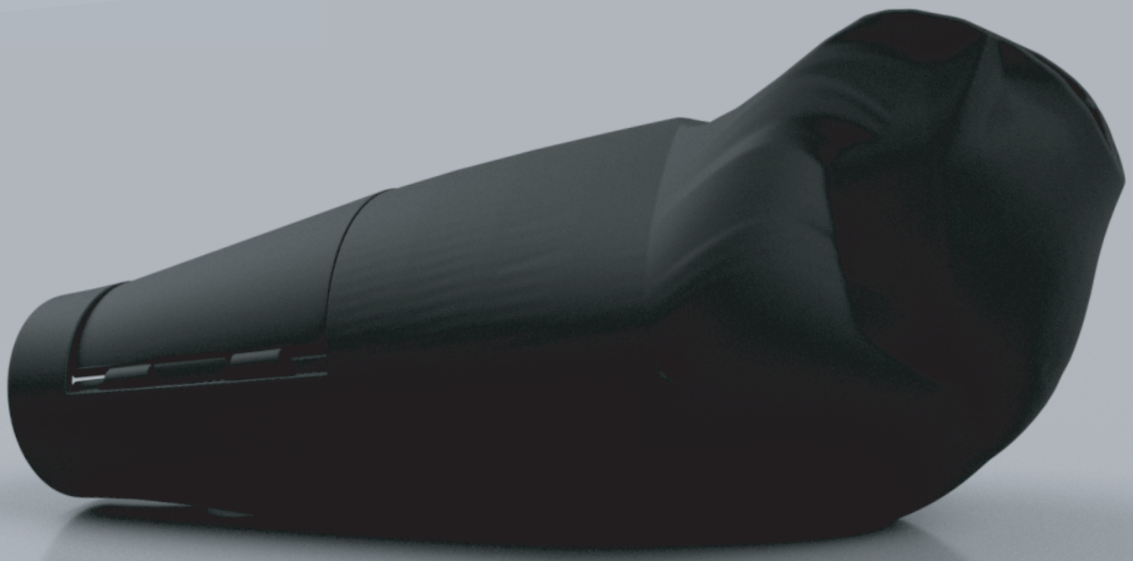

Development of software for digital manufacturing of children's prosthetic arms for 3D-printing

How can we change the way we build prosthetics? Is it possible to make a change when it has been this way for so long? We say yes, let's change the game.

The conventional manufacturing process of prosthetic arms is very time-consuming and labor-intense, with a lot of room for human errors. With today's technology advancement it is possible to offer a more efficient technology that can replace the conventional manufacturing method of prostheses. This Master Thesis is about developing a software to auto-generate the digital design of a prosthesis to offer prosthetists a faster, cheaper and more intuitive way to manufacture children's prosthetics.

Children grow fast. Which means that children need to change their prostheses frequently. This is something that will cost the prosthesis manufacturer and the Swedish healthcare a lot of money. The developed software gives an alternative way of manufacturing prosthetic arms which allows prosthetists to generate a prosthetic arm in fewer and less labor-intensive steps with an 82% reduction of time.

The project started with the identification of the customer needs. To investigate the customer needs an interview was conducted with the primary user. 50% of all the prosthetists in Sweden and Denmark were able to validate the customer needs and rank them by importance. Identified was a need for a new manufacturing process with fewer steps, that is faster and allows changes throughout the process. There is also a need for the model to fit all the components that will be placed inside the prosthesis and that these components are easily accessed. With the customer needs as the foundation the development of the software and the design of the prosthesis could be started.

A big issue with children's prosthetic arms is to fit all the components for the robotic hand inside the prosthesis. Sometimes there is not enough space or just not an easy way to place them. Usually, the wanted size of the battery can't be used and smaller batteries have to be chosen. Our job was to find a solution to place the components inside in an easy and accessible way. The developed design makes it possible for prosthetists to choose any kind of battery size and placing them securely inside thanks to supports for the components.

In the end, the result is a Grasshopper-script where the user only needs to modify a few parameters to auto-generate a basic prosthesis. The user needs to import the scan of the limb into the script. What can the prosthetist modify? Anything! Some of these adjustments are the position of the trim line, the position of the charger hole, i.e., on the bottom or on the side; the size of the supports, i.e., big, medium or small batteries; the length of the prosthesis, etc. The program includes a user guide where it is explained step by step what to do. Cluster was used to reduce the visual complexity of the file.

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ANATOMIC STUDIOS