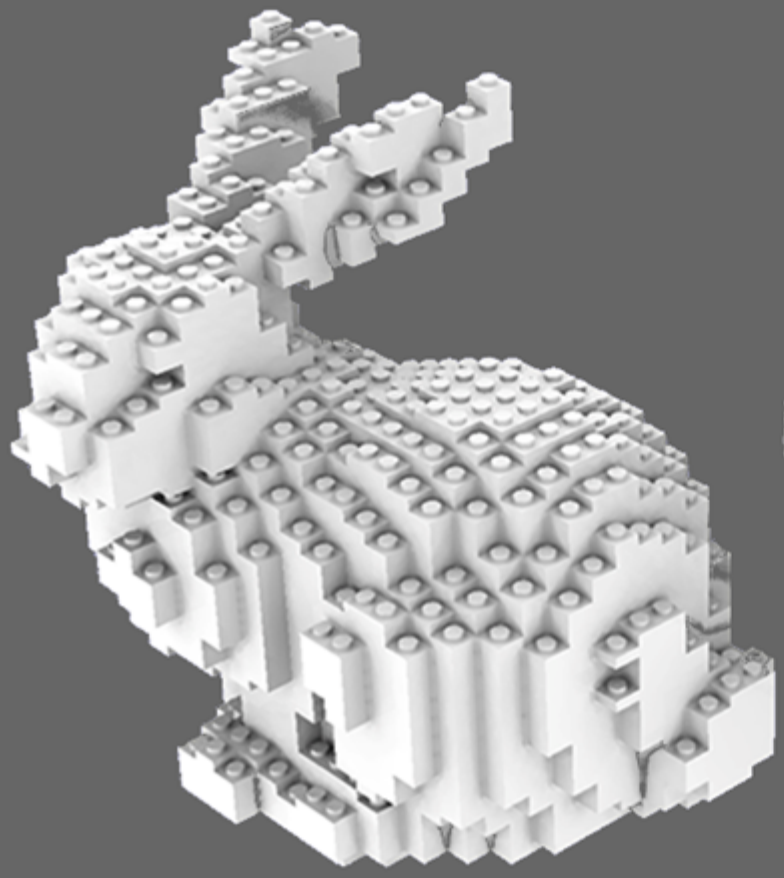
Designing Highly Detailed LEGO Sculptures using LSculpt

Bram Lambrecht

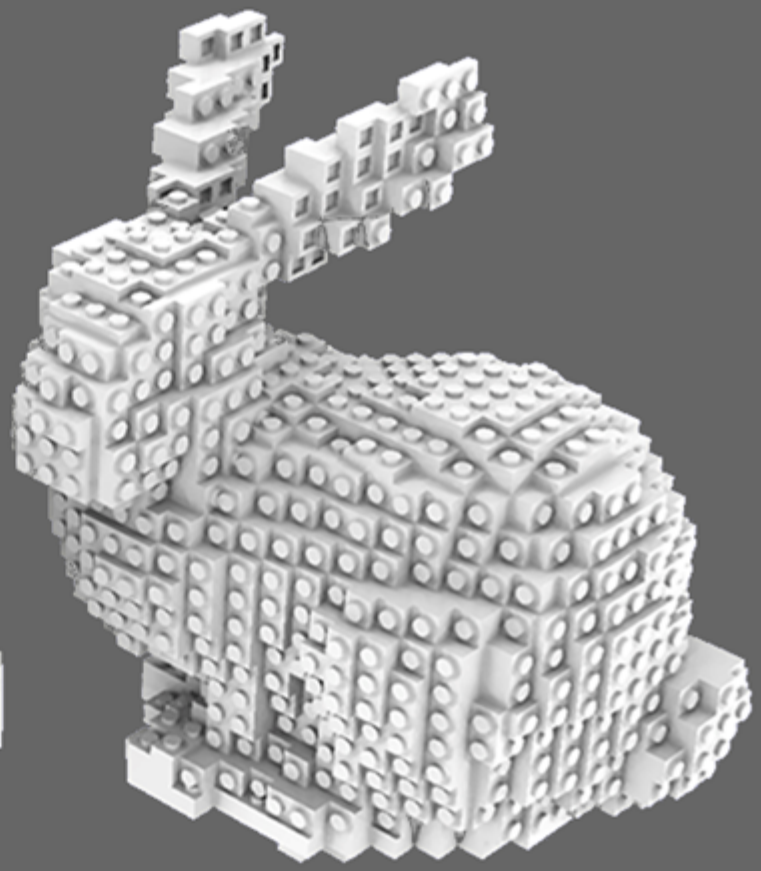
10 April 2010
Bricks by the Bay
Fremont, California

What is LSculpt?

LSculpt creates **studs-out** LEGO plate surfaces from a 3D computer model



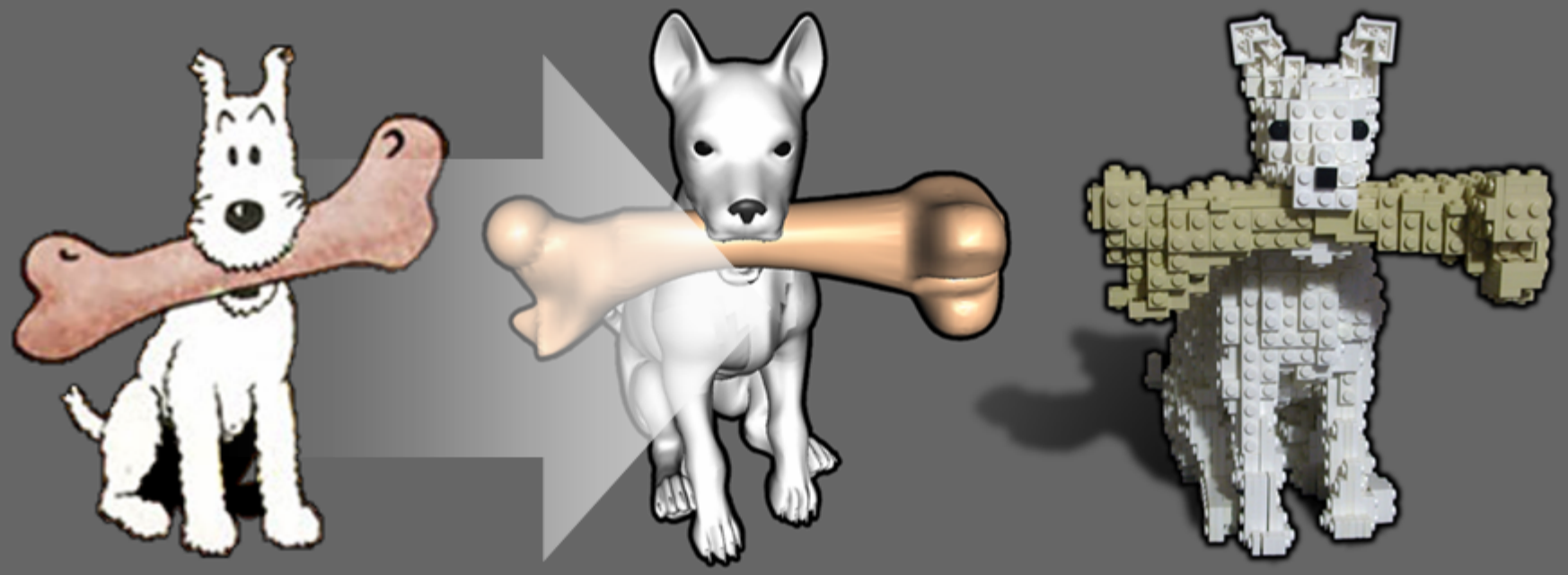
studs up



studs out

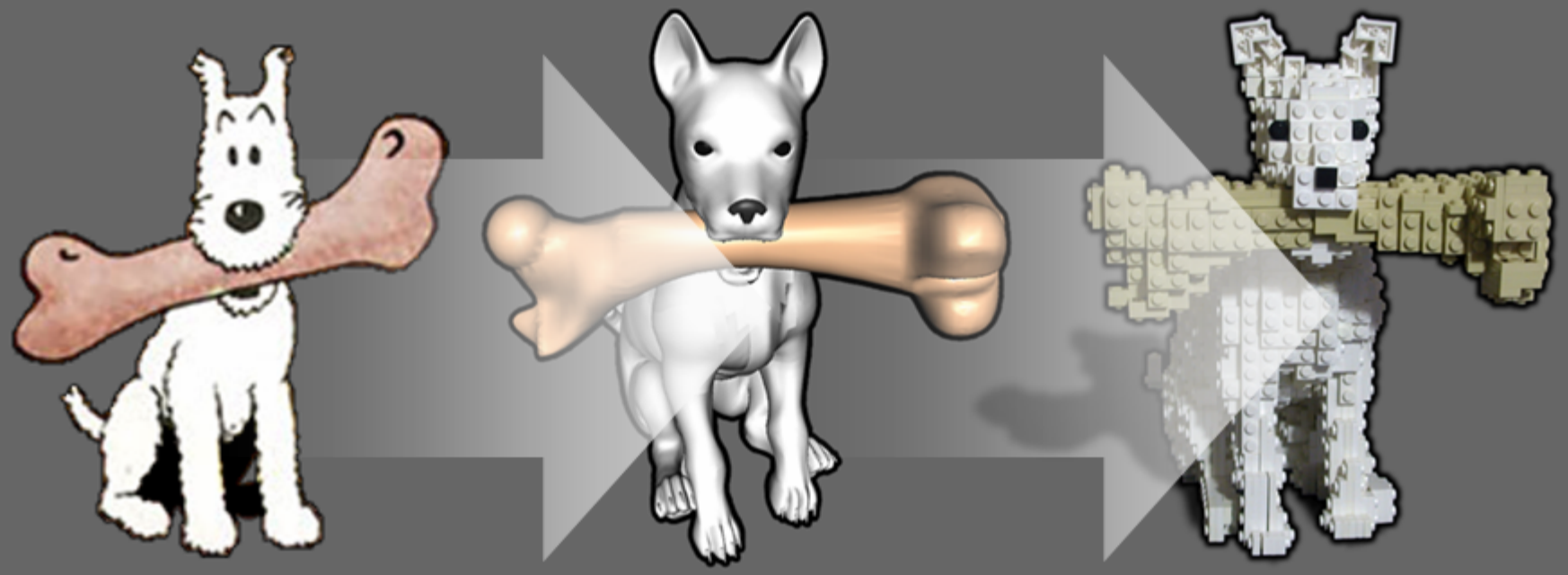
from concept to sculpture…

from concept to sculpture…



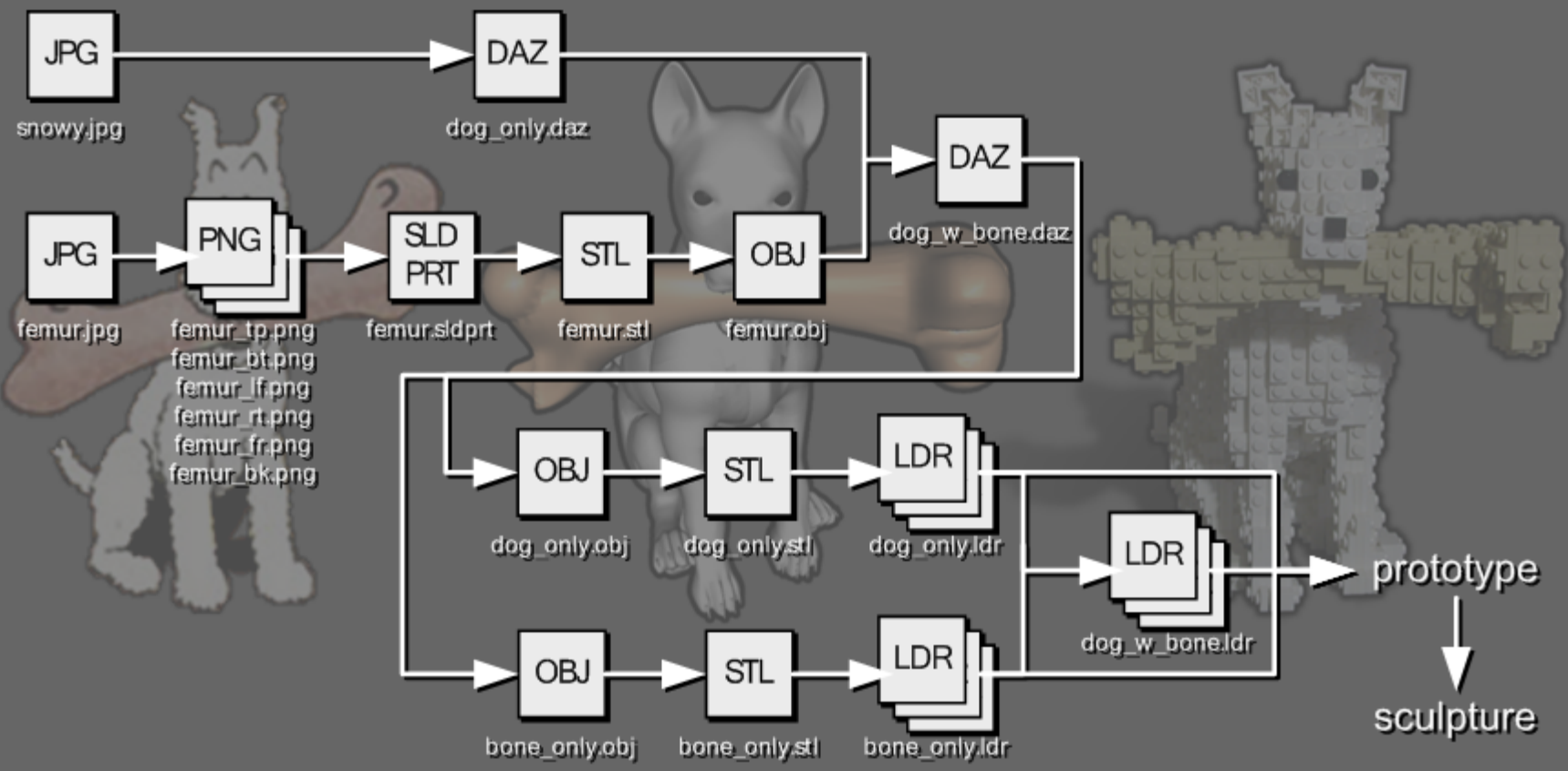
1. create a 3D model
2. convert model to 3D mesh

from concept to sculpture…

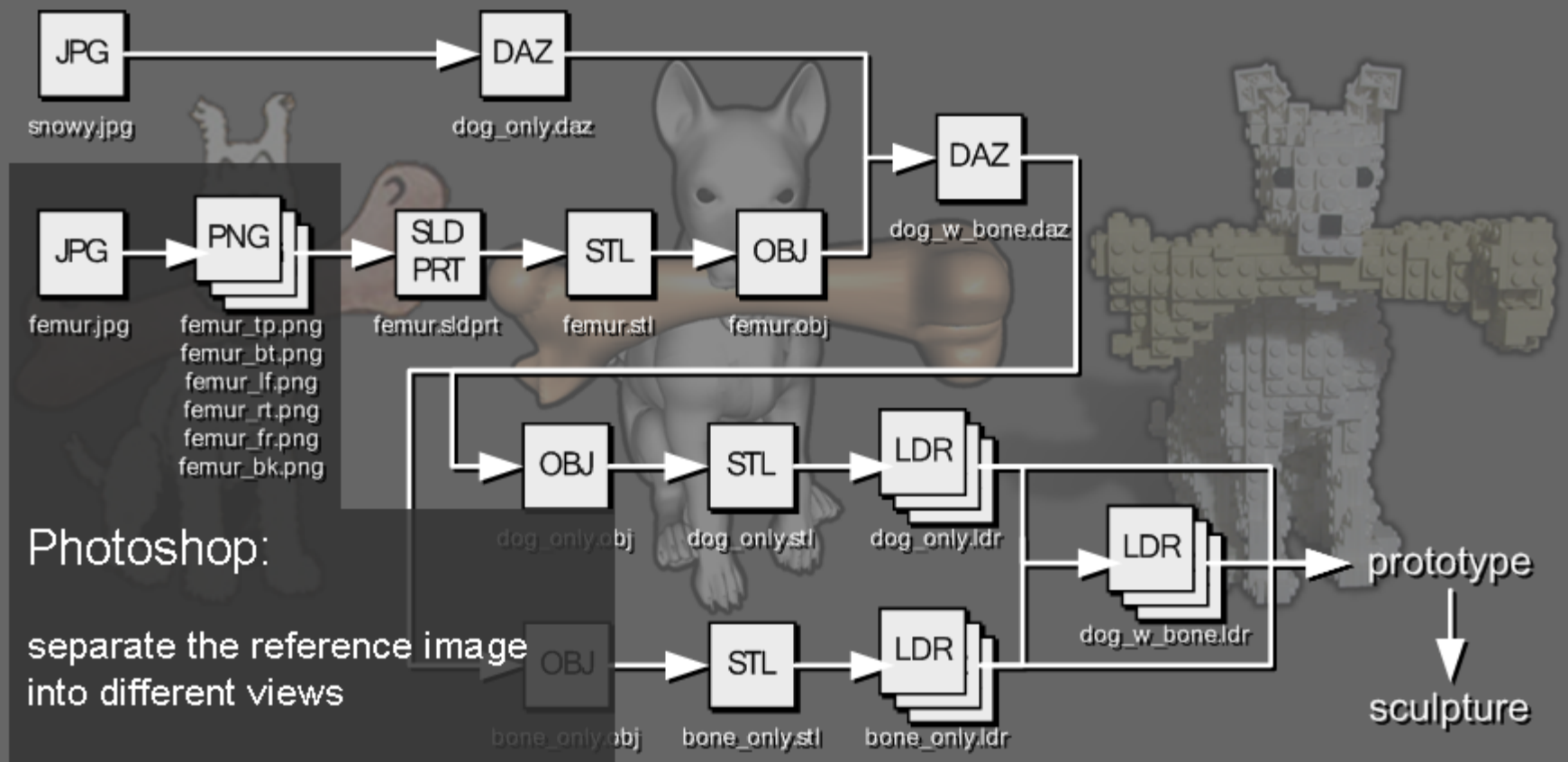


1. create a 3D model
2. convert model to 3D mesh
3. translate to a LEGO surface
4. build the sculpture

the full roadmap…



the full roadmap…

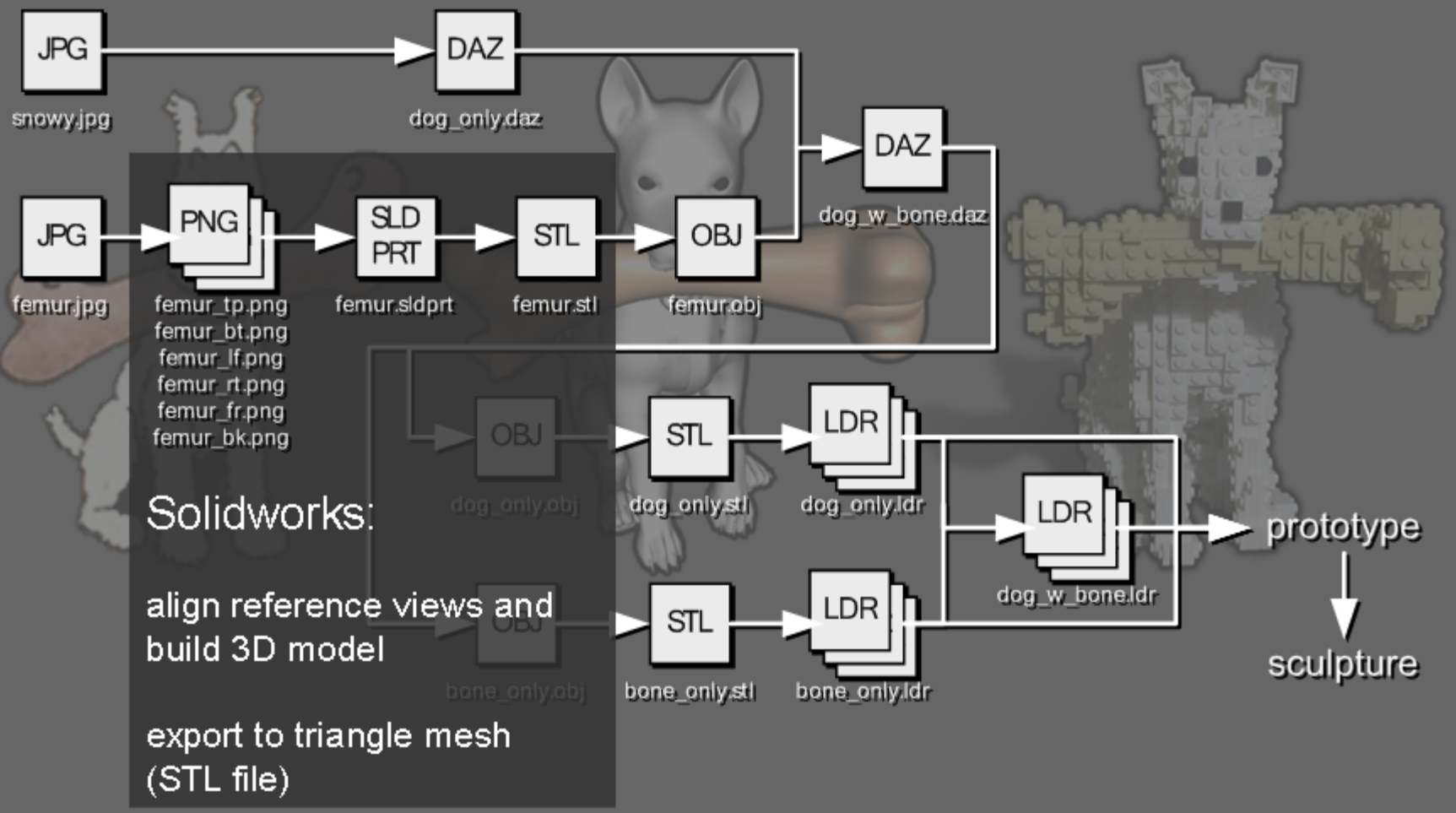


Photoshop:

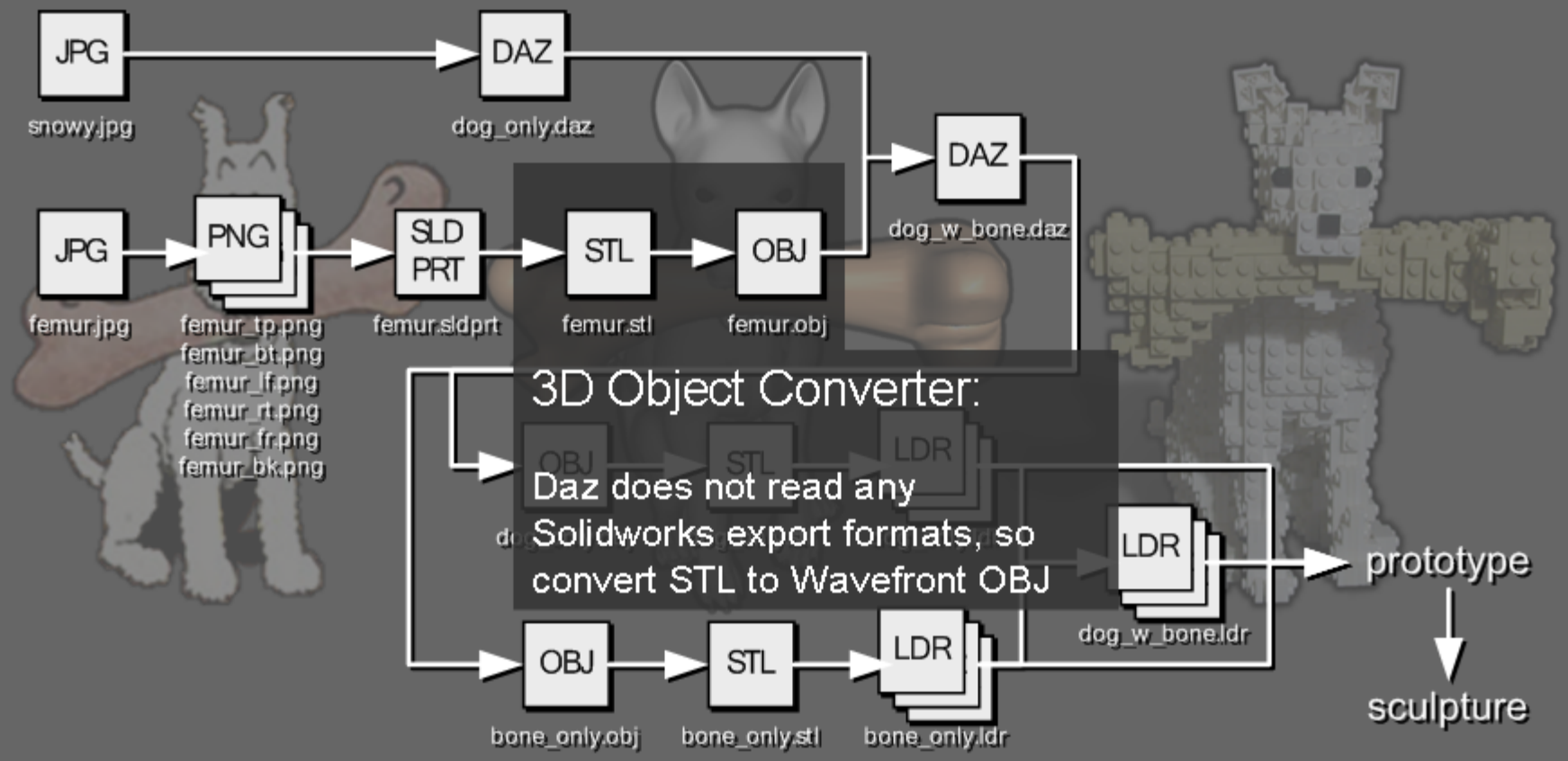
separate the reference image into different views

remove the background on each picture

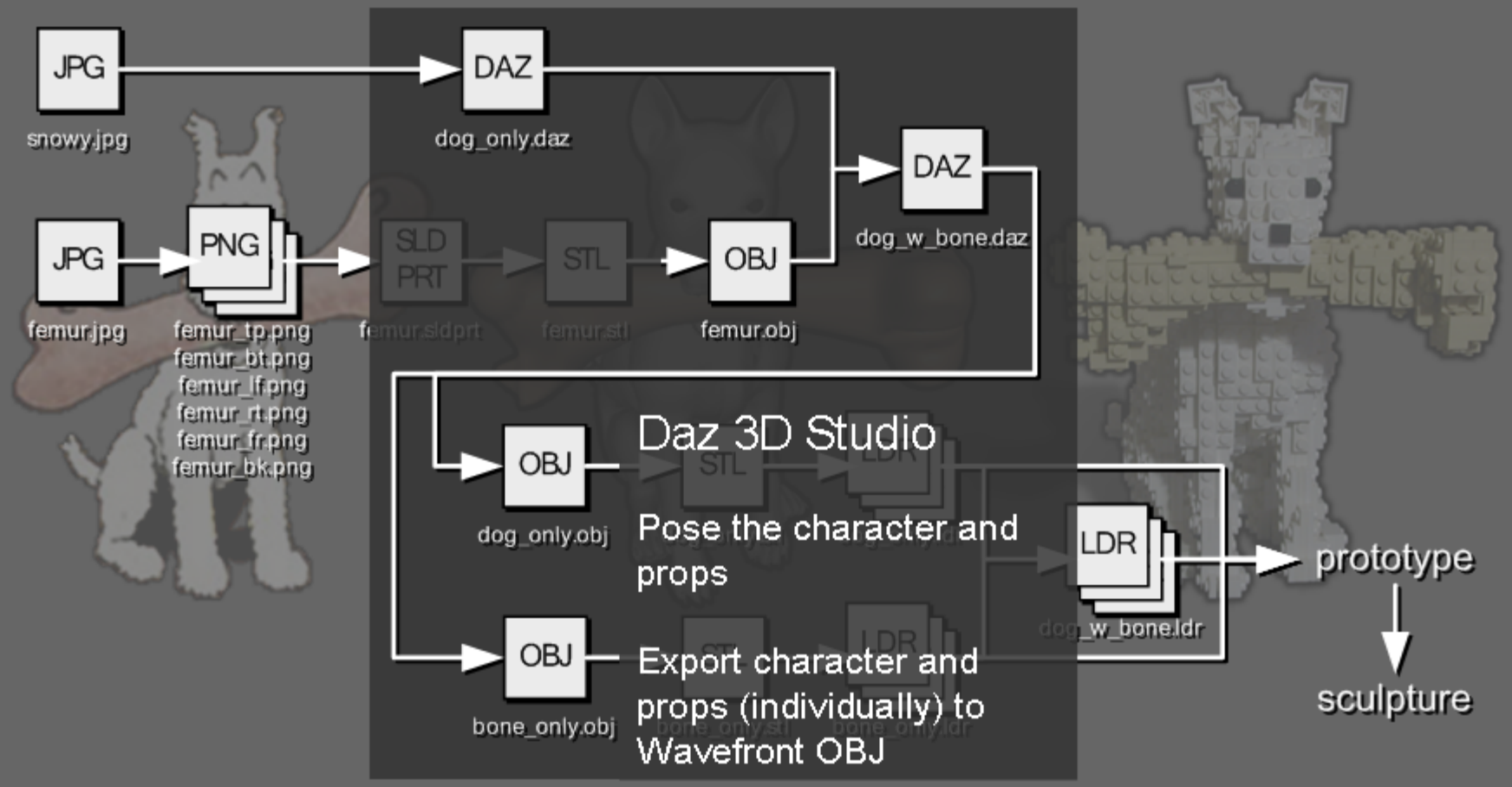
the full roadmap…



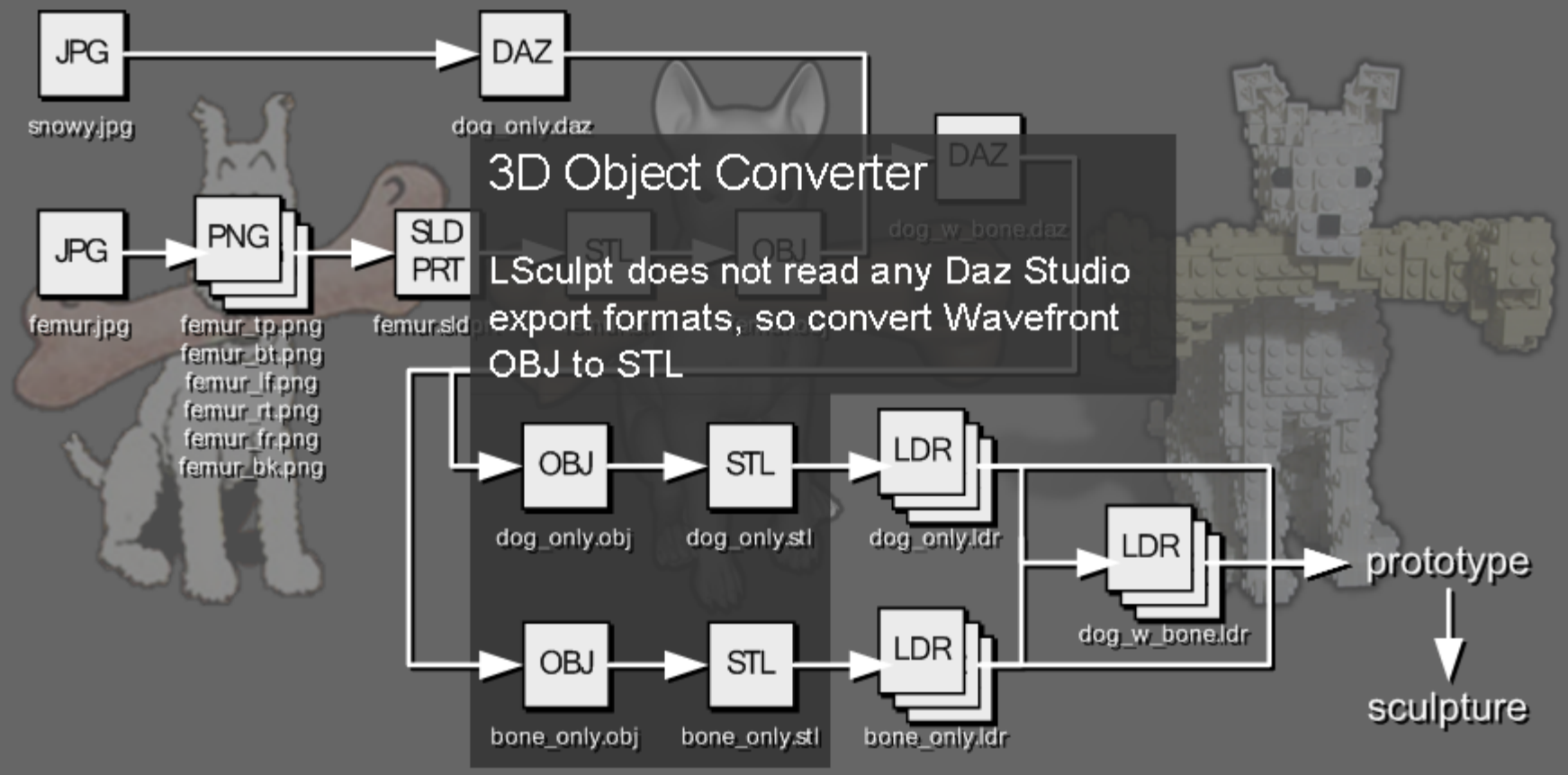
the full roadmap…



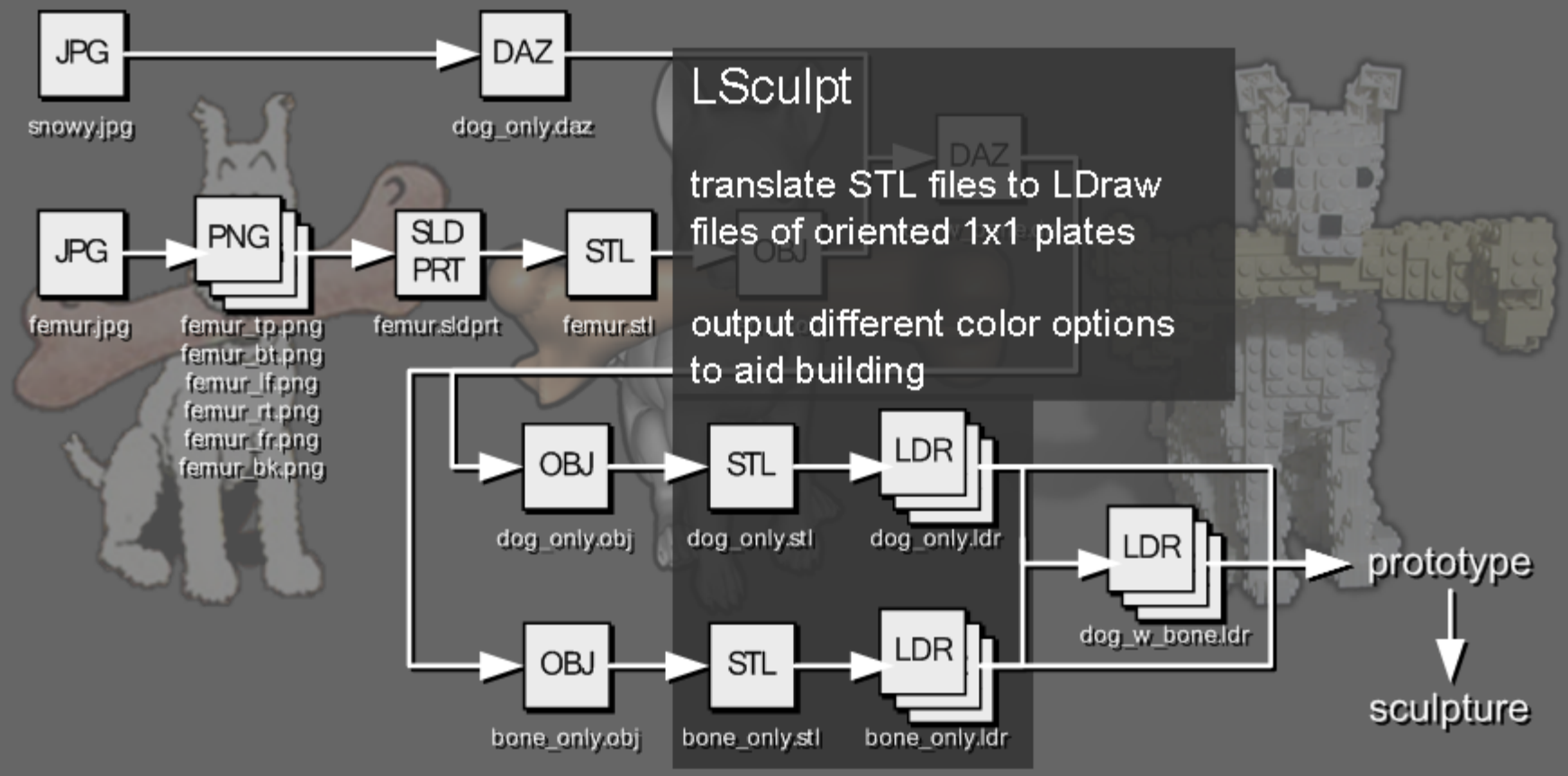
the full roadmap…



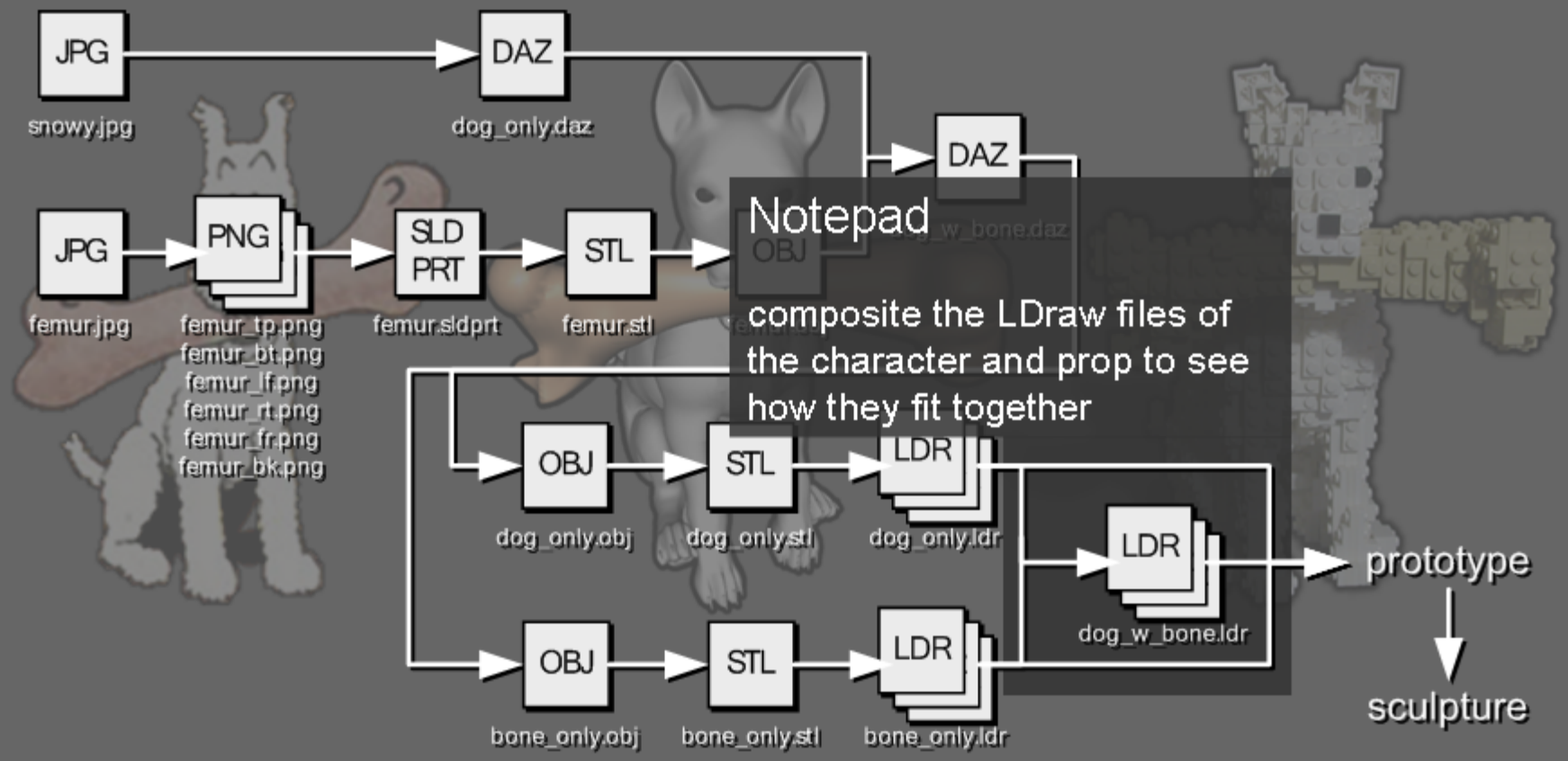
the full roadmap…



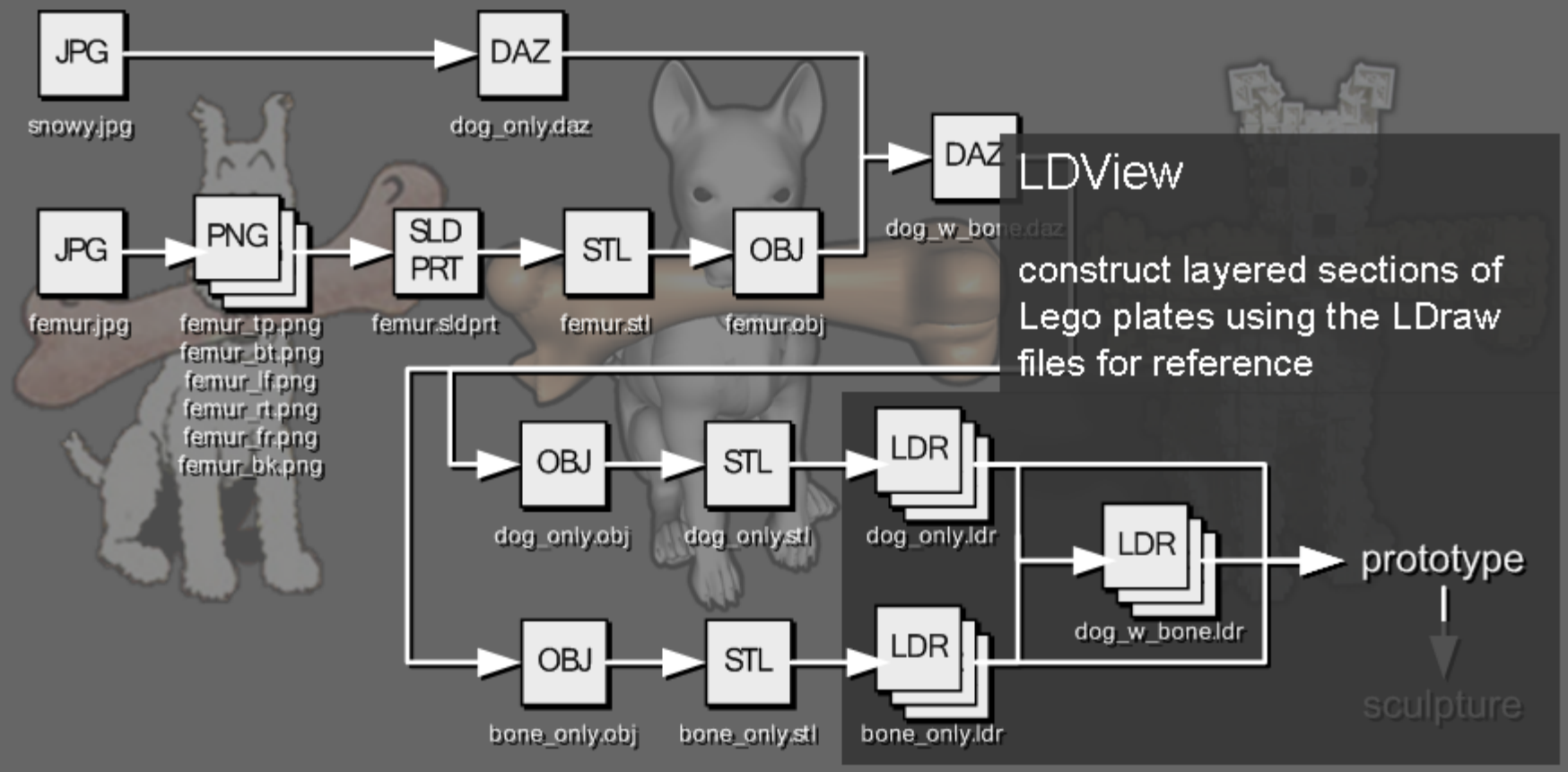
the full roadmap…



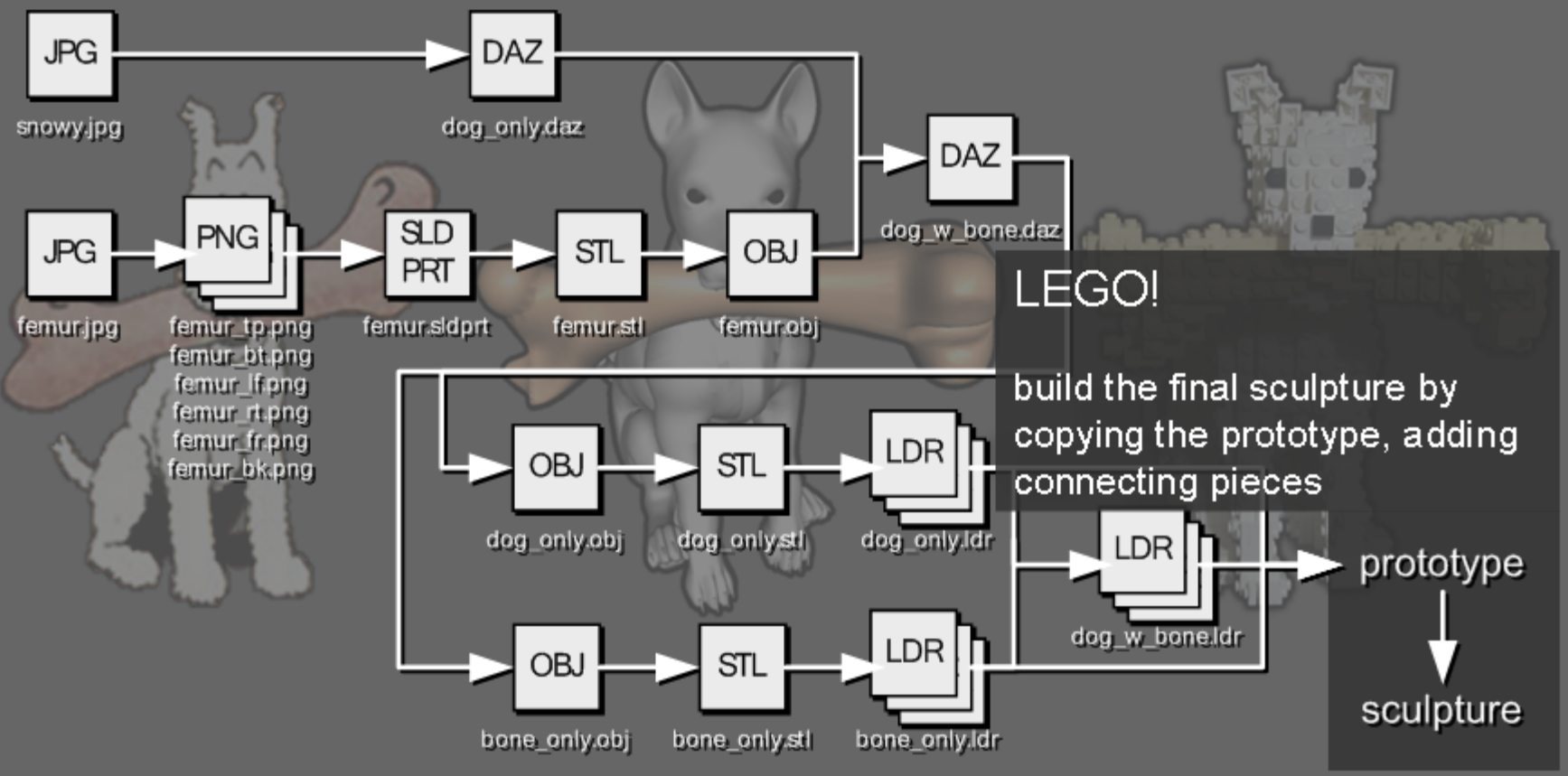
the full roadmap…



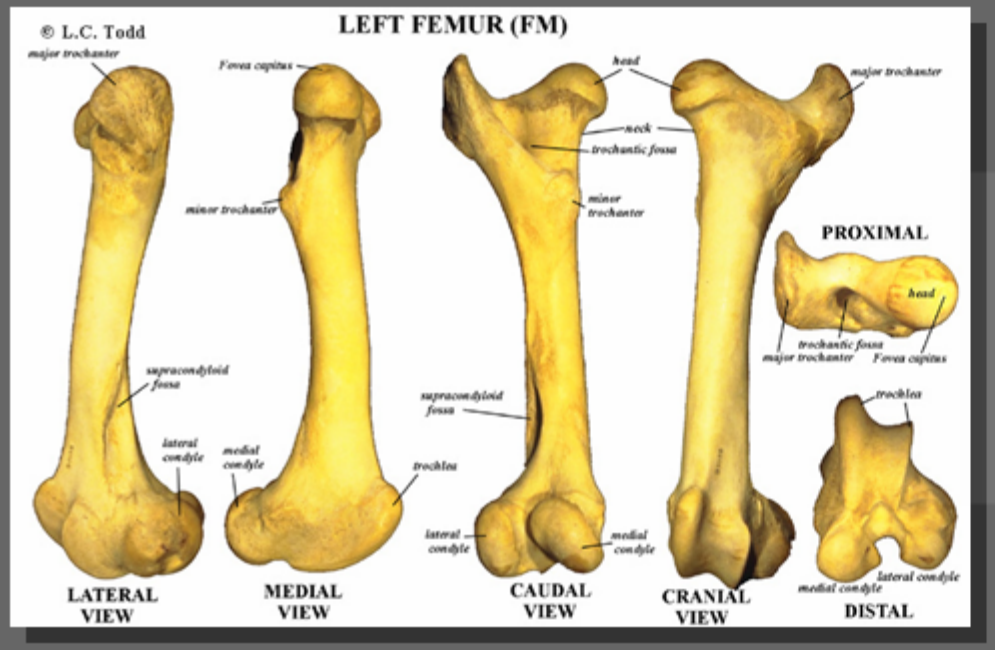
the full roadmap…



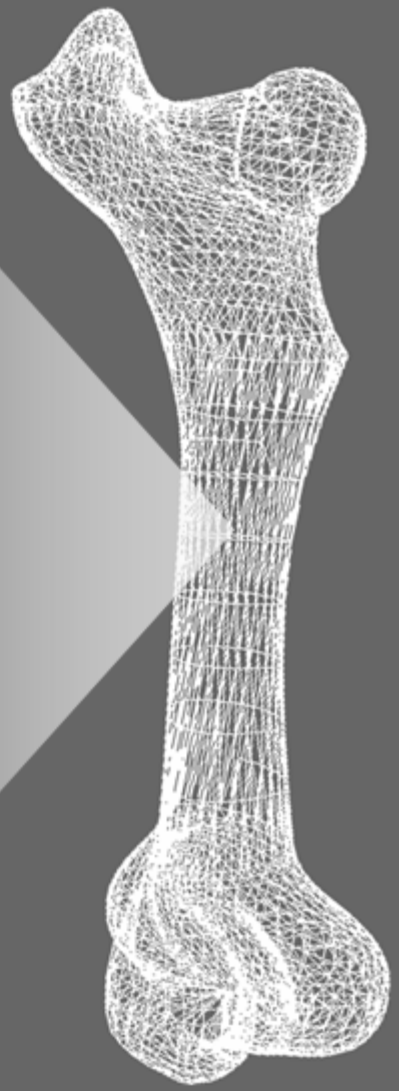
the full roadmap…



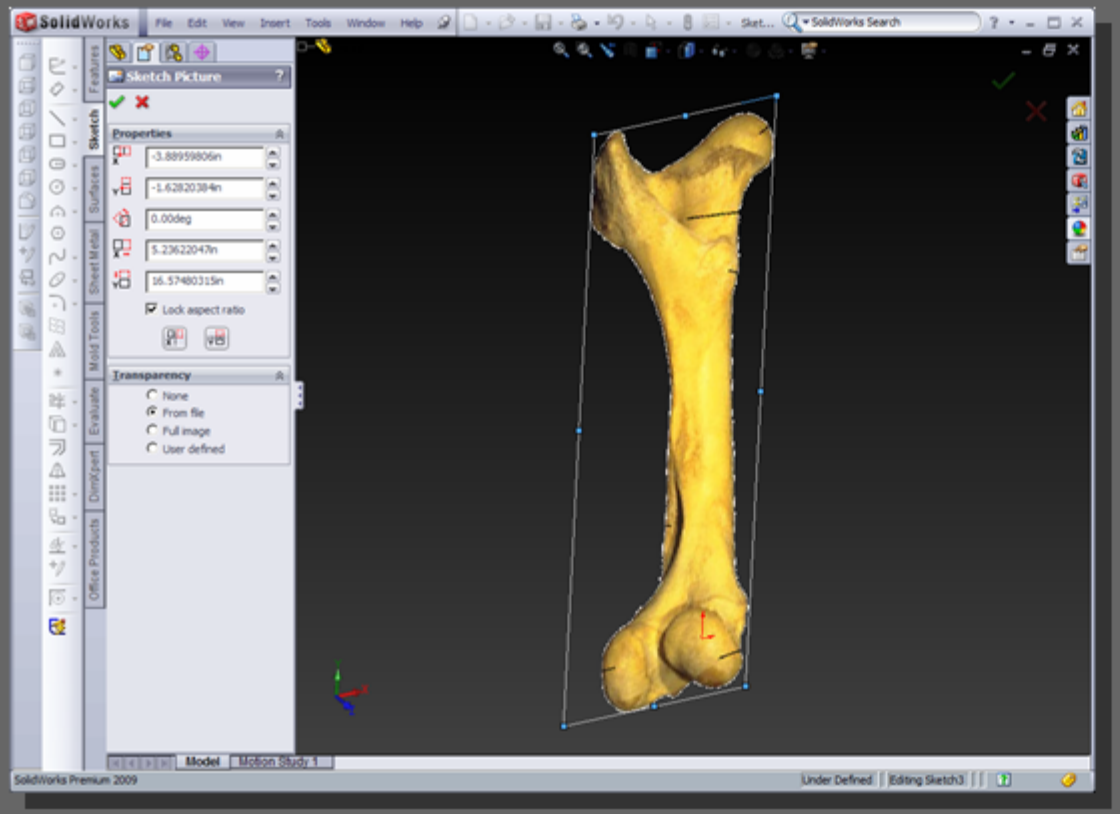
building a CAD model…



source: http://lamar.colostate.edu/~lctodd/femurfm.htm

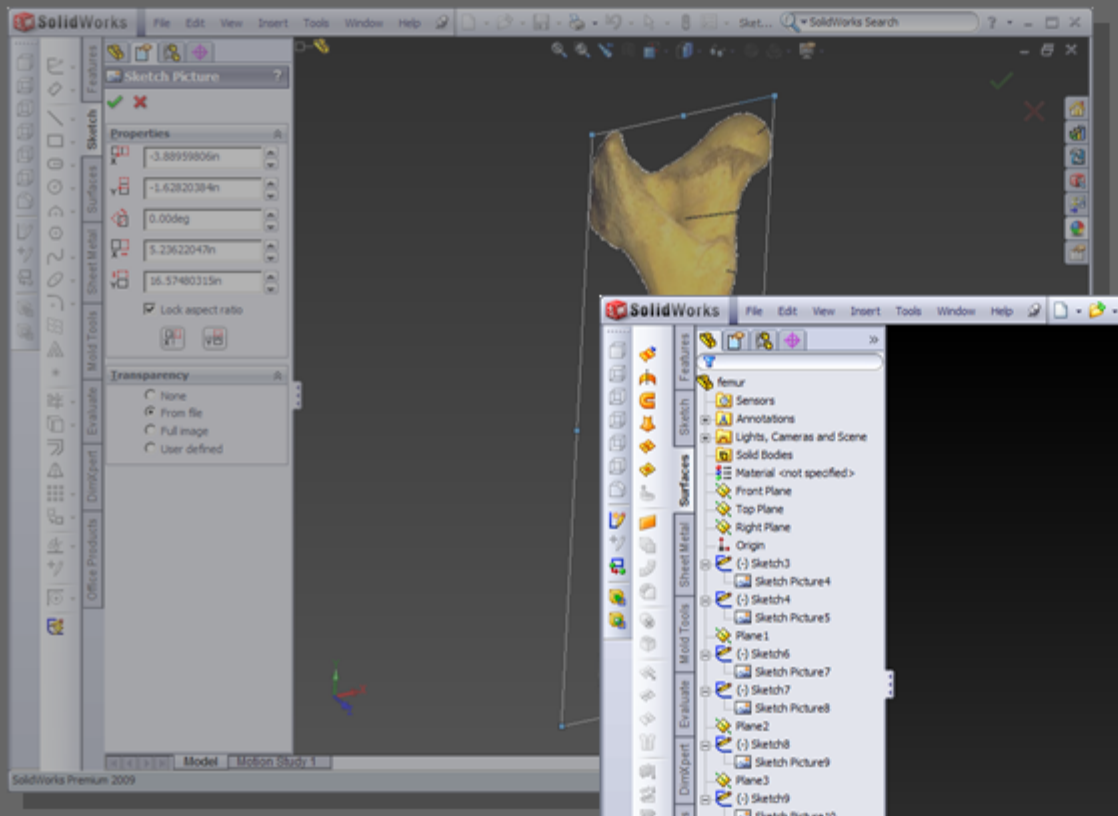


building the bone in Solidworks

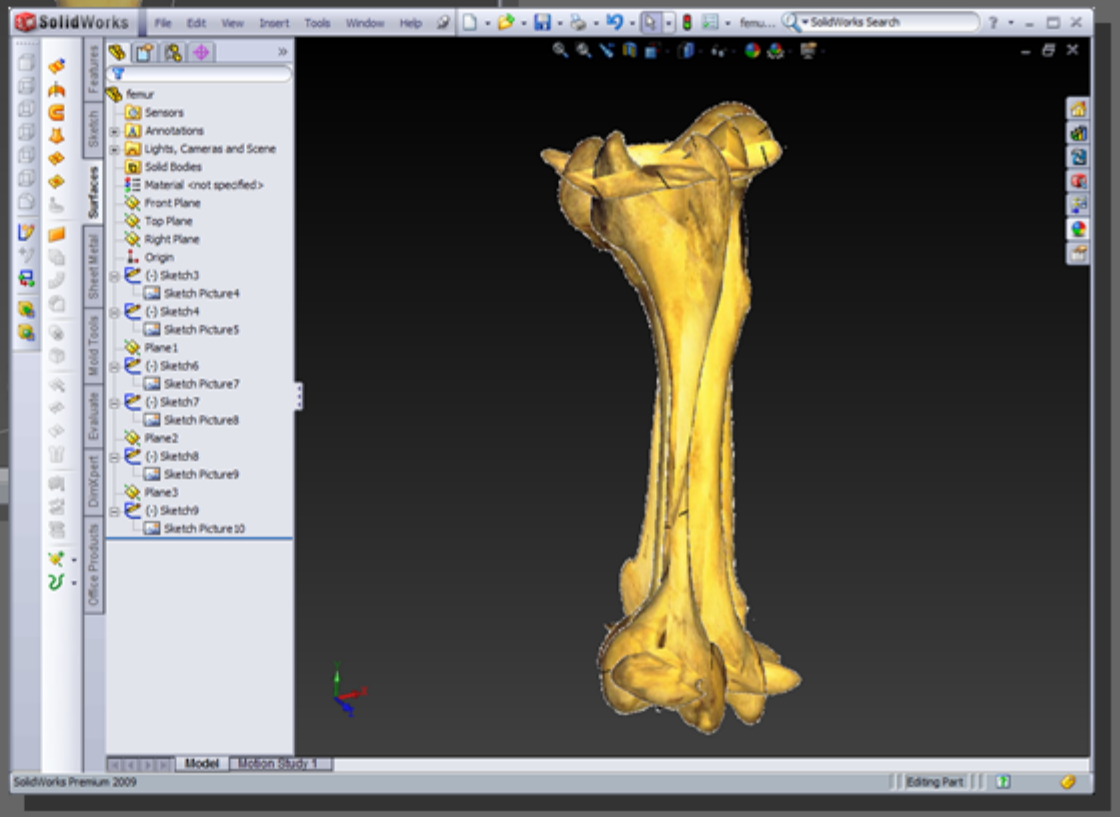


place the reference image (PNG with transparency) on a plane

building the bone in Solidworks

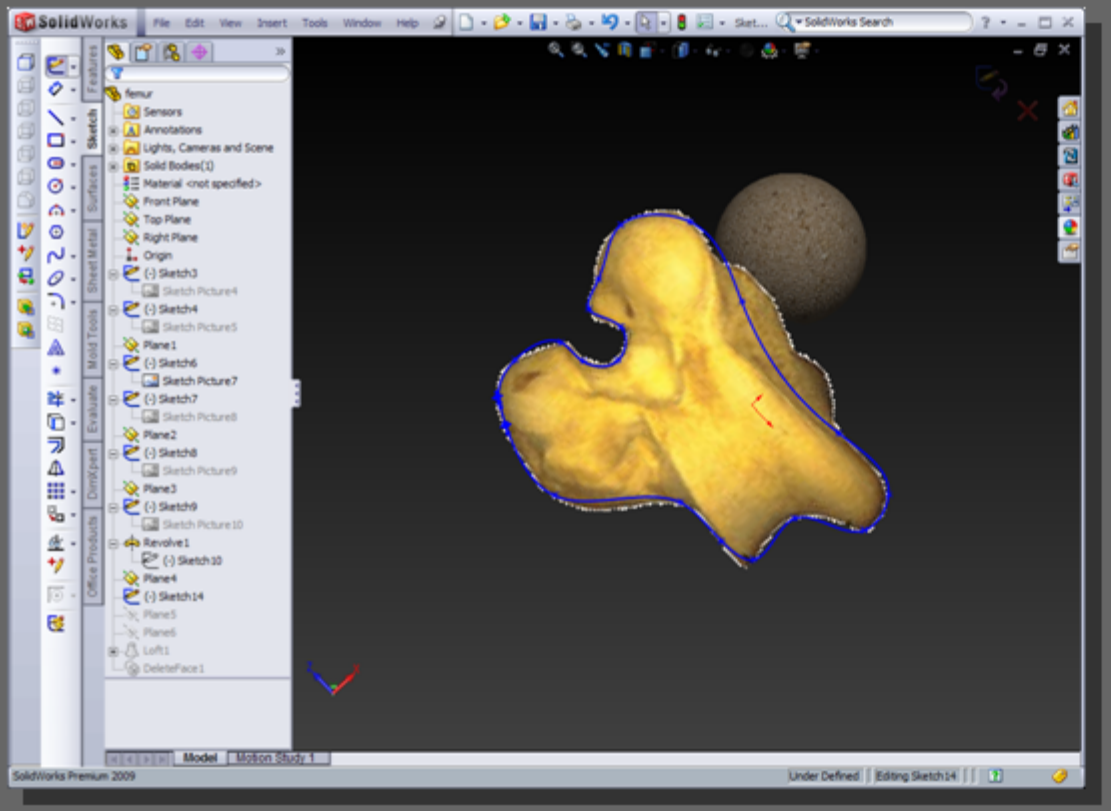


place the reference image (PNG with transparency) on a plane



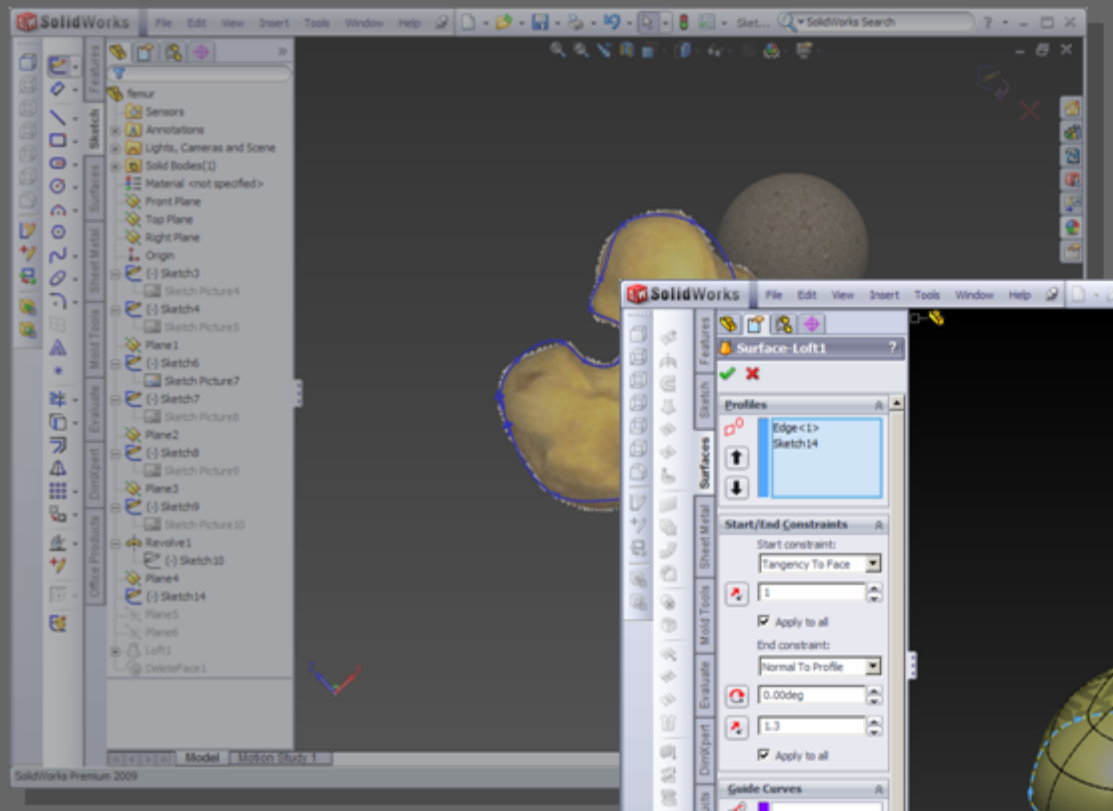
align the other views with the first image placed

building the bone in Solidworks

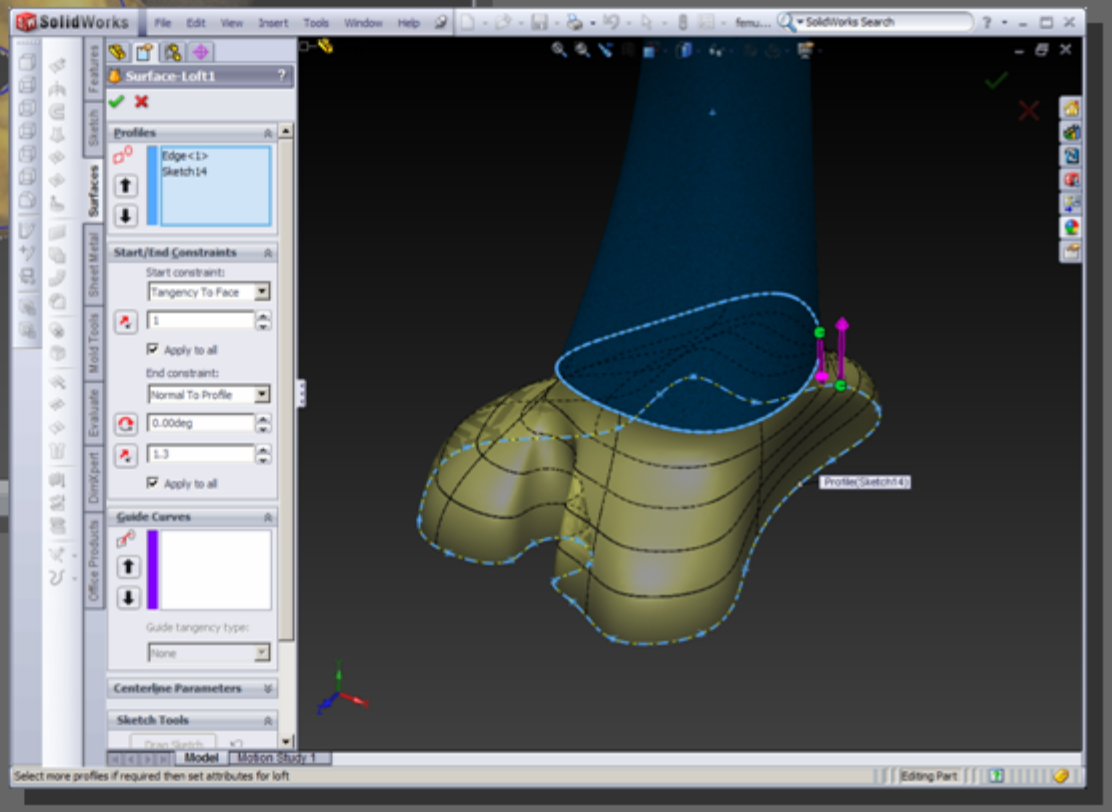


outline the reference image profiles

building the bone in Solidworks

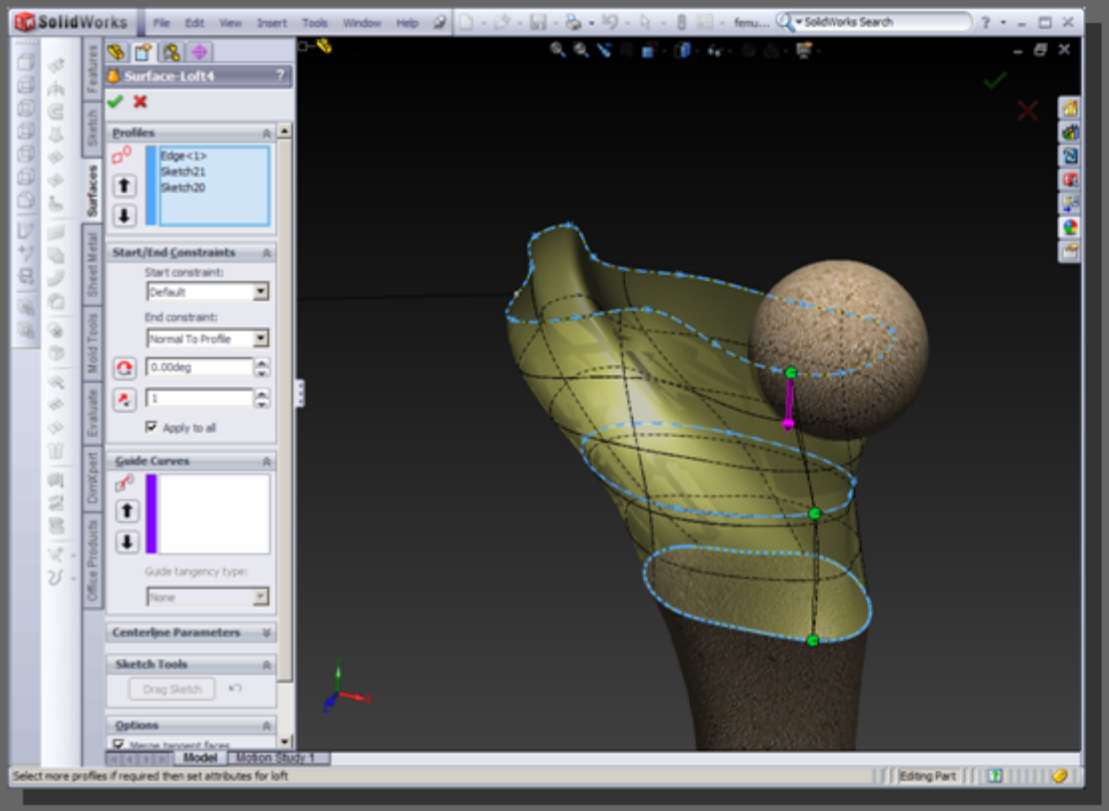


outline the reference image profiles



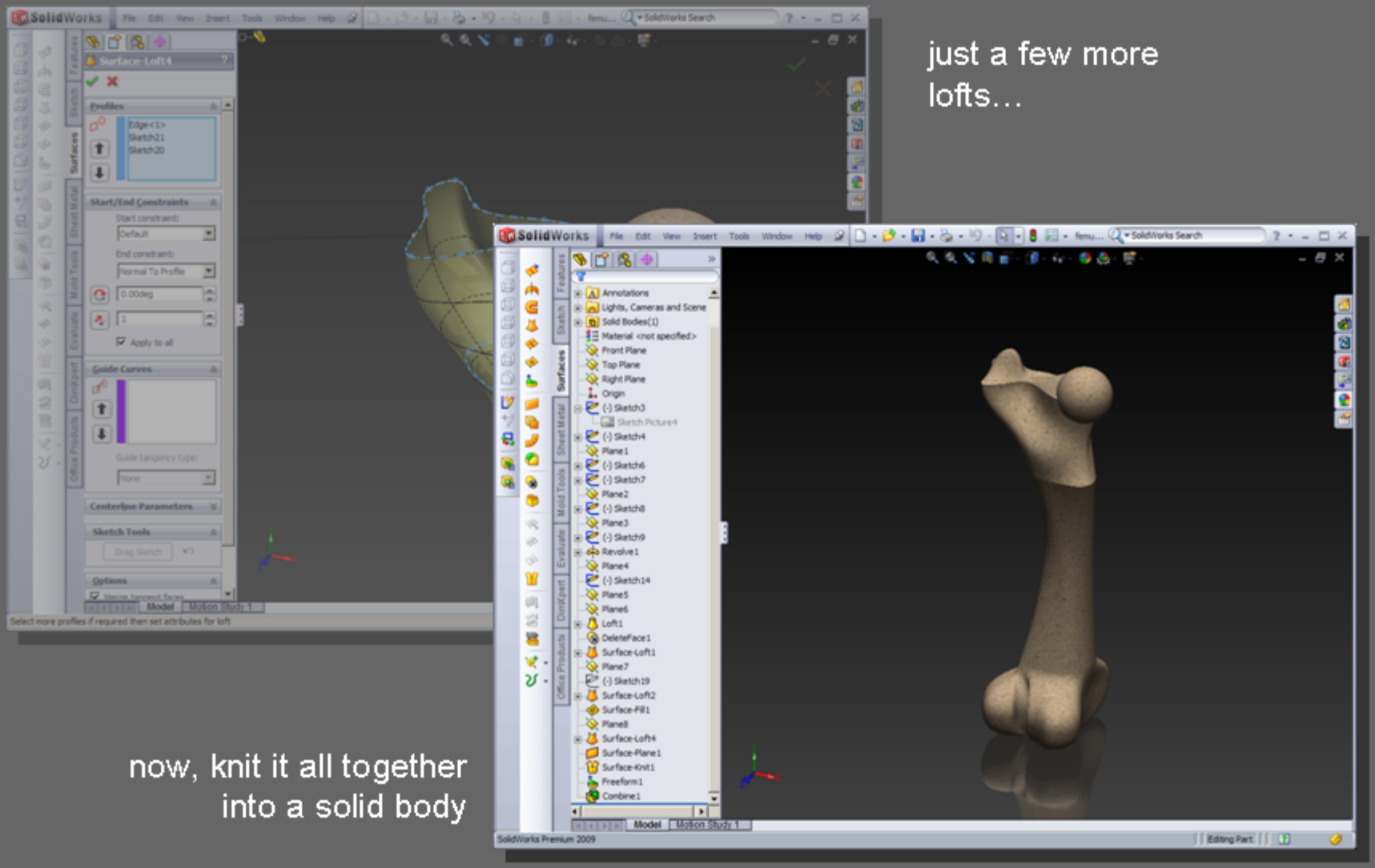
loft surfaces from the profiles to create a 3D shape

building the bone in Solidworks



just a few more lofts…

building the bone in Solidworks

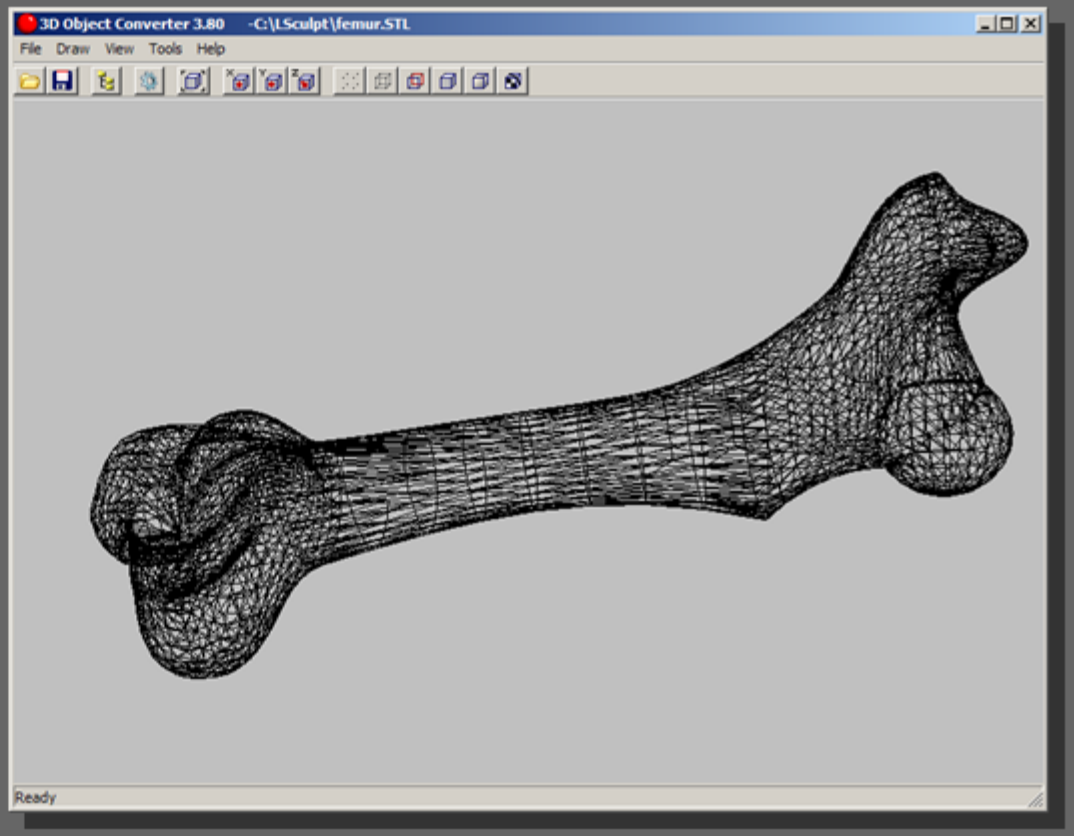


just a few more lofts…

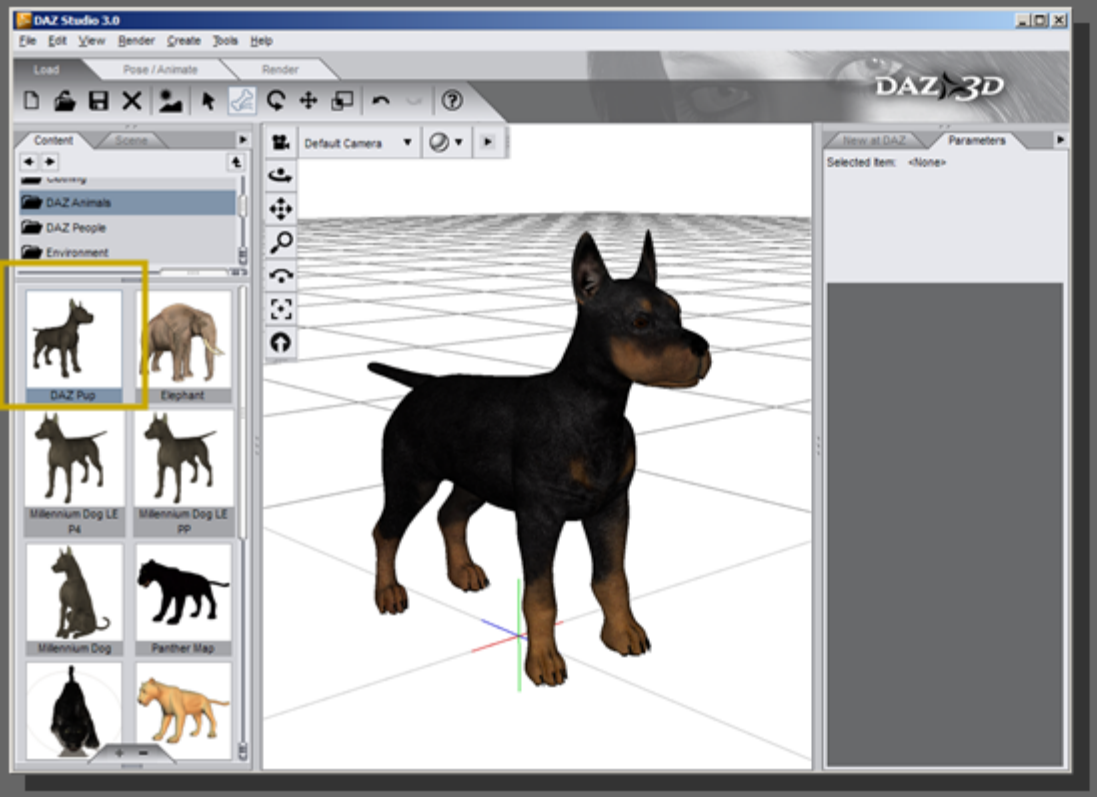
now, knit it all together into a solid body

from Solidworks to Daz Studio

- Save As… in Solidworks to Stereolythography (STL). Set the mesh options to “Coarse” to keep the file size down.
- Open the **femur.STL** file with 3D Object Converter and Save As… to Wavefront (*.obj)
- Import the **femur.obj** in the Daz Studio scene (coming up!)

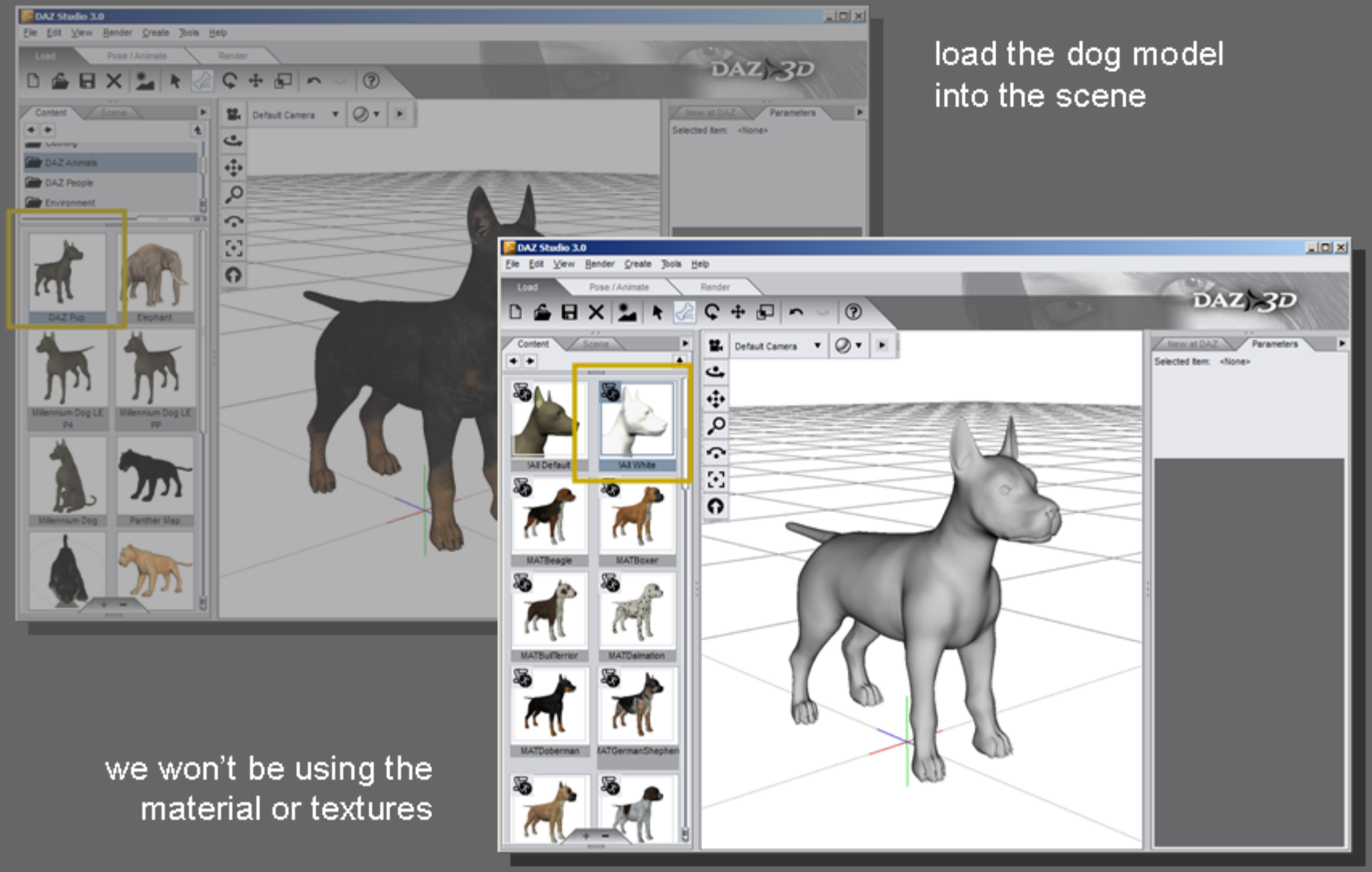


posing the character in Daz 3D Studio



load the dog model into the scene

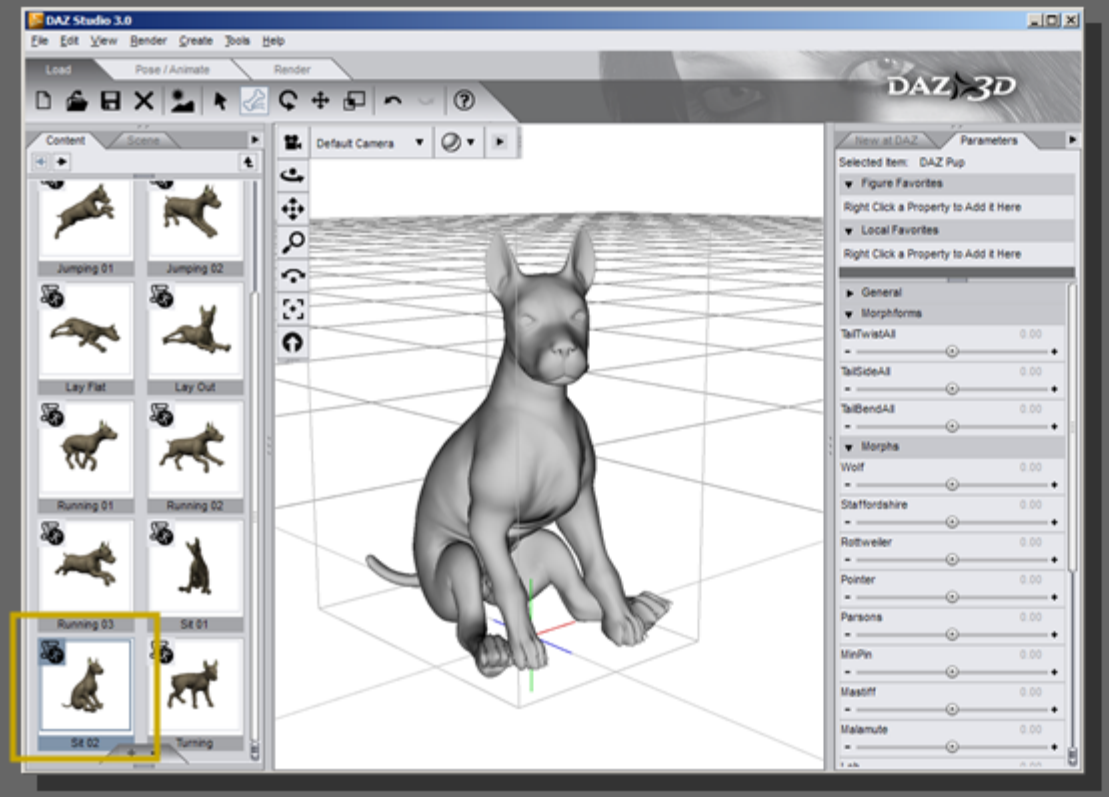
posing the character in Daz 3D Studio



load the dog model into the scene

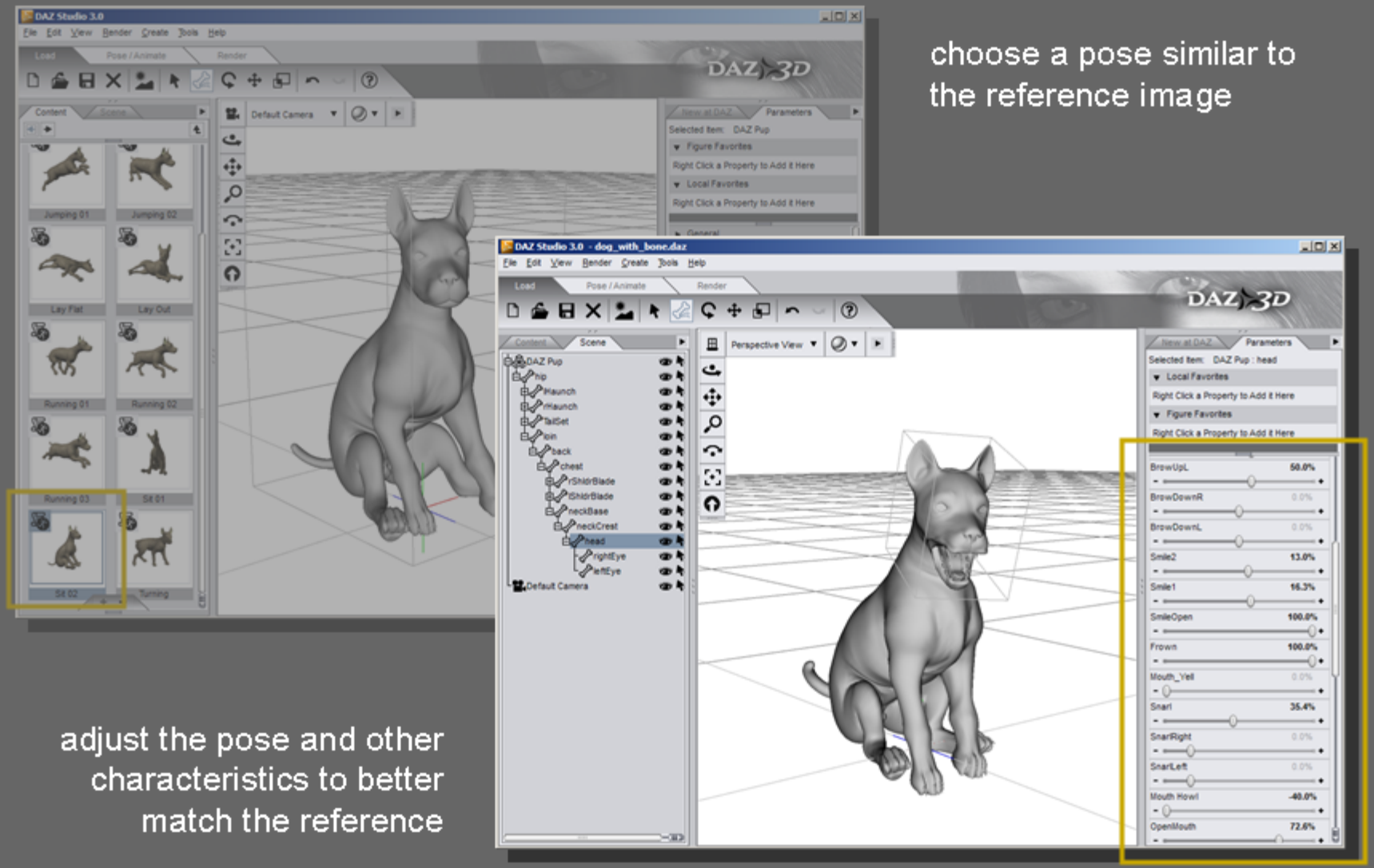
we won't be using the material or textures

posing the character in Daz 3D Studio



choose a pose similar to the reference image

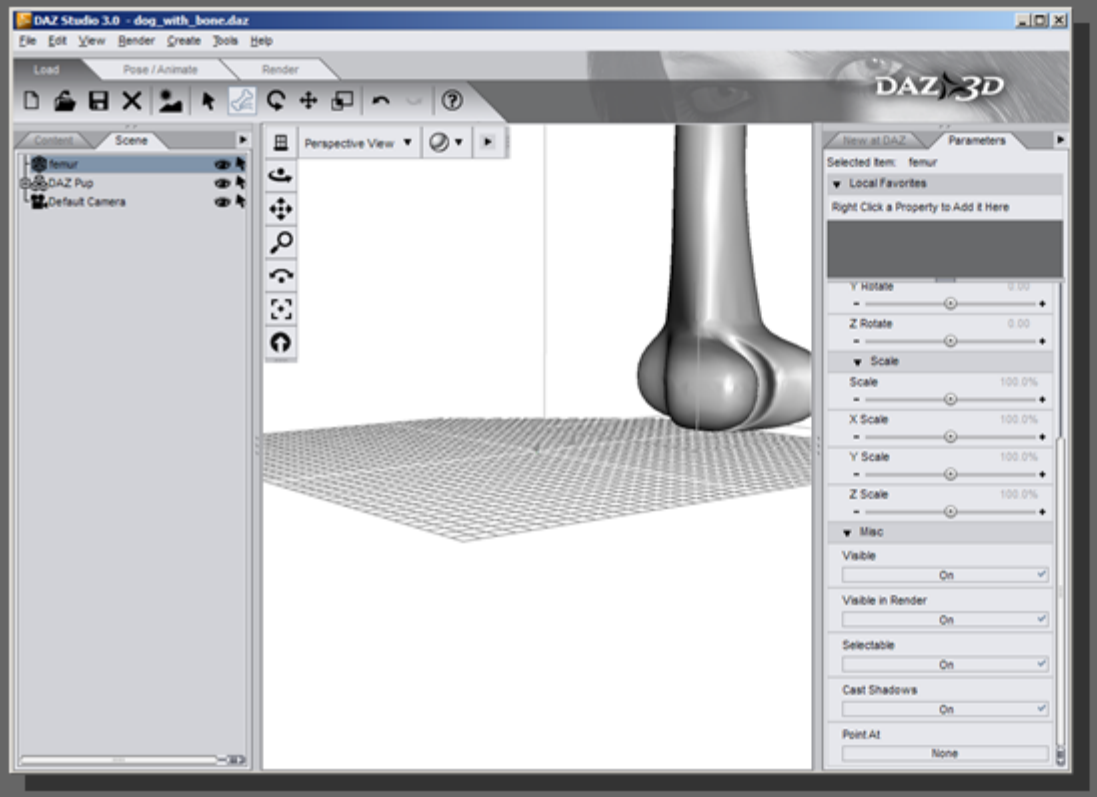
posing the character in Daz 3D Studio



choose a pose similar to the reference image

adjust the pose and other characteristics to better match the reference

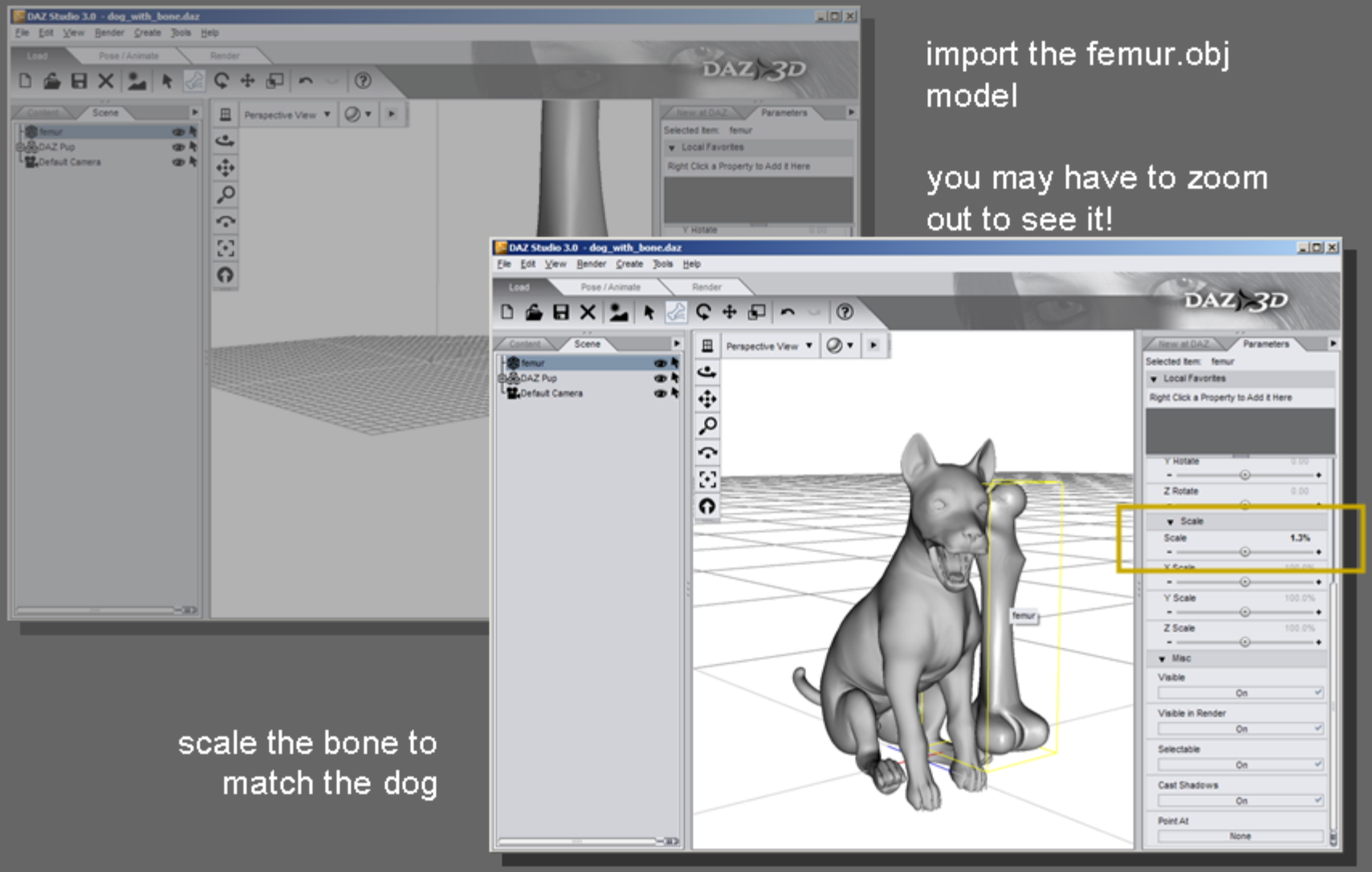
posing the prop in Daz 3D Studio



import the femur.obj model

you may have to zoom out to see it!

posing the prop in Daz 3D Studio

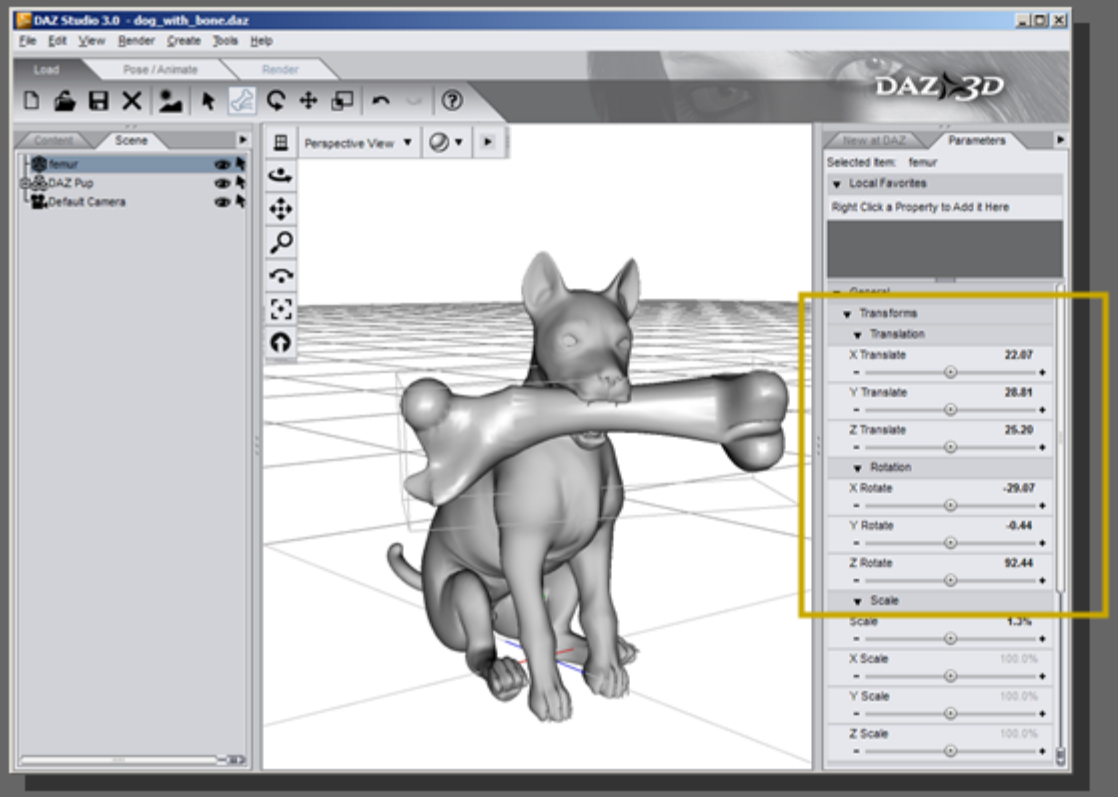


import the femur.obj model

you may have to zoom out to see it!

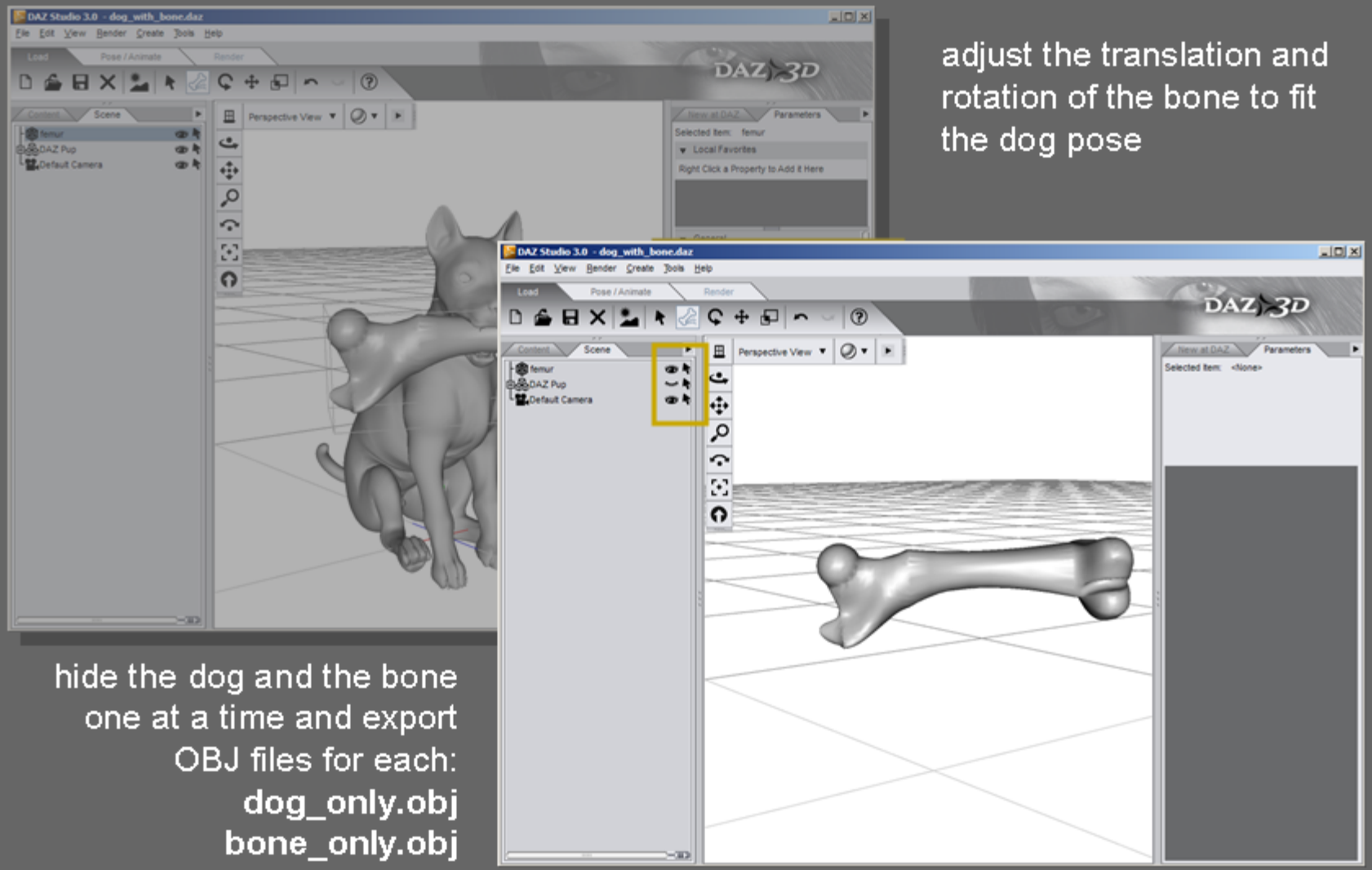
scale the bone to match the dog

posing the prop in Daz 3D Studio



adjust the translation and rotation of the bone to fit the dog pose

posing the prop in Daz 3D Studio



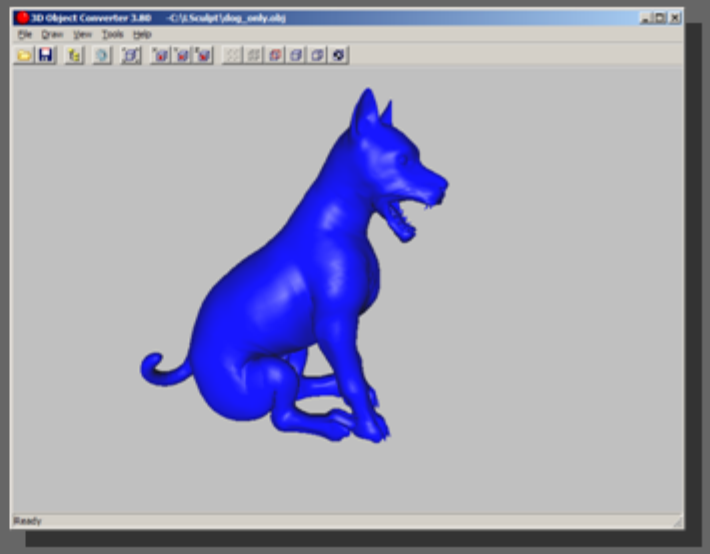
adjust the translation and rotation of the bone to fit the dog pose

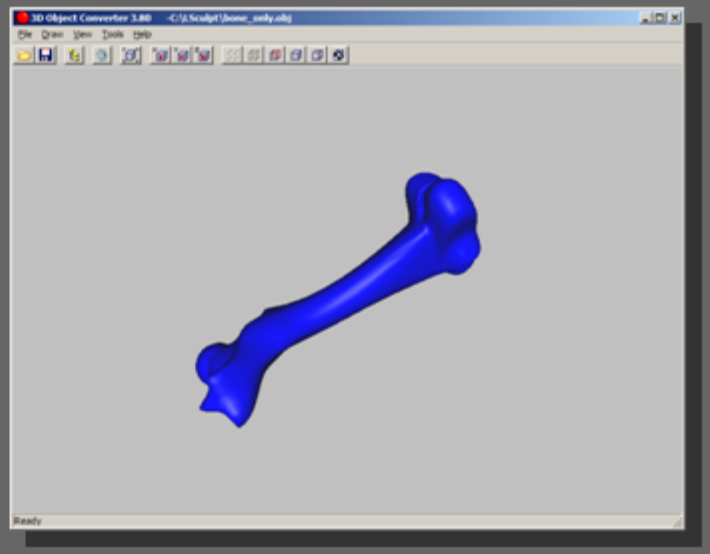
hide the dog and the bone one at a time and export OBJ files for each:

dog_only.obj
bone_only.obj

from Daz Studio to LSculpt

- open **dog_only.obj** and **bone_only.obj** in 3D Object Converter
- Save As… for each file to Stereolithography Binary (*.stl)
- translate the **dog_only.stl** and **bone_only.stl** to LEGO models using LSculpt (coming up!)

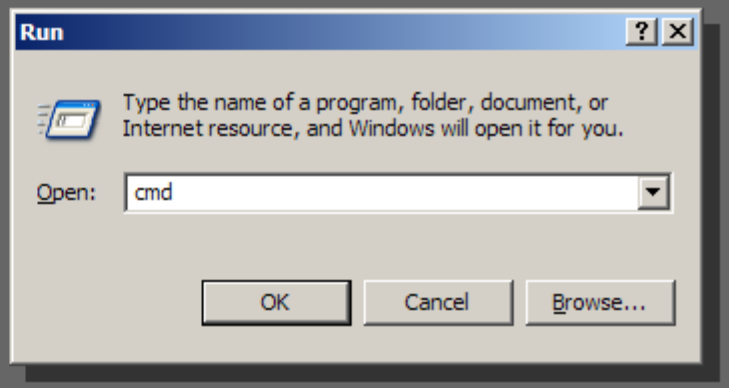




using LSculpt…a command line program

download and unzip **lsculpt.exe** to **C:\LSculpt**
move the **dog_only.stl** and **bone_only.stl** files to **C:\LSculpt** too

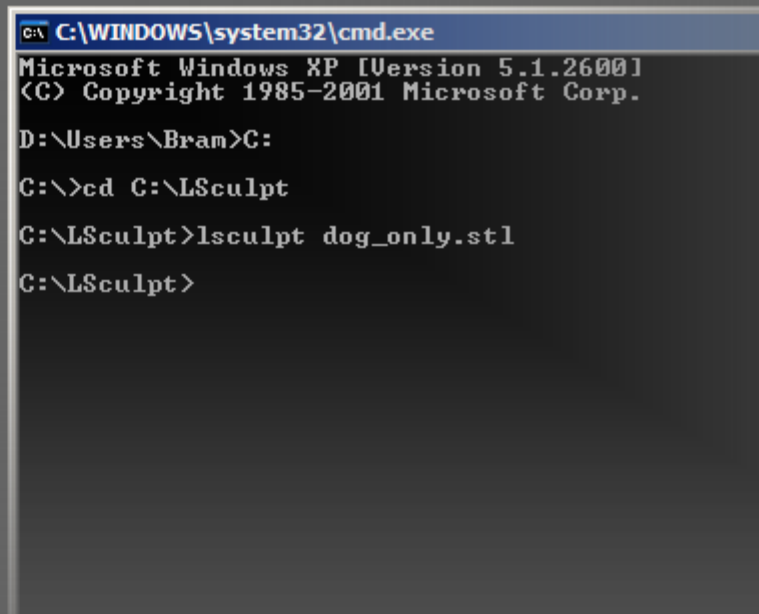
⊞ + R to bring up Run prompt



cmd to get command prompt window

C: to switch to C drive, then
cd C:\LSculpt to get to the install directory

lsculpt dog_only.stl creates
dog_only.ldr in the same location



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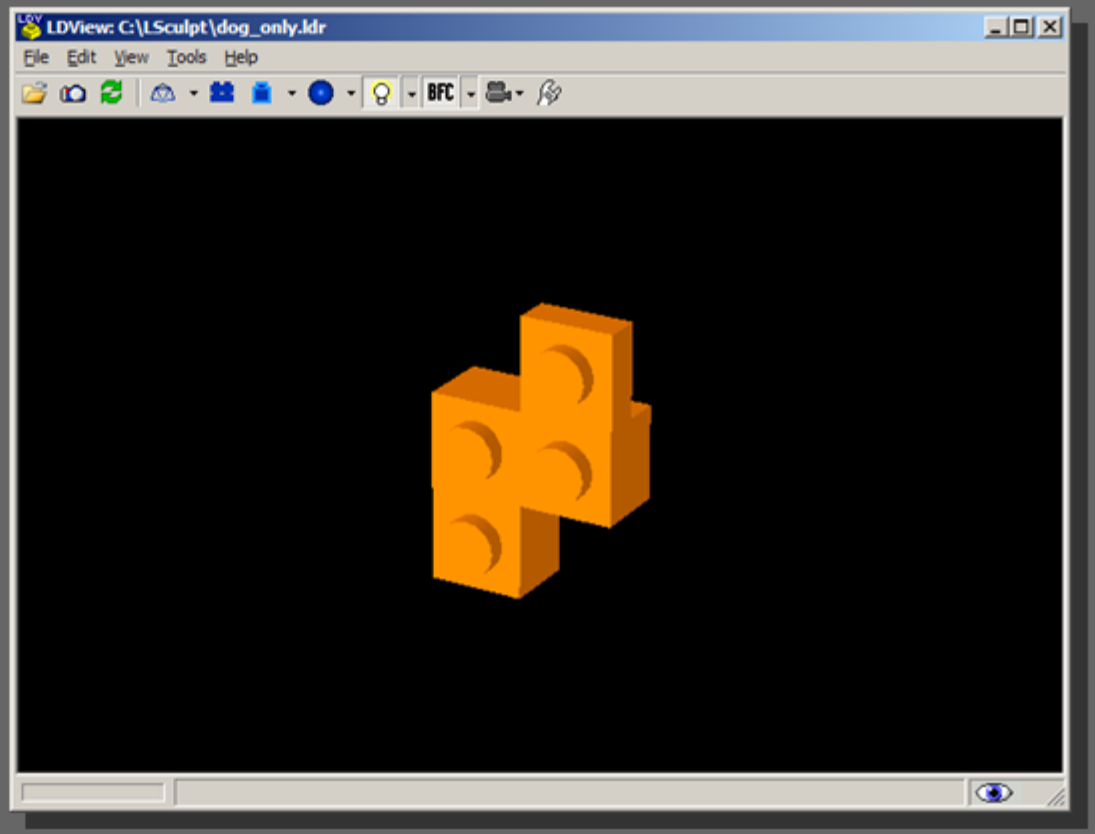
refining the LSculpt results

open **dog_only.ldr**
with LDView

oops…not the right scale!



try this: **lsculpt dog_only.stl –u in –f 9.0**

refining the LSculpt results

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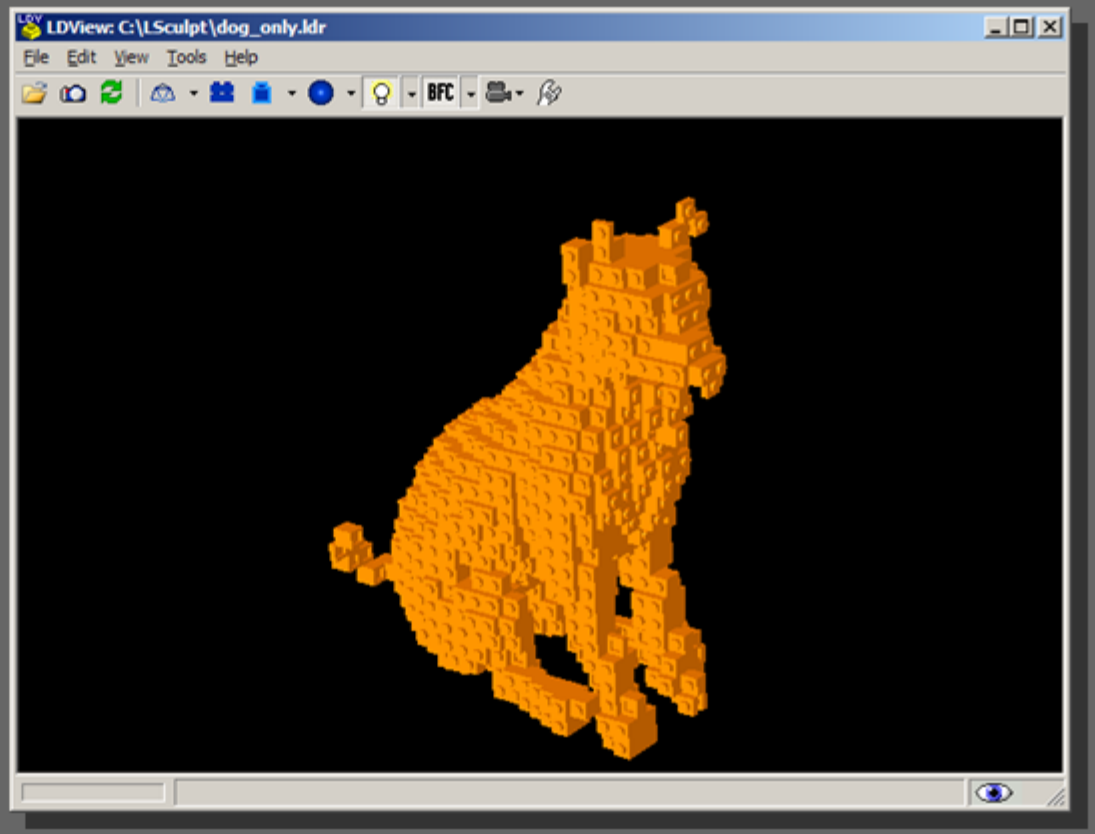

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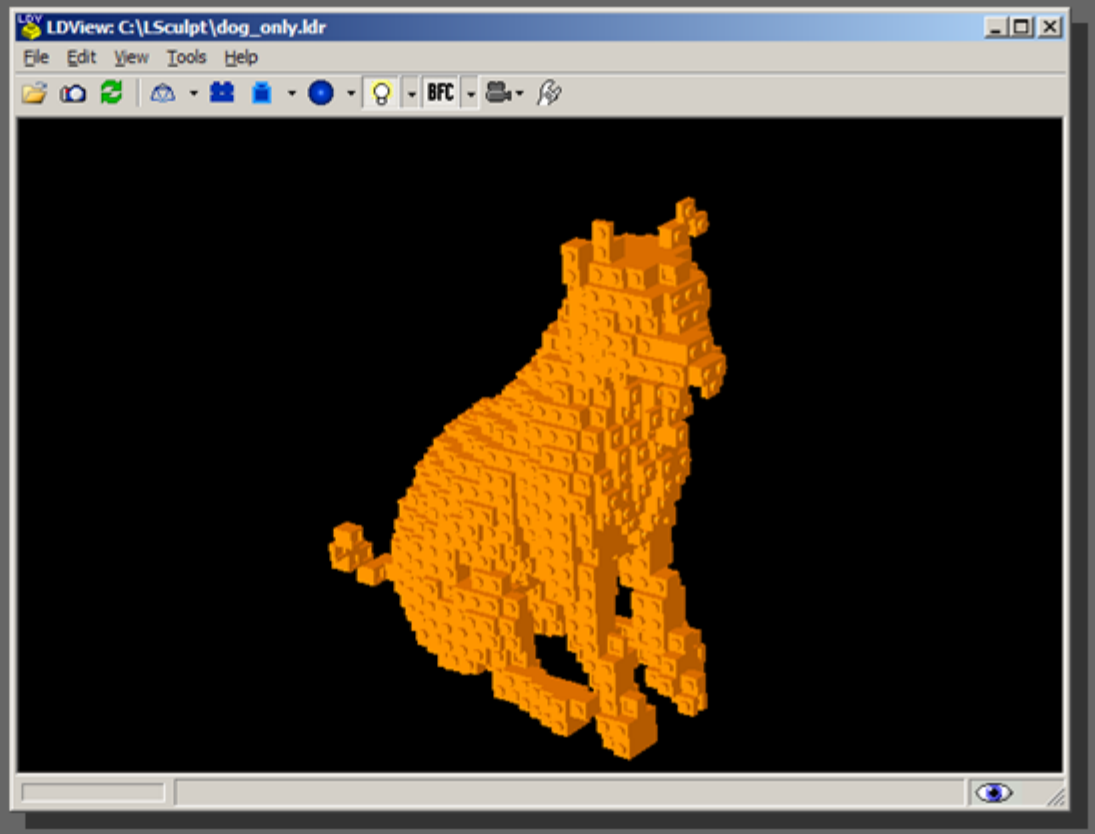


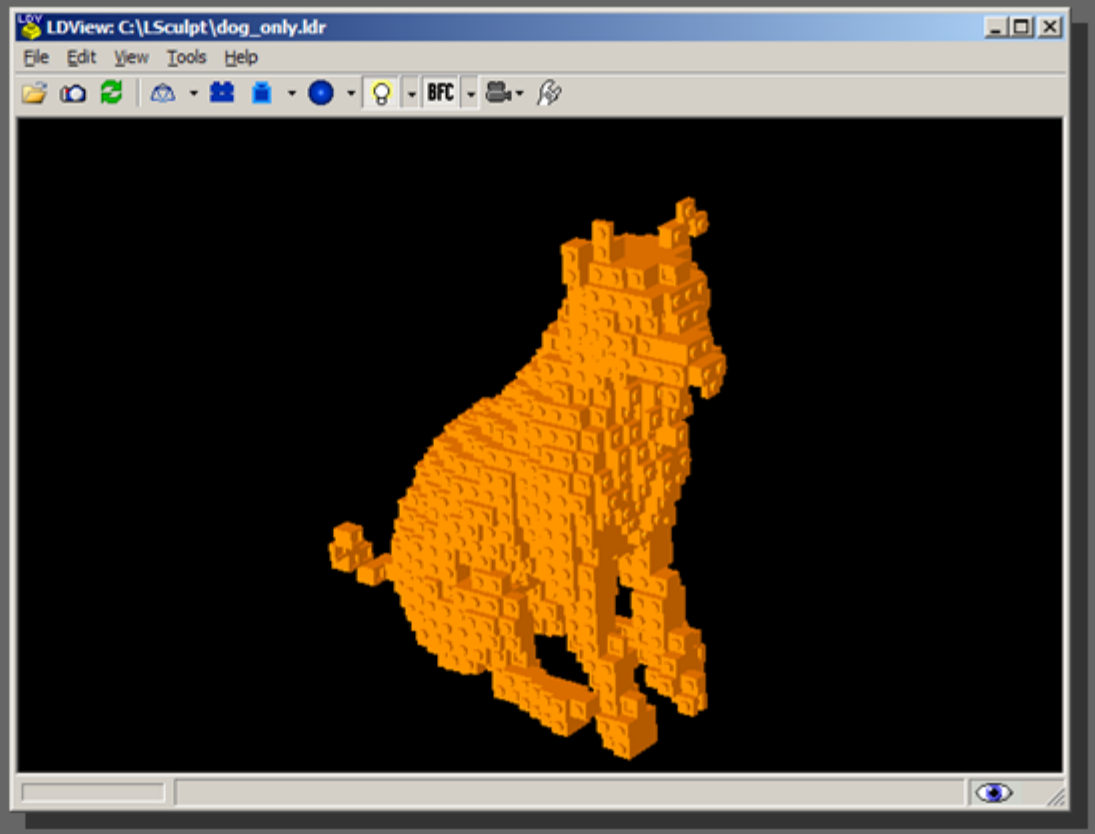
try this: **lsculpt dog_only.stl –u in –f 9.0**

units: inches

refining the LSculpt results

open **dog_only.ldr**
with LDView

oops…not the right scale!



try this: **lsculpt dog_only.stl –u in –f 9.0**

fit to 9 inches in the largest dimension

alternative ways to scale the input file

open **dog_only.ldr** in Notepad

the first few lines show the actual scale LSculpt calculated from the **–u in –f 9.0**

dog_only.ldr - Notepad

File Edit Format View Help

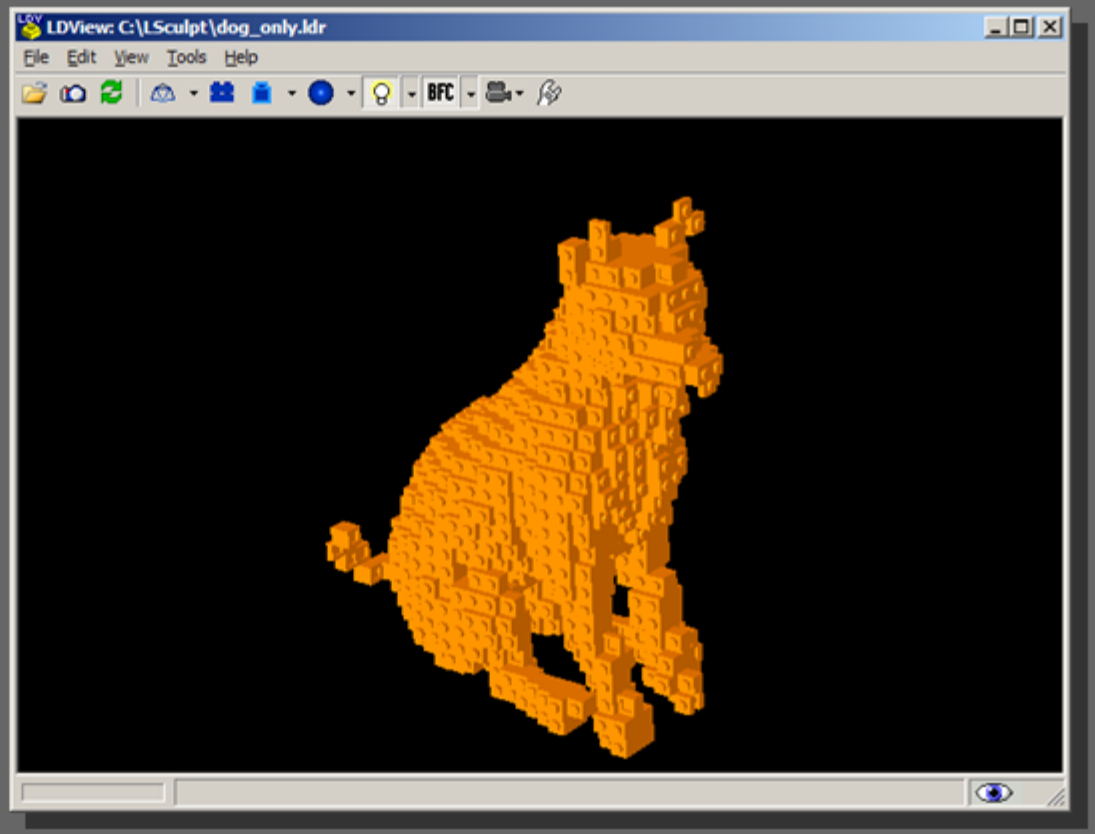
```
0 FILE dog_only.ldr
0 Author: LSculpt
0 LSculpt options:
0 Up vector: Y
0 Rotation:  0
0 Offset:    0, 0, 0
0 Scaling:   8.57466
0
1 16 -88 10 50 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -88 10 30 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -96 10 10 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -88 10 10 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -104 10 -10 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -96 10 -10 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -88 10 -10 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -112 10 -30 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -104 10 -30 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -96 10 -30 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -88 10 -30 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -120 10 -50 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -112 10 -50 0 1 0 -1 0 0 0 0 1 3024.DAT
1 16 -104 10 -50 0 1 0 -1 0 0 0 0 1 3024.DAT
```

try this: **lsculpt dog_only.stl –s 8.57**

refining the LSculpt results: rotation

rotating the input model aligns details with the desired build direction

let's improve how the dog's head lines up with the pieces used to recreate the surface

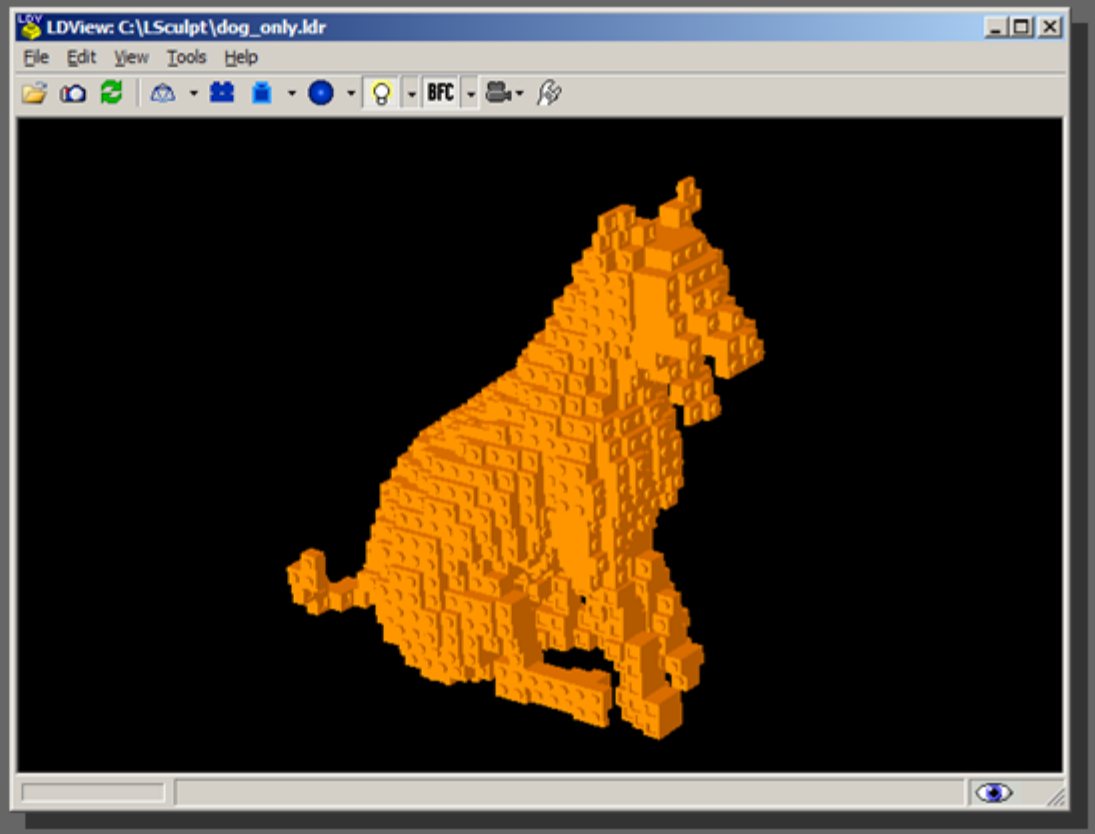


try this: **lsculpt dog_only.stl –s 8.57 –r 20**

refining the LSculpt results: rotation

rotating the input model aligns details with the desired build direction

let's improve how the dog's head lines up with the pieces used to recreate the surface



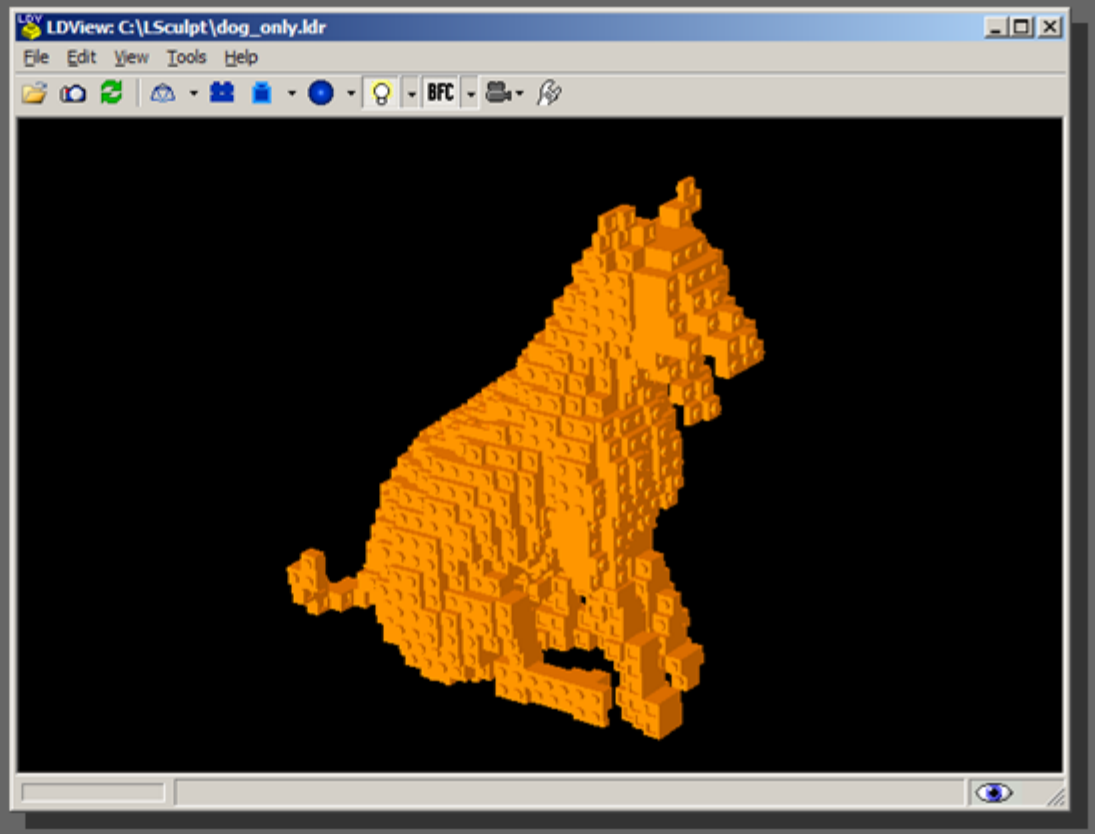
try this: **lsculpt dog_only.stl –s 8.57 –r 20**

rotate 20° about the vertical axis

refining the LSculpt results: optimization

by default, LSculpt will try to optimize the direction of sections of plates to match neighboring plates…which makes building easier

…but optimizing can get rid of detail that we want to keep!



try this: **lsculpt dog_only.stl –s 8.57 –r 20 –q**

refining the LSculpt results: optimization

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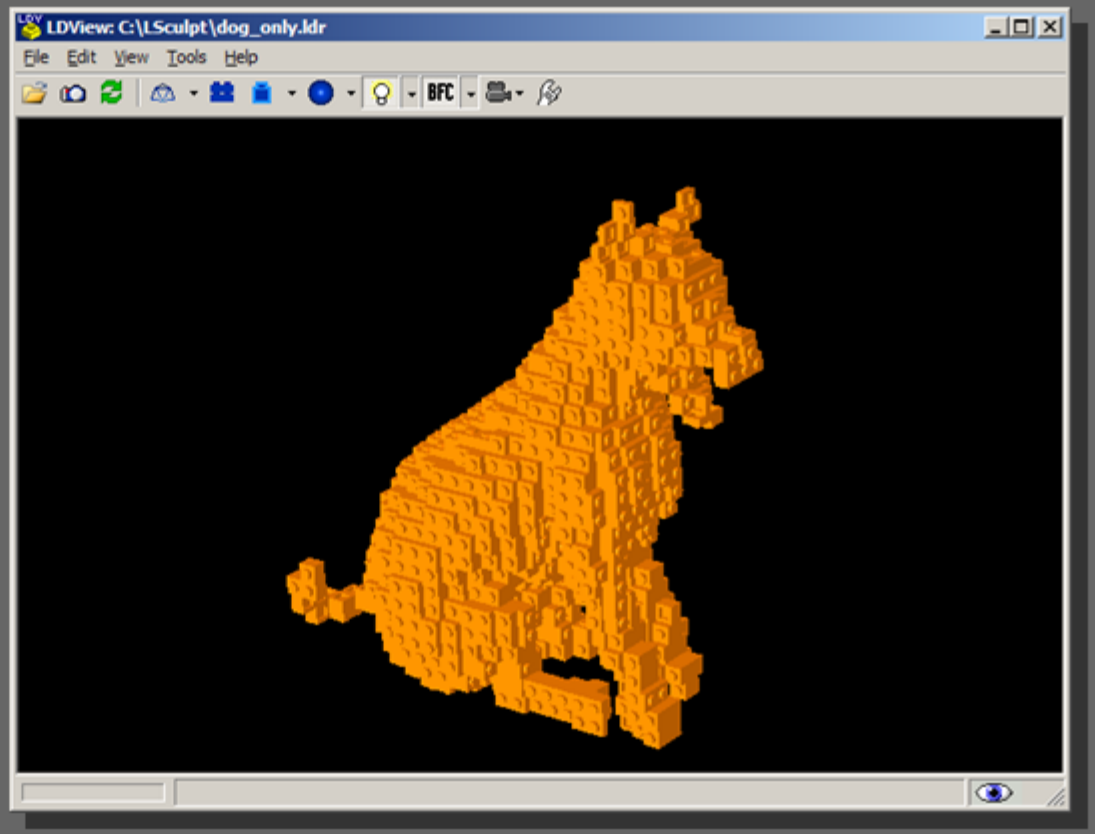
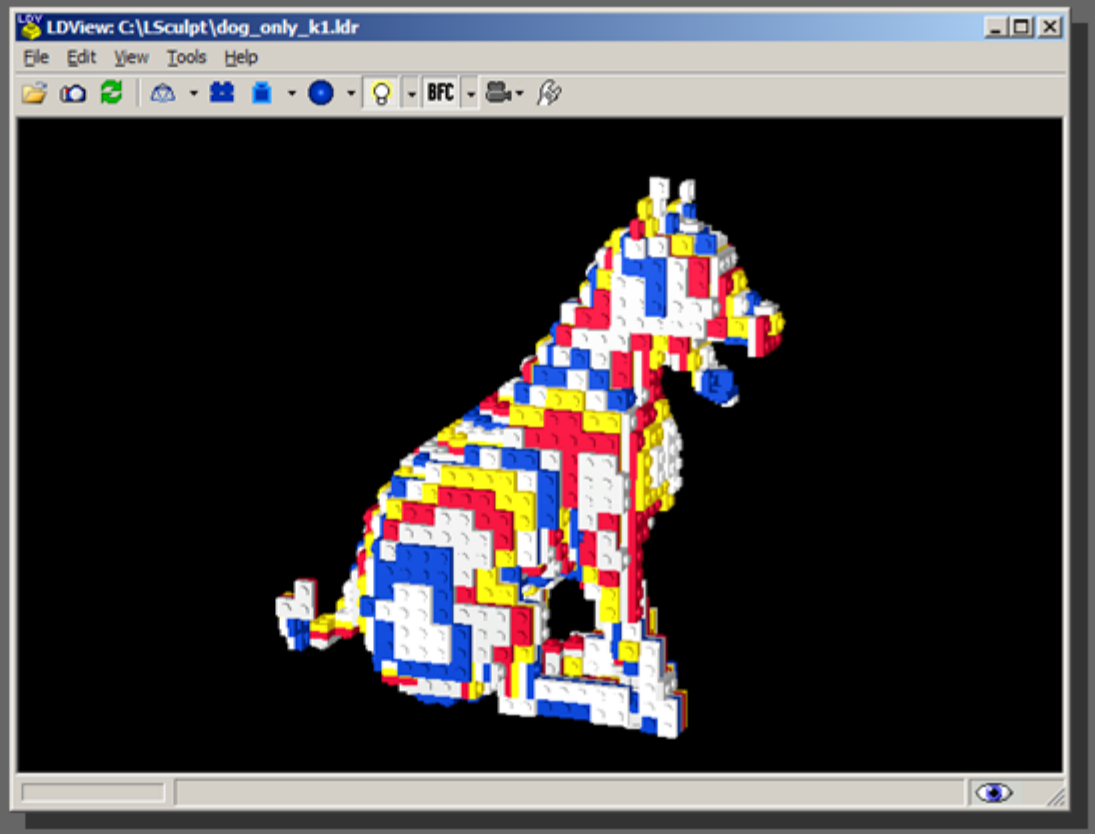


try this: **lsculpt dog_only.stl –s 8.57 –r 20 –q**

turn off optimization

more LSculpt options: output colors

Instead of the default LDraw color (16), LSculpt can also output colors to aid building…

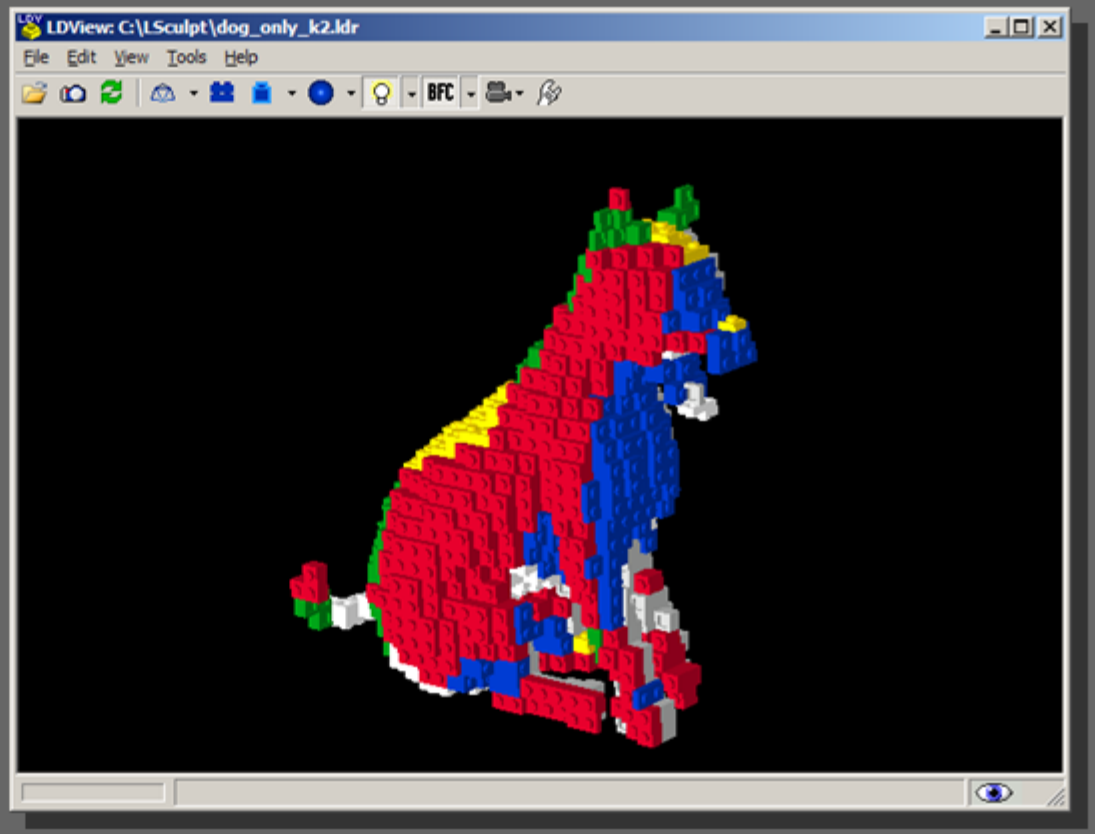


try this: **lsculpt dog_only.stl –s 8.57 –r 20 –q –k 1**

color by layer

more LSculpt options: output colors

Instead of the default LDraw color (16), LSculpt can also ouput colors to aid building…

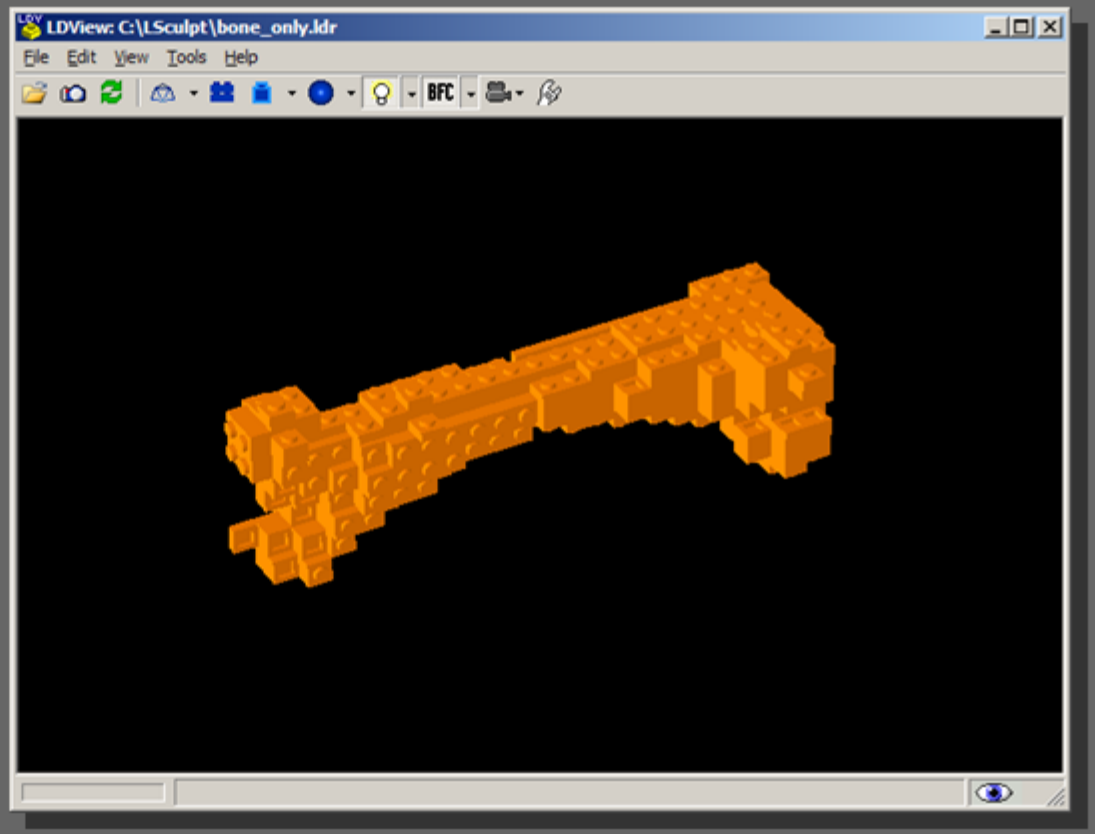


try this: **lsculpt dog_only.stl –s 8.57 –r 20 –q –k 2**

color by direction

translate the remaining props…

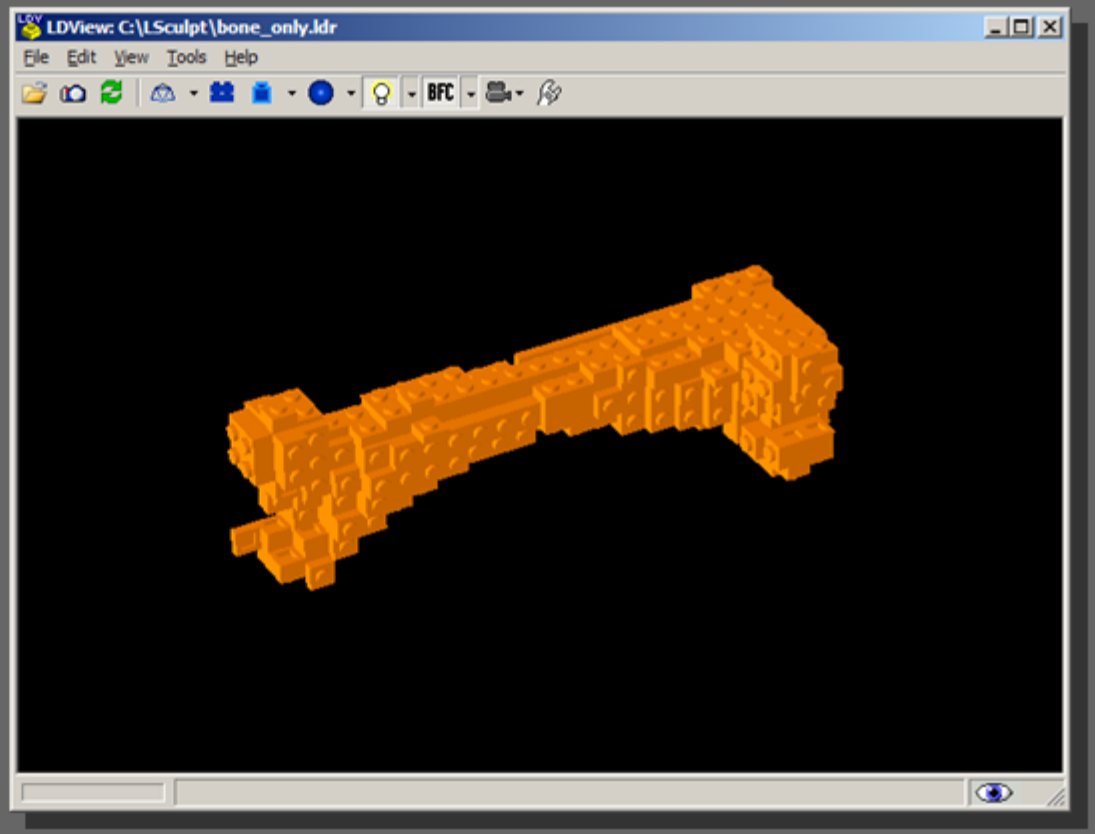
in order to work with the dog model, the bone must be translated with the same scaling and rotation settings



try this: **lsculpt bone_only.stl –s 8.57 –r 20**

translate the remaining props…

in order to work with the dog model, the bone must be translated with the same scaling and rotation settings

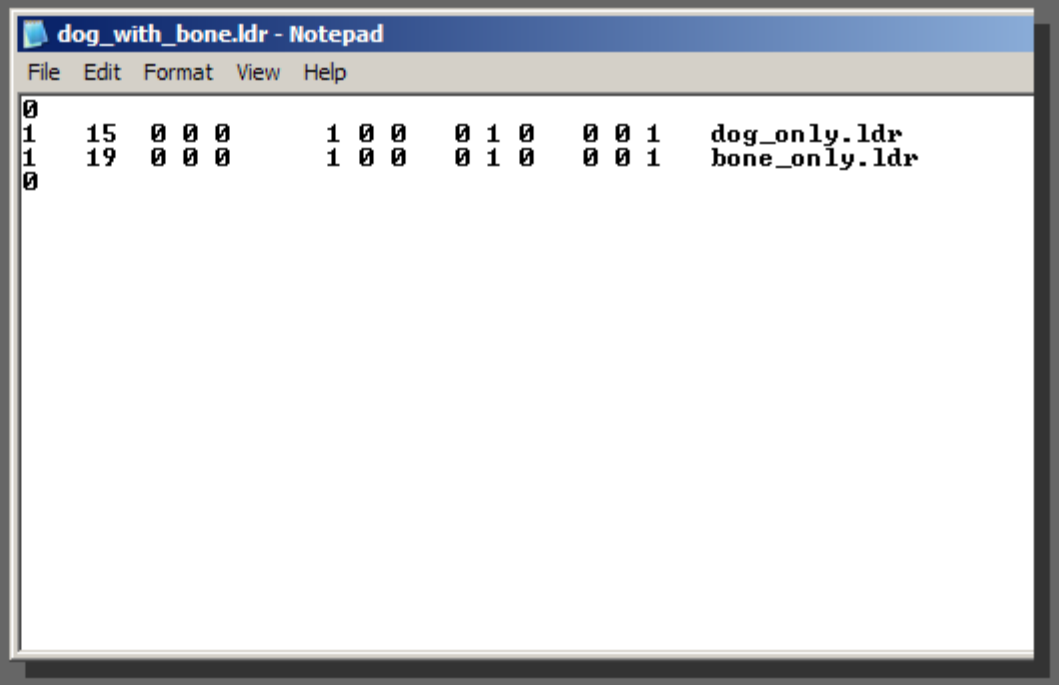


try this: **lsculpt bone_only.stl –s 8.57 –r 20 –q**

turn off optimization

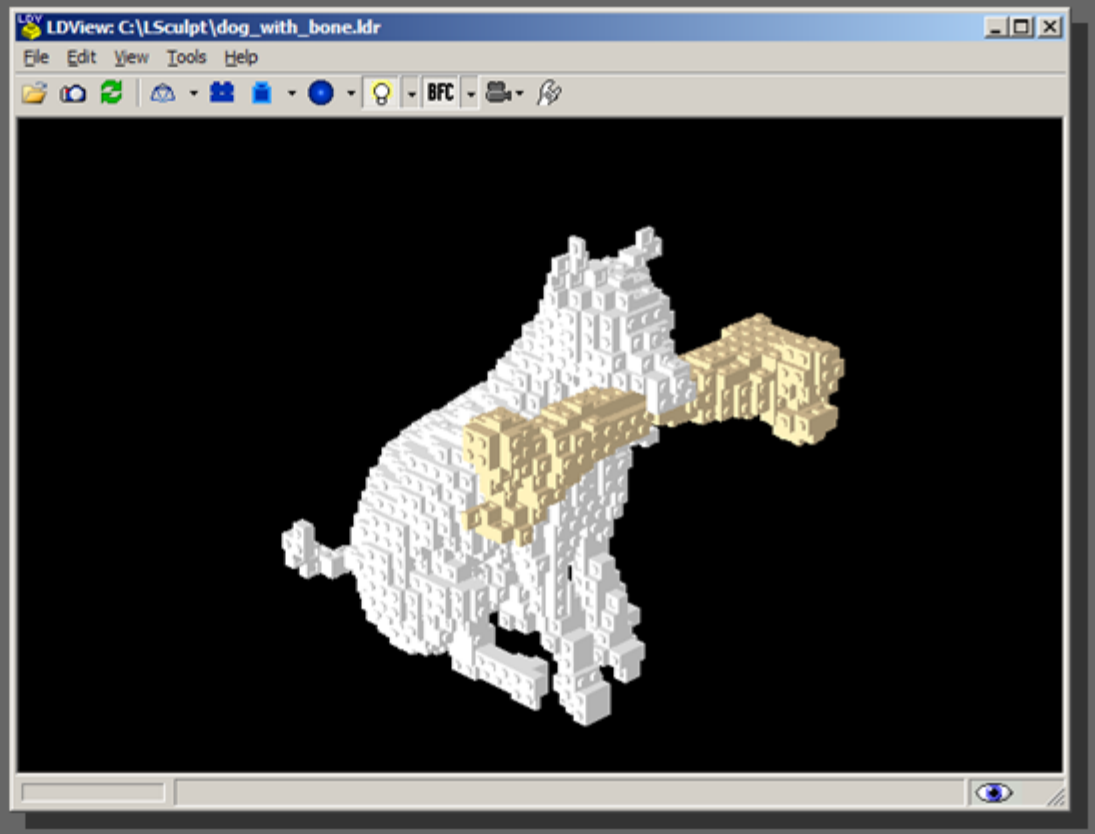
composite the character and prop…

a simple LDraw file (created in Notepad or MLCAD) combines the **dog_only.ldr** and **bone_only.ldr** models.



composite the character and prop…

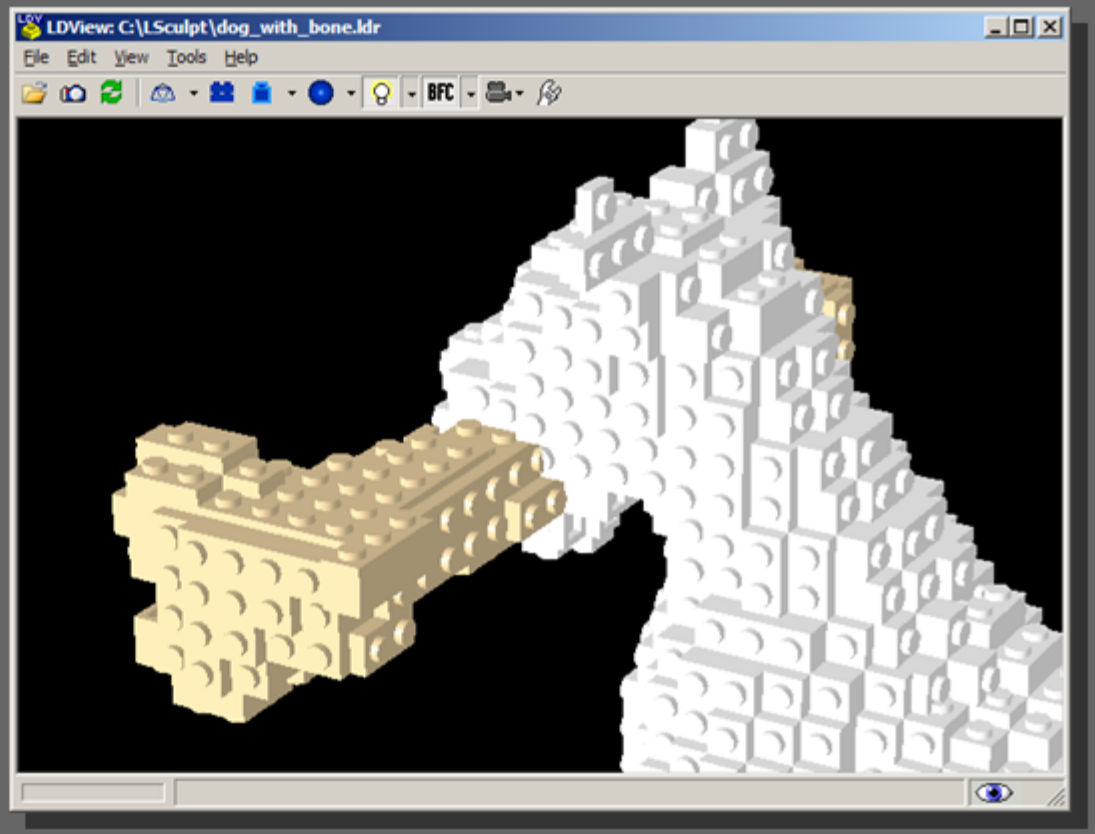
a simple LDraw file (created in Notepad or MLCAD) combines the **dog_only.ldr** and **bone_only.ldr** models.



composite the character and prop…

a simple LDraw file (created in Notepad or MLCAD) combines the **dog_only.ldr** and **bone_only.ldr** models.

use the composite file to see where the two models need to connect together



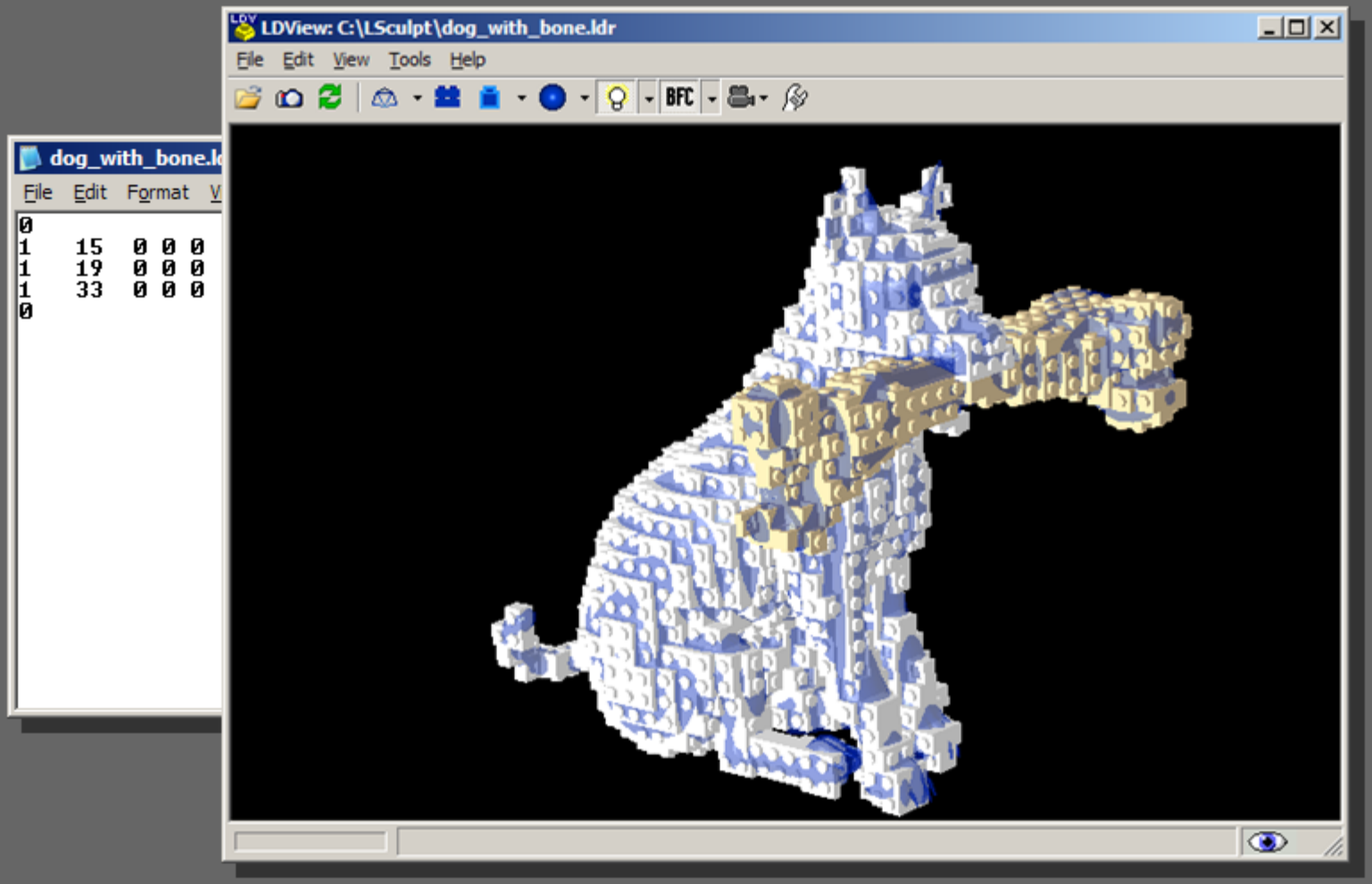
compositing with the original mesh

dog_with_bone.ldr - Notepad

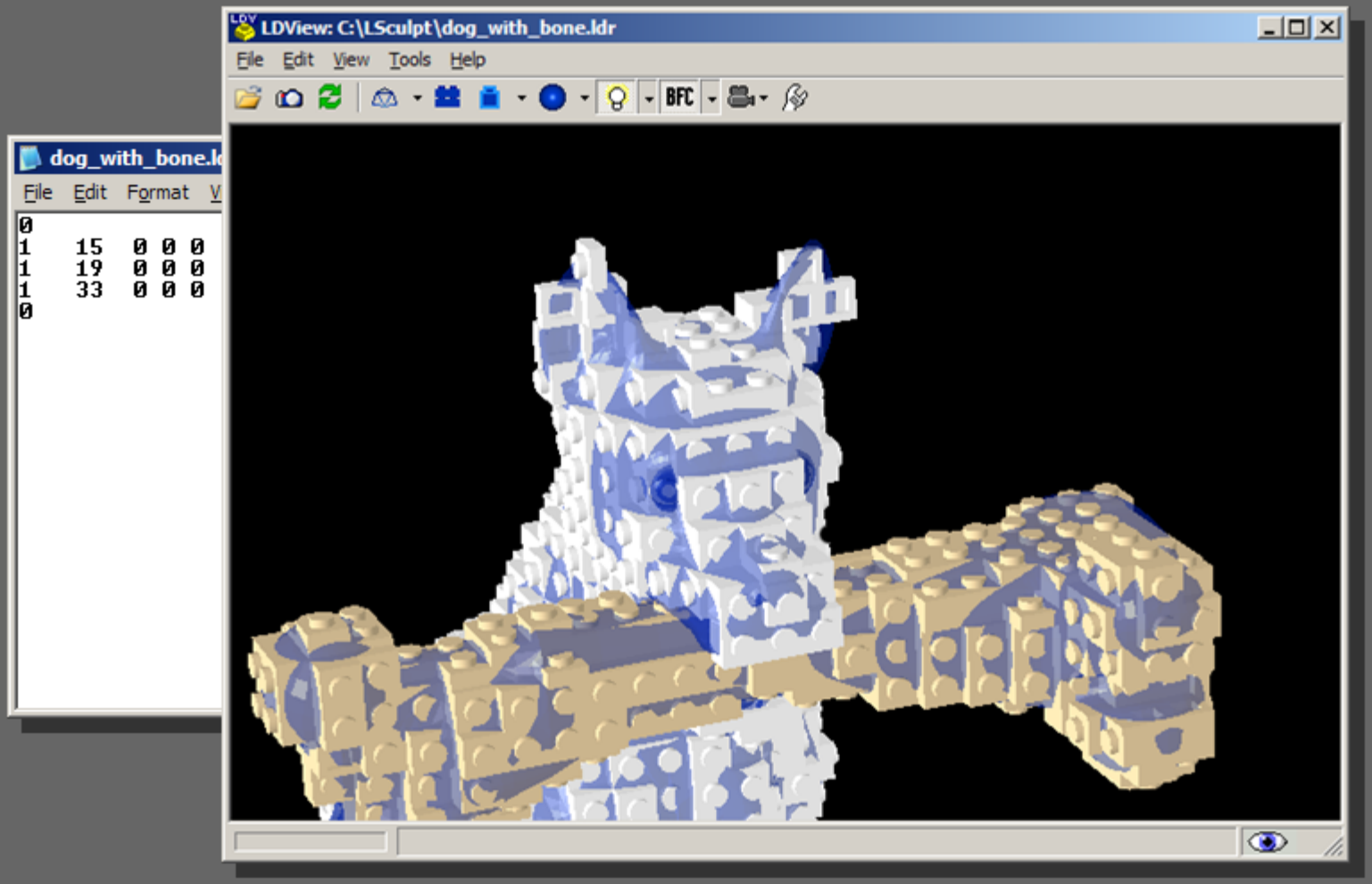
File Edit Format View Help

```
0
1   15  0 0 0   1     0 0     0  1    0   0     0  1       dog_only.ldr
1   19  0 0 0   1     0 0     0  1    0   0     0  1       bone_only.ldr
1   33  0 0 0   8.053 0 2.931 0 -8.57 0   2.931 0 -8.053   dwb_triangles.ldr
0
```

compositing with the original mesh



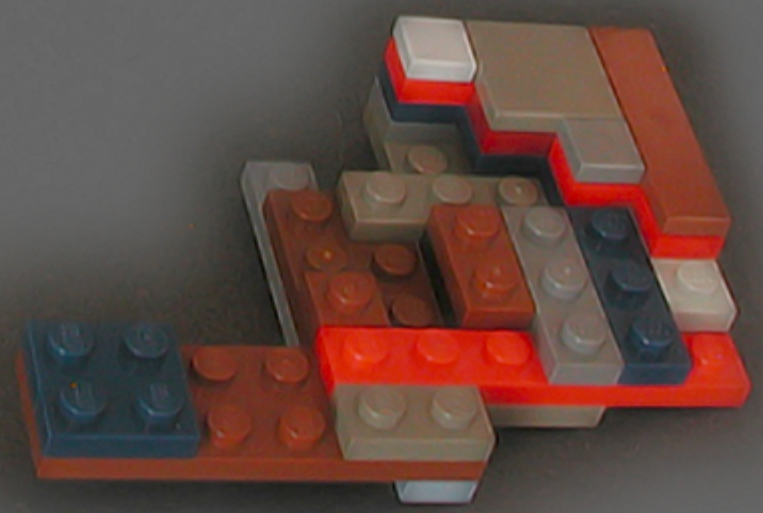
compositing with the original mesh



build a prototype

spin the model around in LDView, and use the different color schemes to build layered sections

use your own judgment to select which sections should use the optimized, or the most detailed results



build a prototype

fit the sections together temporarily (using other pieces, or even rubber bands

build the final sculpture

copy the shape of the prototype model in the final colors

add structural pieces to hold everything together internally

add details, like the eyes, ears, and tail, that did not translate well from the 3D model

end

Free software

3D Modeling

- Blender
- Google SketchUp
- Caligari trueSpace

Character Posing

- DAZ Studio

Format Conversion

- IVCON
- 3D Object Converter

LDraw Viewing

- LDView
- L3Lab
- MLCAD

In the works…

Graphical interface for LSculpt!

- cross-platform
- no more command line
- OBJ file support

Future ideas

- live preview
- live editing
- color support
- support for multiple objects
- grouping selections
- mesh export
- and many more…

http://lego.bldesign.org/LSculpt/