

The Veronica Scanner: Live 3D Portraiture

Royal Academy of Arts: 2 – 11 September 2016

Waddesdon Manor: 22 – 30 October 2016

How Does It Work?

CAPTURING THE IMAGES

The *Veronica Chorographic Scanner* records 96 images in 4 seconds. You are positioned on a seat in the middle of a sphere covered with holes. A metal arm with eight Canon EOS 5D cameras mounted at specific angles moves around the sphere. As it moves the cameras are triggered as they pass holes in the sphere. The cameras are synchronised with internal flashes that cover the interior of the sphere and give a uniform light. They are positioned so that the entire head is covered with overlapping images. Each image is saved as a 24 megapixels RAW format and then transferred and backed-up to a local network where the data is processed.

The recording is no more complicated than having your portrait taken in a photo-booth. During this brief process, fifty-four flashes will illuminate your face. The strength of these specially designed flash units is much lower than standard camera flashes. It has been kept as low as possible so you can keep your eyes open during scanning and make any facial expression you choose.

WARNING: This is an experimental system and there is a chance of failure in the process. We apologise for this in advance. If you move during the scanning session, an error will appear as a misalignment in the 3D model. Smooth skin tends to be less detailed than wrinkled skin as there is less information for the feature mapping software to identify corresponding features. Hair can often look strange: we recommend you tie your hair back to improve the quality of your model. If your hair is very dark or very fine the data tends to have more noise. The eyes will also appear with multiple flashes reflected in them – not just a single light source. It is not advisable for people with claustrophobia or epilepsy to use the scanner.

PROCESSING THE IMAGES

The 96 images provide the information from which a 3D model is extracted using photogrammetry, the science of taking measurements from photographs. These images are collated and aligned by finding corresponding features on more than two photographs. This 'feature mapping' is controlled by the algorithms in the software. Recent advances in both programming and computer vision have resulted in the ability to merge thousands of high-resolution images and extract the information needed to make a 3D model formed from millions of polygons.

The processing of the images is done through a semi-automatic work-flow that has been designed by Enrique Esteban of Factum Arte. The main software packages used in the process are *Reality Capture*, from Capturing Reality in Bratislava and *Autodesk® ReMake* from Autodesk in San Raphael.

The *Veronica Chorographic Scanner* predominantly uses *Reality Capture* but we are also working closely with Autodesk. The development of software that uses server farms on the Cloud is of great importance for the long-term application of photogrammetry to the preservation of cultural heritage – the prime goal of Factum Foundation.

Reality Capture is a software solution which automatically produces high-resolution 3D models from photographs taken with synchronised camera rigs. It can mix various inputs to get a visually consistent triangulated 3D model. It is the fastest and most powerful software package that can be used to produce a model of the human head composed of fourteen million polygons – a file size of approximately 1.3 Gigabytes. <https://www.capturingreality.com/>

ReMake (formerly known as *Autodesk® Memento*) is an end-to-end solution for converting photographs into high-definition 3D meshes. *ReMake* simplifies complex processes since it was designed for users who require digital models of real-life objects but have little or no 3D modelling expertise. In addition to making 3D models from photographs, *ReMake* also offers an easy way to clean up, fix, compare, decimate and optimise the 3D models for various downstream workflows including 3D printing, VR and for publishing the models online. www.autodesk.com/ra

There are other software packages on the market, some are free and some are expensive but you could try Hypr3D, 3D Zephyr, or Agisoft Photoscan.

Within one week of your scan at the Royal Academy, you will be supplied with a web ready 3D model and an OBJ file.

VIEWING THE 3D MODEL

View and share with friends, online, on mobile, on social media etc.

You will receive a hyperlink that will open your model in an online viewer and can be shared.

Embed the 3D portrait on your blog or website

You will receive an HTML code that you can embed as an iframe on any web site.

Open and view the models on your computer

Download the free software Autodesk ReMake (Windows or Mac version) and 'open' the 3D model (OBJ file). <http://remake.autodesk.com/try-remake>

View your 3D model in the Veronica Scanner online gallery

During the events at the RA and at Waddesdon Manor, all the scans will be incorporated into an online gallery developed by Autodesk that is currently accessible through the Factum Foundation website (www.factumfoundation.org).

PRINTING THE 3D MODEL

The OBJ file is the file that can be 3D printed. This model has been processed on site in the Royal Academy using Capturing Reality software. It is a compressed file that contains three files; an OBJ file (the 3D mesh), a JPEG file (for the texture and colour) and an MTS file which connects both. The one needed for 3D printing is the OBJ file, but we recommend sending all to the 3D printing company of your choice.

Data recorded with the *Veronica Chorographic Scanner* can be 'printed' by a whole host of output devices that fuse materials, build in layers, harden liquids or use other methods to materialise volume from a polygon mesh. The data can also be carved with a computer-controlled robot.

The display at the Royal Academy contains examples of printing and carving that push the technology to the limit and merge new technologies with traditional skills. There are 3D prints that have been cast in bronze, glass, plaster, scagliola (an imitation marble technique), silver, chocolate, and wax; there are pieces carved in alabaster and wood – but this is only the tip of the iceberg. The technology is developing fast. It requires curious minds to experiment and find new applications.

The most common 3D processes are:

SLS or Selective Laser Sintering. This is an additive manufacturing technique that uses a laser to sinter (fuse) powdered material.

SLA or Stereolithography. This is a process in which thin layers of resin are cured by ultraviolet light.

Fused Deposition Modelling. This is the most common additive manufacturing system used by most home printers. A thermo-plastic polymer (ABS) is built up in layers.

CNC milling. This is a subtractive method where the tool head is positioned in relation to a block of material and carves the form. Many materials can be carved in this way – from polyurethane board to marble and stainless steel.

HOW TO PRINT YOUR FILE

If you want to print your 3D model, many steps are involved. We suggest you contact a professional 3D printing studio. We recommend you visit the iMakr Store, a showroom for desktop 3D printing and 3D scanning, or talk to the team at Hobs Studio, who printed many of the life-size busts in the exhibition.

iMakr

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If you are interested in commissioning a bust in a variety of materials with the digital and physical artisans at Factum Arte, visit the websites below.

<http://www.factum-arte.com>

<http://www.factumfoundation.org>

You can also use the models you received to order 3D prints online:

<https://www.sculpteo.com/en/>

<http://www.shapeways.com/>