DISABILITY + RELEVANT DESIGN: A PORTFOLIO OF APPROACHES

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ABSTRACT
This paper discusses a multi-methodological approach to integrating the voice and experience of our diverse population (e.g. people with disabilities) into Industrial Design curricula. There is much to gain for all concerned by design students developing deeper insights and understanding of potential users, especially when we consider the shift in demographics (e.g. people are living longer, increase in population with disabilities). The role of the designer has changed, from the purveyor of taste, to one where gaining an empathic understanding of authentic human needs is critical. Empathy helps to ensure more effective design outcomes. Within the classroom we are integrating diverse voices into the designing process, by providing an interdisciplinary environment, which is also supported by empathic design research strategies ('Disability + Relevant Design' course). Outcomes of this new course have led to a major design award and have been exhibited at the Smithsonian Institution's Folklife Festival in 2012 at the Mall in Washington, D.C. The authors will present a number of case studies, including course content, exhibition, design awards, and teaching aids, in order to promote this activity amongst the design community.

Keywords: Design, disability, interdisciplinarity, empathy, inclusion

1 INTRODUCTION

Designers were once considered the source of what is fashionable or trendy. Today, the role of the Industrial Designer is changing from that of the source of trends to include that of the researcher and educator. Design research provides a means of gaining insight into user needs, how to understand those needs, and how to integrate both into the design of good products. Additionally, today design education needs to incorporate the role of the researcher into the curricula to provide students with the skills necessary to ensure our design outcomes reflect real user needs.

Traditionally, design educators incorporate many different topics into the education of their students including communication of comprehensive ideas via various types of media, form and other sensory considerations, as well as material, manufacturing, and assembly of projects. Additionally, educators' previous experiences play a part in the way they present information to their students [1]. Although this can assist them in explanations to the students on the many aspects of design processes, the students tend to have extremely limited personal experience upon which they can draw to assist them in their design practice. Improving upon this limited experience and informing them more about the design process can be achieved with alternate teaching and learning methods.

Combining methods of research and evaluation (triangulation) can assist in understanding of the problem and responding with design solutions [2]. "Designers ensure more appropriate design outcomes by engaging and studying people in their personal environments to gain a deeper understanding of user behaviours and perceptions towards products" [3]. In this paper, the authors discuss a multi-methodological approach to design education to assist students in developing deeper insights and understanding of a potential user's experience. This approach is critical to providing the students with a variety of tools to assist them in gaining understanding of authentic human need in a more diverse population (e.g. people with disabilities). The result of this multi-methodological approach in education concludes with a well-rounded Industrial Designer who can research, develop, and produce products that not only fit into the user's material landscape but also are functional. The environment provided at the University of Illinois at Urbana-Champaign is unique because it is the premier educational environment (since 1948) with dedicated facilities for students with disabilities [4]. Today, more than twelve hundred students and

between 60 to 80 wheelchair users on campus in any one semester are registered with the Division of Disability Resources and Educational Services (DRES) to receive services [5].

2 CHANGING DEMOGRAPHICS

There is also a forthcoming shift in demographics. The potential user is aging. This aging group, the Baby Boomers, will be not only the largest group of people over 50 in United States history but also the wealthiest. Nearly 60 percent of Baby Boomers currently are affected by persistent health problems. Additionally, 51 to 56 year olds present higher rates of recurring health concerns, as well as drinking and psychiatric issues. This group will represent the largest number, nearly 45 million, of households where the people are between 51 to 70 years old [6]. These statistics support the fact that because people are living longer with more health concerns, better products will be needed by this group to allow them to age in place (e.g. remain living in their own homes) for as long as possible.

According to the U.S. Census Bureau, in 2008 there were 19.4 million people (9.9 percent) of working age (16-64) living with disabilities in the United States. Of this total, 3.5 million were related to injuries incurred by U.S. Veterans in the service of their country [7]. Moreover, recent studies have found that personal listening devices such as iPods, mp3 players, and computers using in the ear listening devices/earbuds are responsible for increased hearing loss in adolescents between the ages of 12 to 19. Between a study done in from 1994 to 1998 and a similar one done in 2005 to 2006, the increase of hearing loss in this age group went from 14.9 percent to 19.5 percent. This was significant because it centred in high-frequency ranges [8]. Many other disabilities have occurred recently due to war. The U.S. Department of Labour's Bureau of Labour Statistics (BLS) states that 21 percent of veterans who served in "Gulf War Era II" have a service related disability [9]. The increases of disabilities in these disparate populations are the underlying reason that the Industrial Design curricula should incorporate the multiple methods by which students can gain knowledge to assist them in designing aesthetically pleasing products that function well to accommodate users with varying abilities.

3 MULTI-METHODOLOGICAL APPROACH

Incorporating empathic research into the design process in an interdisciplinary environment results in more dynamic and useful outcomes as evidenced by the Disability + Relevant Design course (D+RD) at the University of Illinois at Urbana-Champaign. In this course, students with disabilities (visual, hearing, and mobility disabilities) work together with students from a variety of disciplines (e.g. Industrial Design, Engineering, Biology, etc.) to create products for people with disabilities. Using this approach has resulted in award winning outcomes that have been displayed at The Smithsonian Institution's 2012 Folklife Festival.

3.1 Role of the User

Incorporating the needs of a user by undergraduate students is often difficult because of access to the user. Additionally, oftentimes the students are not familiar with nor do they have the necessary knowledge to gather and analyze this type of data. These students are more familiar with procuring data from marketing studies rather than working directly with a user. When the students complete this type of research themselves, it can facilitate a more accurate portrayal of user needs that can then be translated into enhanced design outcomes for this user. Providing the students with an opportunity to not only learn and use this method of research in their future practice but also including the students with a different lived experience into the research process gives them all insight into potential user needs. All of the students are immersed into the empathic modelling experience to begin their design process. "The only way to experience an experience is to experience it" [10]. The students with disabilities work as "life-expert-users" or "co-designers" or not simply as "users." A more inclusive environment is created with this important distinction.

3.2 Teaching Empathy

The immersion process usually begins with explaining the differences between empathy and sympathy. The student population is multi-cultural and as such a true understanding of the words is essential. Empathy is "[A]n imaginative projection into another person's situation. It represents an attempt to capture the emotional and motivational qualities" [11] and "our intuitive ability to identify with other people's thoughts and feelings – their motivations, emotional and mental models, values, priorities, preferences, and inner conflicts" [12]. The students engage together in these exercises to gain knowledge and insight into human experiences and the "normality of doing things differently" [13]. Thus, by experiencing empathic

modelling (see Figure 1) and describing their feelings through quick written reflections, the students begin to understand more about living with a disability, the difficulties one can face, and the solutions devised by their "co-designers" to augment and improve the products currently available to them.

Figure 1. Initial Empathic Modelling

Additionally, by expanding the limits of their understanding and stepping outside of their comfort zone, the students begin to increase and further develop their "empathic horizon" [14][15]. By combining a number of traditional research methods (anthropometric, market, and socio-economic) with empathic research methods such as shared language, collaboration, ethnography and empathy, more relevant and viable outcomes are possible, thus providing improved empathic horizons for all [16].

Once the students have decided with whom they would like to work and the persons for whom they are designing, (e.g. people in wheelchairs, people with visual impairments), the teams come together in a variety of exercises to assist them in the design process. Brainstorming sessions (see Figure 2) enable the students to focus upon what they believe to be issues faced by people in their group of focus. After the design students decide on their area of focus, they then work with people who fall into the group for whom they are designing. Ethnography then comes into play. Observation, surveys, and interviews can all assist in the students narrowing the focus of their project. Although all of these systems have been accepted, observation alone is not the only method of ethnography designers should use to create useful products [12]. A second foray into the disability of their focus group provides the student with a more in-depth empathic modelling experience. Once this has been completed they create mood boards to express emotion, mood or feelings evoked by their experience [17]. The students may even ask their "co-designer" to create a mood board to explain how they feel before and after the product is designed (Figure 3). The teams also may use mind maps to put their thinking on paper and help with determining the design direction of the team (Figure 4). The student teams then generate ideation sketches for evaluation by the entire class. Once the team decides which product is most compelling, initial models are created, refined, and evaluated by the potential user/co-designer.

Figure 2. Brainstorming session

Figure 3. Mood Board

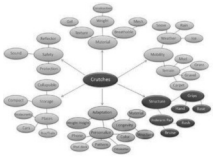

Figure 4. Mind Map

As a requirement of the D+RD course, the student teams must also write a chapter for a book. The first book, Disability + Relevant Design: We Are Able contains the student chapters from two semesters of student work, including a navigation device for people with visual impairments, stimulating toys for children with autism and deafness, a stand for golfers who have paraplegia, and a portable urinary device for women in wheelchairs. Incorporating a multi-methodological approach to an interdisciplinary environment has enabled the students to create insightful and meaningful products, which rather than being abandoned, result in assistive devices that are used.

3.3 Technology + User Needs

Two case studies completed at the University of Illinois at Urbana-Champaign campus through using the technologies provided at the Beckman Institute for Advanced Science and Technology's Visualization Laboratory offer further evidence that the multi-methodological approach to Industrial Design curricula will enhance rather than deter the abilities of the students. The first case study was done as part of an Industrial Design Graduate Studio course. The graduate student designer, who is not only a person who is legally blind but a previous member of the D+RD course, created a new design for a utensil holder for people with arthritis and other manual dexterity issues. The second case study is a product of the D+RD Spring 2012 semester from a two-student team who re-designed the crutch handgrip. In both of these case studies, the students used a 3D-scanning process, followed by CAD modelling to create the solid models, and finally, 3D-printing technologies to render a final model for evaluation.

3.3.1 Case Study 1: PalmGrip Utensil Holder

The graduate student proposed working with a person with arthritis to generate the needed user feedback. The user "Marie" is a 94 year-old female whose hands are mis-shapen caused by osteoarthritis. The process began by casting Marie's right hand by using an alginate to obtain the detail of the hand, then pouring plaster into the alginate mold (see Figure 5). Once the plaster cast of "Marie's" hand was removed from the alginate, it was 3D scanned. The resulting surface was then transformed using Geomagic Studio®. The software enabled the removal of any holes in the surface created during the scanning process, as well as extraneous bumps that were caused by air bubbles in the casting process. Once the surface was clean, only a portion of the palm of "Marie's" hand was used and then exported into a workable file for a CAD program. The graduate student completed the design of the utensil holder using the CAD software at the Visualization Laboratory. After the design and CAD files were completed, the PalmGrip Utensil Holder was printed from the files using a 3D printer (see Figure 6). "Marie" tested the printed device and found it to be "quite comfortable and easy to use." This product, both insightful and meaningful, will allow a person with arthritis to eat independently and discreetly and is currently being prepared to be prototyped.

Figure 5. Plaster cast of "Marie's" hand being revealed.

Figure 6. CAD Rendering

3.3.2 Case Study 2: The Crutch Handgrip

In the Spring 2012 semester of the D+RD course, a team of two sophomore students chose to work on a project to re-design the handgrip of a pair of standard metal crutches. A seemingly simple project, this evolved into a discerning, significant alternative to current products and one that can prevent further injury to a crutch user. The students, after using the empathic design research strategies discussed earlier (e.g. ethnography, empathic modelling, brainstorming) availed themselves of the technologies in the Visualization Laboratory. First scanning a clay model with the 3D scanner, the students used Geomagic Studio® to modify the scanned surface, adjusted the surface in a CAD computer program followed by 3D printing of the final model. This product is currently being prototyped.

Neither of these products would have been possible without first using the multiple methods the students learned while in the D+RD course. They provide a user with discreet and improved solutions, which they can incorporate into their daily lives to accommodate their specific needs. The products are therefore something that will be used rather than abandoned because they either did not work or did not resonate with the user. In both of these case studies the end user was a "co-designer," giving feedback to the students to assist in the final design concept, evaluating the models to provide the students with insight into what worked and what did not, and lastly to assist the students in the overall look of the products.

3.4 Destigmatization and Inclusion

When one looks at products for people with disabilities one can see that there is a stigma associated with these products (e.g. wheelchair, white cane). Stigma tends to be a mark of shame or disgrace. Frequently a diagnosis or disease becomes an identifying mark or characteristic specifically that carries stigma. Categorizing something as stigmatizing puts connotations on it that are generally negative. To compensate

for this negativity, many products designed for people with disabilities in the past were enabling but attracted the least attention possible [10]. The D+RD course is evidence that products can be designed to not only enable but also be appealing instead of being invisible. An excellent example of this evolution in product design is eyeglasses and how they once created an image of the "geek" or "four-eyes" during the mid-20th century only to become the fashion statement they are today. Many people own several pairs of glasses and change them based on what they are wearing or how they feel. Some even wear frames without prescription lenses. Applying good design principles to other enabling products can create a movement towards destigmatization and thus follow along the same path as eyeglasses.

Multiple methods in Industrial Design curricula can also promote the destigmatizing of products as well as an inclusive experience for not only the students with disabilities but also for students without disabilities. In an interdisciplinary environment, such as that experienced in the D+RD course, "co-designers" (student with disabilities) provide a new voice to the design process. Until recently, students with disabilities have had a very limited voice with respect to products and how they are designed. Including these students as "co-designers" gives them a voice in how they will use a potential product, what it will look like, how it will work, and most of all, whether or not they would purchase it for their personal use. Additionally, Pullin suggests other ways the design world can be inclusive. There is potential to create products using specific enabling devices such as Braille, not only as something that people who are blind use to read, but also incorporated into the product as a pattern to make that product more visually appealing to those who can see. [10] The overall design of something can create a visceral response from the user, thus if the user with disabilities is included from the beginning of the design process, this response can be one of genuine pleasure at the outcome. This type of valuable design only occurs when the designer stretches beyond their personal boundaries and uses something other than what they have experienced or a skill capital (e.g. education, environment, physical capabilities) [3].

A multi-methodological approach to Industrial Design provides the student designers without disabilities an inclusive experience as well. They are immersed in a new learning experience with students from disciplines that are sometimes very different from their own–some scientific and some language based–to work collaboratively in creating a product for an end user with a disability. Mutual respect is a cornerstone of collaboration, as is tolerance and patience [16]. These students come together using a shared language to design, develop, and produce viable, inclusive outcomes for students with disabilities.

4 CONCLUSION

Using a multi-methodological approach in Industrial Design curricula has benefited not only the design students but also those sharing in the collaborative space. They learn the different methods they can use in their design process (e.g. empathic design strategies, traditional design strategies, technology). This dynamic method engages the student designer and user (co-designer), as collaborators using a shared language to create viable, insightful outcomes for real needs. In courses at our University that incorporate this approach, the faculty recognize that students that have experienced these specific approaches to designing for "the other" in their industrial design education have actually incorporated it into their working design practice while they are in school. The faculty has also recognized that students who have not experience this approach defer to their own universe. Students who completed this course continue to use these new methods in the process. One stated, "I tend to use the process when it comes to designing services and experiences" and another said, "In one scenario I attempted to have management do some of the tasks they asked of those they look over."[18]

As the population demographics begin to change to include more individuals with disabilities in disparate groups, enabling outcomes are necessary to provide these groups with quality of life, aging in place, and independence. Several examples of the products created during the D+RD course were displayed this past summer in Washington D.C. at the Smithsonian Institution's 2012 Folklife Festival (Figure 7) Campus and Community where the University of Illinois showcased "Accessible Education." These outcomes embody inclusion and destigmatization of products for the population who are disabled.

Figure 7. Exhibit at Smithsonian Folklife Festival

A student designer's education can improve the skills necessary to create these enabling and aesthetically pleasing outcomes and incorporating this approach in the Industrial Design curricula can ensure that these designers will have the appropriate skills allowing them to enter into the many areas in their chosen field. Integrating classroom experiences (D+RD course), visualizing the design concept (Beckman Institute Visualization Laboratory), supporting the students outside the classroom through the Office of Technology Management, and providing venues for publication, will assist these students in developing their design processes and practices. Identifying user needs (empathic modelling) will reach a more diverse population that ranges from medical doctors (Malaysia), business, engineering, boy scouts, and design students. The far reaching implications of this multi-methodological approach starts with the Industrial Design program, which then expands to the University community at large, the local population, and eventually the most diverse of them all, an international population.

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