during real time. Recordings enabled the team to observe the subject's posture and identify relevant information the users revealed about their experience.

DISCUSSION

Recommended Improvements to the Design › Use of two zippers on the main compartment was recommended based on the participants' difficulty zipping the O2 Moba up; participants often reached for a second zipper not included in the design. Shoulder straps needed to be shortened so that the adjustment was within reach; smaller subjects had difficulty adjusting shoulder straps to fit their body. Participant one suggested

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DESIGNING FOR AIR AWARENESS:
MEDIATING USER-CENTERED DESIGN AND TECHNOLOGY

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ABSTRACT

This paper examines the generative design process of a 'smart' vest embedded with sensor technologies for air quality analysis and data visualization (Fig. 1-3). By reframing our knowledge of air safety in industrial and agrarian contexts, my co-designer and I generated human-centered design relevant to everyday air quality issues. Pairing contemporary themes of reality mediation with wearable technology, the design addressed current concerns on air quality through new mediums in interaction design. This paper emphasizes user-centric methodologies in the development of human-computer interaction design.

KEYWORDS

Interaction, design, generative, Arduino™, user-centered, air quality, wearable, co-creation, air safety, co-design

INTRODUCTION

The initial inspiration for Detectair came from a highly specific contemporary issue: Indian cotton farmer's exposure to dangerous airborne particulates when using super-charged pesticides. These incidences of pesticide poisoning have been linked to a number of factors, including illiteracy and lack of training in handling agrochemicals (Mancini, Jiggins, & O'Malley, 2009), as well as inadequate and illegible precautionary information on the pesticide labels (Dhere, Prahcee, & Mahesh, 2010). The original intent was to bridge the gap between illiteracy and risk information in the products' labels; creating a product that enabled a more intuitive way to recognize the risk could abolish the borders created by language and illiteracy. Preliminary research into the surrounding socio-economic and political issues involved, revealed a scenario too complex to undertake as a design problem within the time limitations for the project.

Considering the underlying conceptual framework of air quality, information literacy and reality mediation, my design partner and I reframed the opportunity by placing it into an everyday use context instead of an industry specific context such as agriculture. We borrowed from technologies traditionally associated with industrial, high-risk environments and adapted them for use in everyday environments.

My co-designer and I conceptualized and constructed a vest embedded with sensor technology that could read ambient air quality data, and send relevant signals to light-emitting diodes (LEDs) and vibrators sewn into the vest. Detectair enabled the design team to see the potential of translating ambiguous data into meaningful information through visual feedback, which is embodied by the user wearing the garment.

CONTEXT

In its early stages of development, wearable computing prototypes were characterized by heavy and obtrusive computing gear literally strapped onto the body, as exemplified by Steve Mann's 'WearComp' developed during the 1990s at the Massachusetts Institute of Technology (Mann, 1997). Mann's 'WearComp' consisted of a series of computer clothing, which, if worn regularly, "could become a 'visual memory prosthetic' and perception enhancer" (Mann, 1997). Over the past twenty years, human-computer interactions (HCI) have become technologically increasingly complex, and a greater emphasis has been placed on user experience. Additionally, the recent explosion of peer-to-peer networking, DIY resources, and the open-source movement has made the field of wearable computing more accessible to designers, artists, and hobbyists. In fall 2009, a fellow industrial design student (Pamela Troyer) and myself contributed generative design work to this new medium, combining current health and social issues with sensor technologies, and approaching reality mediation through the visual display of data in a wearable artifact.

Figure 1. Detectair smart vest prototype

METHODOLOGY

The current state of human-computer interactions is undergoing a thorough and critical reassessment. Design thinker and advocate John Thackara outlined the need to reframe the relationship we have to technology in his paper, "The Design Challenge of Pervasive Computing" in which he stated that:

...we are looking down the wrong end of the telescope: away from people, toward technology. Industry suffers from a kind of global autism. Autism, as you may know, is a psychological disorder that is characterized by 'detachment from other human beings.' (Thackara, 2001)

Thackara's reference is to a schematic in design thinking in which desirability or human needs take precedence over feasibility (technological limitations) and viability (the business model). This model of meeting latent human needs is the foundation for user-centered design.

Reframing the Opportunity › The design of Detectair represented an attempt to shift preconceived notions of why air quality sensors and safety awareness devices are used, and by whom. The notion that a paradigmatic shift might occur through reframing of the design problem was described by reflective thinker Donald Schön in the paper "Designing: Rules, Types & Worlds:" "But when a type shifts—when, for example, it comes to be seen as mismatched to its changing environment—then the codified rules collapse..." (Schön, 2009).

What Schön (2009) was describing were the conditions under which generative design happens; because the parameters of any given rule are a 'derivative construct' (Schön, 2009) of the objects that fit within its type, the rules are mutable and dependent on the kinds of objects that are created within it. The

The success of technology ultimately depends on how it relates to its users. In the essay "Beyond the Human Eye: Technological Mediation and Posthuman Visions", Peter Paul Verbeek (2005) outlines the 'post-modern' relationship between humans and technology:

Contemporary technologies like radio telescopes make visible realities to us that cannot be perceived without these mediations. That is to say: the realities revealed by these mediating technologies do not have an equivalent to the naked eye. Such technologies necessarily need to translate what they 'perceive' to something that can be perceived by human beings... The concept of realism does not make sense here, because the 'original' which has to be represented cannot be known directly at all, but only through mediation. What 'reality' is, is co-shaped by the instruments with which it is perceived. (Verbeek, 2005)

Following Verbeek's concept, Detectair uses technology as a means to mediate a reality that goes undetected by our human perceptual system. Like Mann's 'WearComp' the Detectair was comprised of generally non-wearable electronics, sewn to the inside of the garment, that could identify invisible gas molecules in the air and translate the numerical data produced into visual and haptic feedback.

... DETECTAIR REPRESENTED AN ATTEMPT TO SHIFT PRECONCEIVED NOTIONS OF WHY AIR QUALITY SENSORS ... ARE USED, AND BY WHOM.

transformation of a type and its corresponding rules evolve through the use of methodologies like reframing design situations.

Reframing the use of gas-detecting instruments in heavy industry to facilitate a meaningful interaction between user and technology gave my co-designer and I the chance to think laterally and leapfrog into the realm of the technology-user interface of interactive

wearables. Furthermore, by re-contextualizing the use of air safety devices from industrial to everyday environments, the monitoring tool could reach and empower the larger demographic concerned with air quality conditions.

In "Design Serving People", author and pioneer of participatory design research, Elizabeth Sanders (2006), refers to philosopher Ivan Illich's theories on conviviality versus industrial tools as arguments for user-centered design methods:

Convivial tools allow users to invest the world with their meaning, to enrich the environment with the fruits of their visions and to use them for the accomplishment of a purpose they have chosen. Industrial tools deny this possibility to those who use them and they allow their designers to determine the meaning and expectations of others. (Sanders, 2006)

Through the employment of a user-centered design methodology, a previously highly industrialized technology was transformed into a convivial tool that placed emphasis on awareness and empowerment. Detectair attempted to re-adjust the control balance between user and technology, providing a tool that was not prescriptive of behaviour nor closed in purpose, but rather adaptable to the user's unique needs and goals regarding the monitoring of air quality.

Co-Creation › In an effort to produce a design solution that would give agency to the user's experience, a co-creative workshop was set up. The workshop included six young adults, all between the ages of twenty-one and twenty-seven, of varying cultural backgrounds and gender. The scope of user profiles was relatively narrow, which could account for the similarity of responses to the workshop experience.

Figure 2. The circuitry of the smart vest

... BY RE-CONTEXTUALIZING THE USE OF AIR SAFETY DEVICES FROM INDUSTRIAL TO EVERYDAY ENVIRONMENTS, THE MONITORING TOOL COULD REACH AND EMPOWER THE LARGER DEMOGRAPHIC CONCERNED WITH AIR QUALITY CONDITIONS.

Knowing about users' experiences, then, becomes vital to the process of designing the communication. If we have access to both what is being communicated and what experiences are influencing the receipt of communication, then we can design for experiencing. (Sanders, 2002)

During the co-creative workshop, participants were asked to respond emotionally and open-endedly on the subject of air quality. Participants responded to the questions, 'What is good air?' and 'What is bad air?' by making drawings. Through storytelling, participants gave an account of past experiences where air quality had directly affected them. Finally, using building exercises, participants made visualizations of air using materials such as dowels, Styrofoam™ balls and yarn. The purpose of these exercises was to tap into the latent knowledge that our users had about air. Elizabeth Sanders describes this type of design as 'participatory design', in which the key take-away is the ability to design for experience. 'Make Tools' (Sanders, 2002) are toolkits that invite and induce users to create artifacts in response to a design probe, and are used as a mechanism to help create designs that resonate with users. Sanders speaks to the problem of designing for communication by stating:

From the co-creative workshop we converged on the background quality of air, a constant we remain unaware of during normal circumstances, and which only makes itself manifest in a situation of risk through difficulty in breathing or visible as smog in heavily polluted environments.

My co-designer and I decided a wearable, not an autonomous artifact, would best answer the desire for an object capable of responding to the subject in a personal but non-invasive manner. Additionally, the background quality of air was integrated into the design through passive responses to the environment in the form of light signals that mimicked the breathing patterns of humans.

Ideation › Preliminary sketches aimed at defining the most appropriate garment type for both carrying the air quality sensor, and visually displaying the collected data. From this initial stage, it was concluded that a vest with a high collar would be an appropriate choice. The high collar affords an extra responsive feature, allowing the user to cover his or her mouth and nose in a toxic air scenario.

Prototyping › When working with new technologies and in a medium with relatively few precedents, the risk of making erroneous presumptions during the design development requires a highly iterative process of trial-and-error.
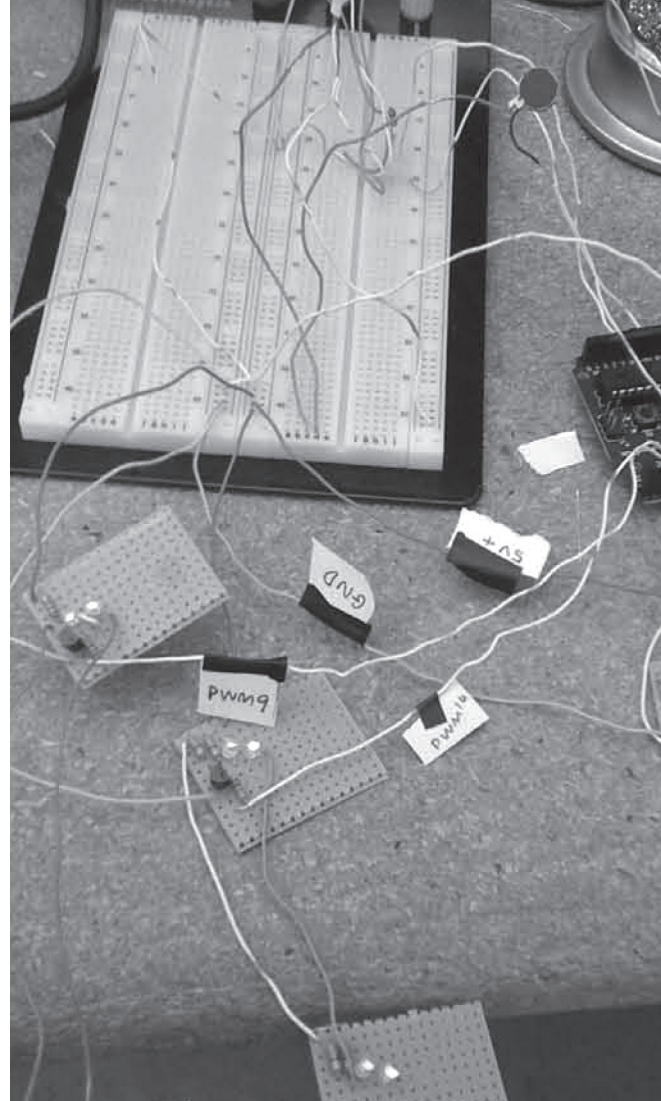
The majority of the iterative process happened within programming the code itself with Arduino©. We used an MQ-135 sensor for air quality control as it detects carbon dioxide, nitrogen dioxide, ammonia, sulphide, benzene, acetone and alcohol. These are the most common air pollutants found in engine exhaust, urban pollution, and household products; and all are found in cigarette smoke. Using Arduino©, we mapped the sensor range to four different outputs categorized as follows: 'ambient' for normal indoor air, 'toxic' in presence of a heavy pollutant, 'dirty' for residual presence of pollutants, and 'urban' for the normalizing to 'ambient' category. Finally, fade values of LEDs were adjusted to convey hierarchy of information while the 'toxic' and 'dirty' categories were given extra haptic signals using two cell phone vibrators.
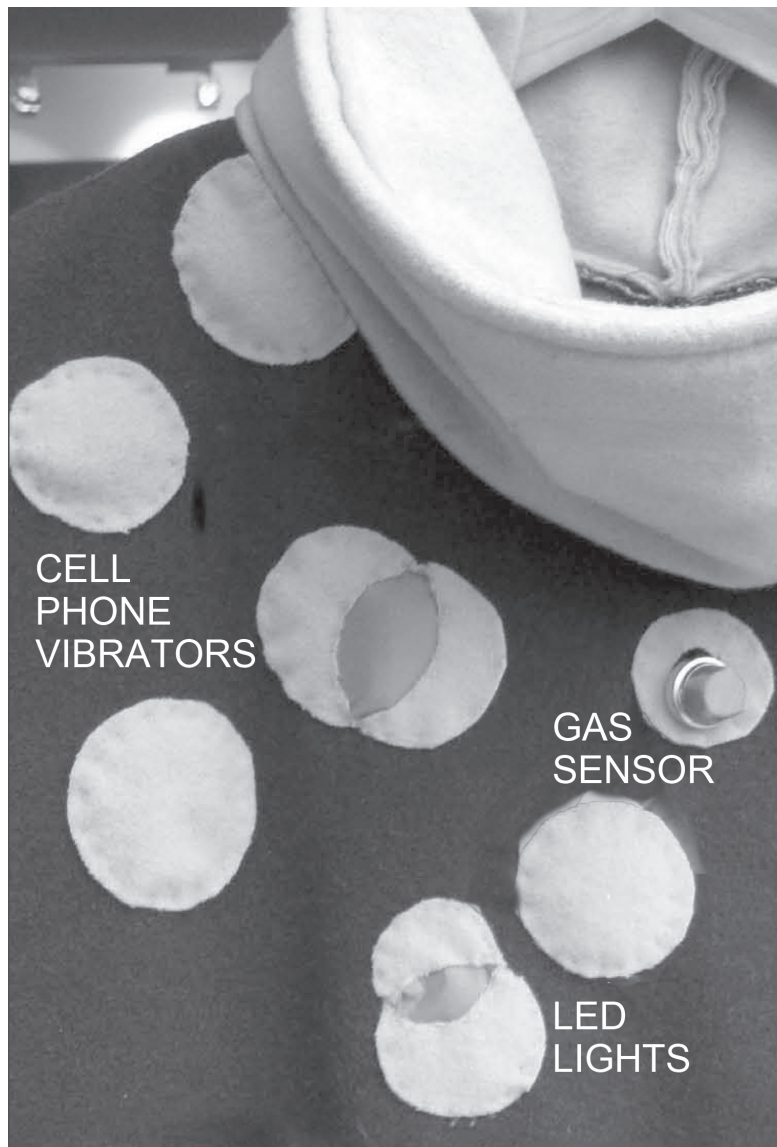

CELL PHONE VIBRATORS

GAS SENSOR

LED LIGHTS

Figure 3. Close up of the smart vest

FUTURE CONSIDERATIONS

Further development of the Detectair vest would include transferring to Lilypad™, a wearable translation of the Arduino© system. Adding a carbon filter to the high collar of the vest would increase its functionality, while reducing the garment bulk would make it more comfortable to wear. In terms of data visualization, diffusing light sources would soften the appearance of the signals and better connect with the circular appliqués' area. Finally, providing a way to output collected data to the Internet, i.e. Twitter©, would provide a new range of options for users monitoring air quality.

CONCLUSION

User-centered design and a critical approach to the relationship between users and technology were core aspects in the development of Detectair. Through user-centered design methodologies, like co-creative workshops and reframing traditionally industrial tools for design, my design partner and I were able to effectively produce generative design in the emerging medium of wearable technologies. Human-computer interaction as an ever-growing field of interest must look to design thinking; using technology as a means to mediate reality for the human user will benefit from user-centric design methodologies.

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CO CREATION

CASE STUDY: LULULEMON®

Physical artifacts and the
actions of beings in a space

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INTRODUCTION

Deb Shackleton, a colleague at Emily Carr University recently made the observation that the associative understandings we have of the world around us are a result of our innate tendencies: to socialize, to conceptualize before speaking and to co-evolve with tools.

During the Winter Olympic Games in Vancouver a collaborative project between Emily Carr University and Lululemon Athletica® resulted in a buoyant window display illustrating what university/industry based partnerships can accomplish. The success of this first project and the excellent performance of Emily Carr co-op students led to a second creative research project entitled Safety Lab. Both projects funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) have investigated the means of merging art and design based practice, and offered insight into the contextual role of artifacts and actions in enforcing and enabling communication between players in the creative economy across boundaries set by disciplines and working contexts.

THE ROLES OF ACTIONS AND ARTIFACTS IN IDEA GENERATION

Lululemon lab®—Windows Display › Where do ideas come from? The Lululemon Lab® window display campaign served to identify two key factors that have enabled discussion, collaboration, and design decisions to be made: artifacts and actions.

A series of incongruent observations led to the window concept created on the corner of Broadway and Cambie over the three weeks of the Vancouver 2010 Winter Games™: artifacts observed in the working studio space of the Lululemon Lab® concept store (large spools of thread), a visual activity on the Emily Carr website (x10 squares), and a dominant winter conversation of many Canadians (hockey) all played a key role. The display was made up of a large peg wall holding over five hundred spools of industry grade thread (generously donated by Cansew Inc.®) configured to form pixelated images of athletes: speed skaters, a ski jumper, a downhill skier (Fig. 1), and a hockey player. Actions—the interchange and re-sorting of the spools to shift the images from one stage to the next—instigated an ongoing discourse between the Emily Carr team and the pedestrians passing by. The viewers became active participants as the story unfolded, guessing the successive outcomes and critiquing the images when they could not be discerned. The project brought together an analogue-interactive display, a sustainable story, and an acknowledgment of the role of process: the time and effort required to achieve any outcome. The artifact of the peg-wall covered in threads, and the actions of the design/art team from Emily Carr University served the purpose of generating anticipation and dialogue with the passersby. The project was a successful illustration of how the relationships between objects and people can play a significant role in the generation of ideas and the subsequent social, communicative spaces that are created.

NEXT STORY: ESTABLISHING AN AGENDA

When the second project, Safety Lab, was launched in the fall of 2010 two dialogues were initiated: one centered on a broad directive to investigate the notion of safety, the other was intent on exploring means of creating and supporting collaborative conversations between individuals working in art and in design in both academic and business contexts. The project was made up of three main groups within Emily Carr: A four member research team (Rteam); a design class (Dteam); and an art class (Ateam).

Tuuli Mattelmäki in her study of design probes has noted the need within Concept design and design in general to 'tolerate things which are indefinite and open' (Mattelmäki, 2006). Set with an open-ended research mandate Safety Lab required a flexible and iterative exploration process. The use of the ambiguous to drive insight is not unique to design, it can be found throughout art-based practice. The artifacts and actions of the Fluxus movement with their 'strong commitment to everyday experience' (Ahn, 2002) are a good example of this. Collaborative Design/Art practices are able to function cooperatively drawing on this commonality. For research entities such as Safety Lab the challenge lies in understanding how this open framework fits into the needs of research partners working within closed time frames. The indefinite is an infrequently used tool in areas of the creative economy whose design mandate is driven by the rigid time constraints of production and demands at the retail level.

Safety Lab's inclusive stance meant a range of methodologies had to work in tandem; these included practice based work, critical, and generative methods (Sanders & Stappers, 2008). A modular blackboard system developed specifically for the project became the nucleus for a range of actions executed by Safety Lab encouraging conversation and interplay of ideas—circumventing preconceived barriers between the disciplines and the different working contexts.

THE ROLES OF ACTIONS AND ARTIFACTS IN IDEA GENERATION AND COLLABORATIVE PRACTICE: SAFETY LAB

Blackboards › *"New artifacts always emerge from or develop from familiar ones. Artifacts are language in interaction" (Krippendorff, 2006)*

The 6'4" blackboards designed for the Safety Lab project resemble the spinal boards used by paramedics— they visually articulate the mandate of the group to explore the notion of safety. The need for cooperation, resilience, and fortitude also implied in their form proved a good starting point to pull out ideas about safety. A system of Velcro® straps and draw cords that link individual units together enable the boards to be configured quickly into small free standing units or large zig-zag screens, dependent on the nature of the creative exploration. The blackboards have acted as agents, mediating actions and conversation and instigating ideas: in the classroom setting, at Share Nights, and through a series of public Semiotic Interventions. They have served as a medium for visual articulation, interweaving language and action to create meaning (Krippendorff, 2006).

In The Classroom › The Safety Lab boards were intended as an apparatus for individual and shared ideation/action. Initial use in the classroom setting provided a testing ground for this. Tall and vertical, the boards encouraged a full body interaction during ideation and afforded students the opportunity to step back from their work for a perspective not available on small-scale surfaces (sketchbooks, laptops). The use of chalk as a mark-making medium encouraged a willingness to move from one idea to the next at a rapid rate. Lined up around the perimeter of classrooms, the thirty boards became a space for exchange, drawing interest and creating a cross pollination of solutions as students interjected and added notes to one another's boards. Individual space was delineated by each board but en masse they worked as a shared repository of ideas—a concrete example of the use of repetition as a means for creating idea cohesion.

A MEETING OF MINDS: SHARE NIGHT

"Creating a space for dialogue with the audience is... vital to the negotiation of meanings and incorporation of multiple perspectives" (Leavy, 2009).

Safety Lab's Share Nights brought together the art and design classes, the research team and five of Lululemon's® designers. The events were an opportunity to explore the synergies of creative individuals working with diverse methodologies and from different action bases.

The strength of the first Share Night was its capacity to shift the attendees' relation to the creative outcomes and ideation from a viewer perspective to a participatory one. The Safety Lab blackboards were linked together in a zig-zag manner across the Motion Capture and Visualization Studio at Emily Carr University. Three multi-unit screens were created. The first served as a backdrop for the cultural

Figure 1. Pixelated image of skier

probes designed by the Rteam. The second as a repository for generative research: notes, visual research and storyboarding done by the Dteam. The third and largest screen displayed the ideation process from the Dteam classroom earlier that day and explored the issue of sweat. The research and process displayed on the zig-zag screens were countered and held in tension by a series of interactive wearable artifacts from the Ateam that dealt with danger. At the onset of the event two research themes identified via the Dteam's generative observe and participate research were introduced to the group: Safe TRANSITION(S), Safe BELONGING(S). This was followed by an explanation of the cultural probes developed by the RTeam, a Post It® Note session that invited participants to place comments on peers work, and finally a discussion forum that addressed boundaries delineating the art and design outcomes, and garment-based design practices from industrial design practices.

The mix of the artifacts and actions of the first Share Night introduced the industry partner to new methodologies and means of bringing 'the unsaid into the said' (Janine Bouchard, Lululemon Athletica®); or, put another way, allowing the indefinite to move from being a threat to a means of indirectly accessing product based solutions. It allowed the creative community of Safety Lab to (re)evaluate and (re) assess work; to pick, choose, and move on independently, while working on the common theme of safety.

PUBLIC/PRIVATE SPACE: SEMIOTIC INTERVENTIONS

Sets as part of staged events are transient by nature. In public spaces they have long been used as a medium to attract. In late November 2010 the Safety Lab boards were put to use in triptych booth formation. Four booths were placed in locations throughout the Emily Carr campus setting the scene for a series of creative private/public actions referred to as 'Semiotic Interventions'.

Drawing on discussions in the first Share Night about scars, birthmarks, stretch marks, tattoos, body modification, graffiti, and the identified themes of Safe TRANSITION(S), Safe BELONGING(S) interventions were developed by the Rteam including: Body Tracing: unintentional marks, Mark Making: intentional traces. These activities were to collect visual clues connected to the accumulation of signs and marks on the body. In Body Tracing participants were invited to have their bodies traced and then asked to add a mark to their chalked silhouette to indicate an unintentional mark existing on their body that they intentionally tried to cover up. In Mark Making participants were asked to enter into one of the Safety Lab's booths with a privacy screen strung across the front and draw an image on a part of their body that they felt comfortable with. The participant, using a digital camera located inside the booth, then documented the mark.

Once again the artifact/blackboard played a role in inviting, informing and encouraging the actions of participants. As subject's bodies were traced, or participants disappeared behind the screen, a social dance formed among the participants, the Rteam instigators, and the spectators—one punctuated by

AS SUBJECT'S BODIES WERE TRACED, OR PARTICIPANTS DISAPPEARED BEHIND THE SCREEN, A SOCIAL DANCE FORMED AMONG THE PARTICIPANTS, THE RTEAM INSTIGATORS, AND THE SPECTATORS...

exclamations and a series of narratives revolving around safety and vulnerability. These became as significant as the collected mark notation in providing further ideas for responses moving forward.

CONCLUSION

As artifacts, the peg wall covered in large spools and the blackboards covered in chalk and Post It® Notes put into play our innate tendency to socialize, our ability to conceptualize, and the close relation we have with the tools we use. Being mutable, they have allowed for a multitude of configurations and actions, and have consequently enabled creative dialogues and narratives for future research. The challenge going forward lies in framing responses so that they continue to pull on the ambiguous while offering poignant, relevant insight applicable to all involved: the key to this is a conscious use of a toolset that draws on the role of actions and artifacts, and which recognizes process as an essential deliverable.

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THE ANATOMY VACUUM:
A TEACHING AND LEARNING TOOL

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ABSTRACT

This article discusses the key methods utilized in the creation of a children's toy: the 'Anatomy Vacuum', a three-dimensional puzzle designed for three-year-old children. Research on behaviour, fear, toys, and mental development of three-year-old children was conducted to understand the needs, capabilities, and desires of this specific user-group. Direct user research through observation and testing with a target user provided critical and insightful feedback and was instrumental to the design. This article highlights the significance of applied research and user testing in aiding the design and development of a children's toy.

KEYWORDS

Co-Design, vacuum, toy, fear, puzzle, pre-school

INTRODUCTION

The Anatomy Vacuum project was inspired by a story entitled "The Vacuum Cleaner" in Sherry Turkle's book *Evocative Objects: Things We Think With*. The objective of this five-week project was to re-imagine an object from the book under the premise that the outcome fostered an interactive experience. "The Vacuum Cleaner" is a story about a three-year-old girl, Emma, and her fear of an object she does not understand: a household vacuum cleaner.

Emma shies away from the vacuum, as she is unsure of how to approach or interpret it. However, as she explores and learns about the vacuum she becomes more comfortable with it and her fear lessens. This exploratory approach to learning about the vacuum became an inspiration for the project.

Beat Schneider defines design as a discipline that can "help make our increasingly complex world more transparent... by simplifying complex information, processes and objects" (Schneider, 2007). The challenge for this project was determining the most appropriate way to make a vacuum more transparent to a child.

Through user and precedent research I identified the puzzle as the most appropriate didactic form for my

Figure 1. The Anatomy Vacuum Puzzle

goal. The refinement, final product, and success of this project hinged on the diversity of knowledge gained throughout the process. This paper intends to emphasize the importance of diverse methodology in the creation of knowledge, and thus, the success of the Anatomy Vacuum puzzle as a teaching and learning tool.

RESEARCH QUESTION

Could the vacuum be re-contextualized into a teaching and learning tool? My intention was to translate the principles of Emma's learning into a toy that could help a child understand the vacuum and lessen their fear of it (Fig. 1). The design opportunity was to re-imagine the vacuum as a puzzle that did not deny the essence of what the object really was: a loud, man-made cleaning device.

METHODOLOGY

Literature Review › Preliminary literature review on children's behaviour and cognitive abilities was not age specific and included a number of online educational resources including Fisher Price®, LEGO® Education Center, and the *Journal of Clinical Child and Adolescent Psychology*. Realizing a significant level of development occurs in children within a period of six months (Fisher Price®, 2009), it became necessary to determine a specific target demographic in order to better identify and comprehensively understand the capabilities of a potential user. I referred back to the story and researched the ages that most commonly experience a fear of vacuums, finding that it tended to be mainly two and three-year-olds (Henry, 1997 – 2011). Within this range, three-year-olds appeared as the relevant audience because of their curious and exploratory nature. Being at a key stage in their development, learning tools are highly recommended—puzzles being one of the most popular didactic tools (Fisher Price®, 2009).

Initially, I questioned whether creating a puzzle was an innovative enough solution. However, after reading an article by M.D. Alvin Poussaint which stated that interacting with a puzzle helps three-year-old children not only understand an object, "but the notion that whole objects are generally made up of parts", I concluded that the puzzle would be the most appropriate medium for the design of a learning experience for my user group (Linn & Poussaint, 2009).

Precedent Review › Precedent research included visits to a local Kids Market and Toys "R" Us™ store to determine 'best-selling items' and purchasing trends through conversational interviews with market shopkeepers and parents. Stuffed animals, building blocks, books and puzzles were popular items. Regarding parental motivations, a toy was likely to be purchased if it offered a unique function that distinguished it from any other toy previously viewed.

Puzzles, and objects that replicated a specific object (vacuum, lawnmower, etc) were typically bright and colourful, and provided a host of surface features (lights and sounds) for the child to interact with. Many were designed to make the imitated object seem 'friendly', and while this approach has its merits, it is also problematic because it denies the essence of the object—the very thing the child needs to explore and understand to alleviate their fear.

NATURALISTIC OBSERVATION

Sociology has introduced a number of ethnographic methodologies that, following the University's research ethics protocols, can be utilized by a designer to "identify key target user requirements, behaviours, and needs" (Vihma, 2007). I approached the day care program coordinator at Douglas Park Community Center (DPCC), and was granted permission to observe and interact with the children in their pre-school program. The class included twenty-two three-year-old children from different cultures and ethnicities, which provided for a diverse sourcing of information. The first session was observatory. I took notes on the

THE DESIGN OPPORTUNITY WAS TO RE-IMAGINE THE VACUUM AS A PUZZLE THAT DID NOT DENY THE ESSENCE OF WHAT THE OBJECT REALLY WAS: A LOUD, MAN-MADE CLEANING DEVICE.

children's behaviour: their interaction with toys and peers, level of activity, and willingness to learn. The pre-school had about a dozen puzzles, most of which were of an object based theme: trains, boats, planes, cars. I paid close attention to the children who played with them, noticing which puzzle themes were most popular and which challenged the children's dexterity. Few children played with the puzzles for longer than ten minutes and most completed a puzzle and moved on in less time. I observed that the children were most excited to see what the 'big picture' of the puzzle was once it was correctly assembled, and while some felt a sense of accomplishment for putting the puzzle together, others simply walked away.

On a second meeting, I brought colored blocks for the children to play with. The blocks were slightly different in shape and size in order to identify which sizes were ergonomically easiest for the children to handle. The interactions showed that three-year-olds' dexterity was generally fluid, and that the children preferred
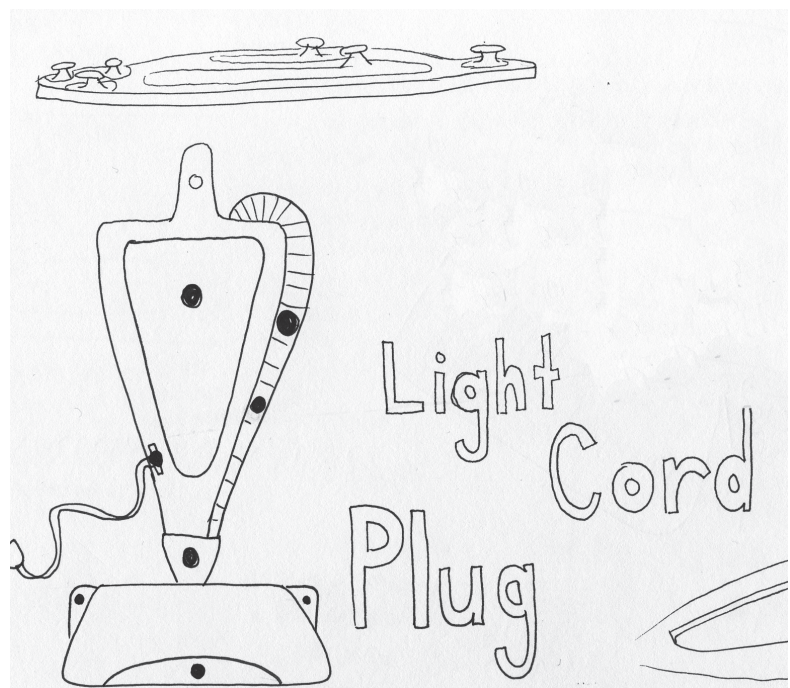

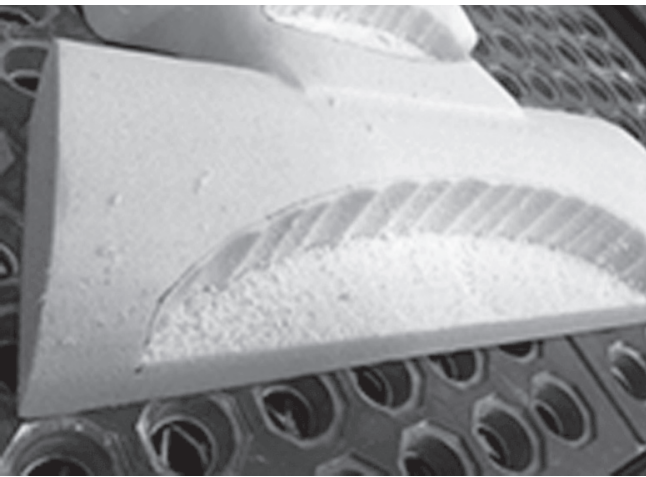
Figure 2. Iterative form exploration

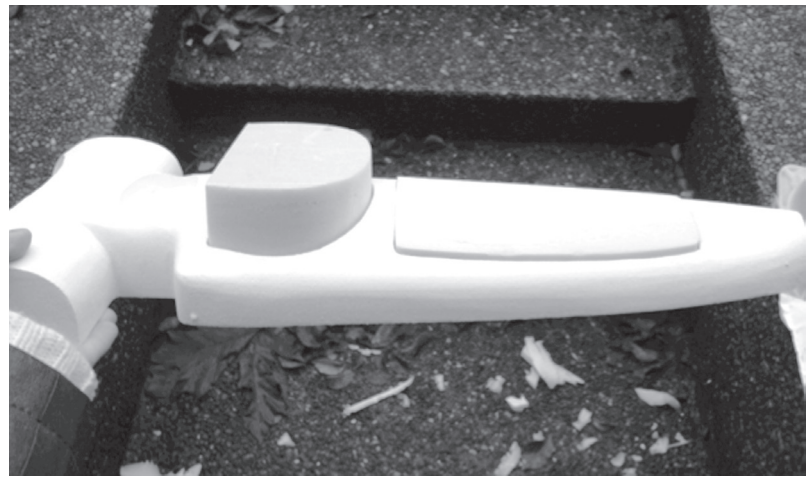**Figure 3.** Early sculpting, creating the body

Figure 4. Creating puzzle pieces to fit seamlessly

the blocks that they could really grip and wrap their hands firmly around. This information would later be applied when designing the handles and size of the puzzle pieces. The children were also consulted to determine their favorite colors; the children seemed to choose spontaneously and no gender differences were patterned in these choices.

THESE ILLUSTRATIONS GAVE THE PUZZLE LAYERS OF INTEREST AND MADE THE FUNCTIONALITY OF THE VACUUM MORE TRANSPARENT, THEREFORE HELPING CHILDREN LEARN HOW A VACUUM WORKS.

VISUALIZATION

Initial sketches were quick and simple line drawings for a range of concepts, and were followed by more detailed analytical sketches that explored and defined the desired form (Fig. 2). My goal was to produce a three-dimensional form and through iterative sketching I was able to identify important characteristics. First, to ensure a realistic presentation of the vacuum, the three-dimensional form could not be too bulbous or abstract as was the case in many of the friendly toys I encountered during research. Secondly, after sketching the puzzle from a variety of angles, I determined that the form had to be presented from the most familiar and problematic viewpoint, the front. Lastly, when sketching the actual puzzle pieces, it became clear that it was not necessarily about creating a number of pieces, but that each puzzle piece had a purpose or meaning that would enable learning about the object. It was out of this conclusion that the idea of the Anatomy Vacuum was born.

Scale Prototype › I produced three cardboard cut outs of the vacuum at different scales. A 30 x 30 cm puzzle based on the observed scale of precedence proved too small to communicate the 'realness' of the object. A close to life size prototype provided a more accurate sense of scale, yet it proved too large for three-year-olds to easily interact with. The third prototype was about half the life size model (24 x 70 cm). This proved to be a realistic, relatable, and accessible scale for the user.

Refined Prototype › The vacuum form was sculpted by hand from a block of insulation foam; refinements to the shapes and lines occurred over a two-week period (Fig. 3, 4). The proof of concept puzzle consisted of eight removable pieces, each representing a specific component: the motor, the bag, two wheels, the light, the brush, the hose and attachment. An illustrated diagram was incorporated to the back of each removable puzzle piece. These illustrations gave the puzzle layers of interest and made the functionality of the vacuum more transparent, therefore helping children learn how a vacuum works.

During the observational process, I watched a number of children spin puzzle pieces between their fingers as a means to determine how the piece would fit. This was translated into each vacuum puzzle piece having a small wooden grip to allow the child to spin the piece in the same manner.

A successful colour palette for the Anatomy Vacuum required a delicate balance between realism and playfulness. The puzzle pieces were painted in bright colors and the body of the vacuum light grey, which reflected the appearance of the household item and allowed for the puzzle pieces to be clearly identified as parts. Finally, the puzzle was mounted onto a ¼″ Baltic birch base with color-coded labels for the vacuum parts.

User Trials › Klaus Krippendoff states that "designers must realize that they cannot go alone. [They] cannot force conceptions onto others, and that whatever they propose must resonate with stakeholder conceptions" (2007). The success of the concept hinges on the ability for it to function for the user, and thus I tested the Anatomy Vacuum puzzle through a user trial. The user, who shall be referred to as

Madison, was a curious three-year-old with a mild fear of vacuums I had met during the observation sessions at DPCC. With the permission of the mother, the user trial was held in Madison's home, ensuring an informal and comfortable session.

Observational Findings › The trial was set up as a 'mommy and me' learning experience, the mother being the teacher and the child the student. I placed the puzzle on the living room floor and gave no direction to Madison on how to use it. The first thing she did upon seeing the puzzle was ask 'is that a vacuum?', confirming the realistic quality of the form. Initially, Madison was hesitant to approach the puzzle, but upon receiving permission from her mother and a little bit of encouragement, she sat down next to it. She began by removing the puzzle pieces, exposing the illustrated vacuum parts underneath. While looking and touching the illustrated components, she asked what they were and what they did. Her mother carefully explained and answered any questions as Madison put the puzzle back together, and then apart again (Fig. 5). Even though she completed the puzzle in seven minutes, she did not lose interest and continued to play with it for an additional twenty-three minutes. By the end of the session Madison was able to name the vacuum parts, confirming that the Anatomy Vacuum puzzle functioned as a teaching and learning tool.

CONCLUSION

The design process is at its best when a designer can "open up the closed algorithmic problem solving process" (Jonas, 2007) to one that reflects and adapts according to the evolving process and problem. A successful design practice must then utilize a diversity of methods, to ensure the solution is as informed as possible. This theory can be confirmed after reviewing the process of the Anatomy Vacuum puzzle. The process was lengthy, but by all means necessary as every method provided knowledge to apply towards the making of the final prototype and the rationale behind it. I had never seriously considered my design process before this project, but it is clear to me now that awareness is essential when making informed design decisions.

Figure 5: Madison and her mother playing during a user trial session

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INTERACTIVITY

CASE STUDY: EBOOK DESIGN

Introduction to interaction design

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ABSTRACT

How do you design a book that lives not between bound covers but on the virtual pages of a tablet device like the iPad®? A class of third-year design students at Emily Carr University of Art + Design tackled this problem in an assignment in partnership with epublishing company BookRiff®. Students created design prototypes that demonstrated the potential integration of next-generation features like touch screen interactivity, kinetic typography and socially generated content. The project revealed the importance of digital design training, new discovery methods and collaborative approaches to ebook development.

PROJECT GOALS

The Art of the ebook is a new research program that brings the university's expertise in communication design, media and creativity to the emergent field of enhanced ebooks. As an art and design university, we are in a unique position to contribute to the re-envisioning of ebooks, beyond the very literal representation of traditional printed pages to something radically different from printed books and even today's modestly enhanced PDFs and ePubs.

Emily Carr University's research aims to make use of the full functionality of tablet devices by creating single-title ebook applications that blur the line between ebooks and tablet apps. These might include video, animations, kinetic typography, touch screen interactivity and socially generated content. Our research has also questioned the linear structure of conventional books and looked for inspiration in video games, mind mapping and other non-linear forms. This agenda emerged from our partnership with epublishing company BookRiff™, launched by venerable Canadian publishers D&M Publishers Inc. BookRiff's™ web service allows authors to resell their work and invites users to create custom publications from content available through the service. Through the partnership, BookRiff™ aims to develop innovative design approaches to the books created on their platform.

DESIGN PROCESS

In October 2010, Professor Jonathan Aitken assigned students in the third-year communication design studio to design a new kind of product for a new medium on a platform that has just been invented. Working with SIM Centre Director Alexandra Samuel, he developed the assignment to challenge students' capacity to work with new forms while supporting an industry partner's practical need for design innovation. Students selected one of five potential titles, and re-imagined it in ebook form following standard design methodology: create a design brief, and then conduct research into the options for fulfilling the its requirements.

RESEARCH

At first, students were thrown by the novelty of researching something that hadn't been done before, without statistics, data, history or established context. Their worked snapped into focus once we directed them to start from what was known: while no ebooks took full advantage of tablet functionality, plenty of creative tablet and mobile apps suggested possible approaches or features. Students had access to a

couple of iPads® with apps demonstrating the potential of such features as the accelerometer, social content and touch screen interactivity, along with how they might make their way into a book title.

Investigating the prospective features of future tablets helped students push their thinking still further. Next, students compiled a list of ways users could interact with a device, from flipping to tilting to typing. Some project teams took this literally, cutting pages apart and reassembling them on large workflow diagrams, making new unanticipated connections. Other teams looked for new ways to present content, in some cases making text secondary to video, colour or location. Much of this stage focused on the user experience, and on creating diagrams that established how users would interact with content or navigate. Students shared their results by presenting sketches of at least ten ideas; these ideas were then refined into a single direction for each project team.

PROTOTYPING

Once students knew where they were going, it was time to show how they would get there. Students were surprised by the suggestion that they create paper prototypes for sophisticated digital interactions. But they were soon won over by what the paper prototypes revealed: icons turned out to be too small for large fingers; a layout did not suit the size of the

Figure 1. Paper prototype by Claire Balderston, Belle Wuthrich, and Brian Tong

virtual 'page'. Even interactions could be modelled with paper, for example by showing how to drag a page off the screen. As students moved from these sketches to creating digital files, they were concerned that they couldn't create functioning applications. Once again, constraint bred creativity. Some simulated time-based interactions by creating PDFs with incremental changes between pages showing how objects moved on and off screen. Other groups timed their gestures during presentations so that it appeared that

page changes were triggered by touch or movement. In their determination to show user interaction, one group even created a complete Flash® animation showing the motion of different interactive elements within the ebook. Since the iPad® doesn't support Flash®, they exported their animation to QuickTime™, uploaded it to YouTube™, and rehearsed 'following' the motion with their fingers on a rented iPad®. Finally they filmed themselves interacting with their original film, and presented the result: a convincing depiction of someone interacting with a fully functional iPad® app.

AS AN ART AND DESIGN UNIVERSITY, WE ARE IN A UNIQUE POSITION TO CONTRIBUTE TO THE RE-ENVISIONING OF EBOOKS, BEYOND THE VERY LITERAL REPRESENTATION OF TRADITIONAL PRINTED PAGES TO SOMETHING RADICALLY DIFFERENT.

DOCUMENTATION

Students created a process book as part of the documentation of their design methodology, showing their approach to the problem and documenting research, experimentation, iteration and outcomes. Wherever possible, students were encouraged to show the evolution of their ideas, what they discarded, and how process influenced outcome. This book arguably was more important for the students than the outcome. They were more self-conscious about the process, knowing they would need to document it. The books helped them see the impact of their choices and actions, appreciate the value of the design process and recognize how process documentation leads to better outcomes. With their creative thinking, rigorous design and creative simulation of user interactions, students presented their colleagues and the client with an eclectic and inspiring set of possibilities for tablet-based ebooks.

RESULTS: NEW FEATURES FOR AN OLD MEDIUM

The student prototypes demonstrated the radical possibilities for expanding both the definition and features of what we call a 'book'. From a wide range of approaches, a few emergent opportunities stood out:

Geo-Locative & Augmented Reality › Tablet devices typically support GPS, allowing applications to identify user's current geographic location. One group's vision for 'augmented reality' featured videos and text superimposed on a landscape: using a built-in camera anticipated in the next iPad® (and already available on other tablets), the reader would see their current surroundings complemented by content contributed by previous visitors to that location.

Social & User-Generated Gontent › Students shared the publishing industry's growing interest in the potential convergence of ebooks and social media. Many projects included the collaborative highlighting and annotation features that are already part of the Kindle™ and other platforms. Students also showed the possibility of embedding tweets or other social media content directly in the text (Fig. 1 + 2). Playful and touch-based navigation: A text-based table of contents is only one way to present or navigate the contents of an ebook. Students presented a variety of playful alternatives, from a mind map to a rainbow to a virtual room. For the client, the student projects raised aesthetic and functional possibilities that broadened their projected approach to template creation and their platform's functionality. BookRiff™ is now investigating ways to offer a more eclectic set of templates for books created on its platform, and options for integrating content into ebook applications that include social, geolocative and/or playful navigation features.
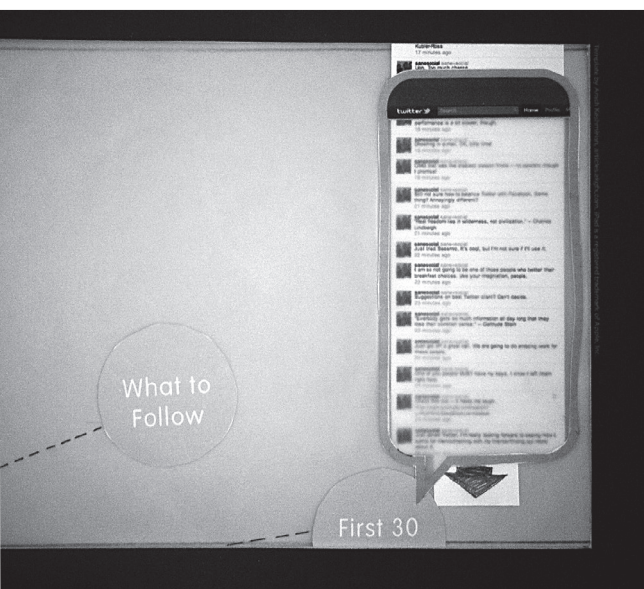
REFLECTIONS AND NEXT STEPS

Our ebook design project revealed a number of challenges and opportunities that can inform future teaching and design work in this field.

1. Digital consumers need training to become digital creators: Although the millennial generation is famously digital, we encountered significant and unexpected resistance as many students initially expressed a preference for designing print books. We speculate that millennials' digital consumption habits don't necessarily translate into digital creation: if anything, the counter-cultural tendencies of design students may lead them to establish some distance from the digital media in which they are so constantly immersed. This experience suggests that digital media assignments need to help students develop the technical skills they will need in an increasingly digital marketplace, and also to help them identify their unconscious biases for traditional media and to embrace digital media as well.

Figure 2. Concept by Claire Balderston, Belle Wuthrich, and Brian Tong

2. Designing for an emergent medium requires new discovery methods: Students were initially overwhelmed by the almost limitless potential they faced, precisely because there were so few precedents to constrain or inspire them. With little access to secondary research on which to base design prototypes, students had to rely on other methods of discovery including brainstorming in small groups, testing with paper prototypes, and critiquing each other's concepts. By working on a challenge that could not be addressed through formal research, students expanded their toolkit with approaches that can be applied to a wide range of future projects.

3. Ebooks blur the line between authors and designers: This project demonstrated the importance of a highly collaborative approach. Students who did not have significant access to the author of the text they were working with had a much harder time in the initial stages of the project. Creating a deeply interactive ebook that makes full use of the new medium is essentially an exercise in collaborative authorship. We anticipate the most interesting ebooks will emerge from author-designer collaborations that function more like the process of creating a movie or videogame than writing a traditional printed book. The other crucial collaborator is, of course, the software developer. It takes development time and skill to take an ebook from the design prototype stage (the result of this project) to the release of a user-ready app. While development tools are getting easier to use, it would currently cost tens of thousands of dollars to take even one student prototype into production. These three insights have informed our approach to the next phase of the ebook research program. First, they have underlined our commitment to ebook design as a useful medium for

DIGITAL MEDIA ASSIGNMENTS NEED TO HELP STUDENTS DEVELOP THE TECHNICAL SKILLS THEY WILL NEED IN AN INCREASINGLY DIGITAL MARKETPLACE.

helping students develop their interest and fluency in digital design. Second, they have helped us develop a suite of research approaches to fuel the discovery phase of our next ebook project: the creation of an ebook version of the Mozilla® Foundation's forthcoming *The Book of the Web*. This project helps us address the third issue: by working with a partner that has access to a huge community of software developers, students will have the opportunity to take their design work through to implementation. As we tackle this project, we will endeavour to create a toolkit that will make it easier for students and designers to build future ebooks.

Figure 3. Concept by Amy Wang

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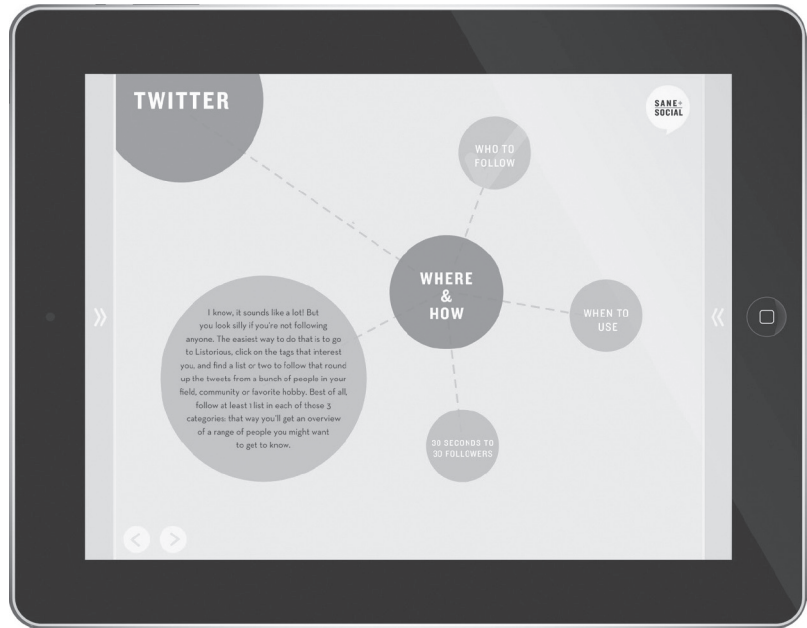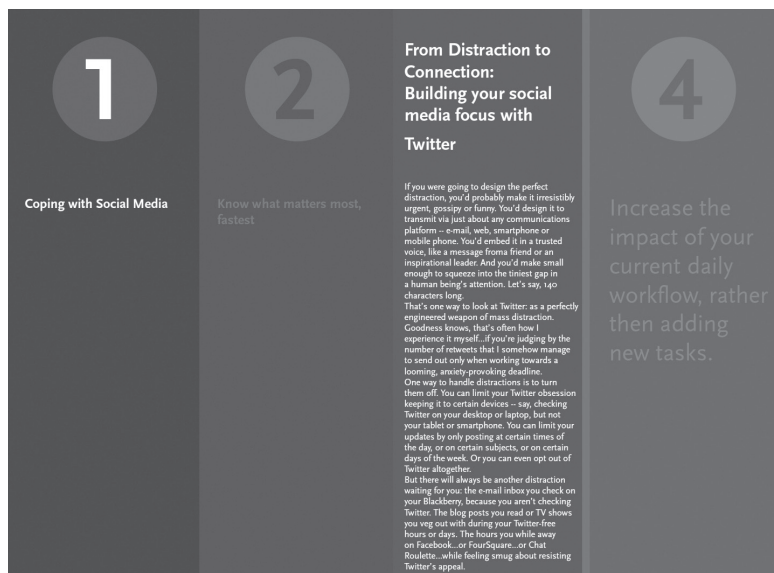
UBUNTU: SOUND RESONATING FURNITURE

Encouraging multicultural interaction via a natural medium

BENJAMIN MCLAUGHLIN

ABSTRACT

The Ubuntu project attempted to re-contextualize the sound and aesthetic of the ancient African tongue drum within the twenty-first century by creating a piece of non-electronic sound resonating furniture that enables creative expression and communal interaction. The framework and development of this piece relates to the African philosophy *Ubuntu: The essence of being human and interconnected.* The design requires no particular skill set for its use, making it accessible to a large user demographic. The project's development was intensive, involving both two and three dimensional design explorations, user studies, and extensive material experimentation.

KEYWORDS

Sound resonating furniture, furniture design, cross generational, cross cultural, African tongue drums, tribal drums

Figure 1. Ubuntu, final prototype

INTRODUCTION

In a world that is virtually more connected than ever before in history, yet simultaneously more isolated, this project sought to encourage multicultural interactions within a communal space. Sound harnesses the ability to communicate celebration, movement, emotion, and creativity. Most importantly, sound can unite people, generations, cultures and places, and embrace their diversity. This project focuses on the design object's capacity to enable a user experience bound to a specific moment in time through the creation of sound and to a specific place by its location.

DESIGN INQUIRY

The nature of the inquiry focused on designing a piece of sound resonating furniture that would encourage multicultural interaction within a communal space (Fig. 1). The design needed to be functional as furniture as well as sustainable; material selection and longevity were important criteria for fabrication. The design opportunity lay in combining two distinct object types (musical instrument and furniture) into one design, while exploring the cultural richness associated with drumming in Africa. I saw the opportunity to apply design and ergonomics as a means to enhance human experience and interaction through the tongue drum.

RESEARCH SUMMARY

Background › "There is scarcely any other West African art or custom that has aroused more widespread wonder and curiosity... as that connected with

Figure 2. View of soundboard

the wonderful West African Drum Language" (Royal African Society, 1923). Extensive research and the creation of these drums opened the door to cultivate a deeper understanding and appreciation of African culture and human communication.

African Tongue Drum › The African Tongue Drum, also known as the slit or talking drum, belongs to the idiophone family of instruments; which use vibrations for resonance. Primitively, these drums were a section of a tree trunk, hollowed out, two to six feet in length. A series of one-inch slits were cut, running the entire length of the log. The log would be struck with a stick to resonate tones. Considered by many to be the first telephone, indigenous tribes in western Africa used these primitive instruments as speech surrogates and to communicate messages over long distances. Additionally, these drums were used within ceremonies and rituals to dictate to listeners the dance to be performed.

Ubuntu › At its core, *Ubuntu* articulates a basic compassion and respect for others; it serves as a philosophical and spiritual foundation for African culture. "Ubuntu inspires us to expose ourselves to others, to encounter the difference of their humanness so as to inform and enrich our own" (Sidane, 1994). More broadly, it is a unifying vision of the world, emphasizing the interconnection of humankind (Fig. 3) (Shutte, 1993).

Sound Resonance › To effectively encourage interaction, the design hinged on its ability to maximize sound resonance and tonal quality. This was achieved by considering factors such as the use of extremely dense hardwoods with linear grain structure, the thickness of the soundboard (Fig. 2), the volume and dimensioning of the sound-box, the width and length dimensions of the notes, and minimal surface area coming into contact with the ground plane. All these factors contributed to either a perfect pitch or off pitch tonal resonance. The notes or tongues on the soundboard worked analogously to the notes on a piano.

Precedents › Within the furniture realm, very few designs exist that integrate an instrument or sound component, much less allow for face-to-face interaction. In my research, I found no precedents fully integrating these considerations.

METHODOLOGY

Methods › The development of Ubuntu relied on a constant dialogue between two and three-dimensional design; each iteration often informed and transformed the next. These iterations were in turn influenced by extensive secondary research on materials, precedents, and sound resonance attributes. Seemingly contradictory attributes and needs emerged from the consideration of form, function, materials, ergonomics, aesthetics, manufacturability, and sustainability.

2D Ideation › A goal was set to ideate and render 100 concepts on the theme of sound resonating furniture using a Wacom® Cintiq® drawing tablet in order to explore a wide range of design possibilities. Concurrently, I explored a range of contextual environments and market demographics.

3D Material Explorations › While in the midst of 2D ideation, I also began constructing drums with a wide range of imported and domestic hardwoods, looking for a combination of hardwoods that would maximize the sound resonance capabilities and tonal quality. The hardwoods used included: Birch Plywood, Pine, Maple, Red Oak, White Oak, Black Walnut, Mahogany, African Pedra, African Padauk, African Bubinga, Bamboo, Bocote, and Tigre. Hardwoods of extreme density and linear grains produced the best overall sound quality; an electronic guitar tuner and sound decibel meter were used to test them. African Bubinga and Padauk hardwoods were selected for the drum component of the final piece both for their sound quality and pertinence to the history and drumming traditions in Africa.

> **SOUND HARNESSES THE ABILITY TO COMMUNICATE CELEBRATION, MOVEMENT, EMOTION, AND CREATIVITY.**

3D Sketch Development › After reviewing the initial 100 concept drawings and evaluating the information collected from the drum form studies, my design direction was refined to a set of three concepts. I constructed a series of 1/10 scale models, each having slight structural modifications. I then created full-scale mockups of the three final designs in cardboard, theorized contextual environments, and ergonomic data.

Fabrication › Once the final design direction was chosen, fabrication started. An important consideration was to fully accentuate the use of exotic hardwoods. I decided to make use of molded plywood and bamboo veneer for the body form, giving this section a light visual weight and acting as a frame for the African Bubinga and Padauk drum. The base and seating were constructed out of two modular units (Fig. 4), which allowed for compact shipping as well as easy assembly and storage by the end user. Lastly, the final form was 100% wood and used no mechanical fasteners.

Figure 3. Face to face user interaction

Detail Refinement › In the words of designer Charles Eames, "The details are not details. They make the design." Considerations such as parting lines, edge and foot finishing treatments, sanding gradient, and the application of tongue oil were crucial considerations that made an impact on the visual aesthetic of the piece.

User Testing › User testing occurred concurrently with the two dimensional and three dimensional development of the design, yet the most significant testing phase took place following completion of the final piece. Primary research was conducted by transporting the piece to a variety of locations throughout downtown Vancouver, Canada. This allowed users to freely interact with it. Locations included: The Vancouver Art Gallery, near the beach at the intersection of Davie and Denman, and Granville Island Public Market. Participants ranged in age and cultural background. Many of the participants and spectators commented on being initially drawn to the sound, form, and natural beauty of the hardwoods. One man said, "I think that this is the first two person instrument that I have ever seen." The most recurring comment during the user-testing phase was in regard to the beauty and curious look of the African Padauk soundboard.

WE LIVE IN A WORLD OF COMPETING AND COMPLEX PERSPECTIVES, OFTEN NEGLECTING TO RECOGNIZE THE INHERENT BEAUTY THAT LIES IN OUR DIFFERENCES.

Sustainability › The most difficult aspect of this project was to address sustainability. Considering the looming threat of deforestation and continued emission of greenhouse gases, the use of exotic hardwoods posed a moral dilemma inherent to industrial design practice. I had attempted to embrace the cultural significance of the hardwoods to the African tongue drum. However, the project outcome may have adverse effects on our eco-system (via production, manufacturing and distribution) or be altogether impossible to produce. Which of these two points should hold precedence? In the creation of Ubuntu, I attempted to use excellent craftsmanship, high quality materials, and beautiful aesthetics to fully showcase the exotic hardwoods. In doing this, I intended to create a design with an inherent artifact quality; I wanted to make a design that would be passed down from generation to generation. So I beg the question; if this design lasts longer than it takes the trees with which it is constructed to regenerate; is this not a step toward sustainability?

FINAL PRODUCT REFLECTION

Throughout my design education and research, one principle in particular seemed to repeatedly present itself: human-centered design requires a designing with ethos as opposed to designing for. In addition, ensuring that a wide range of people could enjoy this design demanded an intuitive and seamless interaction with the piece in which no particular set of skills were required of the user. The overwhelmingly positive response to the design allowed me to consider it a successful beginning into the field of sound resonating furniture.

Figure 5. Interchangeable soundboard experiment

FURTHER DEVELOPMENTS

Taking an introspective and retrospective look at this project, I've found myself inspired to explore other possibilities within the field of sound resonating furniture. The potential ramifications of this idea are vast. The next phase of development will further explore the concept of interchangeable soundboards (Fig. 5). Considering that the soundboard is, structurally, the weakest component on any given piece, it could be easily replaced if ever broken or damaged. This design development would also be advantageous for the purposes of cleaning and storage. Finally, considering the fact that every soundboard has the ability to produce a distinctively different set of tones based on the arrangement of the notes, a user could potentially have a whole library of tones for one drum or piece of furniture. Additionally, I would like to monitor degradation of the hardwoods to estimate longevity of the different pieces and thus better inform my design process as I try to maximize the longevity of my design. I would also like to make the process cyclical, reinvesting profits into the harvesting of my own hardwoods, as a means to offset my consumption.

CONCLUSION

Making this piece, I had an idealistic vision of two people from opposite ends of the planet, having never met and potentially lacking the ability to speak the same language, coming together in a communal space to communicate and create as they interacted with Ubuntu. We live in a world of competing and complex perspectives, often neglecting to recognize the inherent beauty that lies in our differences. In essence, this project is about contrast and unity, about bringing together furniture and instrument, an old world craft and modern technologies, local and imported materials. Ubuntu united users, who celebrated life through the creation of sound.

Figure 4. Modular and ready to assemble

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INTERVIEW WITH THE PRESIDENT OF EMILY CARR: DR. RON BURNETT, RCA

INTERVIEWER: DEBORAH SHACKLETON

February 22, 2011

DS: We're here today with Dr. Ron Burnett, President of Emily Carr; he's been kind enough to spend a moment with us to talk about design thinking. So Ron, in essence what do you think design thinking is?

RB: Well the question is wrong. There is no essence to design thinking. In fact the beauty of the changes in Design over the last decade has been that what we describe as the essential qualities of design have been transformed; transformed from within because design has changed from within and transformed from without by the acceleration of digital culture. So there isn't one essence; there is actually something very important going on which is a change in the way that design is seen and the way that design is understood, and the way that design is practised.

If we really want to talk about design thinking we have to begin to look at the profound shift in the way that designers think about the work that they do and the world they live in. A designer of the mid to late twentieth century would have approached the task of analyzing a context, or a client's needs or company's needs in a rather direct, linear and sometimes mechanical fashion. A designer in the twenty-first century has to simultaneously be an ethnographer, and thus has to understand anthropology and at the same time understand communications and communications technologies, sign systems, the way things mean and why they mean what they mean; and they have to fully integrate those two other components into a deep understanding, a deeply layered understanding of context.

So those three pieces might be the beginning of a shift in what people describe as design thinking but it is not an essence. It is not something that essential or basic; it is something that moves through various levels; it is multidisciplinary and it is a profound shift as it moves designers away from conventional types of relationships where they are beholden to a client to a much more active role of intervener, creator, generator as well as navigator, overseer, project developer, these are all ways in which designers can now actually operate; it opens up the field to every field in the purest of multi-disciplinary ways. That's the beauty of it.

DS: On that note, a lot of terminology has been used by business schools such as Rotman and Stanford to describe this as a unique quality, design thinking, while those who come from cognitive psychology use the term fuzzy front end. How would an education in design differ from one that an MBA program offers in whatever it is that design has been doing?

RB: That's a really good question and the answer is not a simple one. You can't have your cake and eat it. If designers are by their very nature now multi-faceted, multidisciplinary and more capable of entering into many different fields, the narrower and highly specialized, and often linear approach that was used in the twentieth century no longer really applies. At the same time there is something that is unique to design as a discipline, so we have to identify that. And the uniqueness, I think, comes in the learning that accompanies becoming a designer; it would be unlikely for example for an MBA in Roger Martin's School in Toronto, for an MBA student to spend a great deal of time on meaning, communication and language

in the context of studio practices. They would probably spend a great deal of time on signification and the role of meaning in the marketplace, but they wouldn't spend a lot of time with the materials of meaning itself, building that is, the actual objects that people will use.

The materiality of meaning production is not something you ever hear them talk about because their intent is not to produce things, but instead they are involved in the marketplace of ideas. When they talk about design thinking they generally talk about what I would describe as old style systems strategic planning; they don't have a deeper sense of the multifaceted nature of the learning that goes into becoming a designer. That learning, which is highly

material and which is deeply involved with prototyping and object creation, is very different from these new MBA programs. There is just no room in those programs for studios and no time to develop and understand the studio experience.

I've seen some pilot programs where they go out into business and help businesses develop organizational plans and so forth, and they probably have value but it is not the same as actually working in what I would describe as the development of prototypes, testing and trying to understand what it is you create, why you create it and how that object or process, how creating in that context shifts the boundaries of people's relationships to what they see and do. The design company IDEO combines all of these elements into what it does, but always within traditions bound by making and creating.

I keep emphasizing the fact that designers are really twenty-first century ethnographers. I think the interesting problem is MBA schools don't understand ethnography as deeply as they assume. Ethnography in this context is not about simply becoming aware of people in a community and how they operate; it is not just becoming aware of how people think in a community or why. Ethnography is about deeply embedding yourself inside a community and understanding its complexity for purposes that may not be immediately known. Complexity would be the key word here. If

THERE IS ACTUALLY SOMETHING VERY IMPORTANT GOING ON, WHICH IS A CHANGE IN THE WAY THAT DESIGN IS SEEN: A DESIGNER IN THE TWENTY–FIRST CENTURY HAS TO SIMULTANEOUSLY BE AN ETHNOGRAPHER.

we're really to differentiate, and I think we should, I am saying that designers work in studios driven by materiality and, at the same time. they are embedded inside the external space that they are trying to understand, be it the context of a group, company or a community. That's really different from coming into something that exists and applying processes to it to improve efficiency, which is what I believe for the most part, even if they are very creative sometimes, the MBA programs tend to do.

DS: So you've been framing this as practice-based research. And sometimes the design community itself in some of the sub-discipline areas doesn't really do the degree of reflective practice that we are trying to have people here understand as the process. So what can the rigor of practice-based pedagogy and praxis bring to the professions and to other disciplines?

RB: Well, the way to think about it is that a really good scholar who gets involved in a deeply layered research project will take care to examine every facet of what they are about to embark on. And then self-reflexively examine every facet of what they're doing as they work through it. I think the biggest issue around practice-based research is that it somehow says that that scholarly intent is not visible or evident in the product or the outcome.

And so part of the challenge for designers is to be able to narrate both forwards from what they're doing and backwards from what they create. That narration, that storytelling, that capacity to engage in the narrative and to understand it and to understand its nuances and complexities and to practise that complexity within your own storytelling is a really challenging activity; it's not easy but it is fundamentally what will actually differentiate practice-based research in this area in design from other forms of research. Another example would be looking at a communications system, let's say you're looking at the ecology of communications in

Amanda Skuse, photography

a digital culture and it's a very complex ecology with many layers and facets attached to it. You are trying to understand not only layers vertically but cross-sectionally, horizontally, you're trying to get a picture, and get into a deep thinking process about it. You're unlikely to achieve an outcome from that process unless you apply a measure of rigor and multidisciplinary strategy to it and you need to be able to produce not only objects, but also processes. So what does rigor mean in this context?

Rigor means the capacity not necessarily to read a thousand books to come up with an answer to something, not to make a thousand objects to prove that one will be the best, rigor actually means applying deeper and deeper levels of analysis and research to the tasks at hand. It means bringing self-reflexivity to bear at all levels of the process. Before you begin, you're involved in trying to figure out: who am I? what am I doing? and why am I doing it? If you apply

some rigor to that, you actually get smarter as you do it. Then as you actually engage in the process, you're reflecting back all of these layers of knowledge both in the objects you create and the discourses you use. That is self-reflexivity, and rigor is an outcome of this type of engaged research and production.

It never just comes into play at the moment at which you create a prototype, for example; it comes into play well before you engage with material processes. Then, as you engage, as you create, you learn more and this process is non-linear, it cannot be defined or explained in a mechanical fashion and should not be judged entirely by its outcomes.

This circle of self-reflexivity and rigor is so intimate and deeply personal. It also challenges every aspect of traditional learning and teaching all the time, which is good because learning should always be an intense relationship filled with contradictions and challenges; you should never be satisfied that you've actually done it right. If you feel that you've done it totally right then you are not seeing the mistakes. It's better to say I've done it 80% right; I just didn't get it all done, and there is more to learn.

LEARNING SHOULD ALWAYS BE AN INTENSE RELATIONSHIP: YOU SHOULD NEVER BE SATISFIED THAT YOU'VE ACTUALLY DONE IT RIGHT. IF YOU FEEL THAT YOU'VE DONE IT TOTALLY RIGHT, THEN YOU'RE NOT SEEING THE MISTAKES.

DS: I'm thinking now about the role that Emily Carr has taken on in terms of research partnerships and how we connect to community in different ways both as a generator of new services, systems, and products and so on. How do you envision Emily Carr in the world of research?

RB: That's a really good question. So the answer is not going to be a simple one because it is a complicated answer. It is really about a continuum among learning, experiences of varying sorts and the application of knowledge to definable outcomes. Research is essentially what a baby does when they try to figure out how to walk. The baby falls, gets up, falls, gets up, falls, and discovers through continuous work that balance comes from actually walking. If you think about the metaphor a bit more deeply, you'll realize how profound it is. It's not that the baby necessarily had to prepare to learn how to walk, although time, desire, experience and family life were involved; it's not that the baby necessarily consciously had to say "I have to walk;" it's that the baby decided to walk, and then experienced the walk and then makes the walk part of who they are; that's research to me.

So research is about a tremendous amount of rigor in preparation, but at the same time, a specific desire to walk, to just do it. In the context of this University, research will always be in competition with the romantic idea and ideal that creativity is the product of inspiration. There will always be that idea of 'inspiration came from the heavens' or 'inspiration came from the earth' as the nineteenth century poets talked about it. It's an inevitable outcome of this idea that creativity is the product of something that is momentary.

The idea that creative engagement comes from within and not from a dialectical process of learning, failing and learning again has a strong hold on our culture. In this context, research and learning in design and in the arts in general is as much

about outcomes as it is about process. It is just that processes tend not to be as visible as objects. This complex engagement combines creativity, research and learning into productivity and social and economic responsiveness with, sometimes, unclear outcomes. But, we shouldn't be afraid of that.

Another way to think about this is that there is no part of your life on an everyday basis that doesn't involve research. Everyday you practise various forms of research at various levels and all of this gives you insight into your own needs and desires. Learning is research and vice-versa.

DS: What came to mind when you were talking was a comment that Paula Scher made in an interview when asked about the Citibank® logo. The remark went something like the sketch took 30 seconds on a napkin or 30 years of experience. If we take that design and learning are on a continuum, where and how does design move from the baby to say a Paula Scher, who in her sixties can talk about serious play.

RB: That's a really good question. And again the answer is not in any way a simple one. It is about something that is similar to the task of writing fiction. When you write fiction you are involved in trying to imagine as a theatre writer might or a dramatist, you're involved in trying to imagine a space, a world, and the characters who operate within it. You're simultaneously trying to imagine the movement of those characters through those spaces, through those environments and so forth—it's not dissimilar to the task of a designer: it's about the imagination.

CINÉ-TRACTS
A JOURNAL OF FILM AND CULTURAL STUDIES

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SPECIAL ISSUE

$Q(xoy)$ f_{xoy} f_{x} f_{y} $Q(x)Qy$

For the Film Studies Association of Canada on Canadian Experimental Film.
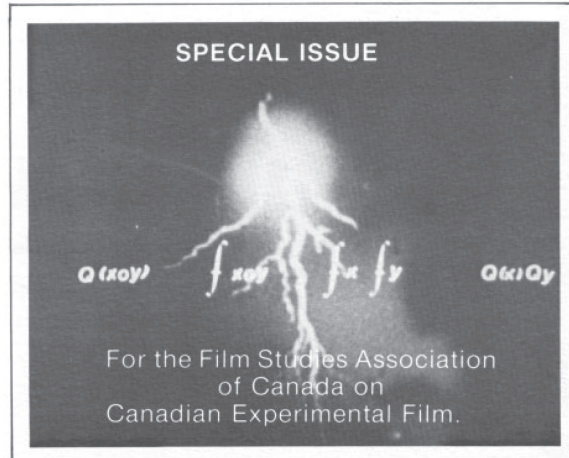
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Cinè-Tracts was founded in 1977 and edited by Ron Burnett

Imagination is about breaking boundaries all the time—stepping over the cliff and falling and making many, many mistakes and discovering that those mistakes are actually healthy as opposed to bad. It's very hard to make a lot of mistakes when the outcome is a 'C' as opposed to 'That was an amazing error. Now, where do we go from here?' That changes the whole context of learning. The irony is that designers, in essence, are at the forefront of understanding those relationships and yet, even with Paula Scher and all her wonderful ideas, a lot of the people working at the cutting edge of design thinking have yet to fully translate that into learning experiences for students.

IMAGINATION, FANTASY AND SPECULATION ARE ALL INTEGRAL AND INTIMATE TO THE ACT OF CREATIVITY AND TO THE ACT OF THINKING... STRIPPING AWAY THE BOUNDARIES AND THE LAYERS AND THEN DISCOVERING.

There is a gap. Some of it is fear. The fear that if you don't know X you won't know Y. But going back to the child, the child didn't know before they got up to walk that they were going to walk. They didn't know what walking was as a concept; they discovered it. So the other key component of the imagination is the capacity to discover, which is a word that is profoundly related to the word 'uncover'. If you think about 'uncover', it is about stripping away the boundaries and the layers and then discovering; they're all related. There is something very profound in that.

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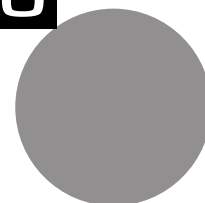WHERE IDEAS WORK
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