Introduction to 3d-modelling with FreeCAD

WIFI:

bitraf

grimbadgerassault

DOWNLOAD: freecadweb.org

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> whois jonnor

...

...

engineer

software

electronics

bike mechanic

maker

hacker

Workshop setup

- 10 minutes talking intro/examples

- Hands-on examples ~ 1 hour

- Break ~10 min

- Hands-on, examples → personal project

3d-model uses

- Games/VR

- Movies

- Concept visualization (arch/design)

- Documentation

- Manufacturing

  - Digital fabrication (3d-print, CNC, lasercut)

  - Conventional (technical-drawings, manual labor)

Approaches to 3d-modelling

Examples

- Direct modelling
  - Mesh / Polygon   Blender Sketchup
  - Solid / Nurbs   Rhino3d
- Parametric modelling   FreeCAD Solidworks
- Mesh sculpting   Z-Brush
- Algoritmic/code
  - Visual   GrassHopper
  - Textual   OpenSCAD
- 3d-scanning   Kinect+Skanect

Solid, Feature-based, Parametric

+ changes updates everything
+ always watertight

+ easy to create families/variations

- order of operations matters

- a bit techical

Examples of FreeCAD work

Things I've done

Mostly from https://github.com/jonnor/projects

Tips

- Use mouse/trackball/ instead of trackpad

- Have pen & paper available for sketch/dimensions

- Use pictures as reference material

LIVE show & tell

Everyone got FreeCAD installed & running?

FreeCAD UI concepts

- Workbenches

    Part, Part Design, Draft

- Object tree

- Object properties (view/data)

- Document viewport

Viewport navigation

Note: configurable
*   right click → nav. Style*

*   Edit → Preferences → Display*   *zoom-at-cursor*

- Key numbers 1-9: top, front, side, ...

- Scroll wheel: Zoom in/out

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Part Design basics

- New Sketch

- Adding geometry: Rect

- Adding constraints: Distances

- Pad

- Map Sketch to Face

- Pocket

Finishing: Fillet & Chamfer

Also used for structural purposes,
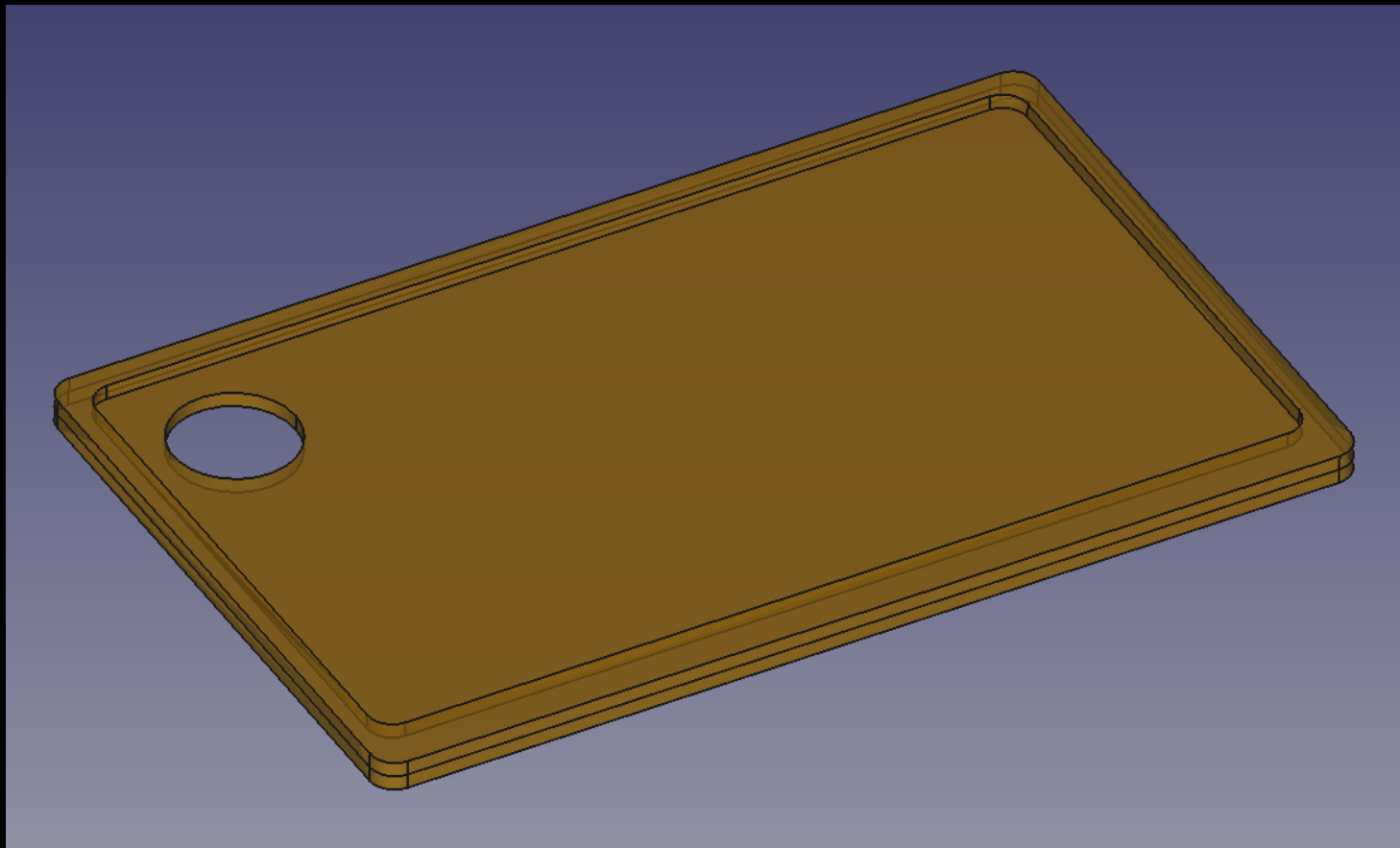ex: compensating for layer bonding in 3d-print

- Select object

- Select edge(s)

- Hit PartDesign:Chamfer or PartDesign:Fillet

- Select value, OK

  WARN: too large value will not work, fail semi-silently
  Part:Fillet/Chamfer has couple of more, advanced options

Project: Tray

Simple tray to keep food on
Designed for laser-cutting

FILE: tray2.fcstd

Export: 2d for CNC/laser

- Part:Cross-Section → 2d object(s)

- Select 2d object

- File → Export → .DXF

- Open in V-Carve / AutoLaser

Note; sometimes need to convert .DXF
Can use QCAD (free)

Intermission

Bitraf tour

Donations

Part Design: Revolve

- New Sketch

- Create a feature: L bracket (using poly-line)

- Select sketch

- Choose Revolve

Part basics

- Adding primitives

- Boolean operations
    - Union "Fusion"
    - Subtraction "Cut"
    - Intersection "Common"

Part: Mirror

Draft: Move & Rotate

Draft: Array
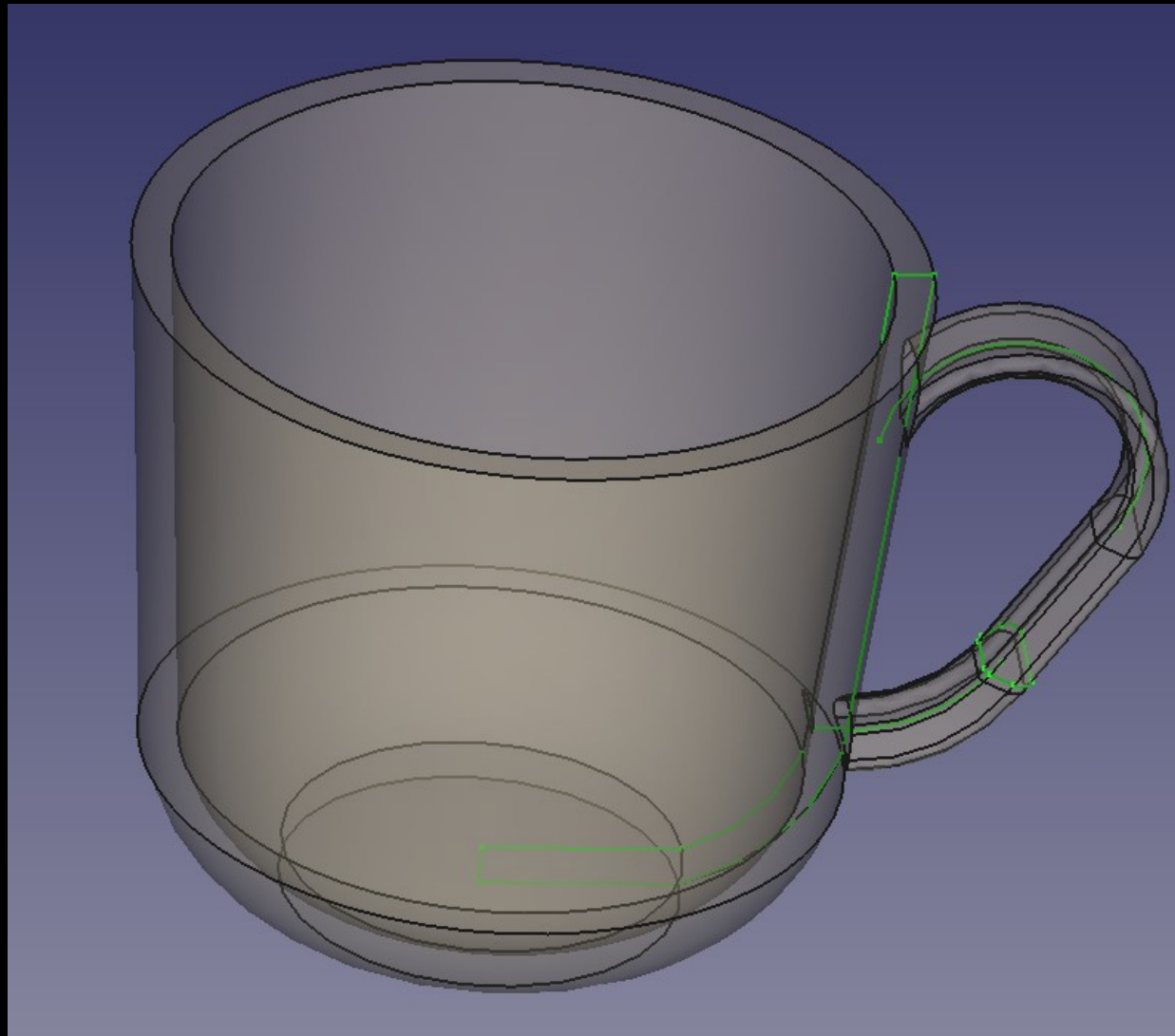
Rectangular, polar

Draft: Copy along Path

Part: Sweep

Project: Cup

Designed for 3d-printing

Revolve,
Sweep,
Union

FILE: cup2.fcstd

Export: 3d-printing

- Select object

- File → Export → Mesh

  .STL output by default

- Import into Cura/Slic3r

  Also used for 3d-milling on Roland Modela
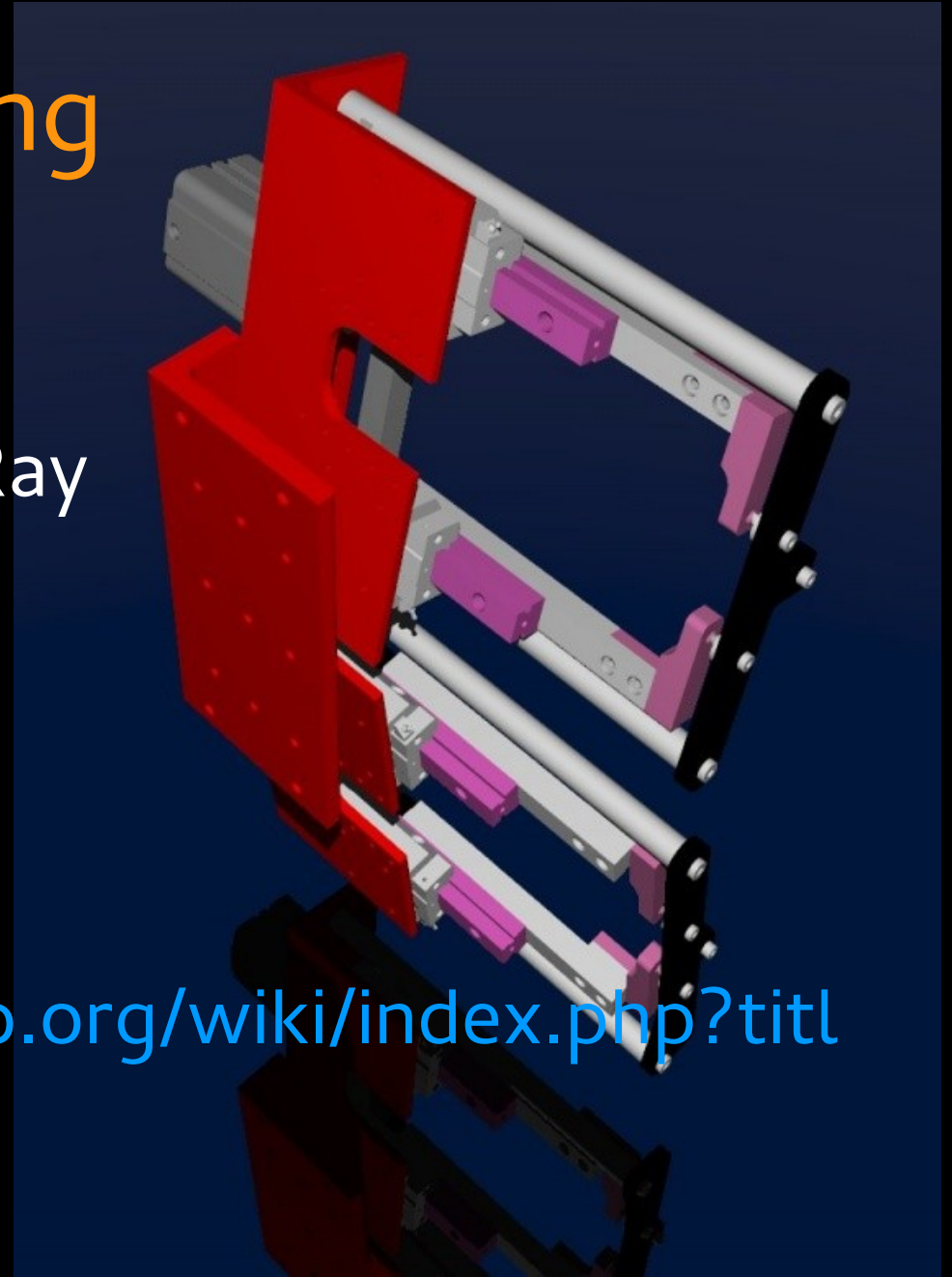
Part: Loft

Finishing: Coloring

- Select object

- Right click → Apperance (Ctrl + D)

- Change material, colors, transparency

Finishing: Raytracing

Uses LuxRender / POVRay

http://www.freecadweb.org/wiki/index.php?title=Raytracing_Module

Best Practices

- Bolts/holes, booleans instead of sketch

- Selecting good origin position

- Feature type with most information

- Jakob

Python scripting

- Everything can be done with Python

- Recorded macros are Python

Part libraries

- BOLTS: standardized fasteners/bearings...

- github.com/yorikvanhavre/FreeCAD-library

- Anything which has .STEP

Animation

Using Python scripting:

https://www.youtube.com/watch?v=KynMmsLJXV0

Altenative:
Export files, do animation in Blender etc

Functionality not covered

Workbenches

    Architecture

    Drawing

    Mesh

    Ship

    FEM

    Robot

In Development

- 3D-printer workbench, using CuraEngine

  https://github.com/cblt2l/FreeCAD-CuraEngine-Plugin

- Path/CAM module, for CNC/laser

  http://forum.freecadweb.org/viewtopic.php?f=10&t=8622

- Assembly workbench

  http://forum.freecadweb.org/viewforum.php?f=20

More resources

YouTube tutorials (NB: FreeCAD 0.14)

http://forum.freecadweb.org/

FreeCAD docs/wiki

http://www.freecadweb.org/wiki/

Visit at Bitraf anytime!