

3D printed ocular prostheses

About the project

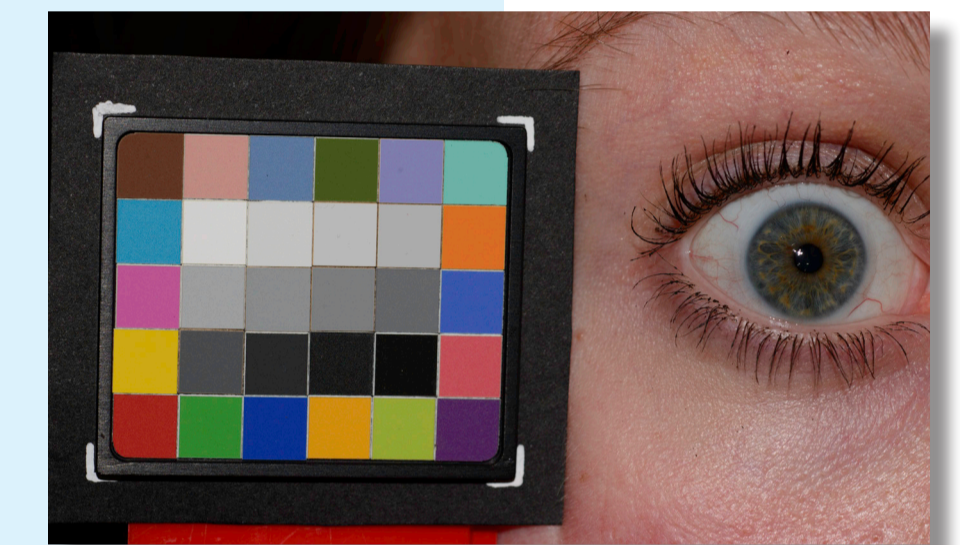
Fabricating custom-made ocular prostheses is currently a highly-skilled, labour-intensive and non-reproducible process performed by an ocularist. This graduation project aims to research a possible digital workflow, including data capturing and calibration, modelling and 3D printing, for producing 3D-printed full-colour ocular prosthetics. The workflow captures and reproduces the eye's appearance to create a life-like ocular prosthesis that resembles the patient's facial appearance as closely as possible.



Conventional prosthesis

Capturing and calibration

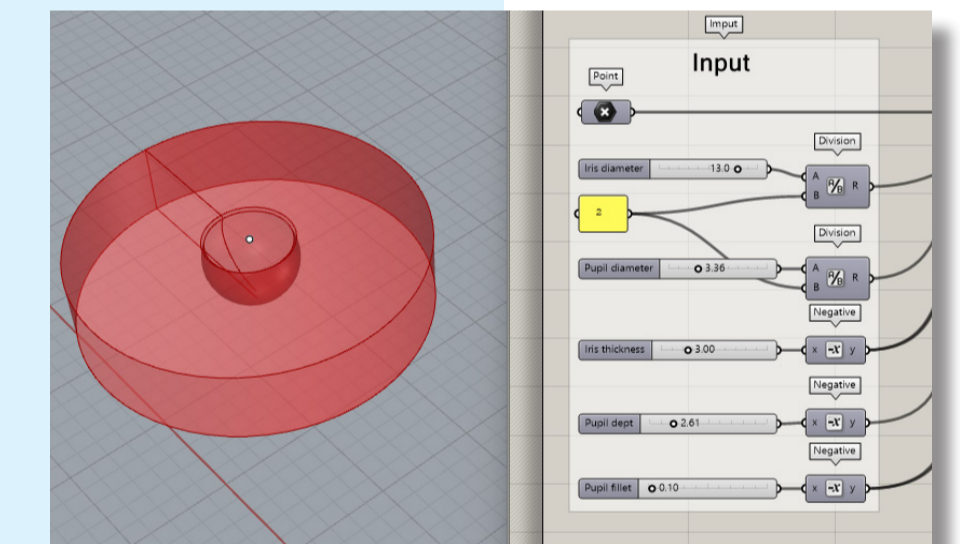
The patient's eye colour data needs to be captured and calibrated to ensure accurate colour reproduction of the eye. The images can be calibrated by applying a colour profile made from a colour target to correct the camera error.



Colour target

Modelling

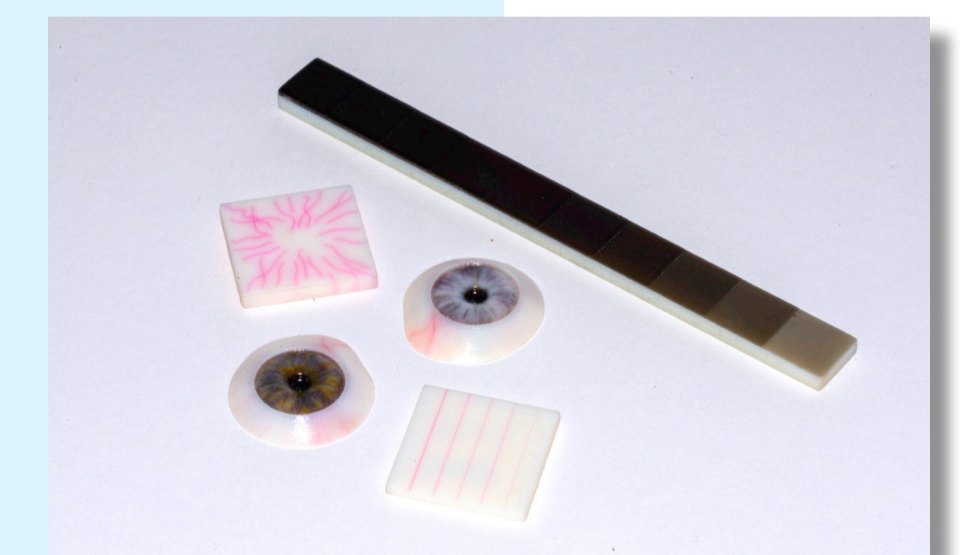
A parametric model based on a computational design template is a suitable solution for adjusting the prosthesis model to a personalised shape. The template should automatically model the inner parts of the prosthesis based on the outer shape and important parameters, such as the iris and pupil diameter. The first steps towards creating this computational design template are shown by modelling a parametric iris disk.



Parametric iris disk

3D printing

The capabilities of the 3D printing technology (material jetting) were exploited to reproduce best the various features of the human eye. This investigation showed that mapping an eye image to the model does not always give the desired result since most blood vessels disappeared and showed a significant blur of detail. Alternative approaches, like contouring, a sclera generator and 'dotting' and 'varying line deepness' techniques, were exploited and showed promising results. However, a voxel-based printing technique is needed to combine and control these approaches, and current software lacks these possibilities.



3D printed features of the eye



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A digital workflow for 3D printed full-colour ocular prosthetics
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Intergrated Product Design

Committee

Company

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