GripFab: Facilitating the creation of customizable grips for individuals with limited hand mobility

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Create Custom Hand Grips with GripFab!

The increasing prevalence and quality of desktop, consumer friendly 3D printers has made it possible for more people who do not have a background in engineering or technology to create personalized items for everyday use. In the spirit of this movement, our lab currently collaborates with the local medical school to conduct a class that helps the physical therapy students design custom assistive technology for patients. The need to facilitate the creation of assistive technology inspired the making of GripFab.

GripFab is a web-based computer-aided design (CAD) software that allows physical therapists to quickly design and create custom grips for their patients who have limited hand mobility. The first iteration of GripFab is a Java applet (Figure 1) user interface that outputs a ready-to-be-printed grip designed based on its specific purpose. Since then, we have expanded this application to make GripFab even more universal and the grips more customizable.

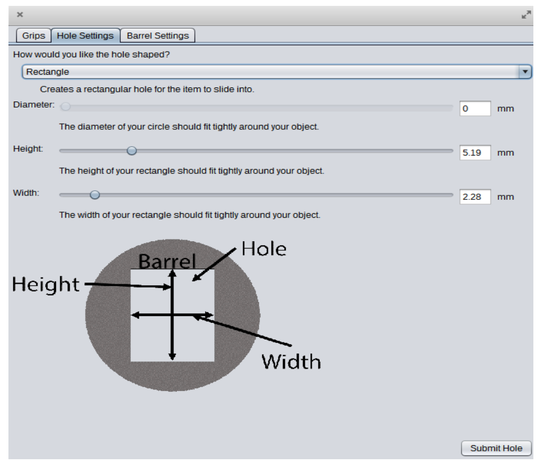

Figure 1. First version of GripFab (Java applet)

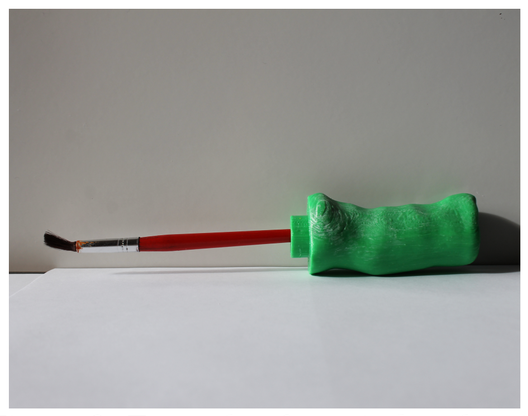

Figure 2. Example of a paintbrush grip made using an earlier version of GripFab.

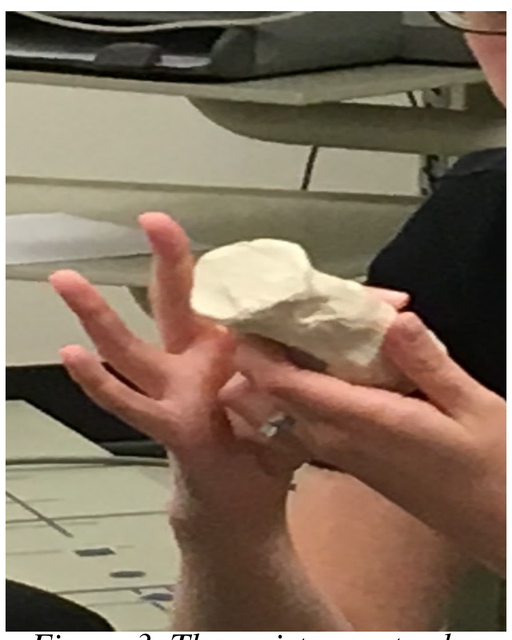

Figure 3. Therapists create clay models of the grips.

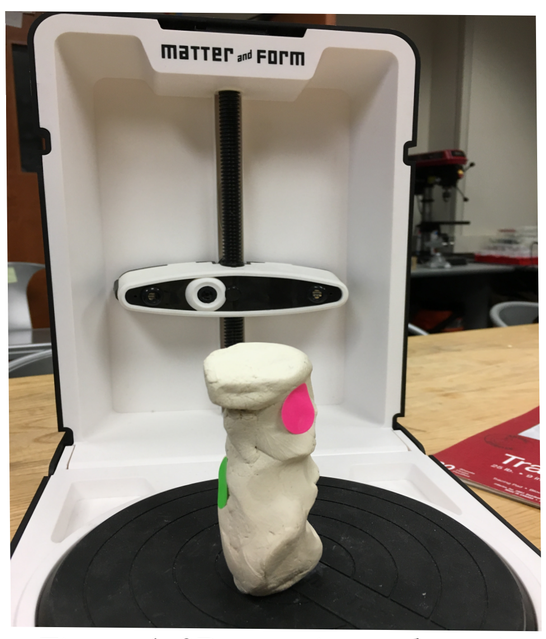

Figure 4. 3D scanning a clay grip.

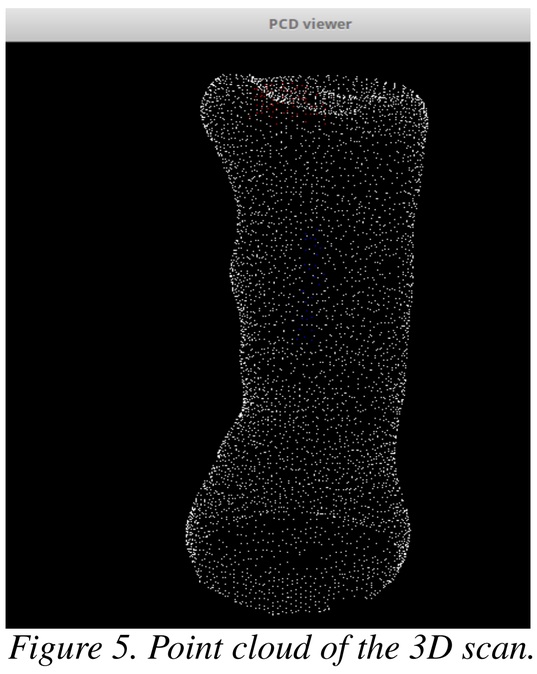

Figure 5. Point cloud of the 3D scan.

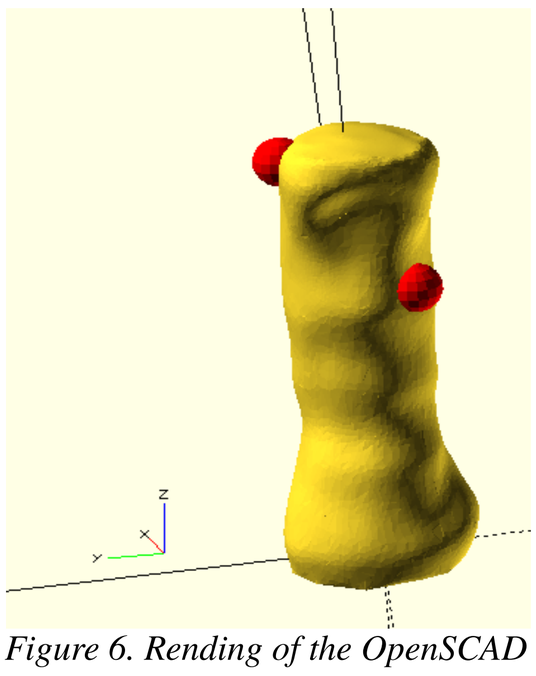

Figure 6. Rending of the OpenSCAD script written by GripFab.

Augmenting GripFab's Clay Model Input

This summer, we expanded GripFab's capabilities by implementing a 3D scanning feature that would allow the therapists to create grips that are more specific to each patient's hand capabilities. In addition, the therapists can now indicate where on the grip the hold for the utensil needs to be, making it possible for the grips to hold more than one utensil.

Here are the steps:

1. The therapist creates a clay prototype of the base of the grip, based on the patient's hand shape (Figure 3). The therapist puts colored stickers on the clay prototype to denote where on the grip the hole will need to be. This augmented clay prototype will then be 3D scanned (Figure 4).

2. GripFab will read the colored point cloud (Figure 5) from the scan and extrapolate the points of interest. The command prompt will then ask the user for the specifics of each hole.

3. Based on these measurements, GripFab will write an OpenSCAD script that will render a 3D model of the augmented grip with the appropriate holes (Figure 6).

Tools used

-- Point Cloud Library (PCL): robust C++ library used for 3D image processing

-- OpenSCAD: 3D modeling software that uses a scripting language

Future Work

1. Augment GripFab interface so user can easily enter measurements for barrels and holes.

2. Make GripFab web-accessible.

3. Extend analysis functions to recognize additional colors (other than only red and blue).

4. Evaluate new functionality with physical and occupational therapists.

Acknowledgements

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