Dessin numérique 3D
Filippo Fanciotti

FIRE2
EPFL // ENAC // LAVIS
2018-2019
tips & tricks

before modeling

part 1
Organize your work

Make different drawings / models
MAKE DIFFERENT MODELS

Physical Model  Axonometry  Detail

Simplified 3D  detailed 3D  very detailed 3D
Axonometry

Detail
PROCEDURE

simplified 3d (physical model)

1. clean simplified 2d
2. import / open the clean 2d in modeling software
3. extrude main elements from plan + elevation
4. add details

DO IT FIRST!
PROCEDURE

detail or axo

1. clean detailed 2d (survey)
2. import / open the clean 2d in a copy of the 3d simplified file
3. extrude main elements from plan + elevation
4. add details
5. make 2d
6. export 2d lines
7. clean / post-produce drawing for printing
Clean it up

a good 3D comes from a clean 2D
PREPARING FOR EXPORT > IMPORT

1. check + change unsupported elements (e.g. regions > polylines)
2. convert/join lines in polylines (lines have no meaning in 3D)
3. close + simplify all polylines (avoid bad extrusions)
4. Delete unnecessary layers (structure preserving)
5. Move geometry close to the origin (lighter operations)
6. Reduce file size (delete things you don’t need)
7. Check the unit of measure (cm > cm)
8. Save in a compatible CAD file format (check it)
1. check + change unsupported elements *(es. regions > polylines)*
2. convert/join lines in polylines *(lines have no meaning in 3D)*
3. close + simplify all polylines *(avoid bad extrusions)*
4. Delete unnecessary layers *(structure preserving)*
5. Move geometry close to the origin *(lighter operations)*
6. Reduce file size *(delete things you don’t need)*
7. Check the unit of measure *(cm > cm)*
8. Save in a compatible CAD file format *(check it)*
CAD DRAWINGS : LINES
COMBINE LINES > REGIONS, POLYGONS, POLYLINES
THINK IN SOLID (NOT A DRAWING ANYMORE)
your lines are full of control points, so your 3D & make2d will be full of edges
simplify your polylines for “cleaner” extrusions
good 2d > export > good 3d
IF WORKING WITH

save as .dwg/.dxf
import .dwg/.dxf

export .dwg/.dxf
import .dwg/.dxf
Before importing a file, it’s helpful to know what CAD elements *SketchUp* doesn’t support and how to prepare your CAD file for best results.
3

Import

good 2d > export > good 3d
tips & tricks

while modeling

part 11
I

Build it up

step by step
Main tools

things you need to know
LIST OF COMMANDS USED

1. Import/Export
2. Copy/Move/Rotate
3. ExtrudeCurve
4. Box
5. BooleanDifference
6. Trim
7. Scale1d
8. Cap
9. MatchProperties
10. Group
11. MakeHole
12. CPlane (+ ClippingPlane)
13. ProjectToCplane
14. MoveFace
15. MoveEdge
16. ChamferEdge
17. FilletEdge
18. ExtractSurface
LIST OF COMMANDS USED

1. Import/Export
2. Copy/Move/Rotate
3. ExtrudeCurve
4. Box
5. BooleanDifference
6. Trim
7. Scale1d
8. Cap
9. MatchProperties
10. Group
11. MakeHole
12. CPlane (+ ClippingPlane)
13. ProjectToCplane
14. MoveFace
15. MoveEdge
16. ChamferEdge
17. FilletEdge
18. CageEdit
19. ExtractSurface
20. DupBorder
21. DupEdge
22. DupFaceBorder
23. InsertKnot
24. InsertKink
25. PointsOn
26. Sweep1
3

Draw in curves

Don’t start off building solids and primitives
Fix + pre-filletize curves

Before generating surfaces / solids
Make things bigger, then trim

it’s always easier to cut
Details can wait

Modeling = sculpting
Use Nurbs rather than Meshes
MESHERS VS NURBS

A mesh is a complex of triangulated polygons approximating the geometry (the more dense the triangles, the closer to the actual geometry).

A “surface” is the actual mathematical expression of the geometry (NURBS and the like) and what you’re seeing in the viewport is a translation of that expression.
Create curves from other objects

that’s why you need Nurbs
Nice tutorial collections

**plethora project**

Jose Sanchez’s series of tutorials focus on a number of tools that are perhaps less “standard” in architecture, including the Unity3d game engine, Autodesk’s Maya software for animations, and C#, Python and Javascript. However, the site also includes the more usual Rhino and Grasshopper tutorials, meaning there is something for almost everyone here.

**digital toolbox**

Focusing on Rhino and Grasshopper, Digital Toolbox, developed by Scott Leinweber and Tam Tran, has hours of tutorials on topics ranging from the most basic uses to more involved processes. Digital Toolbox has a somewhat small collection of videos, but the content is nonetheless valuable.
tips & tricks

axonometrics

part III
Axonometric projection

brief excursus
THREE MAIN TYPES OF AXONOMETRIC PROJECTION

isometric  \[ x=y=z \]
dimetric  \[ x=y\neq z \]
trimetric  \[ x\neq y\neq z \]
GRAPHIC PROJECTIONS

- axonometric
  - isometric
  - dimetric
  - trimetric

- oblique
  - military
  - cavalier
  - top-down
2

Military Projection

Creating an “Axonometric” View in Rhino
The **Isometric command** changes the current viewport properties to a parallel projection isometric view.
CREATING AN AXONOMETRIC VIEW IN RHINO

There is no way to create a real-time 3D axonometric view that’s geometrically correct in Rhino, as axonometric isn’t really a true 3D display mode, but rather an artificial (pseudo-3D) construction ...
Anyway it is possible to create a geometrically accurate axonometric plan view in the top viewport, which can then be used with Make2D to create exportable line geometry for 2D plans.
1. In the Top viewport, Select the object to shear and rotate it to the Axonometric angle desired, depending on the orientation of your drawing (45°, or multiple such as 135°, 225°, 315°).

2. While the object is still selected, go to the Transform menu > Shear.

3. To establish the baseline for shear, indicate two points - with Ortho on, vertical to each other - in the Right viewport.

4. At the prompt for Shear Angle, type -45, and press Enter. The model will shear over 45° to the right. In the Top viewport, you should now see your model in “pseudo-axonometric”.

5. Use Make2D in the Top viewport to create your 2D line geometry.
OR ... YOU CAN SIMPLY COPYPASTE THIS SCRIPT

// For Rhino running in English : //

! _Select _Pause _SetActiveViewport Top _Rotate 0 315 _SetActiveViewport Right _Shear w0 w0,0,1 -45 _SetActiveViewport Top _Zoom _All _Extents

// Pour Rhino en Français : //

! _Select _Pause _SetActiveViewport Dessus _Rotate 0 315 _SetActiveViewport Droite _Shear w0 w0,0,1 -45 _SetActiveViewport Dessus _Zoom _All _Extents

*** WATCH OUT : I USED 315 ACCORDING TO THE FACES I WANTED TO SHOW !

;)
copy-paste the script in the command bar
3

Make 2D

2d > 3d > make2d
always from the top view!
Shear is a relatively simple transformation, it usually doesn’t need a lot of memory or calculation time. However, if your model is VERY complex and your machine is weak, it may take some time.

Make2D on the other hand is very processor intensive and uses a lot of memory. If your model is complex, your machine is slow and/or you do not have a lot of memory, it is not likely to succeed - it will take a very long time or crash Rhino. Bad objects or many objects with concurrent edges will also cause Make2D to take much longer to execute.
1. make a copy of your model before Shearing
2. save your file before Make2d
How to Get Make2D to Perform Better
tips & tricks

post-production

part iv
Export for post-production
EXPORT YOUR DRAWING IN THE DESIRED SCALE (1:10)
the layers are the same of Rhino, even the colors (avoid yellow&white)
1. make everything editable (use illustrator only for the very last touches).
2. export from Rhino always using the same origin, structure and settings to preserve the paste in place in post-production.
Post-production

Only for the last touches
draw a A2 (x10) rectangle to include your drawing to export (ref point)
export selection in 1:10 scale
opening the .ai file you find out the importance of drawing close to origin :)

opening the .ai file you find out the importance of drawing close to origin :)
select A2 rectangle
check
"adapt to selected graphic"
all lines set to black 0.12
cracks and other details thinner (and/or gray)
two colors (and their shades) to materialize