

Ingenious

GAINING THE INSIDE TRACK

CARLETON RESEARCHERS LOOK TO ACCELERATE CANADA'S CONNECTED AND AUTONOMOUS VEHICLE REVOLUTION



MIND OVER MATTER

Ultra-high-speed helmet tester targets concussion prevention

VENTURING FORWARD

Virtual Ventures celebrates 25 years of STEM youth outreach

REDESIGNING THE WHEEL

Hybrid wheelchair aims to improve accessibility in Uganda



The latest prototype of the Mbili-kwa-Moja is currently being built by a collaborative team including fourth year research assistants Jakob Robinson-Hoffmann (left) and Samantha Astles (right), along with Professor Bjarki Hallgrímsson (centre) from Carleton's School of Industrial Design. (Photo: Ainslie Coghill)

The Mbili-Kwa-Moja: Building a Transatlantic Community Through Design

Rather than *reinvent* the wheel, over the past seven years Professor Bjarki Hallgrímsson and a revolving team of Carleton University students from the School of Industrial Design have been challenged to *re-design* the wheel, and its attachments, as part of a collaborative project impacting the lives of people half a world away.

In 2012, Carleton's Research Education Accessibility and Design (READ) initiative connected Hallgrímsson and his team with the CanUgan Disability Support organization, a non-profit based in Ottawa that looks to solve issues for people with disabilities in the Kasese District of Western Uganda.

This region, located precariously at the border with the Democratic Republic of Congo (DRC), experiences a great deal of poverty as well as disability. CanUgan's partner organization, the Kasese District Union of Persons with Disabilities (KUDAPEDI) represents over 50,000 people with disabilities (PWDs) in the region.

The School of Industrial Design's initial project, funded

by the International Development Research Centre, began when CanUgan co-founder Navin Parekh sought help with re-designing hand-pedaled tricycles intended for use by PWDs traveling long distances on rough and rural western Ugandan terrain.

The Carleton team's re-design, which featured stronger frames that could hold a variety of income-generating attachments for their users, involved close consultation with local end users as well as artisan manufacturers to ensure the new design was functional for the environment, and could be produced locally.

CanUgan's mission statement asserts that *disability* is not *inability*. In a May 2018 article for Canadian Geographic, Parekh reflects on the tricycles' use by women with disabilities that live near the border with the DRC for cross-border trade. They use the tricycles to move goods between the two countries.

"Some of these women are now the main breadwinners in their families," says Parekh. "Some have bought their own

homes.”

On a team trip to Uganda in 2014, then fourth year student Jennifer Vandermeer made a breakthrough discovery after interviewing local women and visiting an elementary school. The tricycles were simply too big for use in homes, schools and markets.

“The tricycles are a good way to get people to their destination,” says Hallgrimsson. “But once they get there, they’re crawling on the ground because there’s no wheelchair for them.”

To address that problem, Vandermeer designed a tricycle-wheelchair combo with two separate and distinct front attachments. She worked with Hallgrimsson and the School of Industrial Design technicians to produce an initial prototype of the two-in-one design as part of her final year Capstone project.

So how does it work?

When the user arrives at school, work or home, they can remove the hand pedaled front tricycle wheel attachment and replace it with castors, transforming the vehicle into a wheelchair, helping to manoeuvre in smaller spaces. The wheelchair attachment can be conveniently stored on the back of the tricycle for long distance travel.

Realizing the potential usefulness of this new design, Hallgrimsson applied for funding from the Swedish organization Promobilia. This new funding was required both in order to continue the development and also for the



Mbili-kwa-Moja

Translation: “Two-in-One”
in Swahili



purpose of increasing the capacity of local manufacturers in Uganda.

The new project named Mbili-kwa-Moja (Two-in-One in Swahili) involves close collaboration with Katelemwa Cheshire Home for Rehabilitation Services, a disability focused non-governmental organization in Kampala, Uganda’s capital city. This organization has extensive experience with producing locally made customized wheelchairs for children and a good understanding of the local context.

Furthermore, design expert Professor Emmanuel Mutungi at Kyambogo University in Kampala has provided consultation on the cultural and functional design aspects.

Katelemwa reproduced Vandermeer’s design while also infusing some of their own ideas to create a second



The first Mbili-kwa-Moja prototype, pictured here, was built in Uganda. (Photo: Jennifer Vandermeer)

generation prototype.

While on the right track, the team identified a problem with the early iteration of the design: it was hard to convert the vehicle from one configuration to the other. Further refinements and a simple and elegant conversion mechanism would be needed.

“Even though the team from Katelemwa liked the idea and are currently testing the product to standards, they have identified shortcomings in the design that would make it hard to use,” says Hallgrimsson. This iterative approach is further proof, he says, of the importance of receiving local feedback before finalizing a design.

Into 2019, a team of fourth year research assistants have joined on to help improve the design in consultation with the partners. CanUgan board member Jack McCarthy recently returned from Uganda and has helped the team establish better ongoing communication through the Whatsapp social media platform popular in Uganda.

Another goal is to have the final design freely available online.

“The philosophy of this project is that we design *with* rather than *for* people,” stresses Hallgrimsson. “The

ownership and ideas have to be shared and open so that everyone can get involved and improve the mobility, freedom and access to work that goes hand-in-hand with that.”

Hallgrimsson notes studies which demonstrate that sometimes well-meaning international charity organizations import and donate wheelchairs that are, sadly, unsuitable for the local environment and needs.

These imported wheelchairs aren’t 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.

The individuals and organizations involved in the Mbili-Kwa-Moja project are looking for holistic solutions built to last. As for what the future holds, Hallgrimsson is both hopeful and confident he’ll manage to keep the wheels spinning.

“Time will tell. We have been involved in this partnership for over seven years and we will find a way to keep going,” he says.

CSALT Lab Team Building Vision for “Hundred Mile House”

Jesse Bird’s entry for the 2016-2017 HERE+NOW student design competition demonstrates that sensitive, sustainable thinking comes naturally to him.

Under the supervision of Azrieli School of Architecture and Urbanism Professor Sheryl Boyle, Bird envisioned a near net-zero energy semi-isolated dwelling that was respectful of the sun, wind, and flood level patterns of its unique site conditions, and explored the use of modified structurally insulated panels (SIPs) for a prefabricated modular

building system.

“I dove deep into site analysis and critical thinking of what environmental design can produce in terms of residential construction,” says Bird.

Out of nearly 200 project submissions from over 50 schools across North America, Bird’s project, called the Upper Squamish Research and Residence, came in first place.

It wasn’t long before the story of Bird’s big win happened to catch the attention of Carleton alumnus Tony Humble.

Humble graduated from Carleton’s Bachelor of Commerce in the 1970s, then embarked on a varied career, working in natural resources, finance, and the

