

DESIGN FOR EXTREME POVERTY AND DISABILITY: A SOCIAL INNOVATION PROJECT CASE STUDY IN RURAL UGANDA

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1. BACKGROUND

The Design Innovation for Disability in Kasese (DIDK) project addresses needs of people with disabilities in Kasese District in the western part of Uganda. Design for extreme poverty and disability includes the identification and application of a range of cultural, disability related, economic, geographical, and social issues. This requires an extensive network of participant and expert involvement to arrive at real world feasible outcomes. Specifically the DIDK project teamed four final year undergraduate students as well as faculty at the School of Industrial Design at Carleton University with a range of international organizations. The team collaborators included the Research Education Accessibility and Design initiative (READ) at Carleton University as well as the CanUgan Disability Support Project. The latter being a joint undertaking between a Canadian NGO (Hindu Society of Ottawa Carleton) with a Ugandan umbrella organization called Kasese District Union of Persons with Disabilities (Kadupedi), which represents over 50,000 people with disabilities. The project was aided by expert advice and involvement from three companies: Catapult Design and Whirlwind Wheelchair, both from San Francisco, USA and Dana Douglas Inc. in Ottawa, Canada.

The work in Kasese District had been initiated in 2011 through The CanUgan Disability Support Project, which had already been raising money to purchase and locally distribute products for people with disabilities. Involvement by the School of Industrial Design was facilitated through the READ initiative at Carleton. Although the School has a long history of involvement in design for disability, the complexity of extending such a project to include extreme poverty in an international setting would clearly be challenging. This broader scope was made possible through a grant from the International Development Research Centre (IDRC) in Ottawa, Canada.

2. EXTREME POVERTY AND THE OTHER 90%

Given the high level of poverty facing the majority of the world's population, this paper refers to the "majority world" as opposed to "developing/third world", which has a negative connotation (Balaram, 2010).

In recent years designers and design educators alike have begun to recognize that professional design has typically been limited to the most affluent 10% of the world's population. The Industrial Designers Society of America (IDSA) held a Design-About Workshop in Palo Alto, California in 2005 to discuss how the "Other 5 Billion People" on this planet could benefit from design, which was then followed by the creation of the IDSA "Design for The Majority Section". In 2007 The Smithsonian Cooper-Hewitt, National Design Museum held a groundbreaking exhibition titled "Design for the Other 90%". This exhibition explored a growing movement amongst design professionals to use design as a form of social entrepreneurship to "help alleviate the suffering of those lacking even the basic necessities" (Smith, 2007, p. 6). Such design activity is usually motivated by social and developmental needs and typically involves "non-commercial clients for example governments and NGO's" (IDSA). This also recognizes the emergence of design firms that specifically focus on low income communities and examine the design opportunities that exist in those situations. As more and more people are lifted out of extreme poverty they will continue to be able to have higher standards of living exemplified by access to goods and services. This is not only a matter of philanthropy, but also the realization that designs for the majority world market poses a growing opportunity. Design educators correspondingly need to emphasize the design objectives associated with the needs of this majority such as low cost (and sustainable) production, simplicity, functionality and local availability of spare parts.

Given the complexity of poverty, the distinction between relative and extreme (absolute) poverty has to be defined. Relative poverty is common in industrialized countries where it is evidenced by lower living standards, but not typically in terms of hunger or survival. Extreme poverty on the other hand is more common in the majority world, where it forces people to struggle for survival due to their lack of basic necessities such as clean water, housing or food. The international standard set to define extreme poverty is an income below \$1.25/day. Whereas Uganda's last official census in 2002 measured 24 million people (Uganda Bureau of Statistics), the current estimate of the country's population is closer to 35 million people (CIA, 2013). In Uganda, the number of people living below \$1.25/day is 38% (The World Bank), which thus represents 13 million people.

3. PERSONS WITH DISABILITIES AND THE MAJORITY WORLD

This paper refers to "persons with disabilities". This emphasizes the person first and the disability second, while also acknowledging that disabilities range from mild to more severe. According to the World Health Organization "Disability is thus not just a health problem. It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives". It affects approximately 15% of the world's population corresponding to about 1 billion people worldwide (WHO, 2012). In Uganda this percentage is estimated to be even higher, given a high prevalence of diseases, accidents and historical conflicts. As a result 5-6 million people are believed to be living with disabilities in Uganda. Studies from Uganda show that the poorest of the poor are usually persons with disabilities (Ahmed, et al., 2007). Additionally this does not take into account the lack of other human rights that people who live with disabilities in extreme low-income communities are faced with on a daily basis. Within that is the challenge for these individuals to fulfill their right to work and have an income, access to basic health care, education, as well as social and cultural involvement. According to Baluku Peter, Coordinator of Kasese District Union of Persons With Disabilities (KADUPEDI), these people face the cultural stigma of being "non-providers". This means that they are often seen as a burden in the extended family concept rather than as net contributors. Interestingly if an individual with a disability can contribute even something small to their family and/or income, this stigma can be lifted to a certain degree.

4. THE STATE OF UNIVERSAL DESIGN, ASSISTIVE TECHNOLOGY AND ACCESSIBILITY IN UGANDA

Many international charity organizations import and donate wheelchairs that are unsuitable for the local environment and needs (Oderyd & Hotchkiss, 2004). These imported wheelchairs are neither able to function given the state of roads and infrastructure nor is there an availability of local spare parts and in many cases the construction makes repairs impossible, due to the lack of local skills and equipment to repair aluminum frames.

This situation is quite common in the majority world and has led to the adaptation of different mobility devices, most notably the hand-operated tricycle. These are easy to build and use bicycle parts and technology instead of more complicated folding frames and wheel designs used in wheelchairs. A wide range of hand built models exists across Africa and Asia, depending on local knowhow and available materials. The added benefit of tricycles is that they are useful to cover longer distances, much like a bicycle and are most appropriate for the terrain. In 1967 Dr. Huckstep designed a locally manufactured non-folding wheelchair using appropriate technology and bicycle parts within the Mulago Orthopaedic Workshop in Kampala, Uganda. These wheelchairs are still in wide use in Uganda and are built to be extremely tough and serviceable. The problem is that they have been described as bulky, non foldable and not easily transported utilizing public transportation, additionally the production output has largely reduced due to a lack of funding at Mulago (Oderyd & Hotchkiss, 2004).

"Universal Design, Design for All and Inclusive Design all provide guiding principles that promote design that considers the needs of everyone. These principles seek to create an environment that is usable by the greatest number of users, regardless of ability" (Canadian Human Rights Commission, 2006). In Uganda such principles are yet far from implemented due to poor road conditions, non-accessible and unhygienic public toilets, as well as a public transportation system that is unable to accommodate assistive devices and a range of other barriers such as cluttered and poorly maintained sidewalks. Given these problems, this places additional burden on the assistive devices that people use.

5. LOCAL OR GLOBAL MANUFACTURING

The debate about local or global manufacturing is quite relevant to design in Uganda. On one hand the country does not have a large-scale manufacturing sector and very little infrastructure exists for quality manufacturing of

goods. The fact is that many products can be produced more economically and to a higher degree of quality off shore than within Uganda. On the other hand, any production of goods in Uganda will both increase the local knowhow and manufacturing capability and allow the local manufacturers to work more closely with end users to produce products that are unique to the local market. Also the economies of scale would dictate much larger production volumes for any imported product and raises the question of availability of local spare parts.

Outdoor artisans or “jua Kali” –translated in Kiswahili as “hot sun”, form part of a large informal industrial sector in eastern Africa (Kenneth King). Also called “katwe” in Uganda, they largely dominate the current state of manufacturing in the country, as evidenced while driving through the urban centers where they are found making a wide variety of household goods and furniture. The ingenuity, creativity and value of these local artisans is quite remarkable as confirmed in interviews with faculty at Makerere University in Kampala. One specific local artisan had been chosen as a suitable manufacturer for the DIDK project. This was based on his successful production of a series of tricycles for CanUgan and also his level of interest in new challenges. The manufacturer, named Kio, was operating by the roadside and aided by a handful of assistants. He produces assistive devices and also bed frames and a range of other metal welding related projects.

In light of the problems seen in imported wheelchairs there exists a need to design suitable and cost effective devices for people with disabilities that can be built and maintained by local tradespeople in Kasese, in order to reduce logistics, keep costs low, build local expertise and contribute to local economic development. CanUgan had already funded 48 hand-pedaled tricycles that were built by a local manufacturer in the district. These tricycles provide much needed support and were built through the resourcefulness of the local manufacturer. Whereas it was clear that a more formal design process offered the potential to improve the production capacity, usability aspects and quality of the tricycles, it also raised the prospect of outside design support to stimulate innovation and inspire stakeholders in Uganda to realize the potential and importance of designing for people with disabilities.

6. METHODS

Four final year Carleton University students from the School of Industrial Design were chosen from a class of 33 students to take part in the DIDK project, as part of their yearlong major capstone studio project. They were selected, based on their stated interest and subsequent interview with the studio instructor. The Fall Semester focused mainly on research including ethics approval and conceptual development. The Winter Semester focused more on implementation including a testing phase and subsequent design refinement.

The objective was not to “design for people”, but to “design with people”. The research and design efforts therefore leveraged participatory design methods including “co-design” activities as outlined by Sanders and Stappers to include people not trained in design working together with designers (Sanders & Stappers, 2008). The project team coordinated several initiatives and events to this end. A preliminary briefing in September 2012 on the work of the CanUgan Disability Support Project introduced students to the experiences and many issues they would need to consider when designing with someone in Kasese, Uganda.

After completing additional secondary research a workshop was held at Carleton University in November 2012. Representatives from Uganda were initially included in workshops and additional meetings through online video conferencing. Experts from organizations with experience in design and disability for low-income communities and developing countries were also invited to the workshop to share their knowledge and facilitate brainstorming and ideation.

Prototyping was a primary strategy for successful project output and was conducted both at the School of Industrial Design shops and by the tradespeople in Kasese. Prototyping in this context is an interdisciplinary and iterative research method that allows stakeholders to give feedback and to participate in the co-design process. From an educational point of view it was also necessary in order to allow the students to learn more about manufacturing and the limitations that they would encounter in terms of making products in Kasese. Prior to the field trip to Uganda, final instructions were sent to the manufacturer Kio so that his shop could start building prototypes for field evaluation in time for the visit in February.

The 16 day trip to Uganda was multifaceted. It included visits in Kampala with rehabilitation experts and production workshops. This was followed by a 10 day fieldtrip to Kasese where the group met with disability advocates, spent considerable time with the manufacturer in co-designing working prototypes and engaged in prototype testing with end users. Ethnographic studies also included visits to the homes of people with disabilities.

7. OUTCOMES

Given the immense need for better mobility products and the current success of manufacturing and distribution of tricycles made locally in Kasese, the design of a next generation tricycle was chosen as the project genesis. The students started researching this problem by trying to understand a wide range of contextual issues. On one hand they did secondary research through literature reviews and online readings about Uganda, poverty and design for the other 90%. They also had access to video and stories that had been documented by CanUgan as real life personas and scenarios. This was an important aspect of creating empathy with the end users.

It was however clear that none of the students had ever built a tricycle and needed to immerse themselves in bicycle manufacturing and servicing. To this end they received a quarter scale model of a tricycle from Uganda that was built by Kio. They also started building a crude low fidelity full scale model tricycle in the student shops so as to experience the problems and issues with manufacturing first hand. As much as possible they limited themselves to tools that they knew were available to Kio. This was an important exercise and established a sense of confidence and comfort with the manufacturing aspects.



Figure 1. Quarter Scale Model Built by Kio (Left), First Generation Low Fidelity Student Tricycle Model (Right)

This reverse engineering lead to many insights about how the product was being made in Uganda and what potential design problems existed in the current version of the tricycle. What also began to emerge was a broader understanding of the tricycle as not just as a form of mobility, but as a potential platform for economic generation. In addition the limitation of the tricycle as a form of transportation also became more obvious, raising the prospect of additional mobility devices that could perhaps be produced locally.

The involvement of end users in Kasese, was initiated through email and questionnaires to address specific questions or hypotheses as they arose. Establishing a rapport between the people in Uganda and Canada also included social media in the form of a blog that was created early in the process for the purpose of sharing information with stakeholders anywhere in the world (Hadley, Liu, Theobald, & Wongkee, 2012). This also became a project results depository.

Representatives from Catapult Design, Whirlwind Wheelchairs International, CanUgan Disability Support Project, READ Initiative and the School of Industrial Design participated in the November workshops in Ottawa. Ugandan participation and interaction was enabled through online video calls using Skype. The Uganda stakeholders included members of Kadupedi with various degrees of physical disabilities as well as the manufacturer Kio. The interaction and open dialogue allowed the students to get invaluable feedback and encouragement on their design directions.

By the end of the Fall term the students had produced their preliminary concepts and ethics applications for the project in order to fulfill fieldwork testing in Uganda. New ideas for products envisioned by students were communicated further through email and using simple descriptive graphics to representatives in Uganda. These were printed out and discussed with end users as well as the manufacturer who would then send feedback and comments to the students via email. The blog was also updated with a project description that outlined each student's area of focus, allowing Kadupedi and Kio to have a more personal understanding of the team's efforts.



Figure 2. Student Blog Showing How the Students Identified their Project Areas

8. FIELD VISIT TO UGANDA

The logistics of arranging a field trip to Uganda for a group of 7 people was a large undertaking. Cost effective safe lodging and travel arrangements had to be considered in detail. Inevitable culture shock is another main consideration and needs to be pre-empted with some training. In this situation all the students had extensive travel experience, which was a practical benefit. As well, the ethics implications and approval process required University involvement and expertise. Fortunately, the experience of the NGO as a research collaborator that accompanied the team on the trip was invaluable in terms of the introductions and other experience offered.

The trip from Kampala to Kasese took 9 hours as it is in the far western part of the country adjacent to the Democratic Republic of Congo. The landscape was noticeably more challenging than foreseen with a lot of mountainous and steep terrain making it difficult for anyone except in low lying areas to use tricycles or wheelchairs.

The field visit included working directly with Kio the manufacturer to further the prototypes, including alterations as well as evaluation with real end users. Prototyping thus served as a tangible means of sharing ideas and rallying

people around the issues surrounding accessibility and independence. What became immediately apparent is that the local community wanted to be involved. People with disabilities would notify each other through cell phones and other end users would show up interested in finding out about the project. Non-affiliated NGO's would also hear of the project through this electronic grapevine; this also broadened the project visibility.



Figure 3. Students Co-Designing with Local Manufacturer and End Users

Furthermore ethnographic studies included field trips to rural areas. This included a trip to the border of the DRC to engage with a group of people with disabilities that were using the tricycles for cross border trade in soft drinks. It also included trips to several homes of people with disabilities. This exposed the team to the primitive living conditions and poverty that some of these people were living in. It also shed light on the small size of the living spaces and lack to some basic amenities such as electricity and running water.

The trip to Uganda concluded in Kampala with a visit and knowledge exchange with faculty at Makerere University and Kyambogo University. The former has a Faculty of Engineering as well as Art and expressed an interest in further collaborations. Kyambogo has a Faculty of Disability Studies and would also make a very good partner in future collaborations.



Figure 4. (From Left to Right): Final Prototypes Produced in Kasese Including a Modified Tricycle Frame, Pedal Powered Grinding Tool, Mobile Technology Platform, Low-Cost Rolling Walker

The students' final design consists of four connected projects looking at opportunities to expand on the existing tricycle.

- Alyssa Wongkee focused on a redesign of the tricycle frame, looking at how to make it more structurally rigid and economical to produce through a simplification of the manufacturing process and reduction of material. The benefit of the adaptations proposed were immediate and apparent through testing that future tricycle frames are now built in this manner.
- Using the tricycle as a foundation for accessible mobility, Carmen Liu looked to take advantage of the power output from the tricycle's drivetrain to allow for the potential of a collection of tools to be powered through hand

pedaling. This project took the form of a grain grinder that works by pedaling the tricycle and allowing them to provide a mobile grinding service to families living in the rural area. This project received great interest by locals as it provided an opportunity for individuals with disabilities to be able to contribute to their families and communities.

- Following the idea of empowering people with disabilities, Andrew Theobald also leveraged the tricycle as a means for generating income through small businesses. A common mobile communication system was adapted to be mounted and stored onto the tricycle, based on studying how users would interact with it in their daily business.
- Lastly, Ruby Hadley's project explored opportunities beyond the tricycle wheelchair based on the existing manufacturing platform and how it could be leveraged to produce different assistive devices. This project took the form of a rolling walker designed to withstand the local terrain and simplified to be efficiently produced for a fraction of the cost of those seen in North America.

9. CONCLUSION

The student projects were successful in facilitating a design process with the direct input and involvement of both stakeholders and beneficiaries. These students and their projects were able to demonstrate the value of prototyping and co-designing with end users and spark awareness about design with and for people with disabilities. As a final deliverable for the course, the students completed their final design iteration upon return to Canada for their graduation show. These included some final tweaking with a plan to have those prototypes replicated in Uganda.



Figure 5. Final Prototypes Recreated in Canada for Student Final Graduation Show

Two delegates travelled to Canada from Kasese to partake in the final discussion and next steps for an ongoing project relationship. The hope is to continue to work together and form a sustainable alliance. The project has been described by many stakeholders as a big success and lead to the following insights:

- People with disabilities in Uganda are not only looking for mobility aids, but also a way to gain more economic independence through the better use of mobility aids.
- The focus of two of the projects is thus on attaining economic independence by turning a tricycle into a mobile business platform. Another project for a rolling walker has been expanded in scope to provide a business platform as well.
- The co-design process is very important and has to happen face to face, to involve end users, community based rehabilitation experts and manufacturers at the same time.
- Prototyping as part of the development process and also the co-design process allows ideas to evolve and be discussed. They also create a high level of visibility and interest in the community.
- Extreme poverty has to be better understood in terms of the extreme limitations it places on manufacturing methods. The tools and workshop conditions of the local manufacturer is extremely limited. This is a common limitation of the local artisan and expanding this would aid in quality and production output.

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