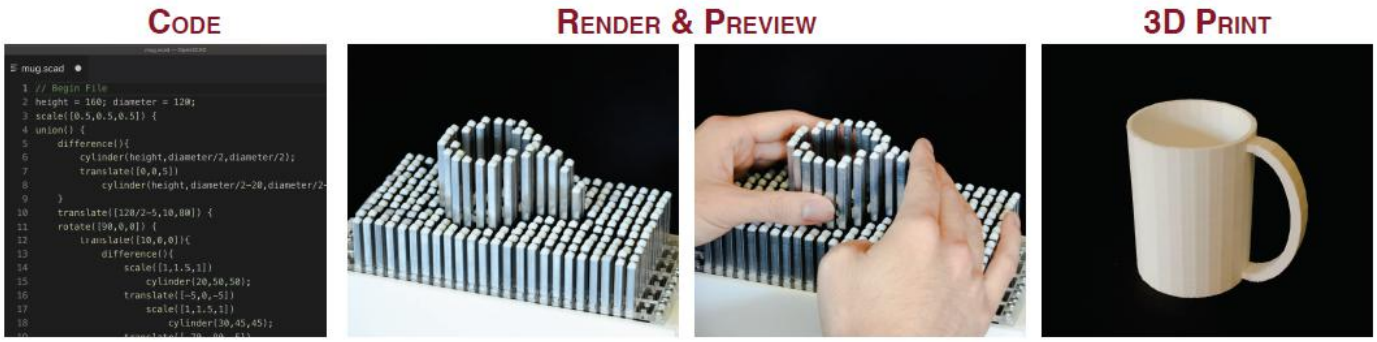
Advancing Accessible 3D Design for the Blind and Visually-Impaired via Tactile Shape Displays

【Summary】:

The thesis aims to create accessible 3D design and printing workflows for BVI by using a 2.5D haptic display, and a strict understanding of how BVI uses work in the context of perception, interaction, and learning.



【Thesis focuses on 3 questions】:

- How can complex 3D information be effectively encoded through tactile representations?
- What are the interaction techniques necessary to create and manipulate 3D models on tactile displays with limited resolution?
- How does access to 3D design and printing in the wild for BVI people change their self efficacy of making and their attitudes towards STEM?

【Thrust 1: Representing Spatial 3D Information】:

1) to elucidate on the benefits of the different encoding representations for 3D spatial information; compare contours versus reliefs.
2) to understand the in-terplay of tactile array resolution (low, medium, high).

【Thrust 2: Co-Design of an Accessible 3D Modelling System Supported by Tactile Displays】:

Look at the paper in detail, and his previous work

【Thrust 3: Long-Term Deployment To Assess Learning and Self-Efficacy】:

back gathered will allow me to frame insights for future educators and researchers on: 1) guiding tenets and continuing challenges for accessibility in Makerspaces, 2) necessary software and hardware support, 3) a repository of 3D models to inspire future domain specific design tools, and 4) recommendations for course design and integrated classroom dynamics.

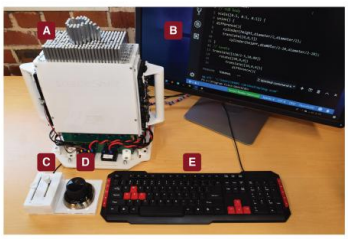


Figure 2. Overall setup of the 3D modelling system comprised of A) a 2.5D shape display, B) OpenSCAD programming language, C) slider inputs for control of zoom and object views, D) 3D mouse for translation and rotation, E) and computer keyboard.

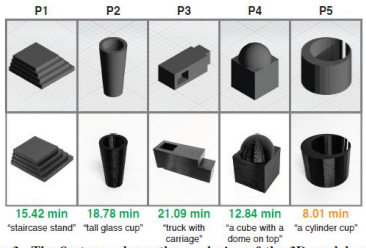


Figure 3. The first row shows the rendering of the 3D models created by four blind and one visually impaired user of the 3D modelling system. The second row shows the model 3D printed using a MakerBot Replicator. All participants reported being satisfied with the final results except P5.

【Important Reference】:

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adolescents of different visual disability. IEEE Transactions on Neural Systems and Rehabilitation Engineering 25, 7 (2017), 861–872.

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