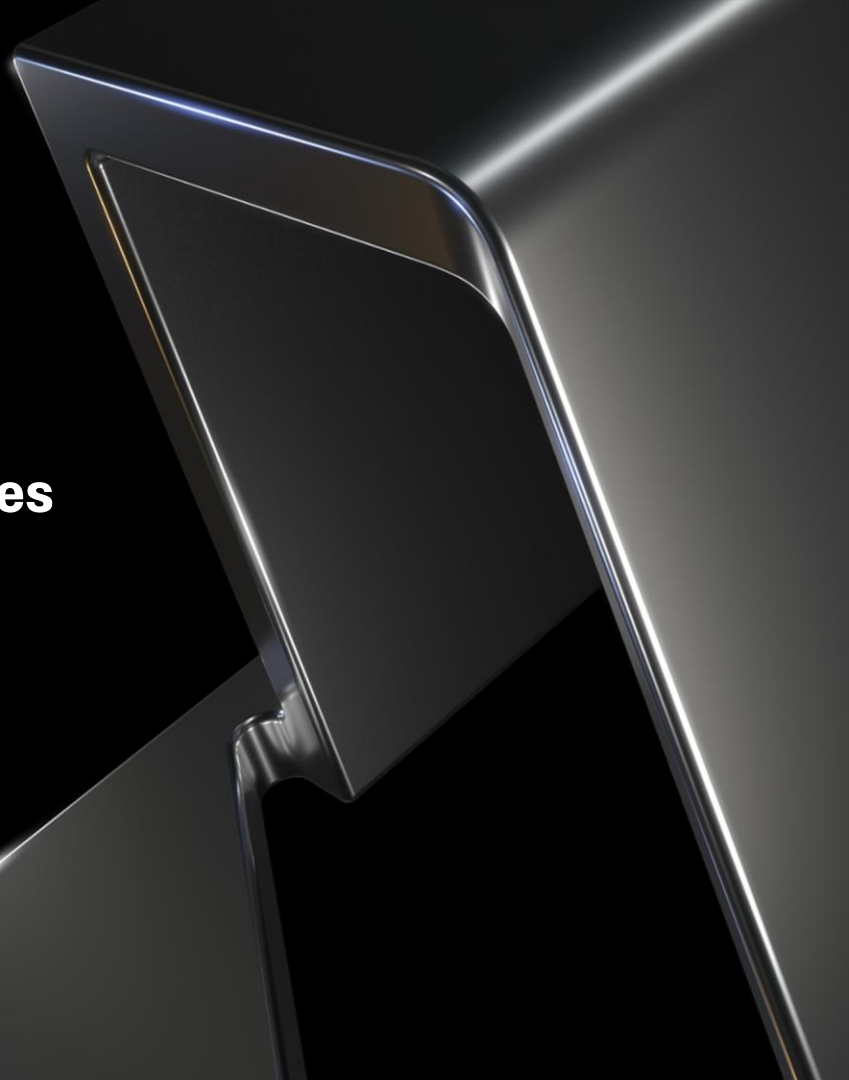
AUTODESK UNIVERSITY

Using Fusion 360 to Design Patient-Specific Prosthetic and Orthotic Devices

Michael Peirone

Chief Operating Officer | @vichandproject

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About the Speaker

Michael Peirone

- Chief Operating Officer (COO) of Victoria Hand Project (VHP)
- B. Eng. Biomedical Engineering, 2016



Class Summary

This class will cover the following topics:

- Victoria Hand Project’s work in the field of prosthetics and orthotics
- The design of 3D printed prosthetic hands
- Issues we ran into with mass customization
- Solutions to streamline our workflow of making custom prosthetic devices
- How we use the Fusion 360 API

Learning Objectives

1. Define Fusion 360’s use by healthcare professionals in an orthotic and prosthetic context

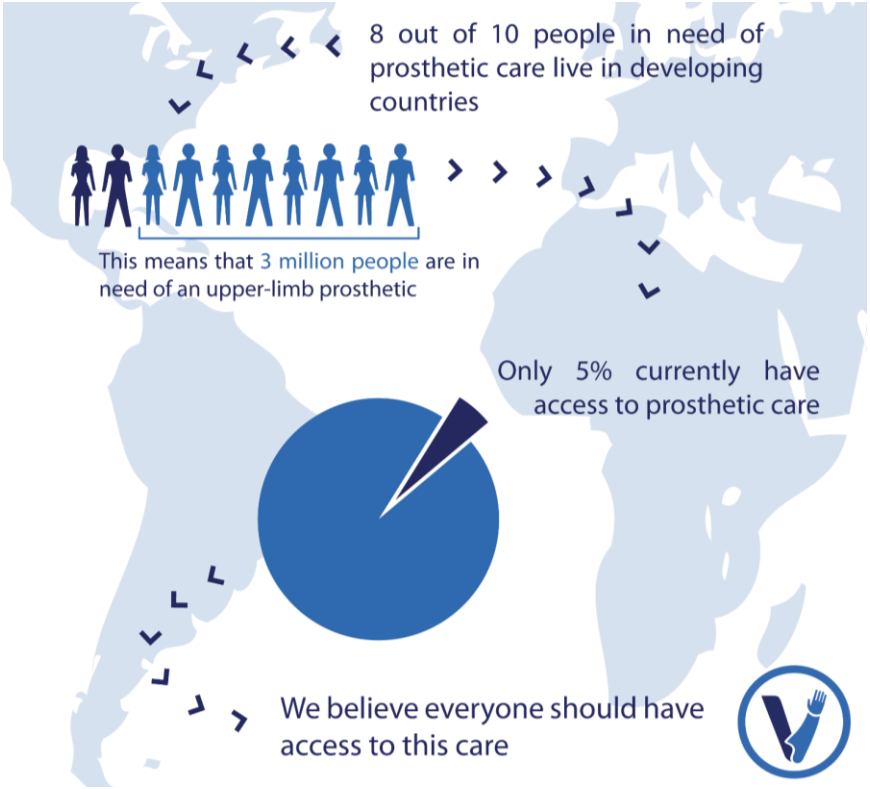
2. Model designs parametrically with a user interface for quick and easy customization

3. Implement Fusion 360’s API to make the design process easier for users who have little to no CAD experience.

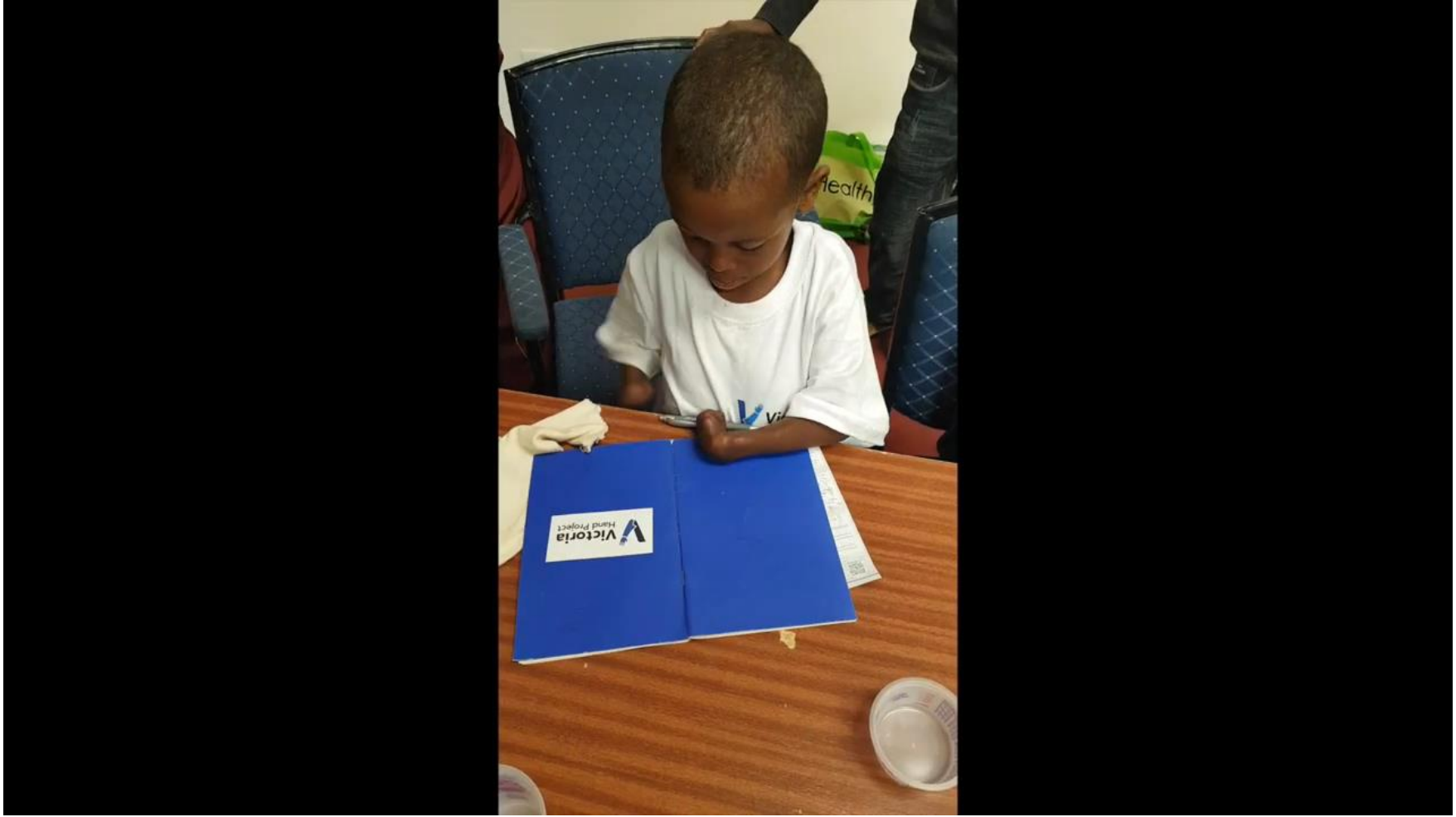
4. Create workflows to generate user-specific devices using Fusion 360

Victoria Hand Project

Our non-profit work







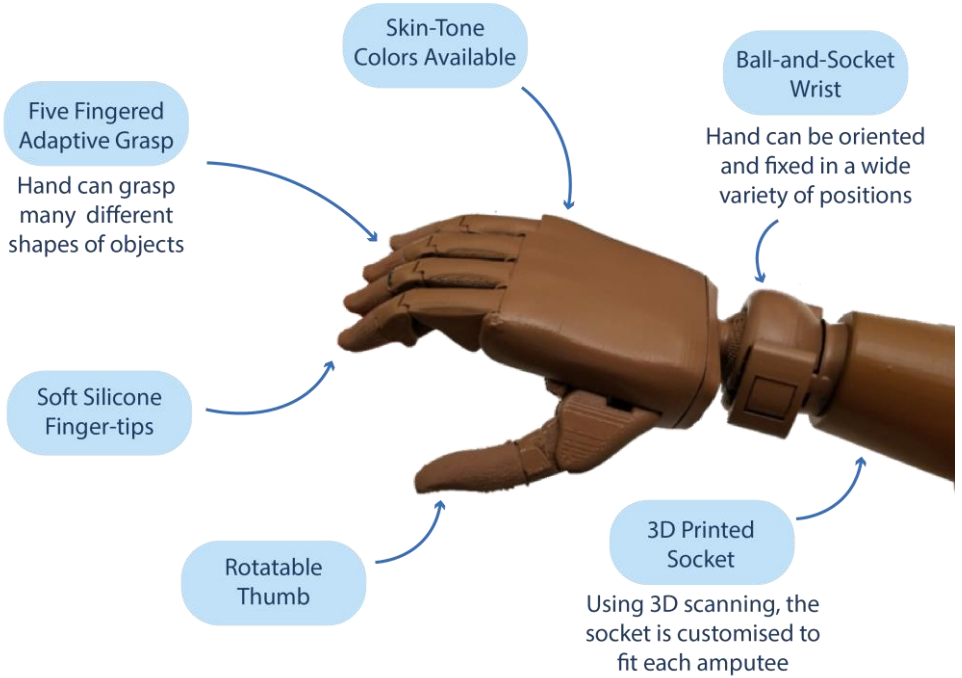
Link to video: https://www.youtube.com/watch?v=qIfNoHiKQcY

Victoria Hand

Our Hand Technology



Cambodia, 2018



Custom-made Prosthetic Arm Sockets

Each limb socket is custom-sized to each recipient.

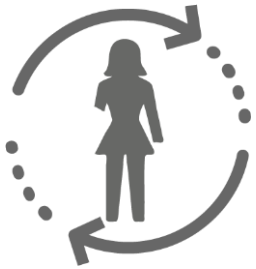
- Creates a more comfortable fit
- Socket is more natural-looking on the user



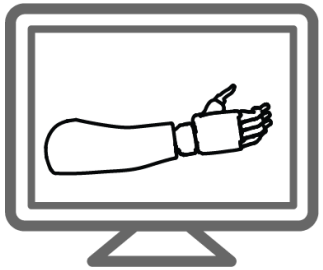
Jacob, Kenya, 2020

Custom Socket Workflow

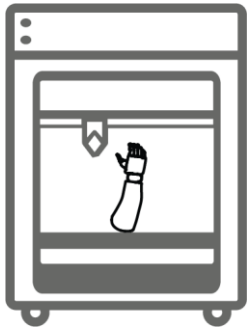
How VHP Makes Custom Arm Sockets



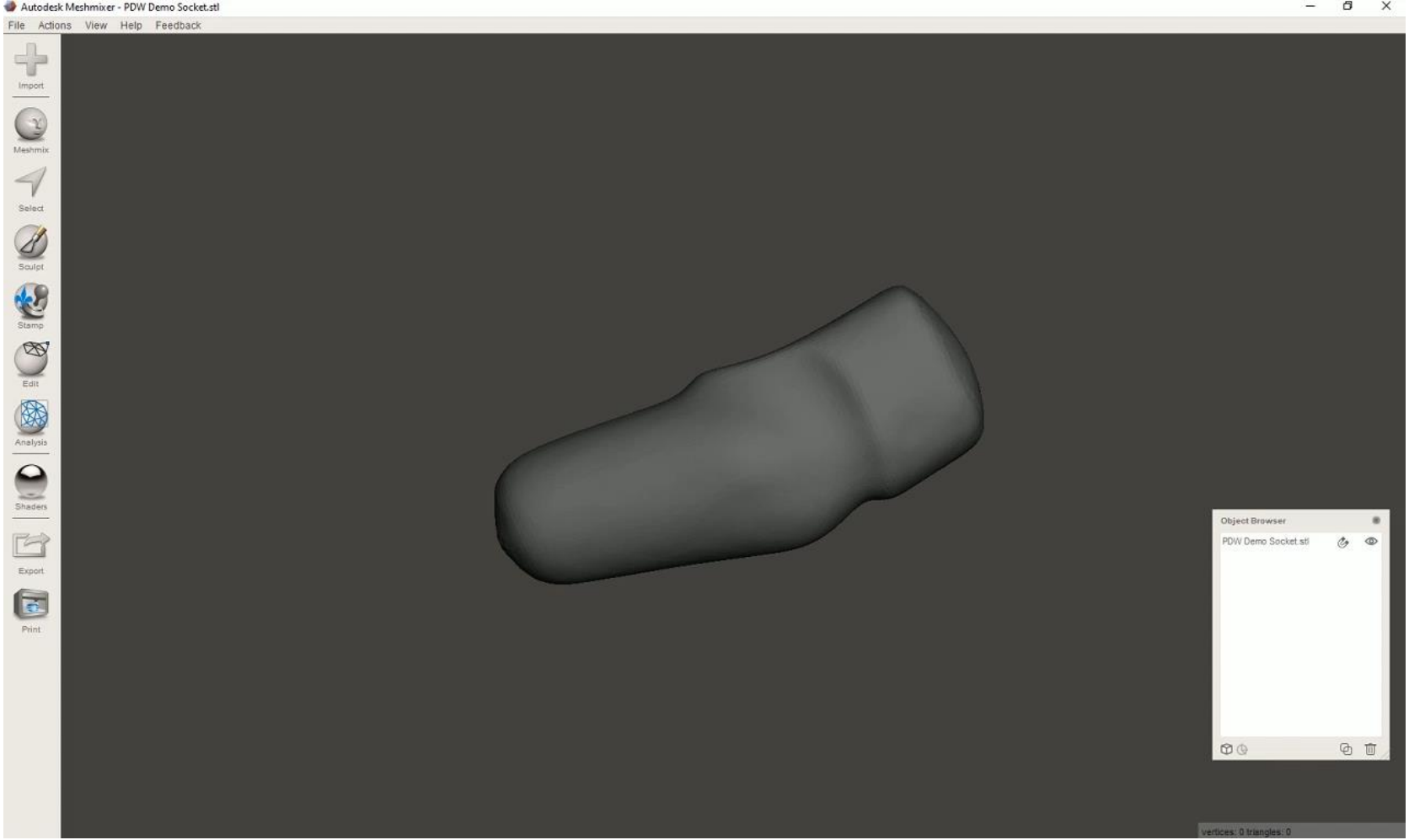
3D scan the limb shape



Cut the limb shape from the socket



3D print the limb socket



Link to video: https://www.youtube.com/watch?v=_0dcCScPKCM

Design Issues

Original Method

- Socket was designed in CAD program and each size of socket needed to be manually exported
- Thousands of combinations of sockets
- Time-intensive process
- Avoided design updates because each socket would need to be exported again



Louis, Haiti, 2016

Better. But Not Perfect



Mary, Kenya, 2020

Improved Method

- Redesigned socket in Fusion 360 and found a Fusion script that would automate creation and exporting sockets
- Less person-time required to output sockets
- No hesitation implementing changes to socket design and re-export

Too Many Socket Sizes



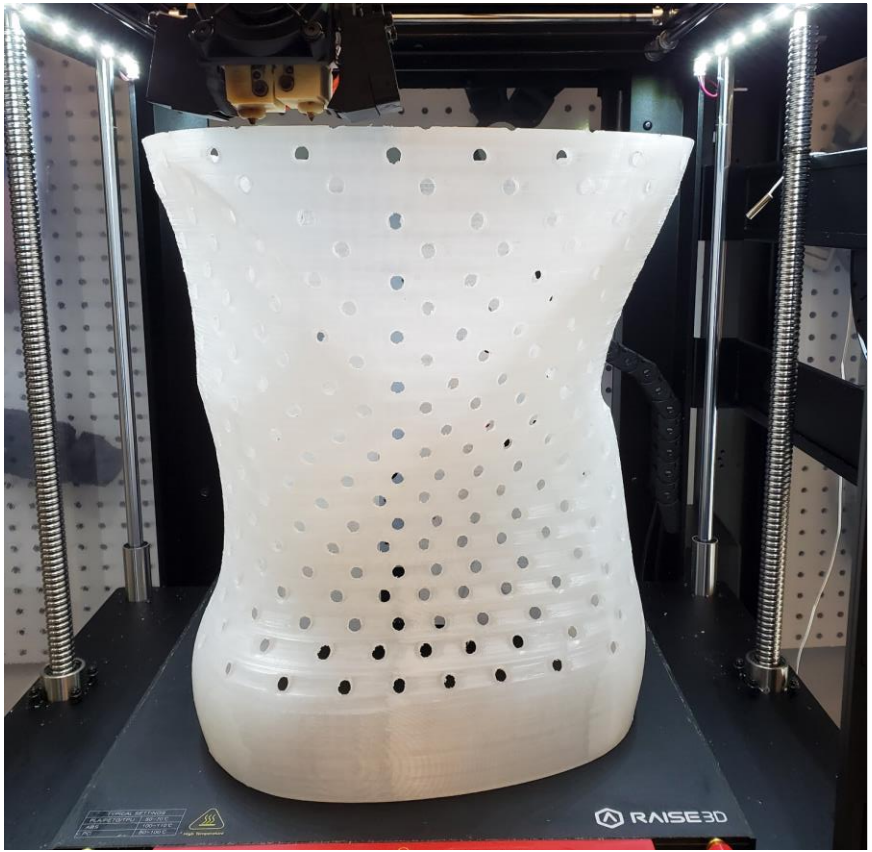
Angel, Nepal, 2019



Samer, Egypt, 2019

3D Printed Orthotic Devices

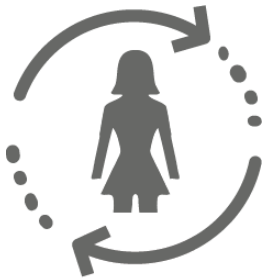
- >20 parameters to change
- Additional adjustments required
- Custom made braces, no pre-made sizes like the sockets



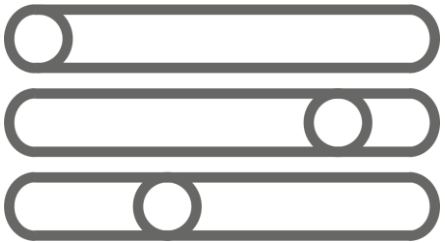
3D Printed Back Brace

How to Design Custom Braces?

Software must-have capabilities



Capture human shape



Easily make adjustments



Can be done by non-technical users

AutoDesk Consulting



Brandon Cramer
Principal Research Engineer,
AutoDesk Research



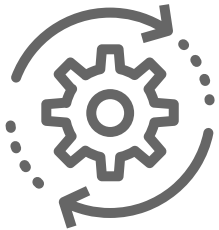
Kevin Acker
Senior Technical Consultant,
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Technical Consultant,
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Fusion API

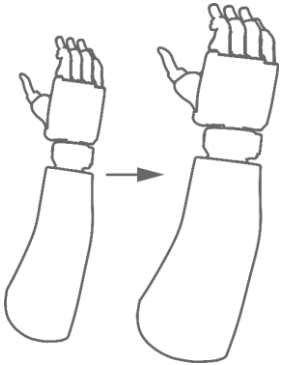
Application Programming Interface (API)



Automate repetitive actions



Create custom programs for non-technical users

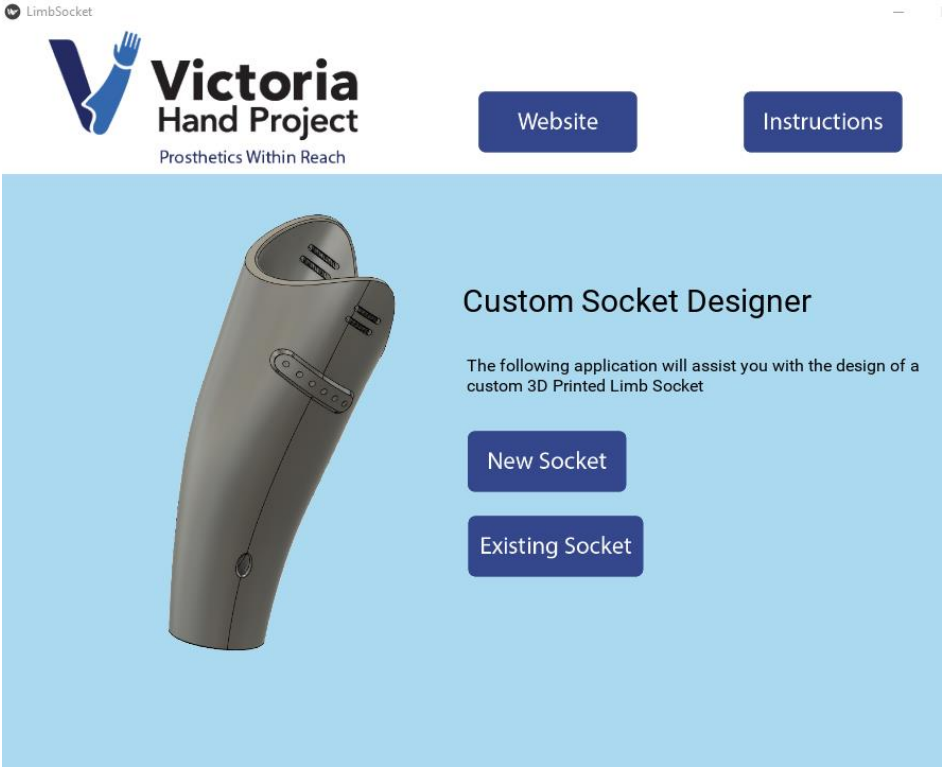


Easily alter parametric models

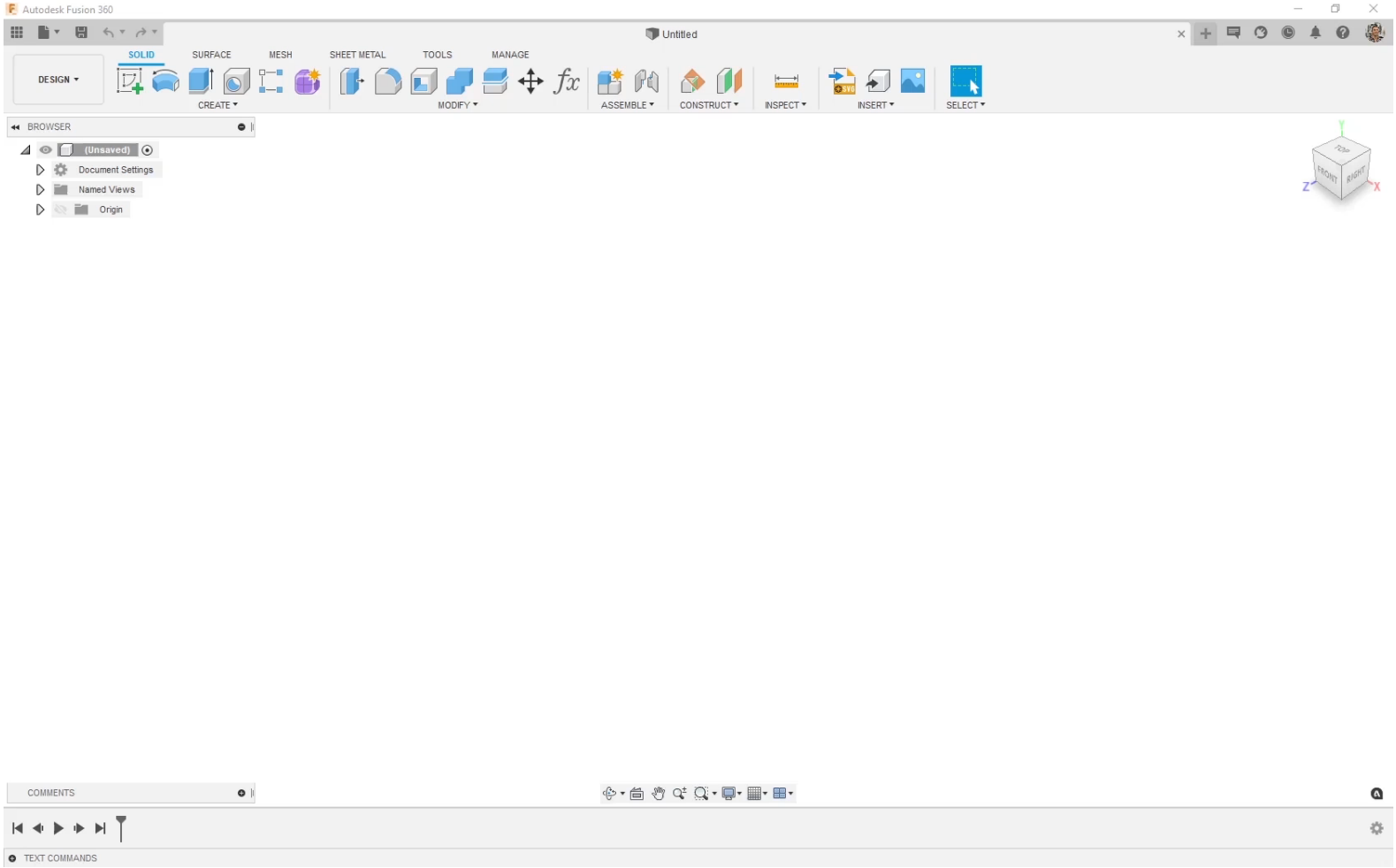
Using Fusion to Make Sockets

The Fusion 360 workflow allowed for a simpler and more efficient socket design

- Each socket is made to the exact dimensions, rather than approximations
- Easier for clinicians to pick the correct size



Victoria Hand Project Custom Socket Designer software

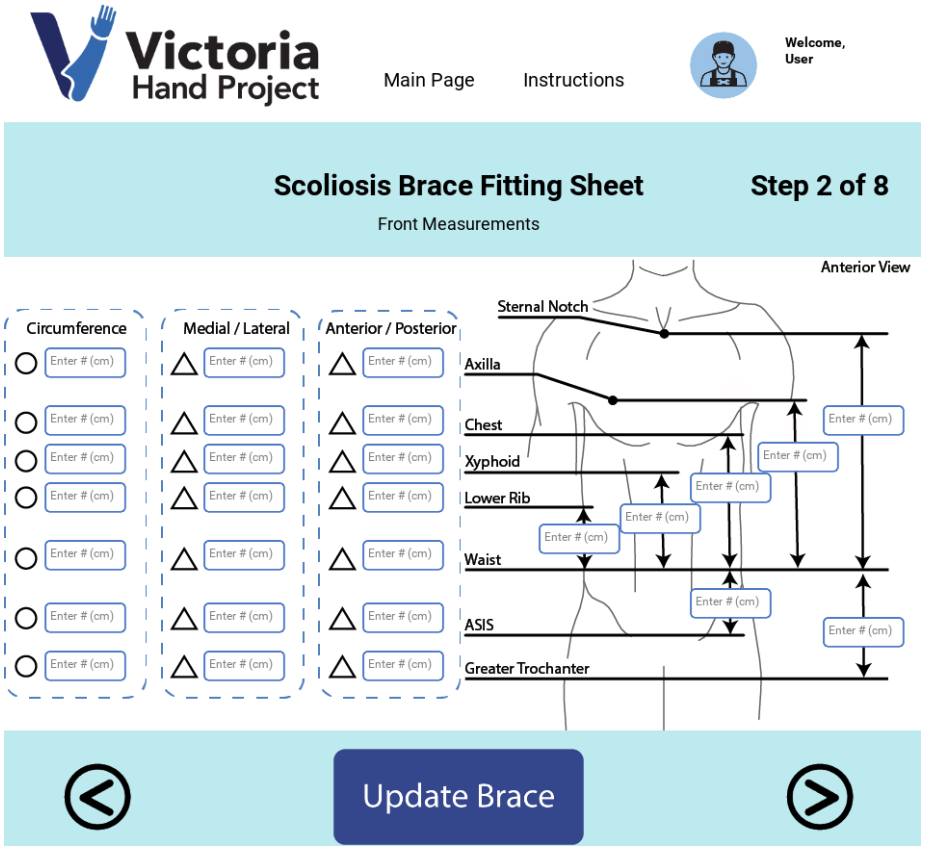


Link to video: https://youtu.be/ee8s5tQXPGE

Using Fusion to Make Orthotic Braces

We were also able to use Fusion to make custom orthotic braces

- Simple UI to enter patient dimensions
- Automated workflow
- Logic introduced



VHP Orthotic Software

Future Work

- End-to-end socket design workflow in Fusion 360
- Use scan data for custom socket
- Implement T-spline functionality in brace program



Trans-humeral Socket Prototype

To Summarize

- Design and deployment of low-cost prosthetic and orthotic devices
- Victoria Hand Project used the Fusion API to create custom UI and design software
- Allows for automation of workflows
- Design time can be reduced



Palpasha, Nepal, 2018

Our Team



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Executive Director



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Biomedical Systems Designer



Derek Bell, B. Eng.
Software Developer

Thank You!



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Hand Project

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