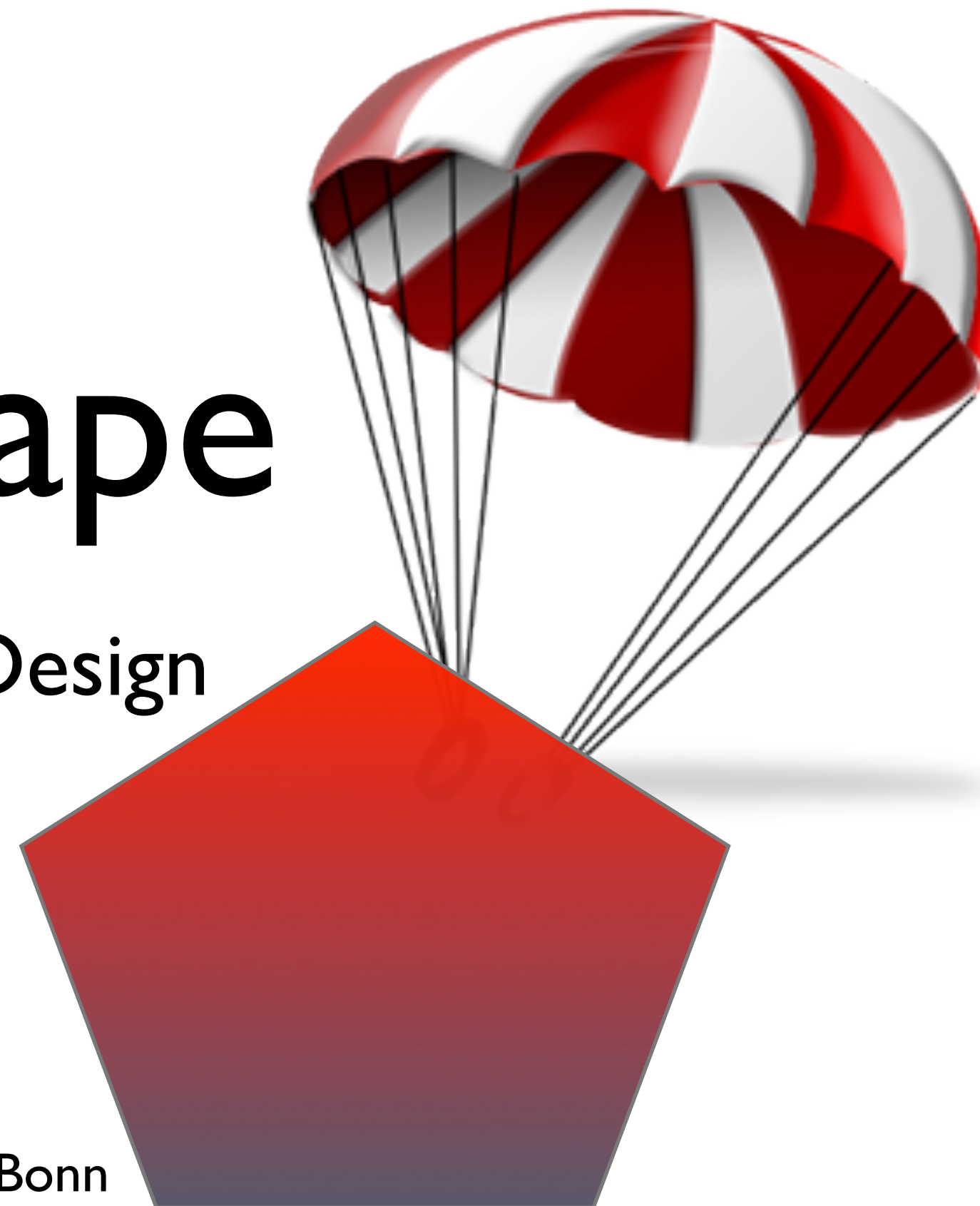


# ParaShape

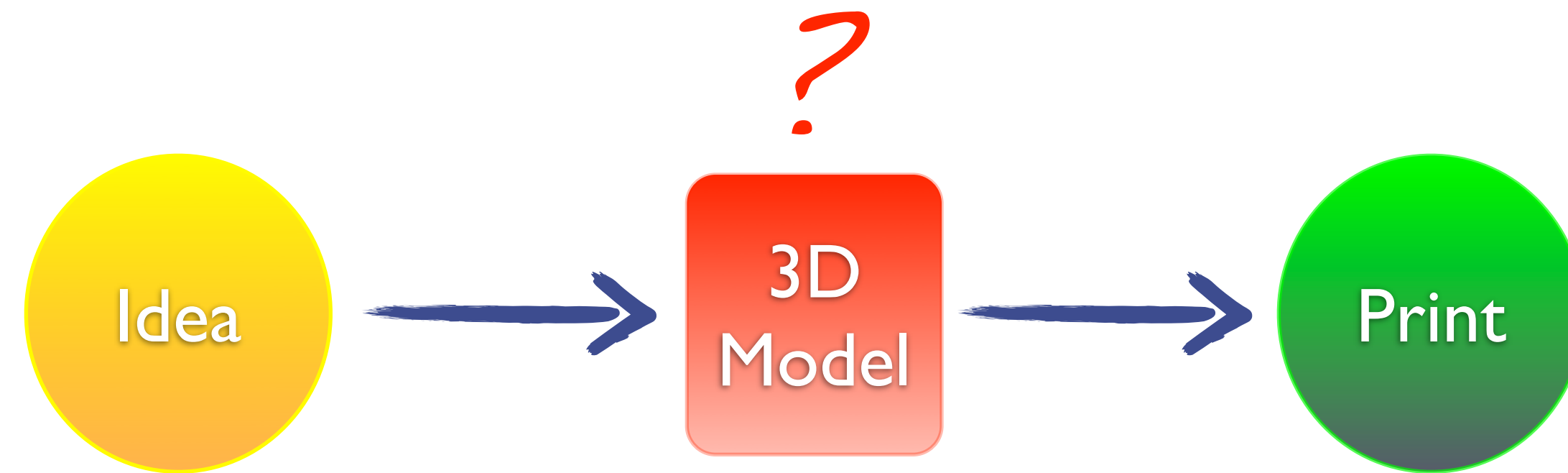
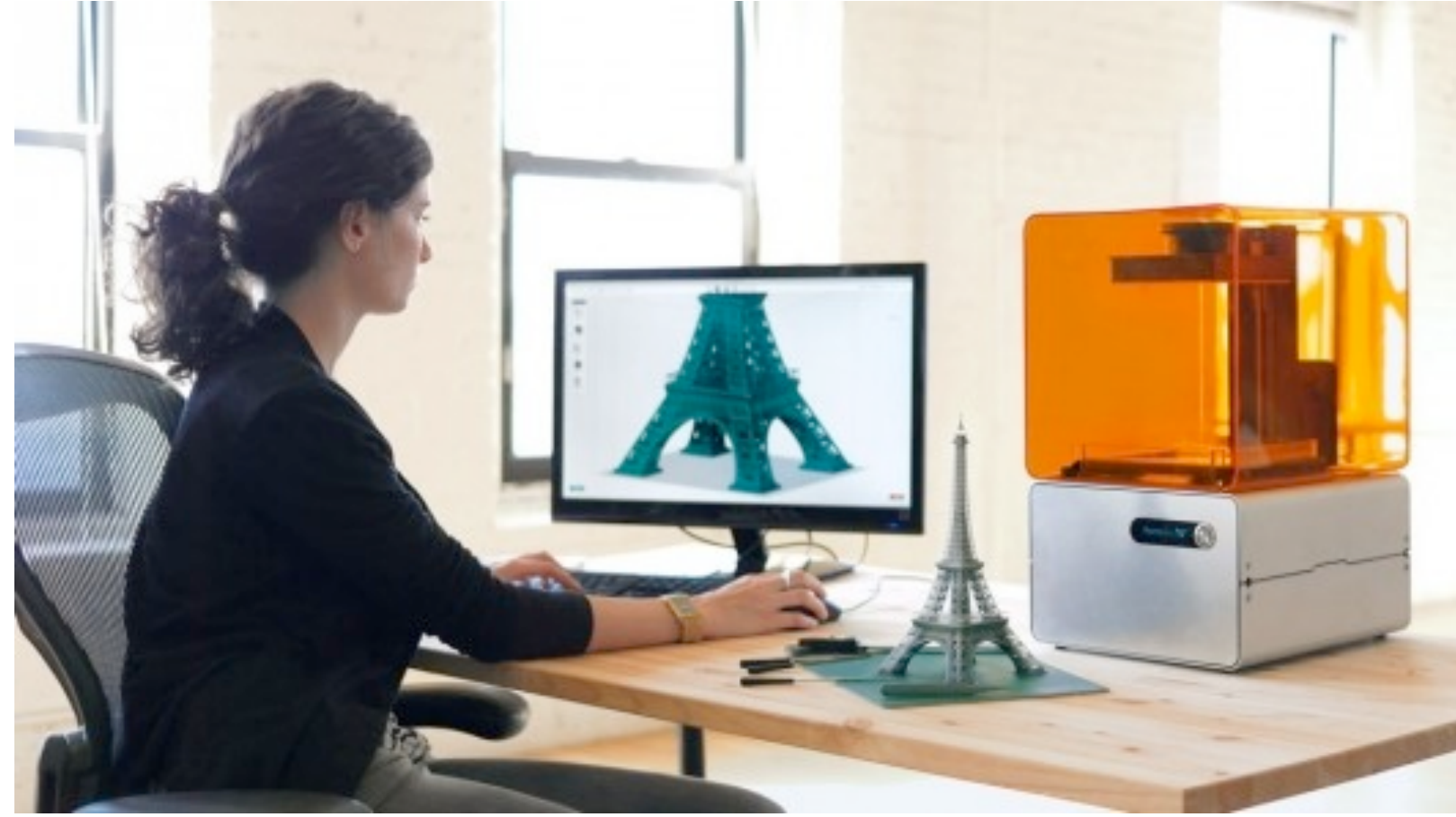
Parametric Approach to Personal Design

Shadan Sadeghianborojeni

Master of Computer Science Student at the University of Bonn



# Motivation

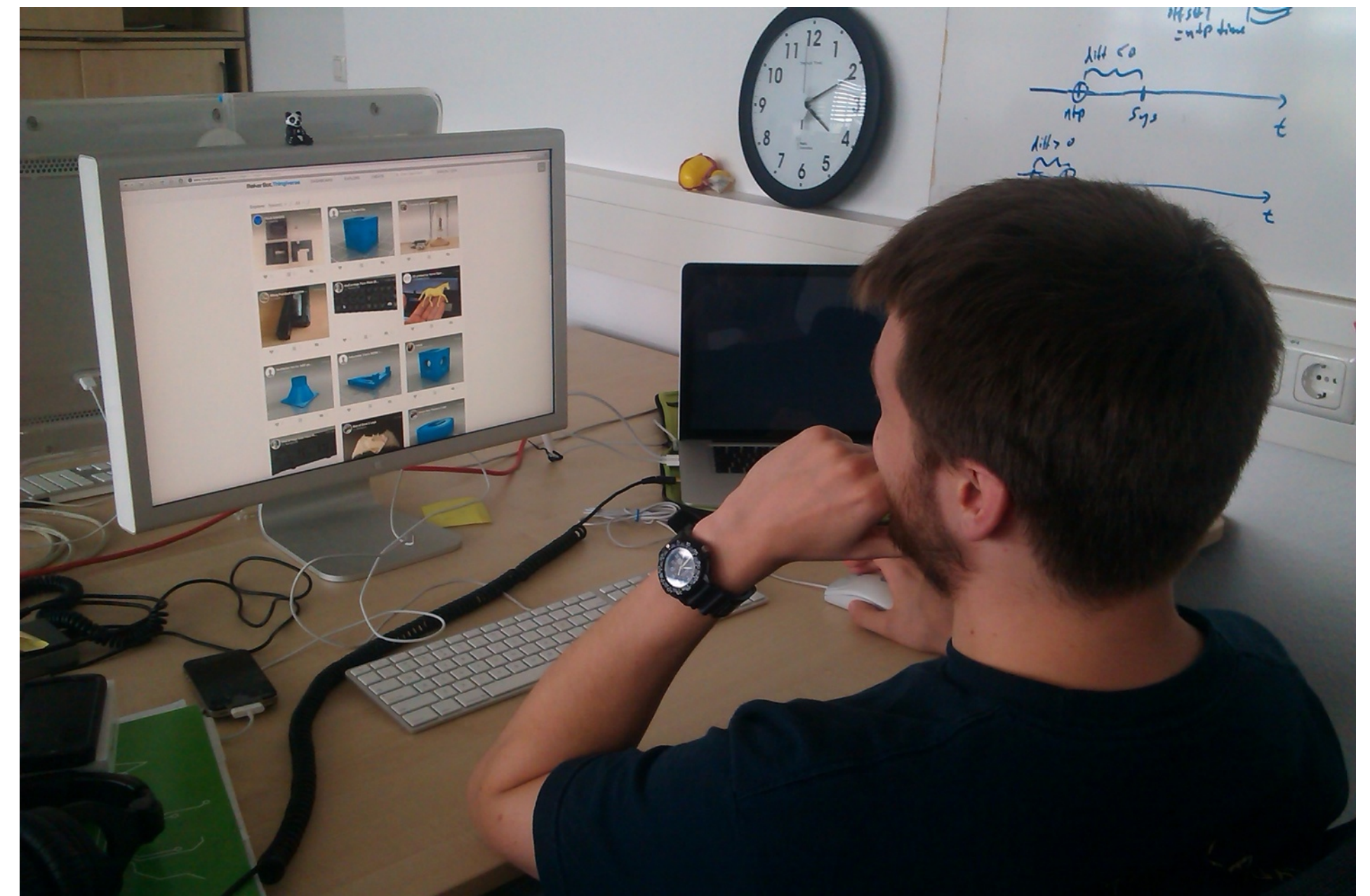


# Who is the User?

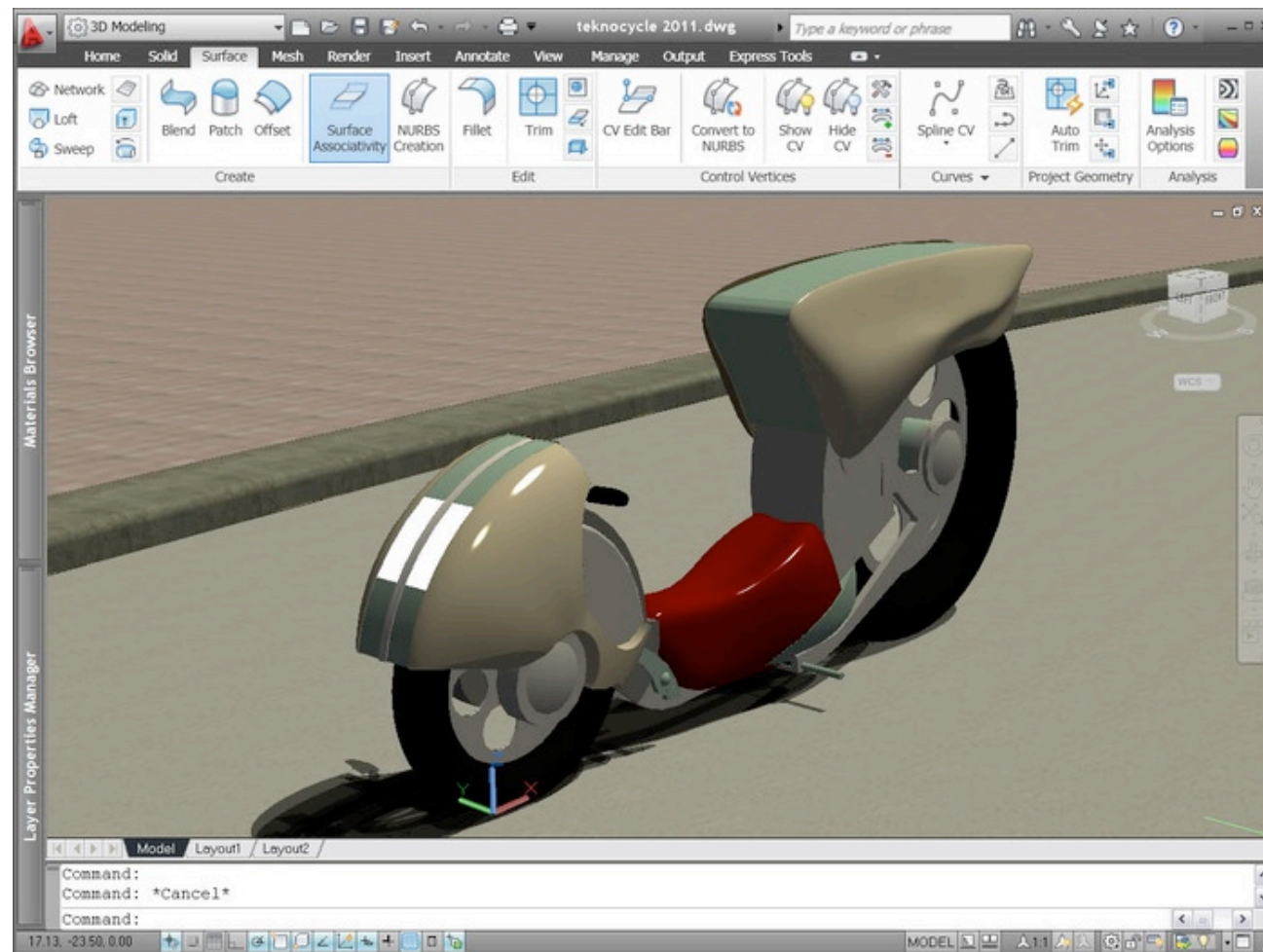


Novice User

Expert User



# Initial Survey



## Expert Users

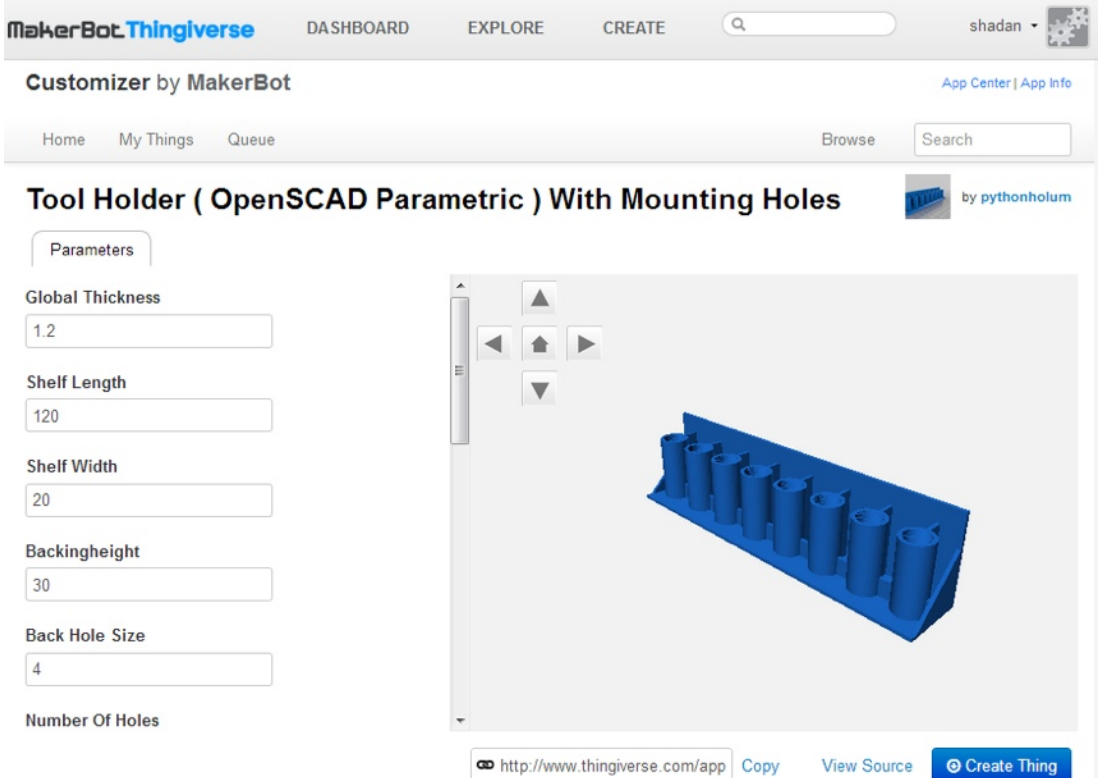
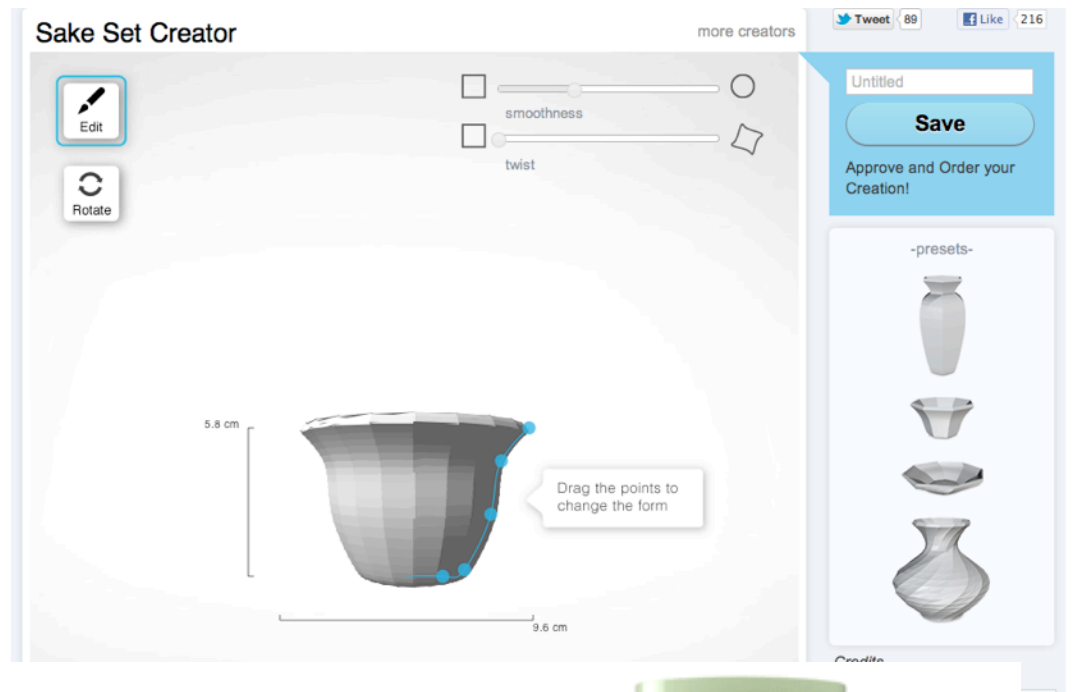
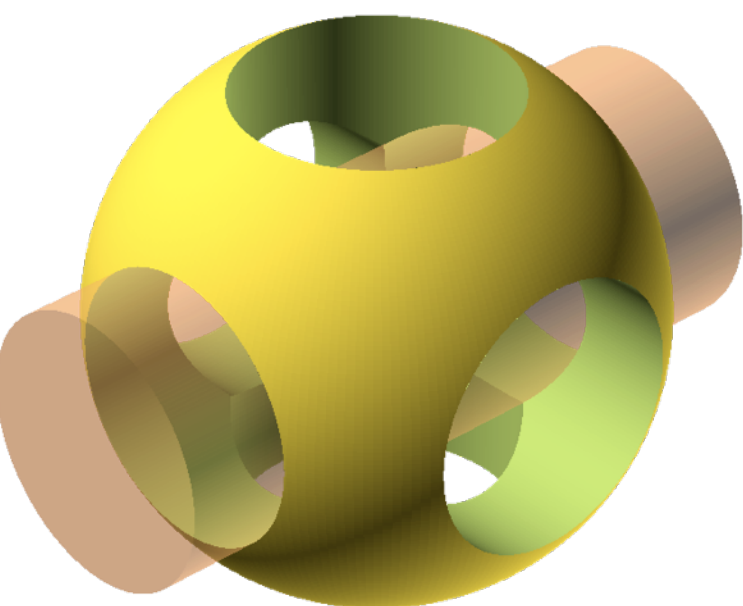
- Use WYSIWYG CAD to visualize design ideas (AutoCAD)
- Think more functionalities and learnability makes a tool usable
- Spend minimum 30 minutes on a design visualization

## Novice Users

- Use pen and paper and to visualize design ideas
- Like composing parts to make complex objects
- Spend minimum 30 minutes on a design visualization



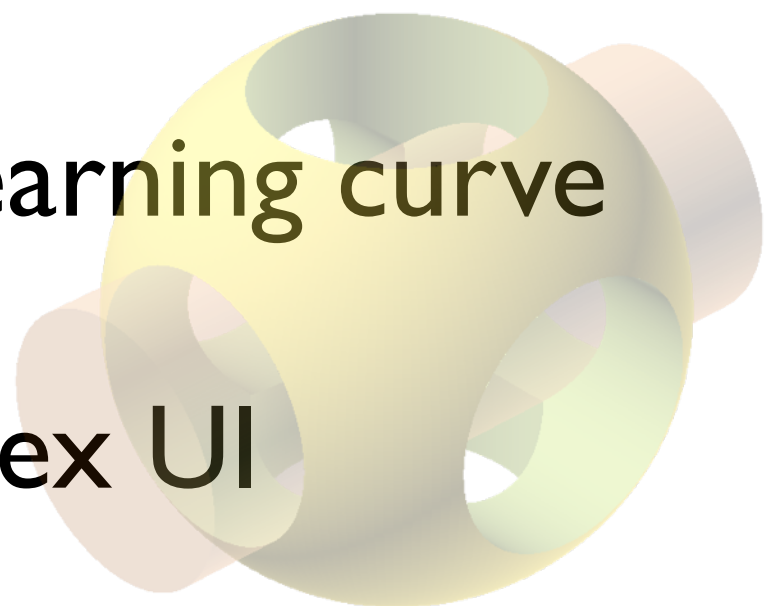
# Related Work



# Related Work (Problems)

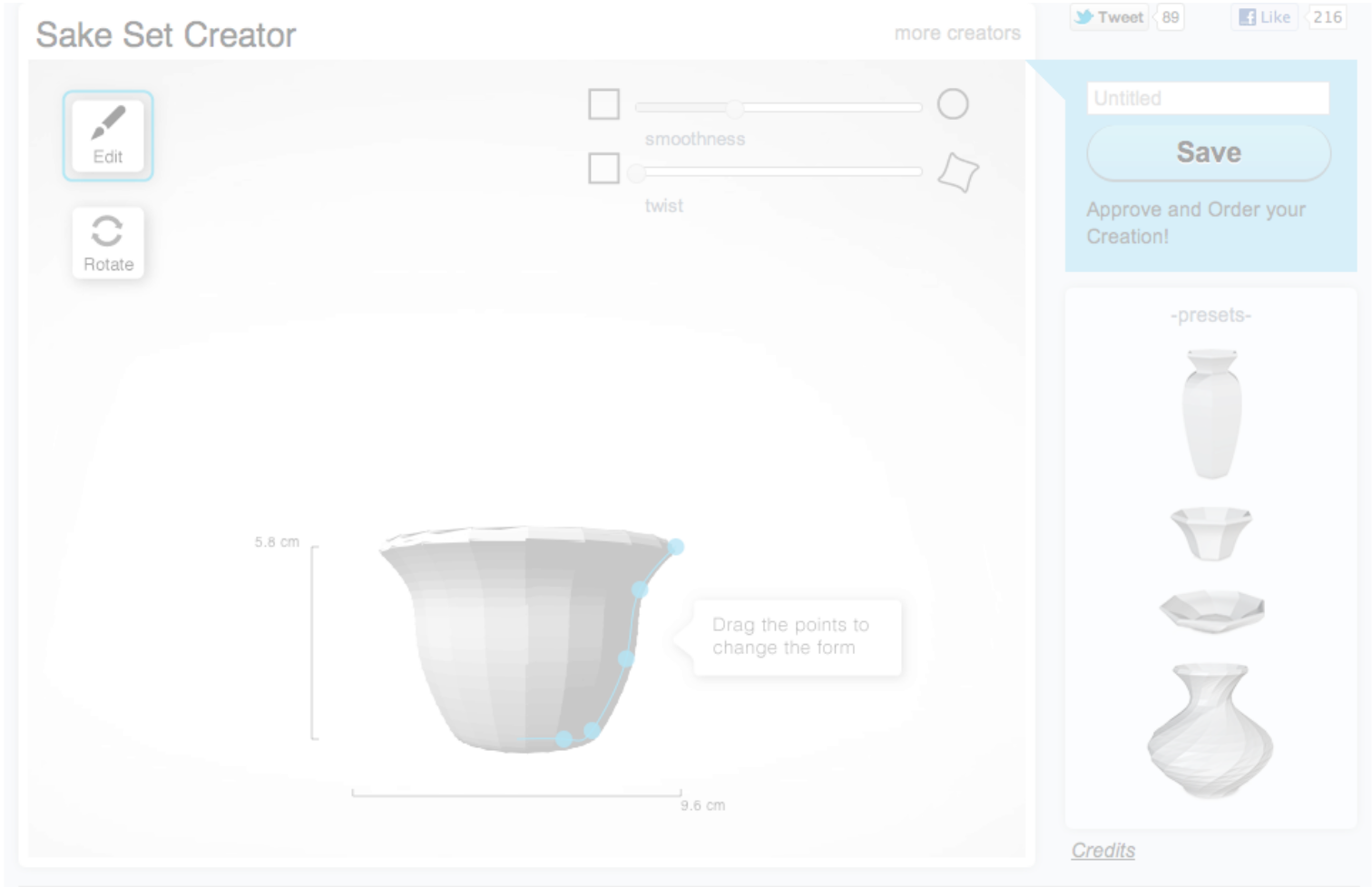
## CAD

- High learning curve
- Complex UI



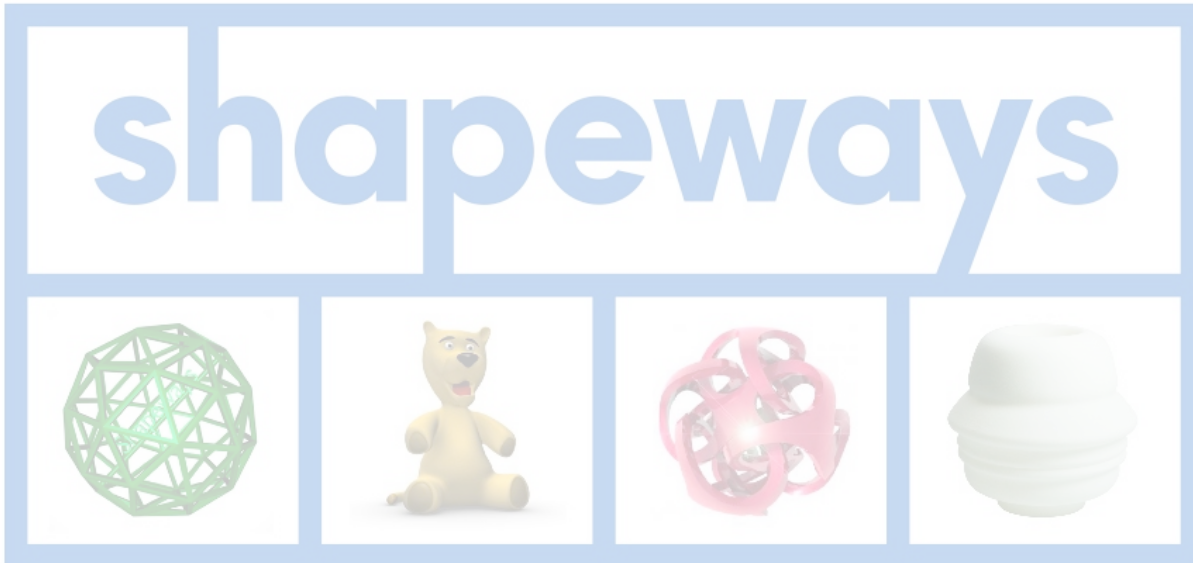
## 3D Creators/Customizers

- Small range of object models covered



## 3D model libraries

- Static models, 3D modeling skill required for customizing



# Requirements

High range of object 3D models

High flexibility of the existing 3D models for customization

Understandable interface

Easy and fast search and browsing for the models

Understandable units of measurement

Capability of making complex 3D models  
without having 3D modeling skill

High learnability of the system

Time efficiency of the system

High readability of 3D model code  
Capability of code reuse



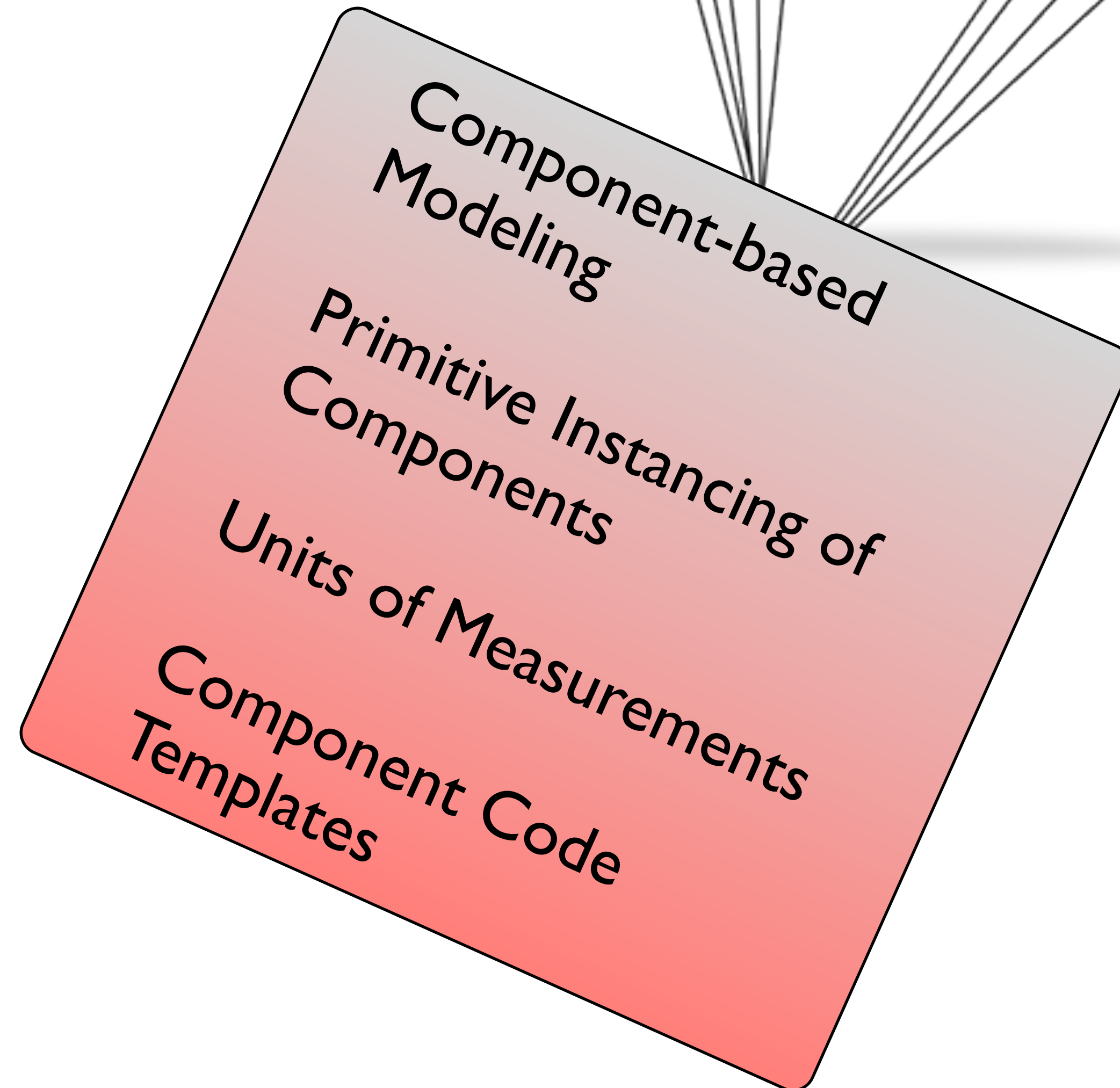
# Makerbot Customizer



- Met 5 out of 10 of our system requirements
- Low system usability scale (52%)
- Users feedback not satisfactory



# Hypotheses of ParaShape

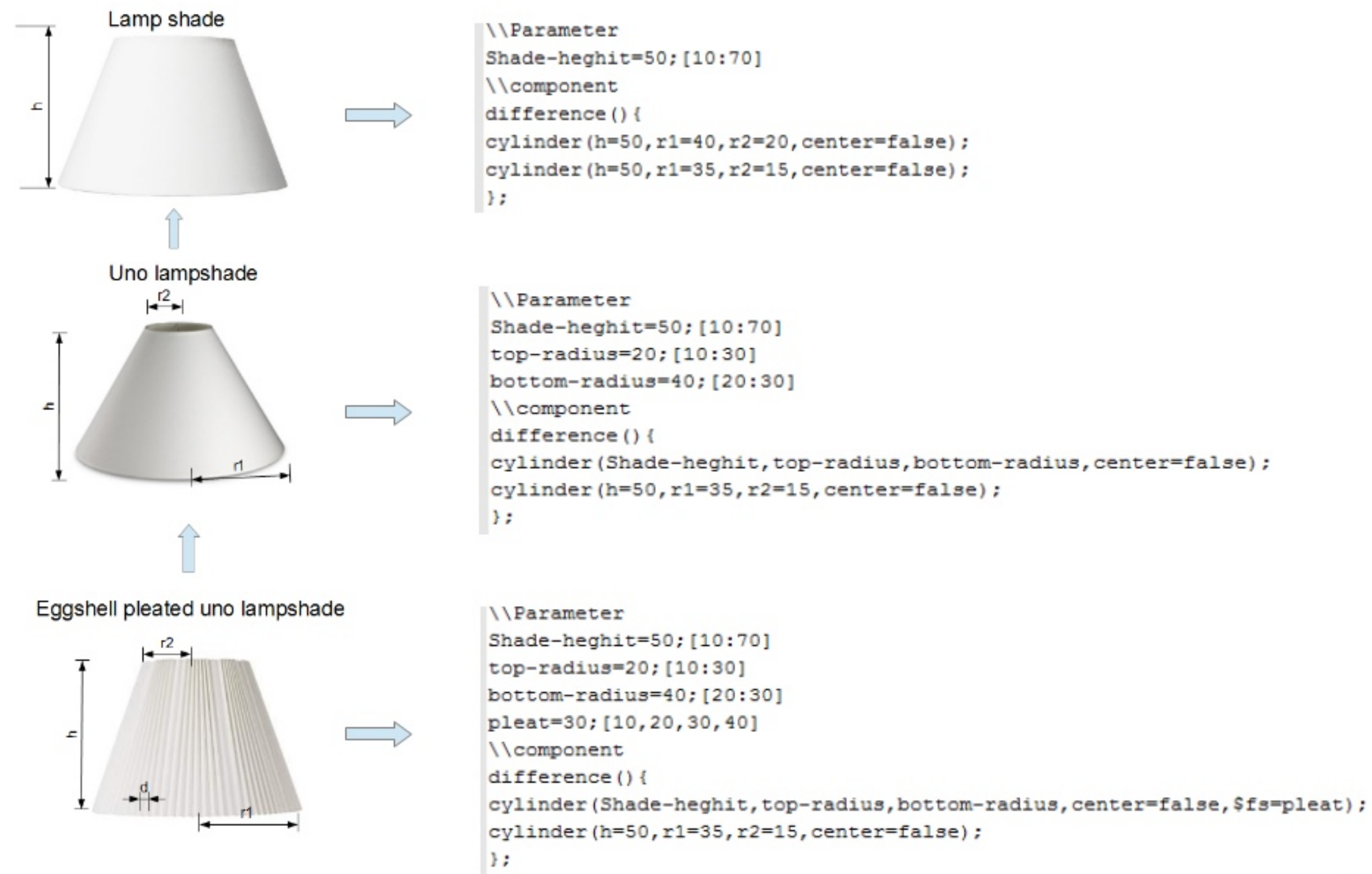


# HI:Component-based Modeling

Every object is made of its  
composing components



# H2: Primitive Instancing of Components



# H3: Units of Measurement

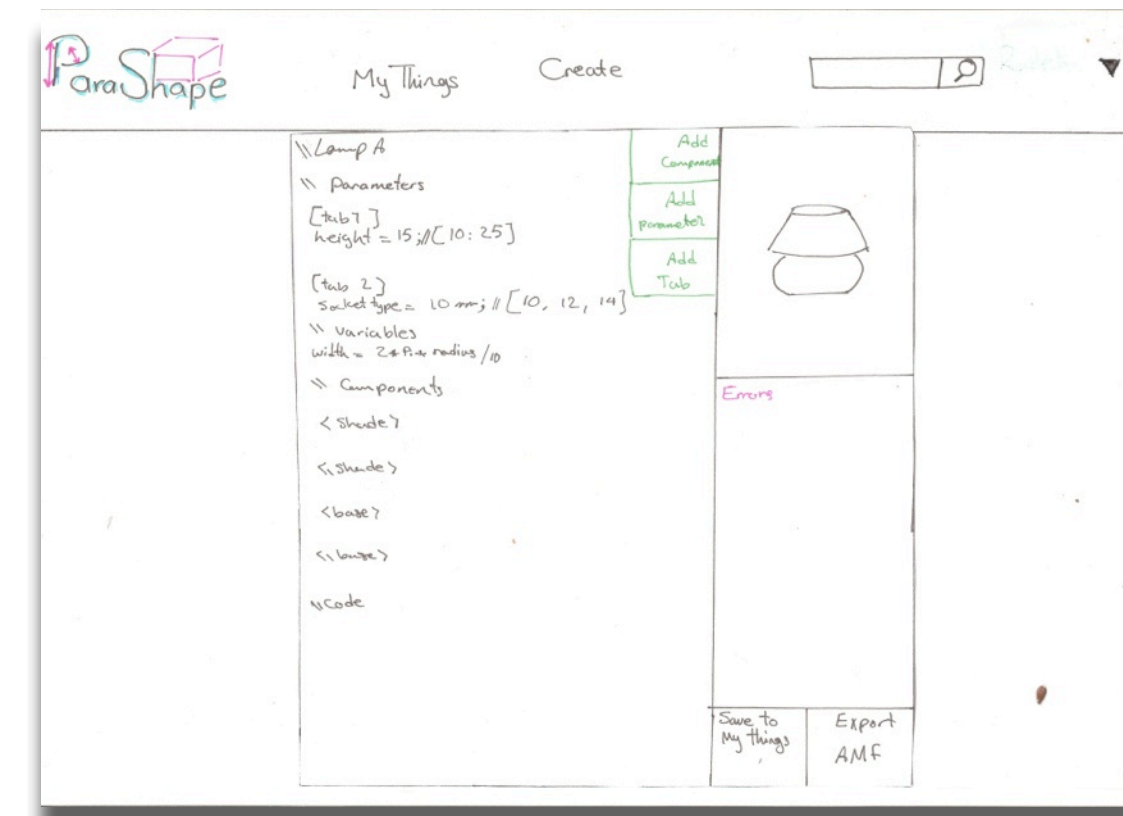
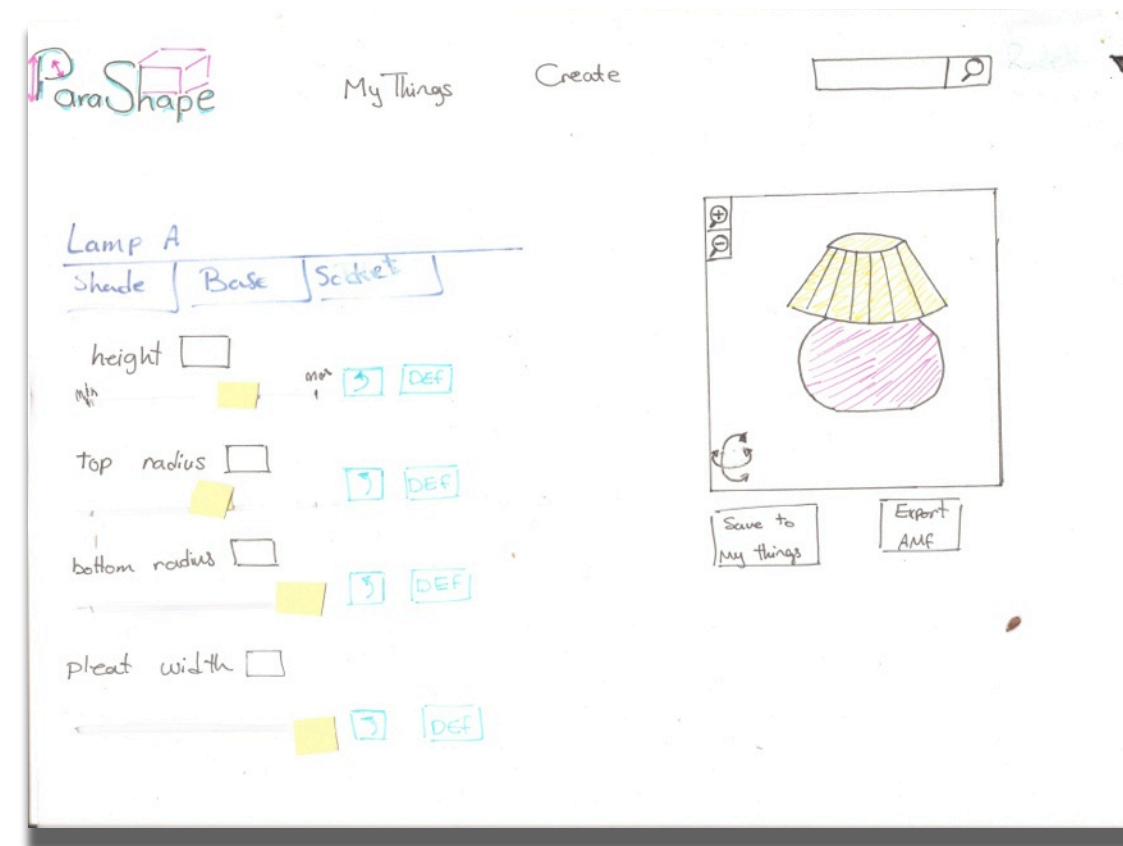
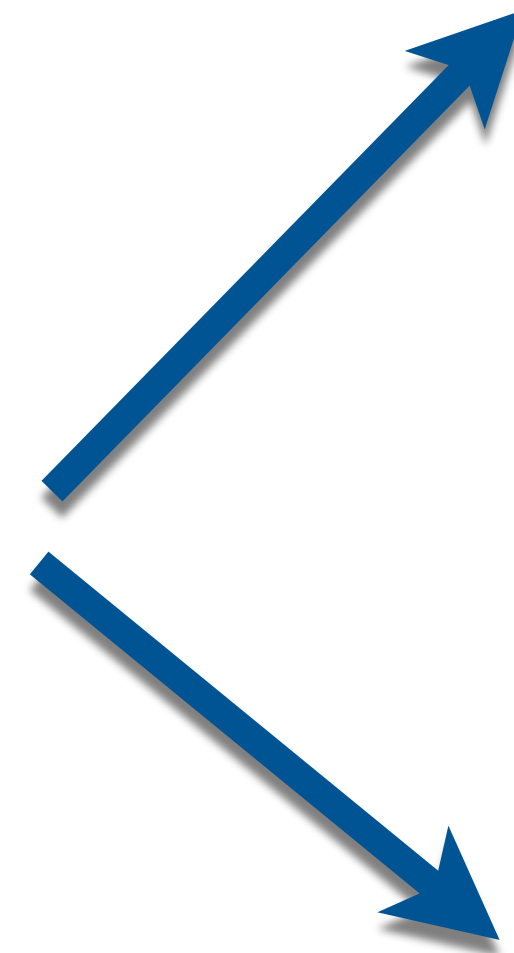
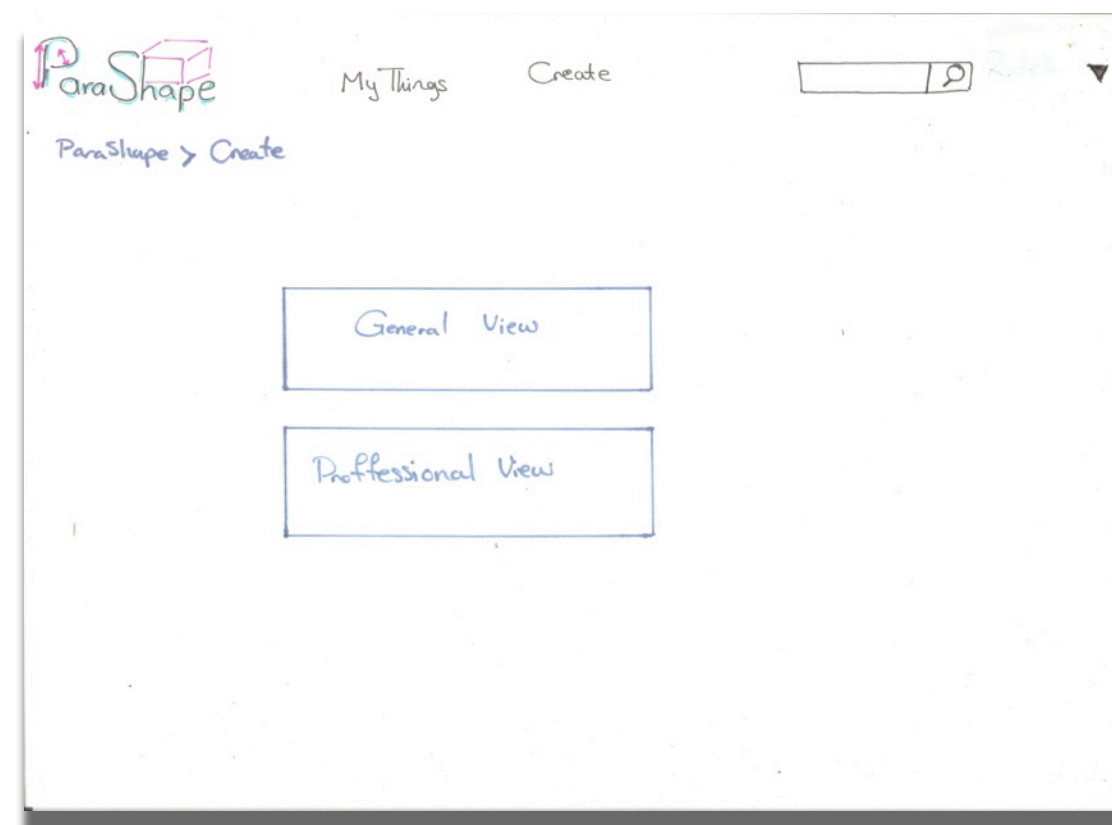
- *Metric Units:* a cylinder with a cross section radius of 10 millimeters and height of 44 millimeters
- *Market Units:* AAA battery

76% rated the market units of measurement as a more acceptable system: is more familiar, prevents measurement errors



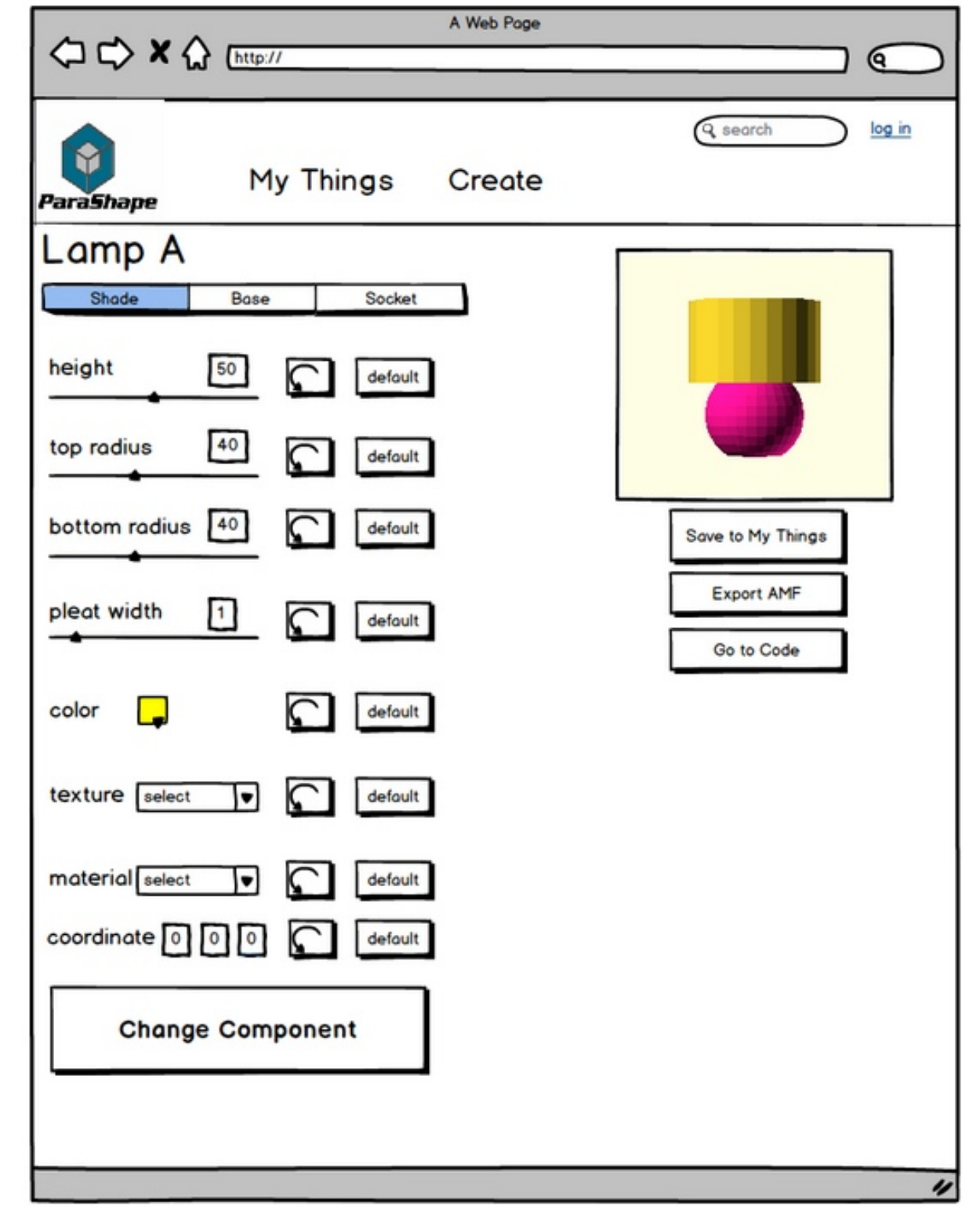
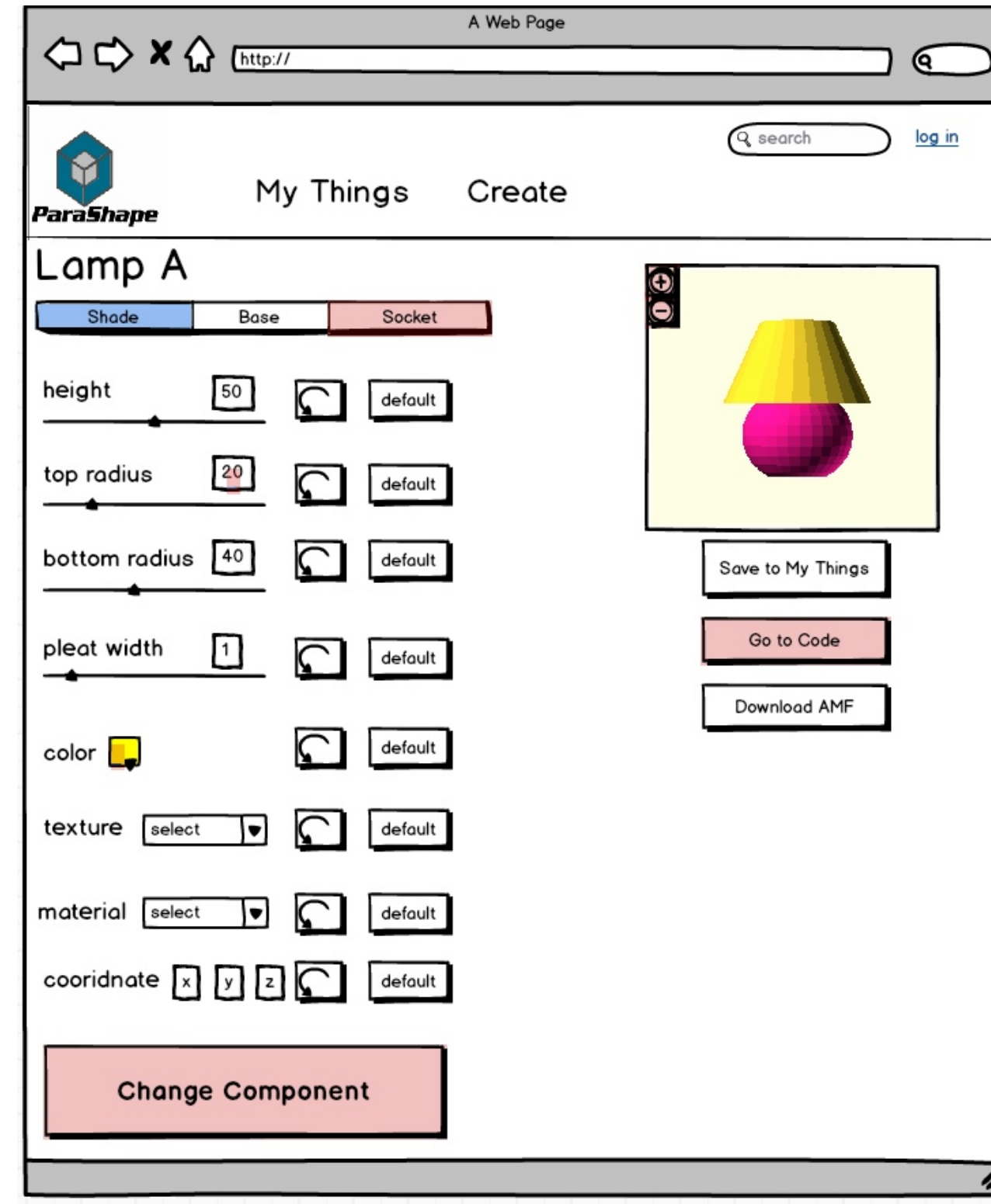
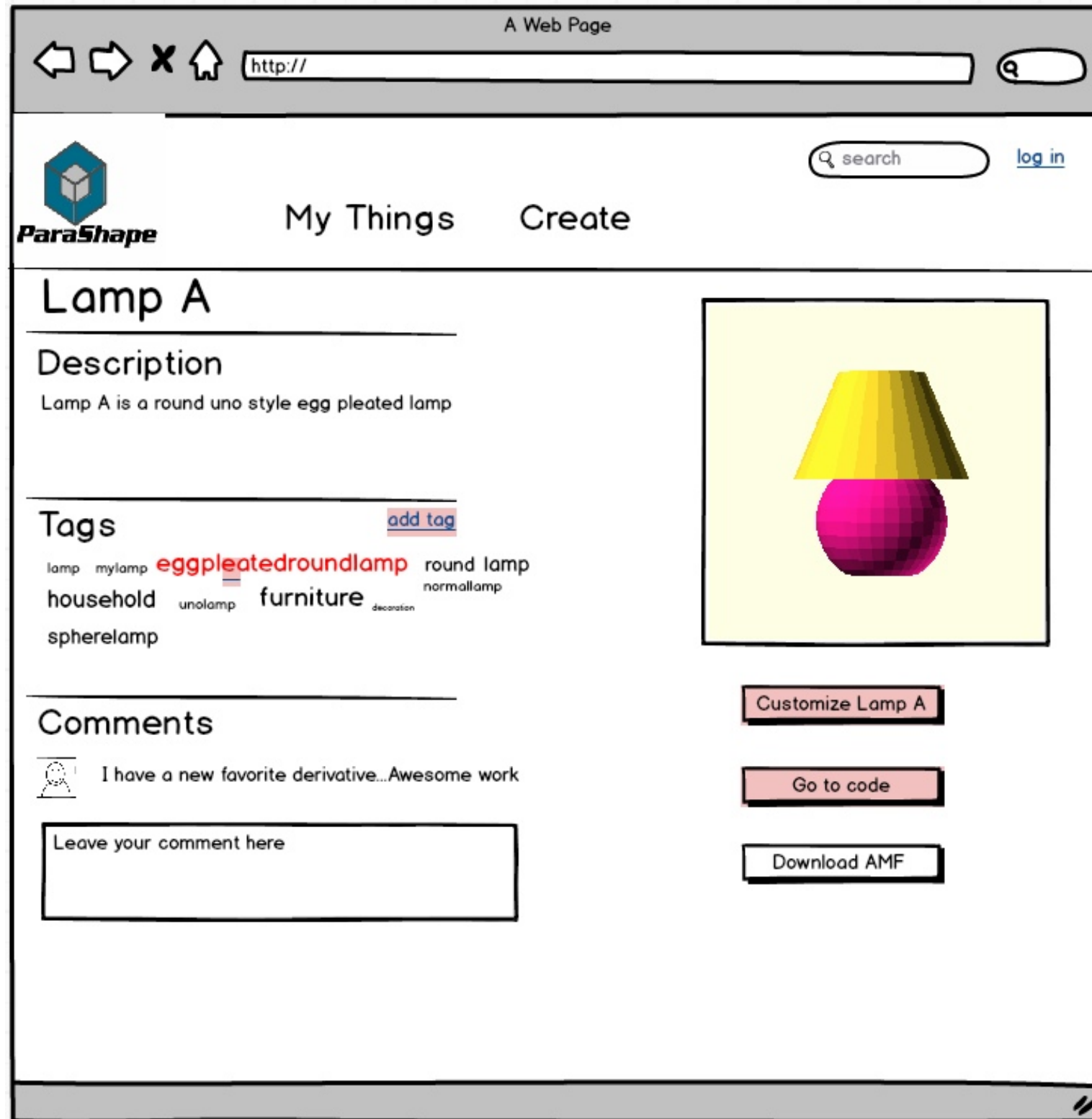


# Paper Prototype

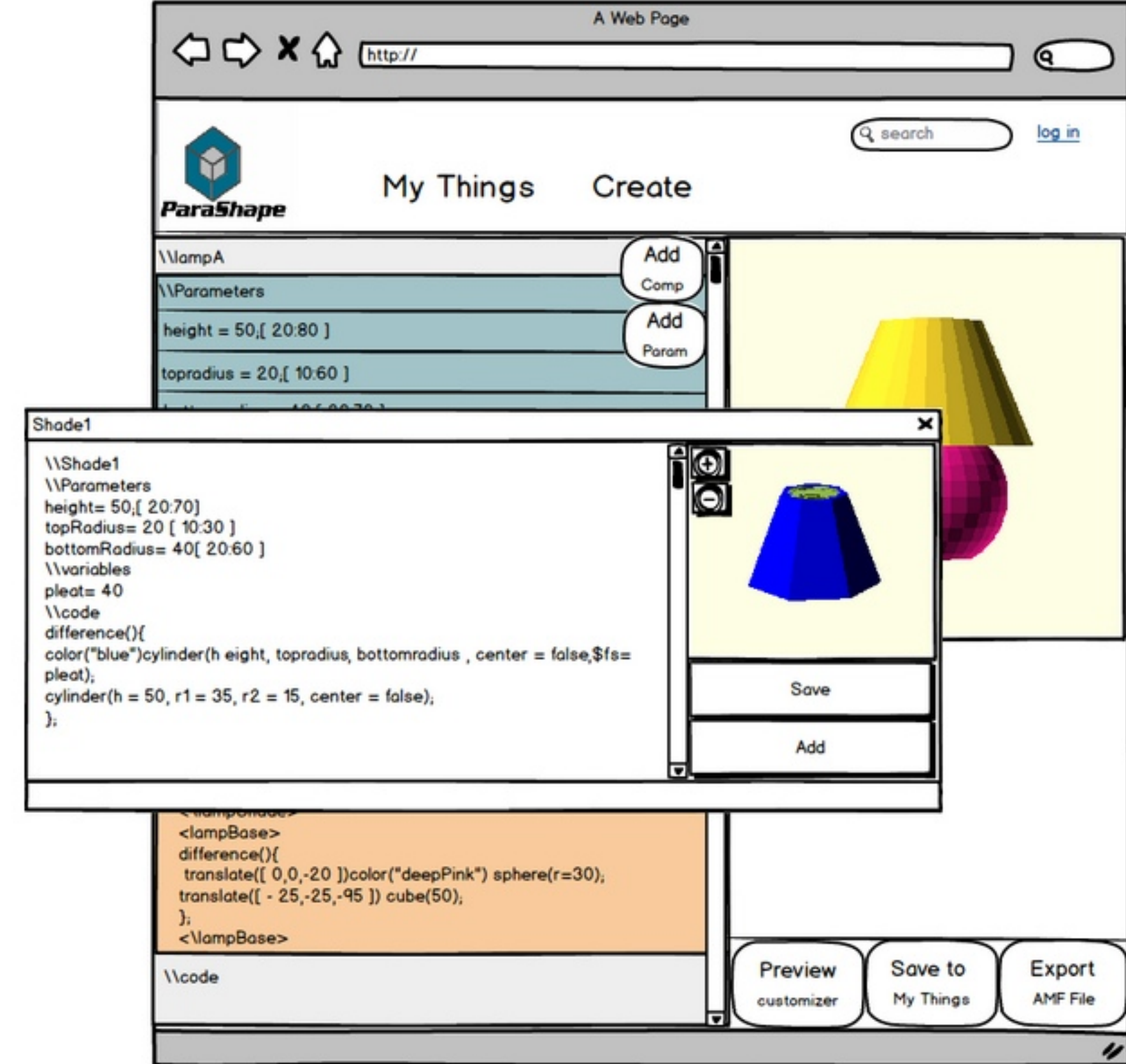
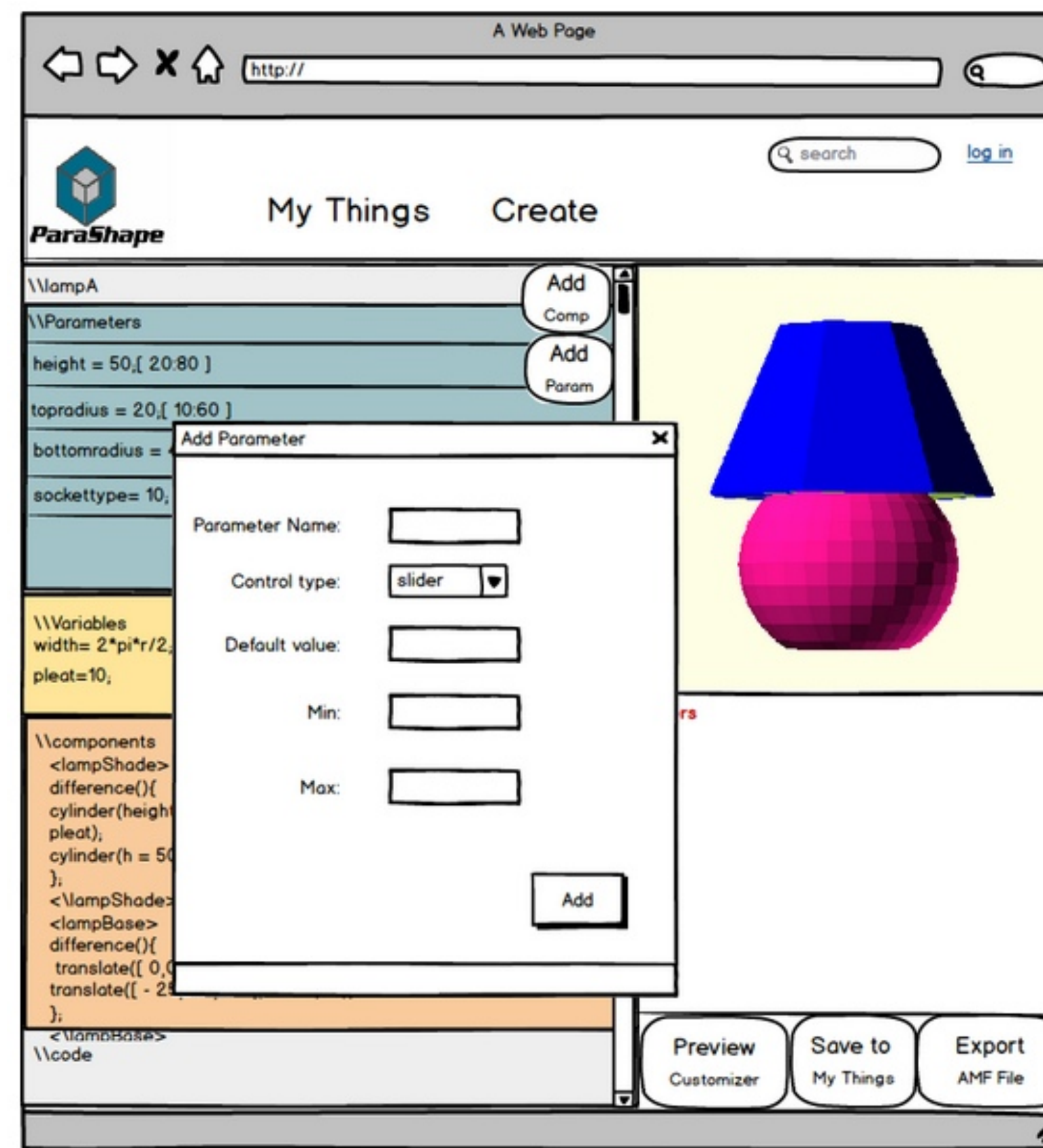
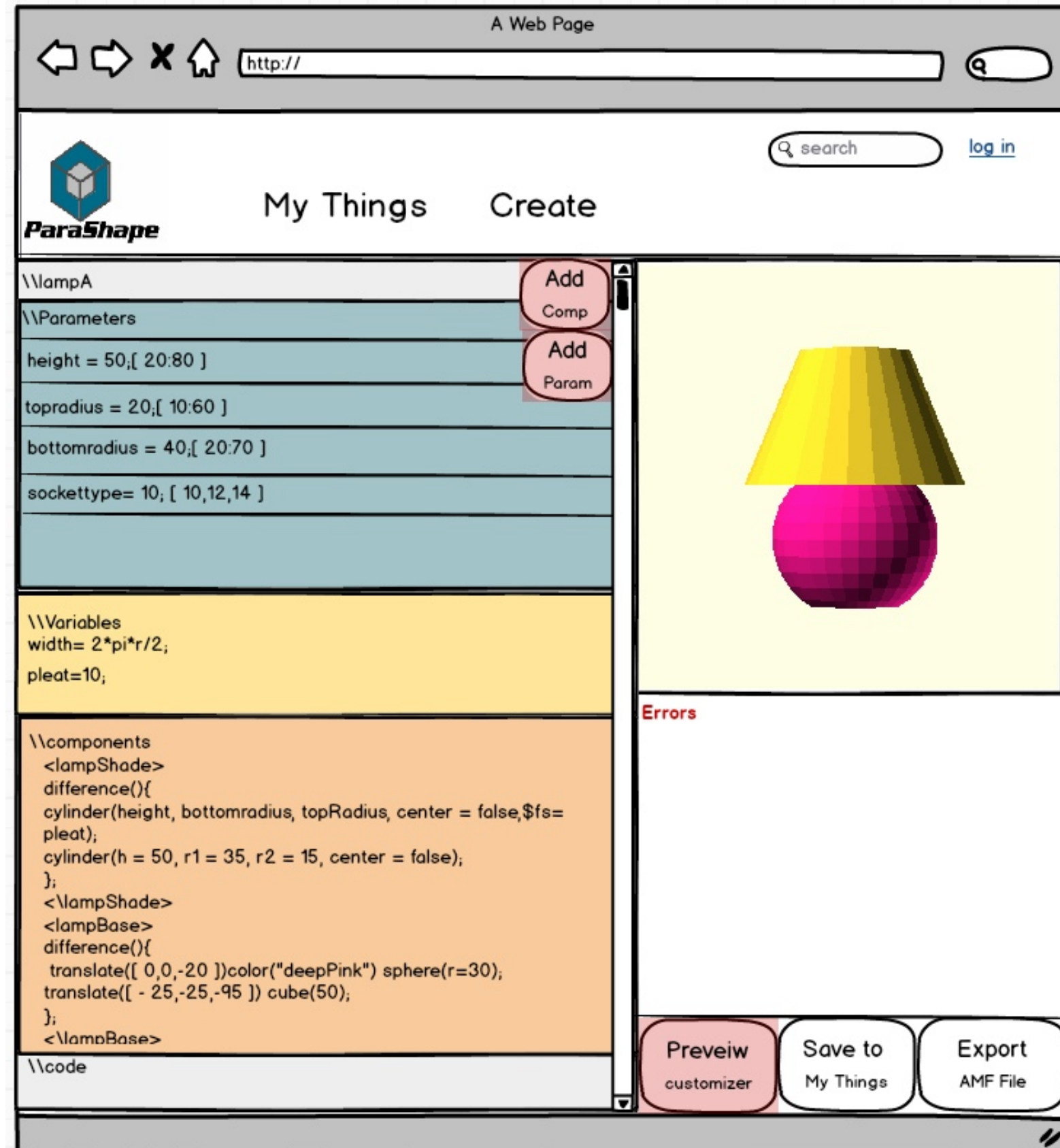


- Qualitative user study
- Separate questionnaires for both user groups
- Comments and suggestions used as requirements for final mockup

# Mockup



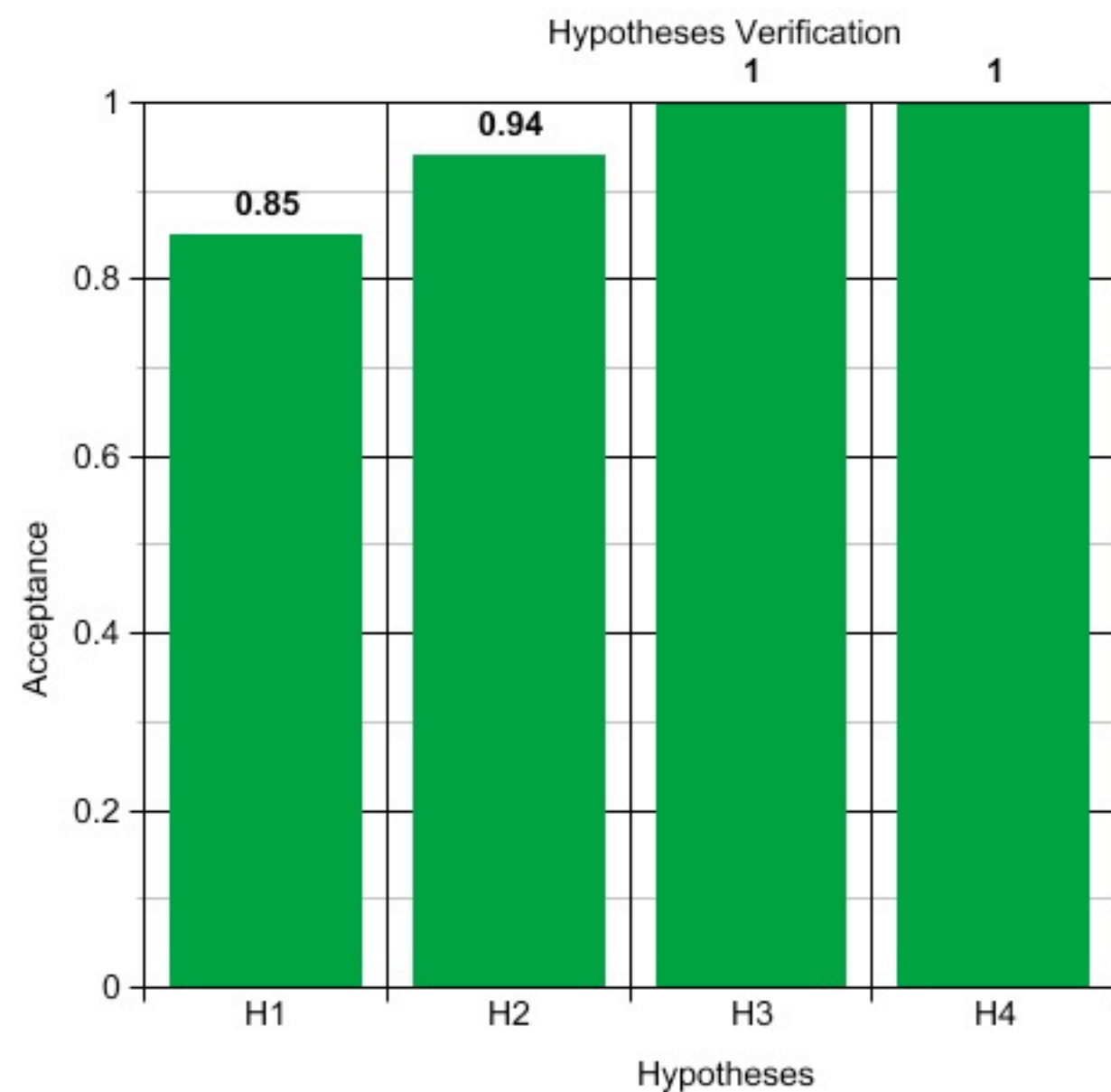
# Mockup





# Evaluation of Mockup

- Hypotheses Verification
  - H1: Component-based modeling
  - H2: Primitive instancing of components
  - H3: Units of measurement
  - H4: Component code templates



- PSSUQ Results

Overall	85%
SysQual	86%
InfoQual	87%
IntQual	88%

# Future Work

- Implement a working system of ParaShape
- Evaluate the system with 3D printers
- Using other interaction techniques (digital pen, virtual clay, etc.)
- Prevent 3D printing mistakes ( printability of the model, ergonomics, cost)

# Conclusion

- The goal of personal design is to make everyone able to turn their ideas into physical objects.
- ParaShape proved that by using the knowledge of experts, we can make almost everyone able to make complex 3D models needless of having 3D modeling background.

Thank you!

