Design Tools for Robots

- Project Plato
  - interactive tool and workflow for designing *families* of objects
  - each family exports free parameters and contains code for creating a (printable) *family member* given parameter values
- Fabrication *a Lavoisier*
  - interactive system for designing fabricable models from existing template collections
  - the user creates a new models by recomposing parts of existing templates
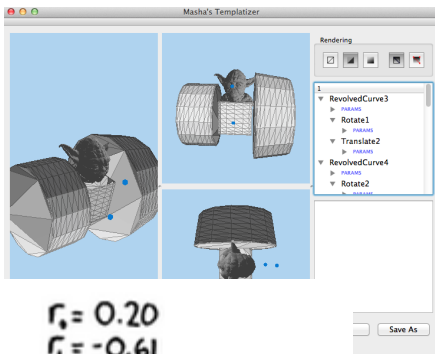
Project Plato

design for mass customization

General Idea

Engineer designs a *family* of objects
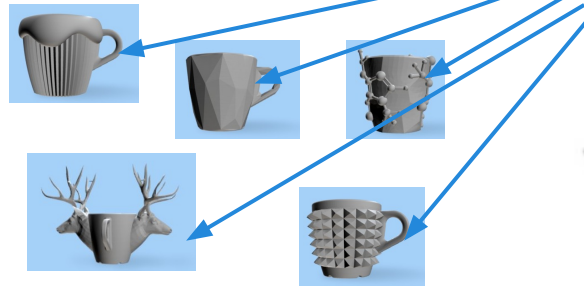
System compiles it into an efficient *program*

Casual user interactively *customizes* it

Customized printable objects

Engineer

Compiler / Optimizer

Casual User

Engineer's Tool

- inherently parameterized design
- supports basic CAD operations
- supports more expressive operations
  - e.g visual design
- built to be extensible (e.g. can link in a new elementary or composite procedure "CreateWheel")
- supports low and high level constraints

Object Family: Operation Tree

Compile a template into a tree of operations on 3D geometry of types:

- CreateShapeOperation
  - e.g. CreateBox, ImportMesh, ExtrudeCurve
- ModifyShapeOperation
  - e.g. Scale, Translate, DisplacementMap, LaplacianMeshDeform
- CombineShapesOperation
  - e.g. RelativePosition, CSGUnion
- DuplicateShapeOperation
  - actual copy is only created on demand

Object Family: Operation Tree

Example:
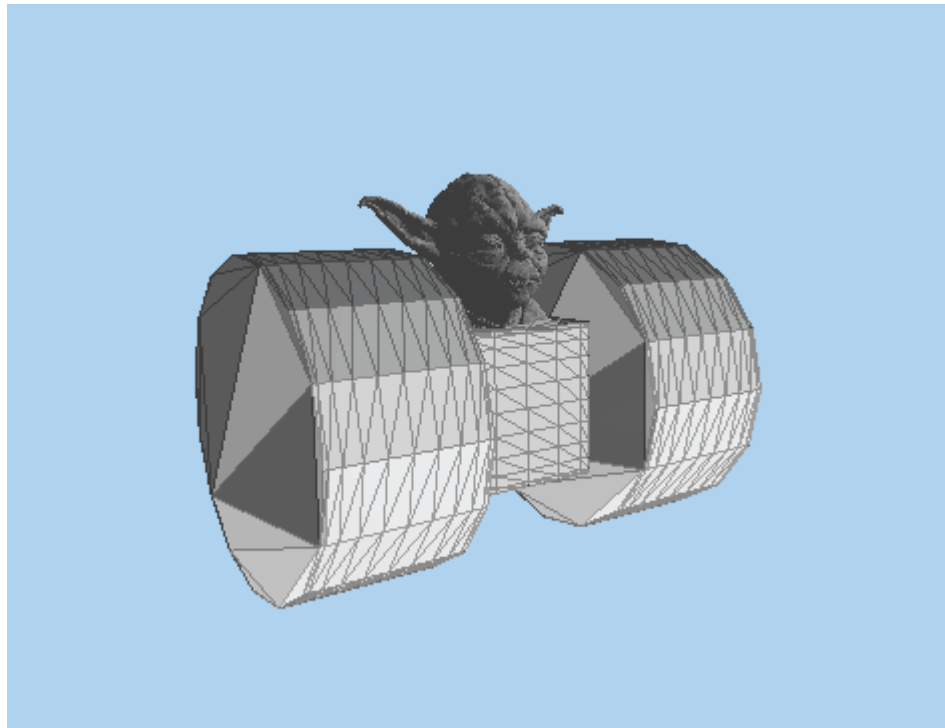
Object Family: Operations Tree
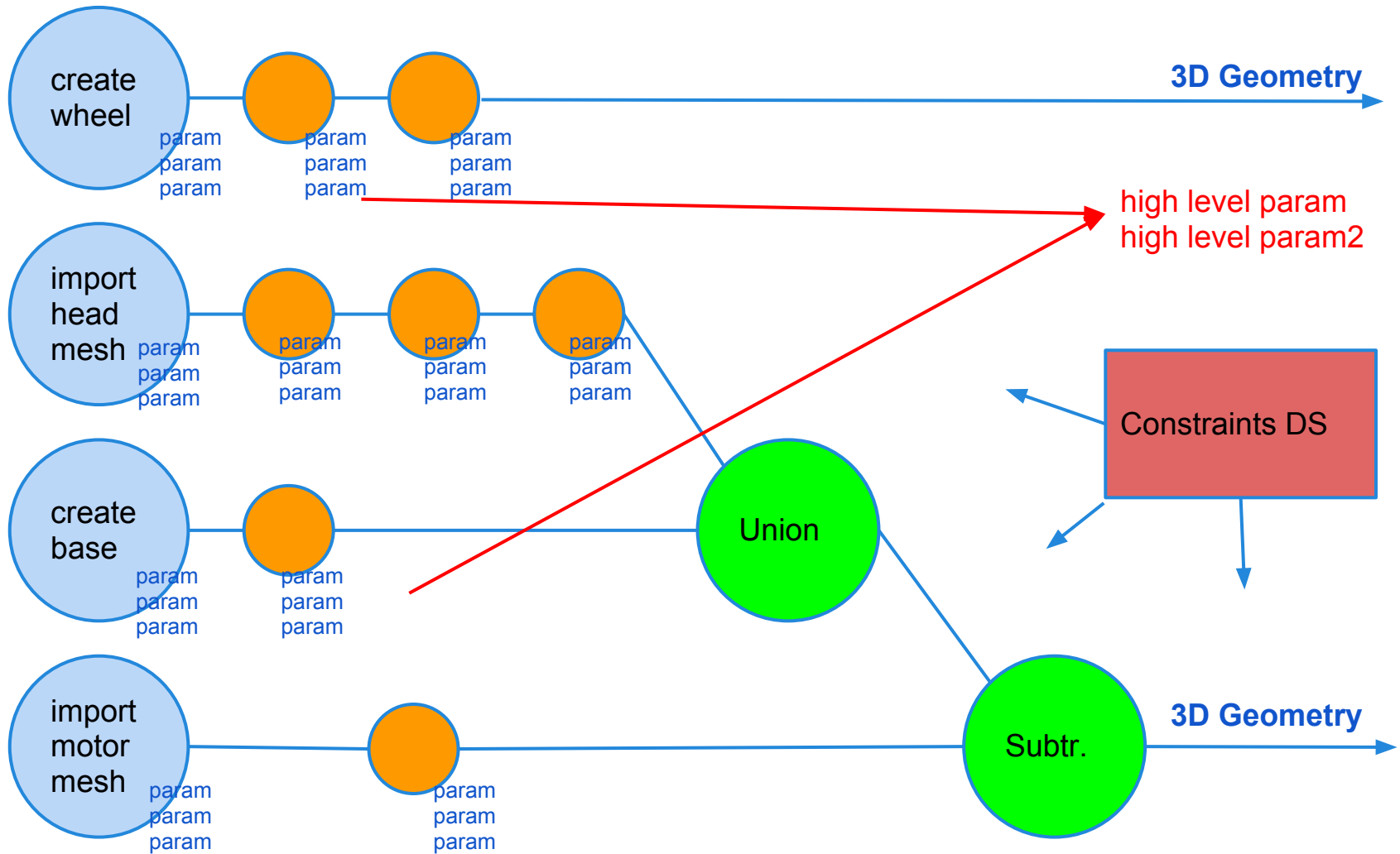
Customization / Interaction

UI like shapeways customizer apps, but:

- very fast preview
- only valid parameter ranges
- custom UI is built automatically based on template parameters

UROP Project:

- client / server

architecture