# 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 | Blender Sketchup |
| – Solid | Rhino |
| • 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

# Tips

- Use mouse/trackball/ instead of trackpad
- Have pen & paper available for sketch/dimensions
- Use pictures as reference material

# LIVE

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
-

# Part Design basics

- New Sketch
- Adding geometry: Rect
- Adding constraints: Distances
- Pad
- Map Sketch to Face
- Pocket

# 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

# Part: Loft

# Intermission

Bitraf tour

Donations

# 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

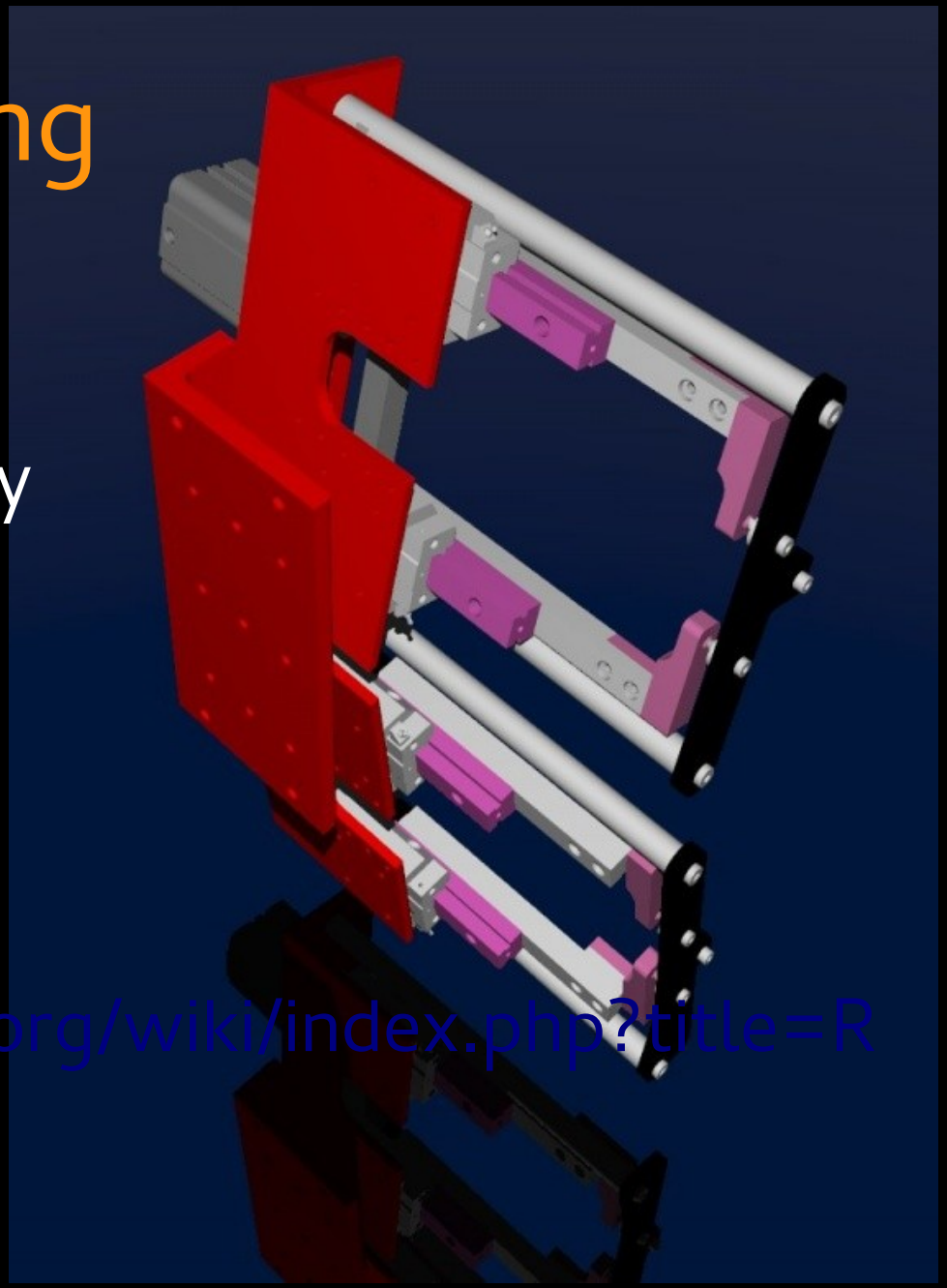
WARN: too large value will not work, fail semi-silently
Part:Fillet/Chamfer has couple of more, advanced options

# 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

# Export: 3d-printing

- Select object
- File → Export → Mesh

  .STL output by default
- Import into Cura/Slic3r

Also used for 3d-milling on Roland Modela

# Export: 2d for CNC/laser

- Part:Cross-Section → 2d object(s)
- Select 2d object
- File → Export → .DXF
- Open in V-Carve / AutoLaser

# 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!