Digital 3D Geometry Processing
Project

Handout date: 12.11.2016

Final submission deadline: 23.12.2016, 23:00 h

General Description

The goal of the project is to produce a 3D model of a lamp that fits the specifications given below and that can be fabricated with a 3D printer. We selected one of your scanned meshes (see link Geralt mesh) as the most suitable for this task. This ensures a level playing field for everyone and makes the final results easier to compare. You are of course welcome to process one of your own models in addition, but this will have no impact on the final grade. You can use existing tools (e.g. meshlab, 123d make, meshmixer, etc.) to partially process your model, but you need to clearly document each step. Most importantly, you need to implement some non-trivial methods yourself. The main task is to take the given surface mesh and turn it into a perforated model of sufficient thickness so that 3D printing will work and that light is emitted in an interesting way. You can also modify the geometry, e.g. by smoothing or exaggeration, or other types of deformations.

Lamp Specifications

Your lamp shade should fit the lamp shown in Figure 1. To attach your 3D print to the existing lamp, your model needs to have a circular support at the bottom of radius 14mm. The light source is approximately 5cm above this circular ring. Scale your 3D model to fit the given measurements in millimeters. Please make sure you create a large enough void to avoid collisions with the light bulb.

3D Printing Software

To check the quality of your final model, you can use the software Cura to prepare your object for 3D printing. Note that Cura will automatically handle multiple intersecting meshes (for example two intersecting spheres).

https://ultimaker.com/en/products/cura-software

What To Hand-in

First deliverable (November 21st):

- short description of your goals

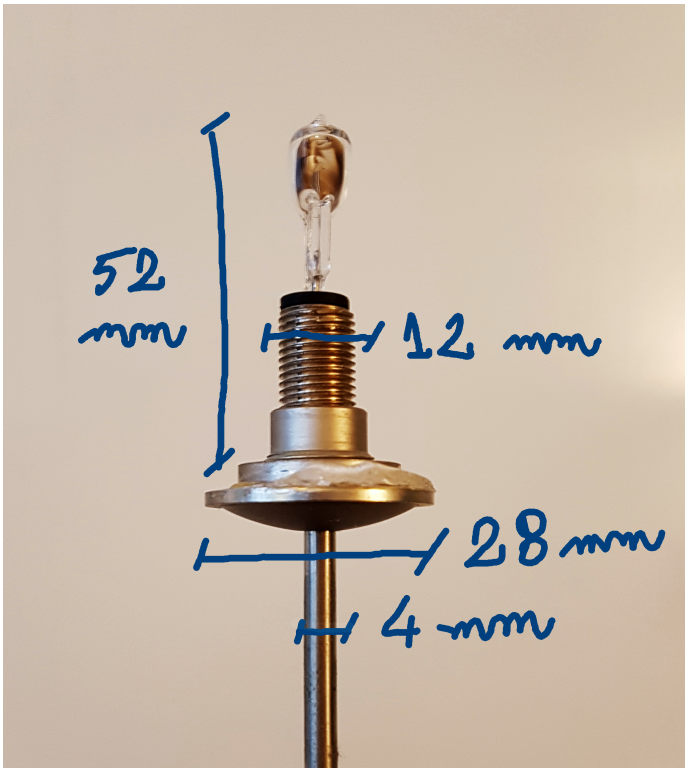

Figure 1: Photo and measurements of the lamp that will be used as a base for 3D printed models.

- selection of methods you plan to implement
- outline of which existing tools you intend to use for which processing tasks.

Second deliverable (December 8th):

- brief progress report explaining what has already been achieved, where difficulties arose, and what is planned for the remaining 2 weeks.

Final deliverable (December 23rd):

- polygonal mesh ready for 3D printing
- images / video of model (we will provide a Maya scene and short tutorial that you can use to create your renderings)
- code repository
- report that explains which steps you have taken from the initial geometry to the final model. Provide details on all the processing steps, list all external tools that you have used and describe the algorithms that you have implemented, carefully listing any external code in case you used any.

Grading

Below is the breakdown of the grading for the project. The bullet points highlight the aspects that we will consider to determine the grade.

20% Quality of the final model

- complexity of the geometry
- interesting surface structure and lighting effects
- 3D printable

10% Processing using existing tools

- surface clean-up
- interesting geometry transformations
- preparation for 3D printing

50% Implementation

- relevance of algorithms for the achieved goals
- difficulty of the implemented algorithms
- effective use of class material or newly acquired knowledge

20% Reports and documentation

- completeness of documentation of all project steps
- clarity of report (textual and visual)
- documentation of code

Some random images for inspiration

http://certified-lighting.com/images/lights/3/3d-printed-lamps-animal-lace-bear.jpg
http://certified-lighting.com/images/lights/3/3d-printed-lamps-animal-lace.jpg
https://www.shapeways.com/wordpress/wp-content/uploads/2012/11/lampshade.jpeg
https://s-media-cache-ak0.pinimg.com/originals/97/e4/dd/97e4ddf15c67f4ab4d267349c0348162.jpg
https://akhlysthinks.files.wordpress.com/2010/12/fall-of-the-damned-lampshade-from-hell-xl.jpg

Scientific Papers

Here are some links on latest research in this domain. These methods are too involved to implement in the remaining project time, but might provide some inspiration. The papers will also give you some insights into what the open research problems in this area are.

https://www.disneyresearch.com/publication/designing-structurally-sound-ornamental-curve-networks/
https://www.inf.ethz.ch/personal/chschuma/publications/stencilingSGP16.pdf
https://arxiv.org/abs/1510.03023
http://i.cs.hku.hk/ wkchen/projects/proj_sig16.html
https://members.loria.fr/JDumas/publications/sfsyn/