GENDERED DESIGN IN STEAM

São Paulo, Brazil

Team

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"We started looking for more things about design, about Gender Design, involving more people, and asking ourselves what it was... our priority has been girls and women, because one of the goals is to increase the number of cases of assistance given to girls and women."

— *Maria Elizete Kunkel*

IDA

3D-printed prosthesis to support female survivors of domestic violence, accidents or cancer treatment in Brazil

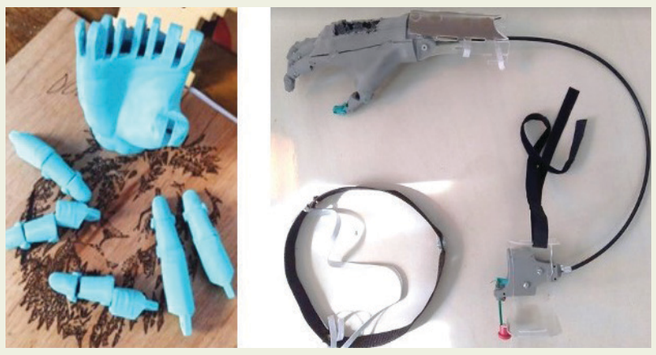
ENGINEERING · TECHNOLOGY · ACCESSIBILITY · MANUFACTURING

During development before birth and throughout life, the human body can be mutilated or amputated due to a variety of causes. This study investigates how 3D printing as an innovative technology can be utilized for prostheses production for women with visible disabilities caused by domestic violence, accidents, medical conditions, or cancer treatment. 3D printing offers a more sustainable alternative when compared to traditional prosthetics as it allows for higher levels of customization at lower production costs. This project used Design Science Research (DSR), which incorporates theory, artifact development, creativity and innovation as a methodological approach. This project investigates the impacts of 3D printing technology on gendered design prosthesis to rehabilitate identity, confidence and independence of women in low and middle income countries.

Occupational therapy session for woman who received an upper limb prosthesis.

Outcomes

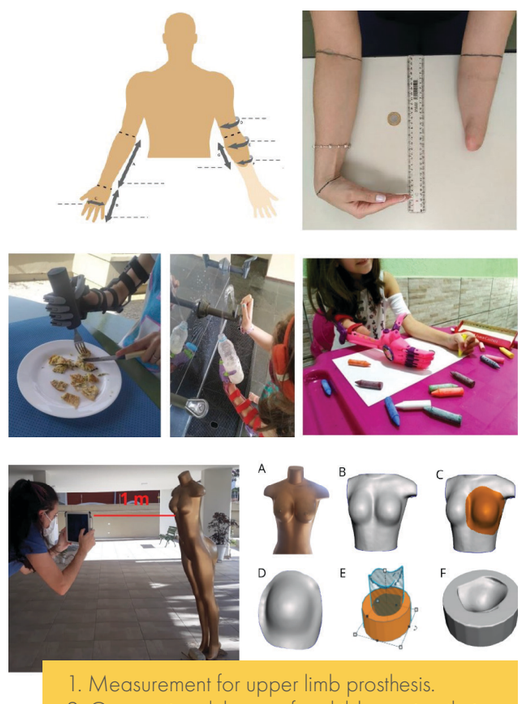
- 11 upper limb mechanical prostheses printed with improved aesthetic design and strength donated to 10 women and girls.
- 2 breast prostheses 3D printed in silicone and TPU 95A printing material to create a lighter product was donated to 2 women.
- 1 ear prosthesis was printed and donated to 1 woman after experimenting with different moulds and colours for different skin tones.
- Developed a prototype for the "Mariana Project" which was a project to develop prostheses for a 3 year old girl born with a congenital malformation of both arms.
- Developed a Perineal Elasticity meter prototype to be able to measure the perineal diameter in pregnant women.
- Numerous articles were published, as well presentations and workshops were held by the research team such as "Collaborative Research for Social Inclusion", "Digital Catalogue of 3D upper limb prosthesis with customization of colours and characters", "A conversation about gender innovation", and "3D printing in healthcare".



1. 3D printed upper limb prostheses.
2. Ear and nose prototypes and prostheses.

Methods

- Developed a form for donation of an upper limb prosthesis for women and girls to submit. 10 women and girls were chosen for prosthesis donation.
- Held meetings with the chosen applicants to evaluate which activities they intend to use the prosthesis for, discussed the management of expectations, measured the non-amputated limb, and discussed the psychological and occupational therapy options available.
- After applicants received their 3D printed upper limb prostheses, multiple appointments were organized with an occupational therapist and psychologist to help applicants learn and adjust to their new prostheses. These sessions also allowed the researchers to investigate what improvements need to be made for better grip, comfort and aesthetic.
- Breast prosthesis prototypes were developed in three ways. First by obtaining a 3D breast model through digital services, second by using photogrammetry software to reconstruct the breast from photos sent in from 2 participants in need of a prosthesis, and lastly by scanning a mannequin and reconstructing the breast from the scan.
- From the different models, researchers printed the breast in silicone but noticed it was too heavy so new materials were explored such as TPU 95A, a material that was more flexible, lighter and softer. Similar process used for nose and ear prostheses.



1. Measurement for upper limb prosthesis.
2. Occupational therapy for children using their new upper limb prostheses.
3. Scanning and reconstructing breast prostheses prior to 3D printing.

Lessons & Future Directions

- Further research has begun on making aesthetic prostheses with materials more resistant to external reactions.
- Developing more partnerships with cancer hospitals outside of the region in order to produce more upper limb, breast and facial prostheses for more people in need.

Learn more

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