3D Articulation

Using OpenGL

moving parts & hair

Book 3 in the 3D Rendering Series

...just the color figures for those who got the B&W printed book...

by D. James Benton

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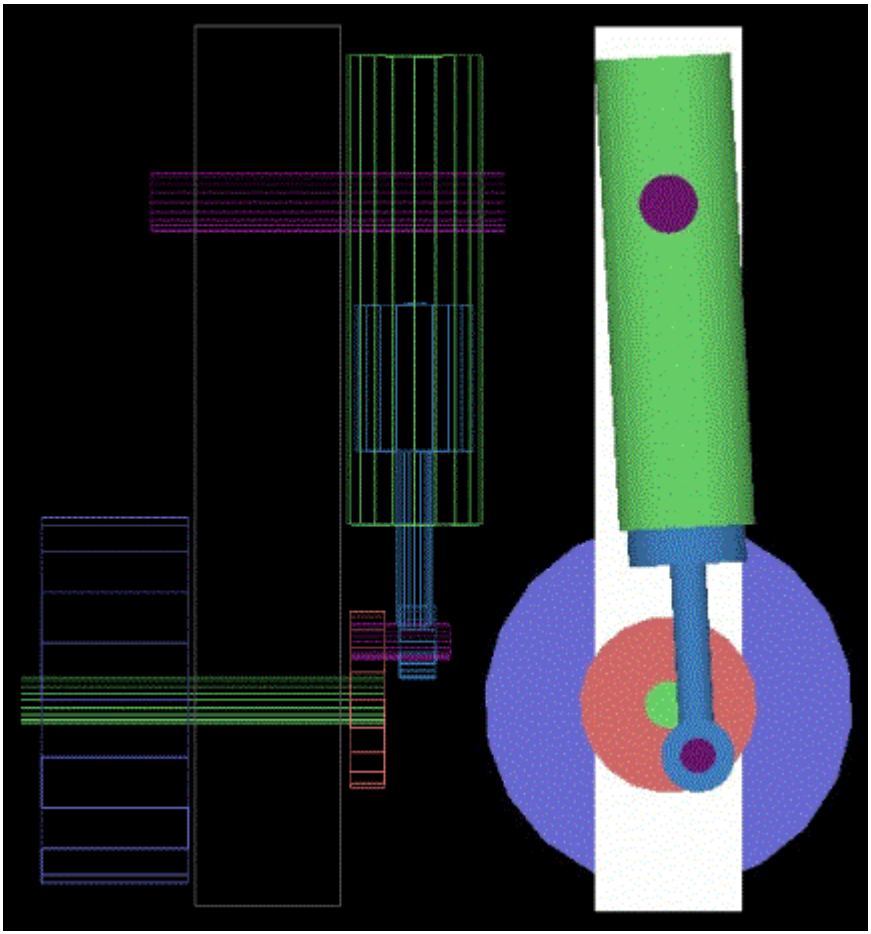
Forward

This is a third course on three-dimensional rendering of models, building on my previous books, *3D Rendering in Windows* and *3D Models in Motion*. In this text we will cover spatial manipulation of objects in order to create the appearance of specific articulation. We also cover finer details, including hair or fur. The Windows® operating system and OpenGL® rendering engine will be our platform, but the same principles apply equally well to other environments. We assume the reader is familiar with C and programming for the Windows® operating system and will not dwell on those details. Many references are available on these foundational subjects, including my book, *Version Independent Programming*. As in that text, we require that all code function properly on any version and configuration of Windows®. All of the software and associated files described herein is available free online.

All of the examples contained in this book,
(as well as a lot of free programs) are available at…
http://www.dudleybenton.altervista.org/software/index.html



based on the work of Troy Robinette

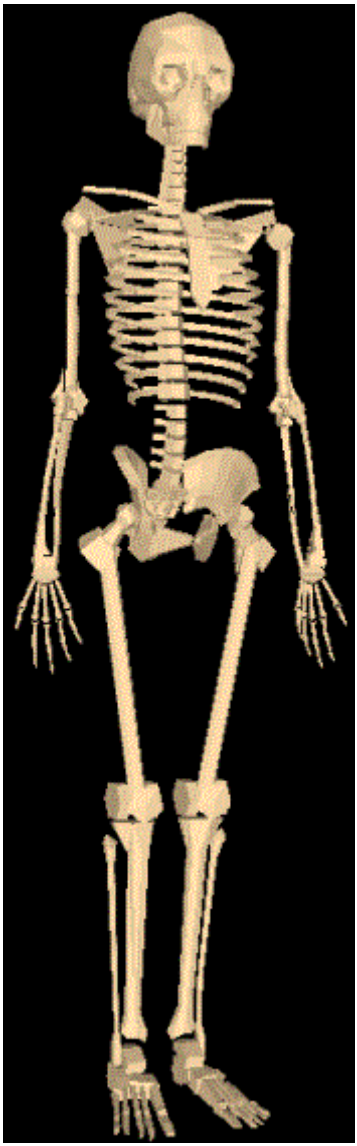
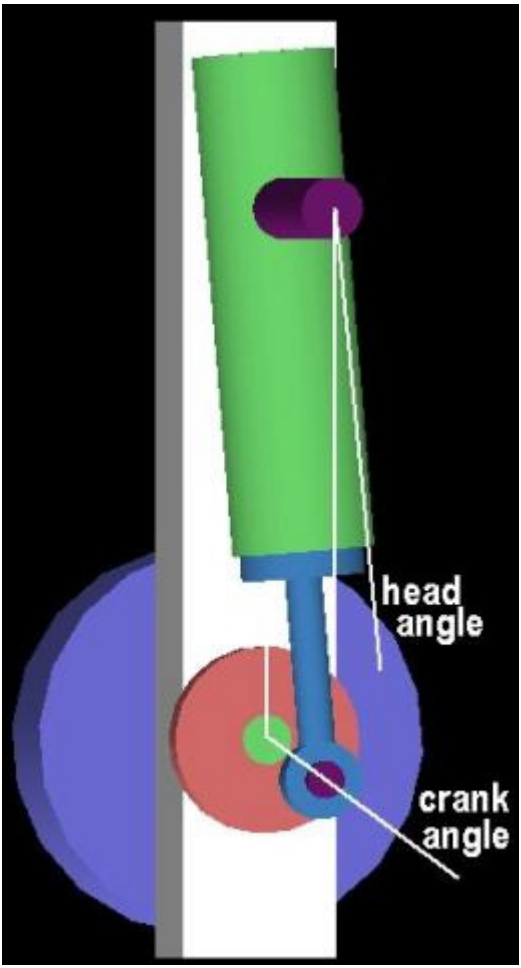


Figure 2. Skeleton (3D Model by Thomas Baier)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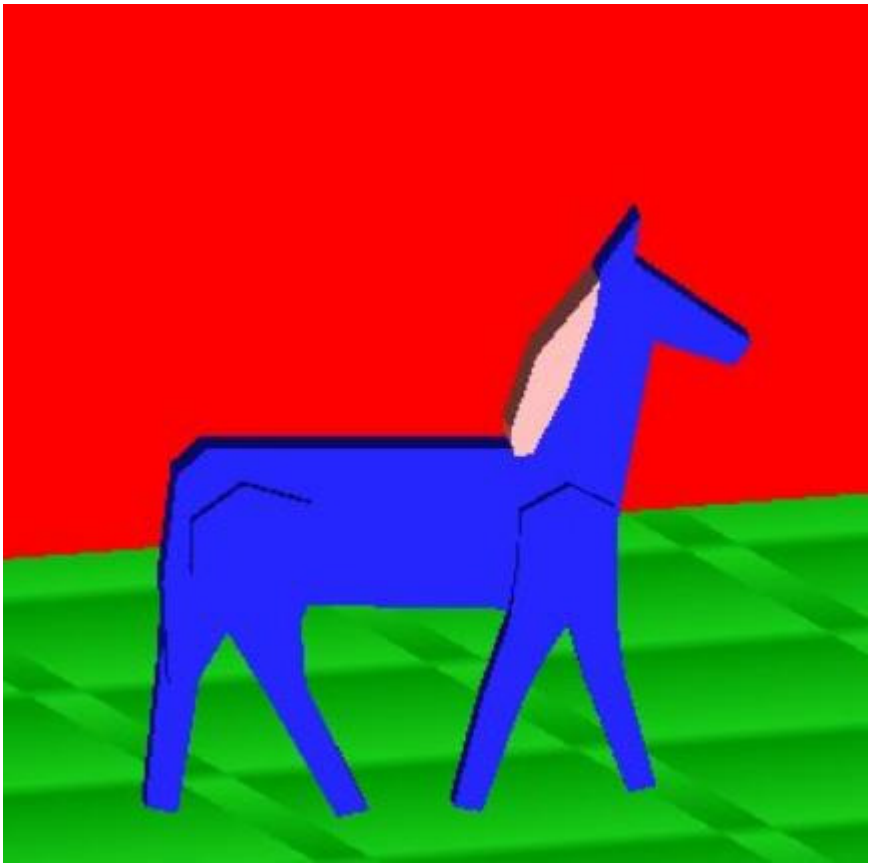

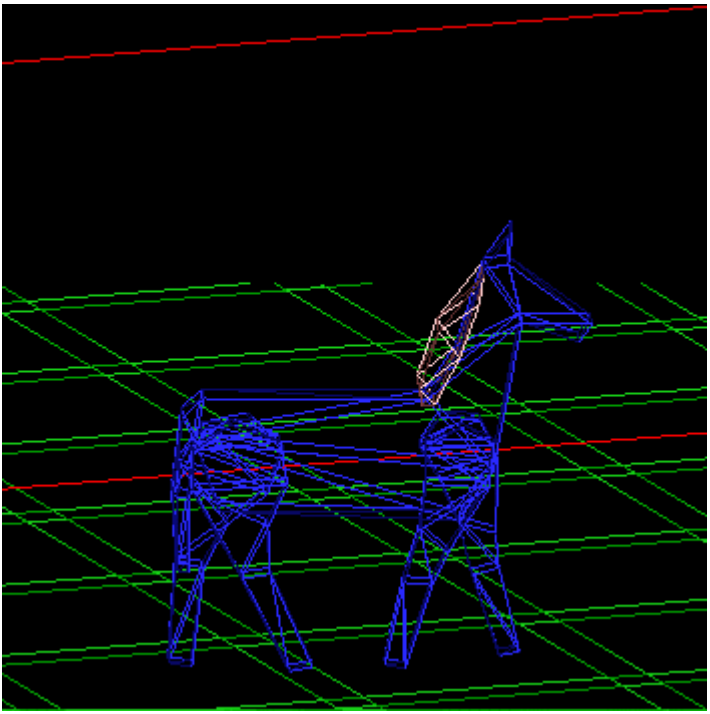

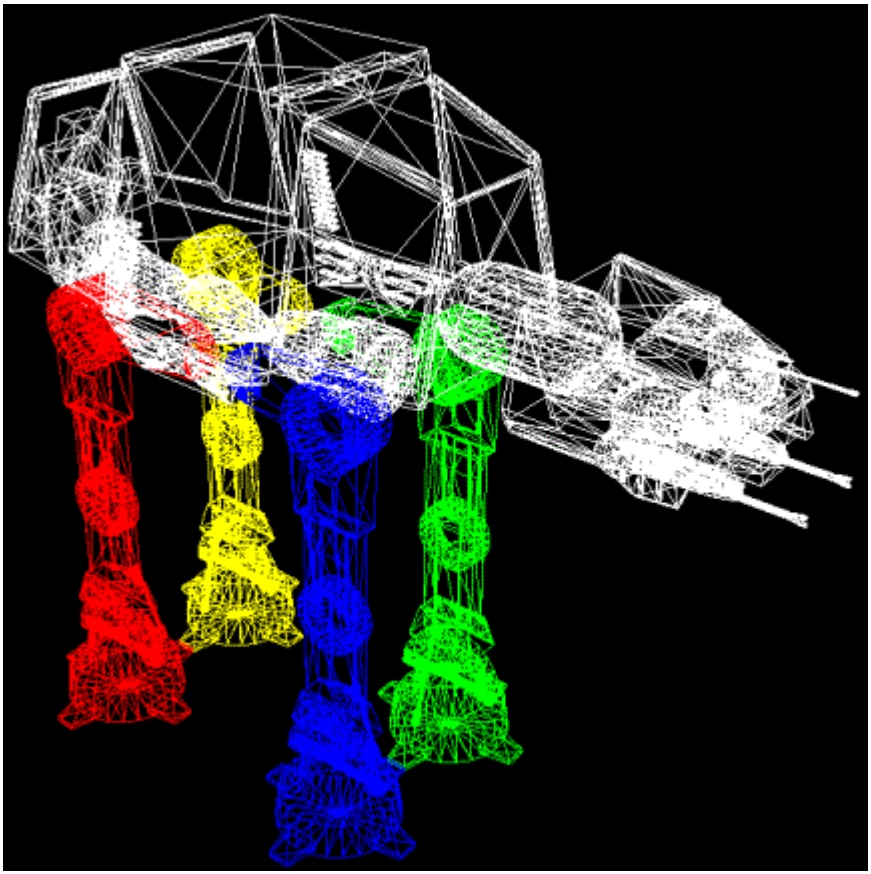

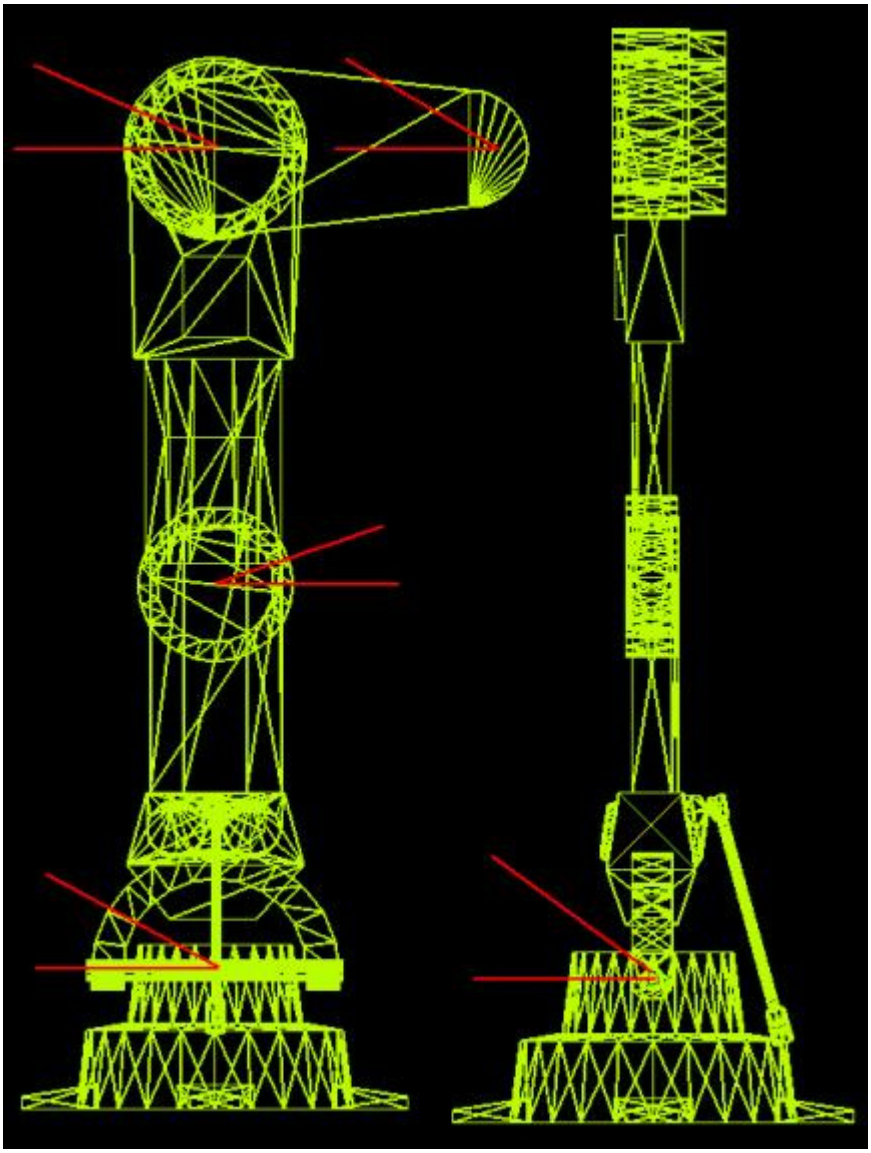

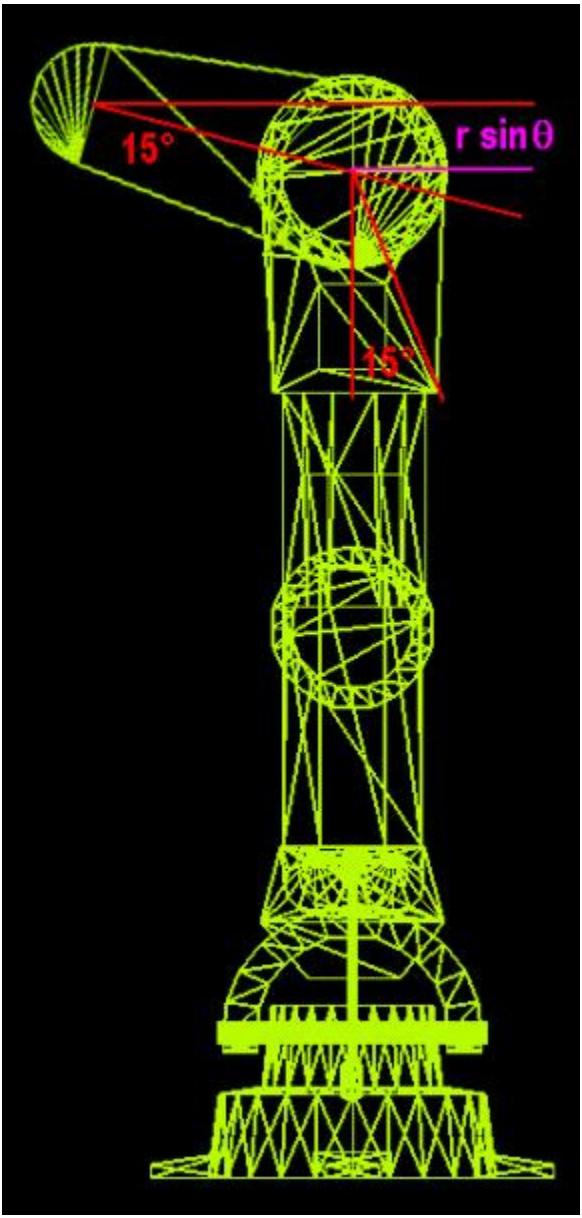
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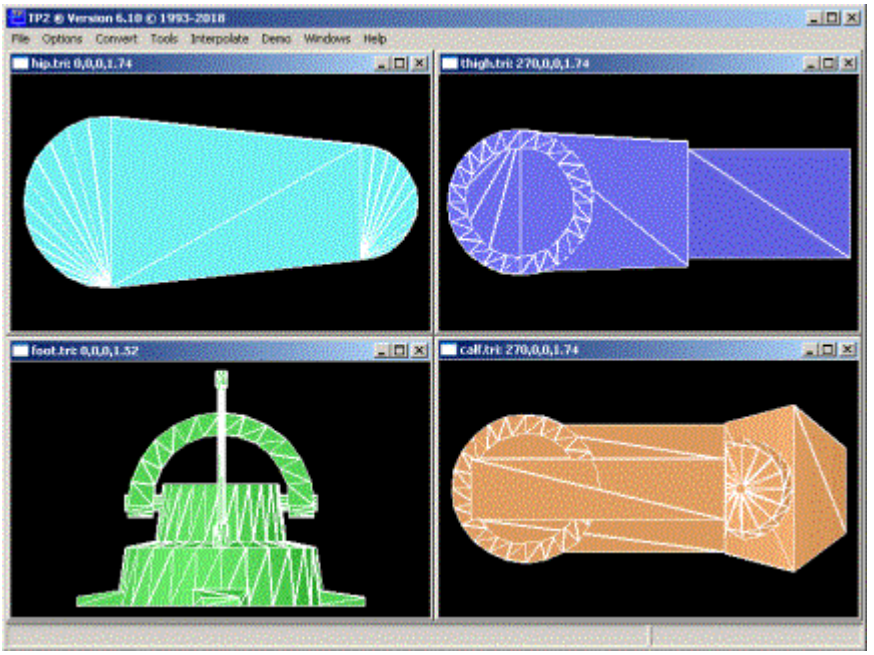
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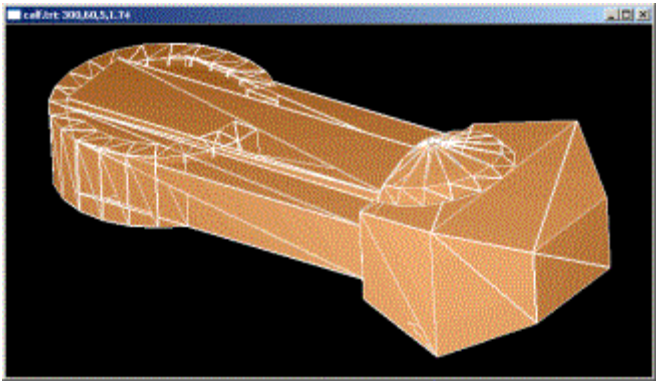
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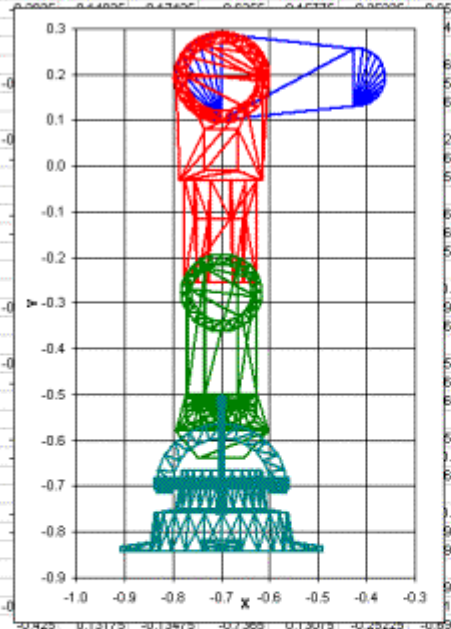

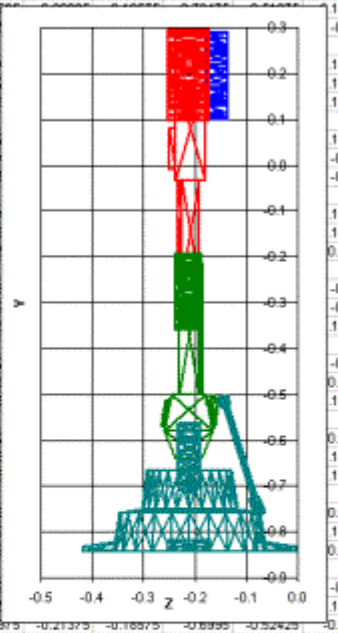

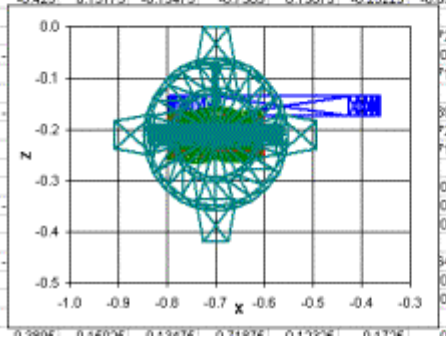

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37	-0.46126	0.022034	-0.05378	-0.77773	-0.05371	-0.12416	-0.643					
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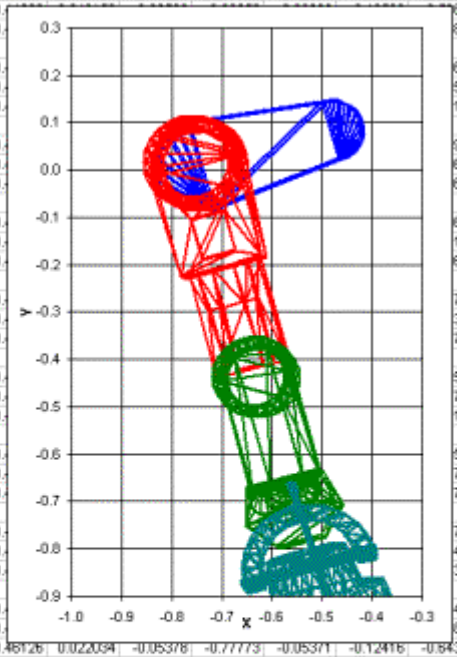

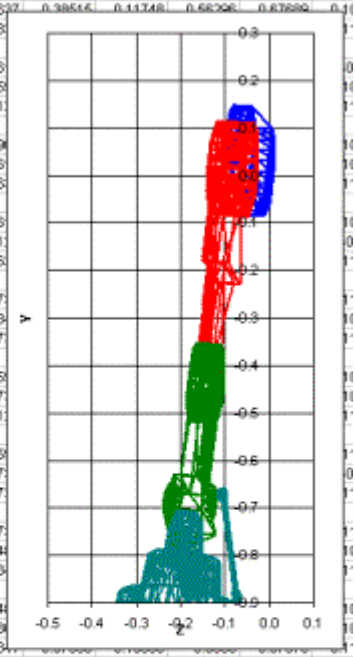

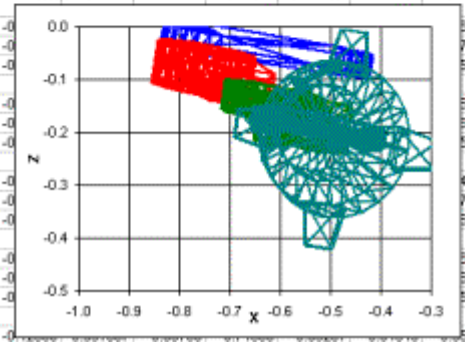

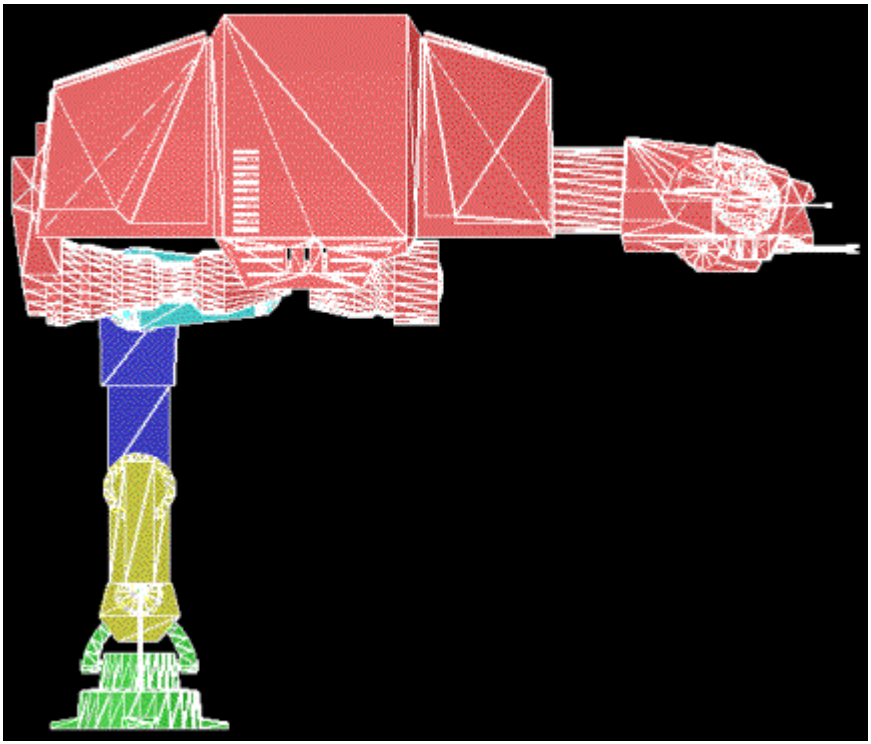

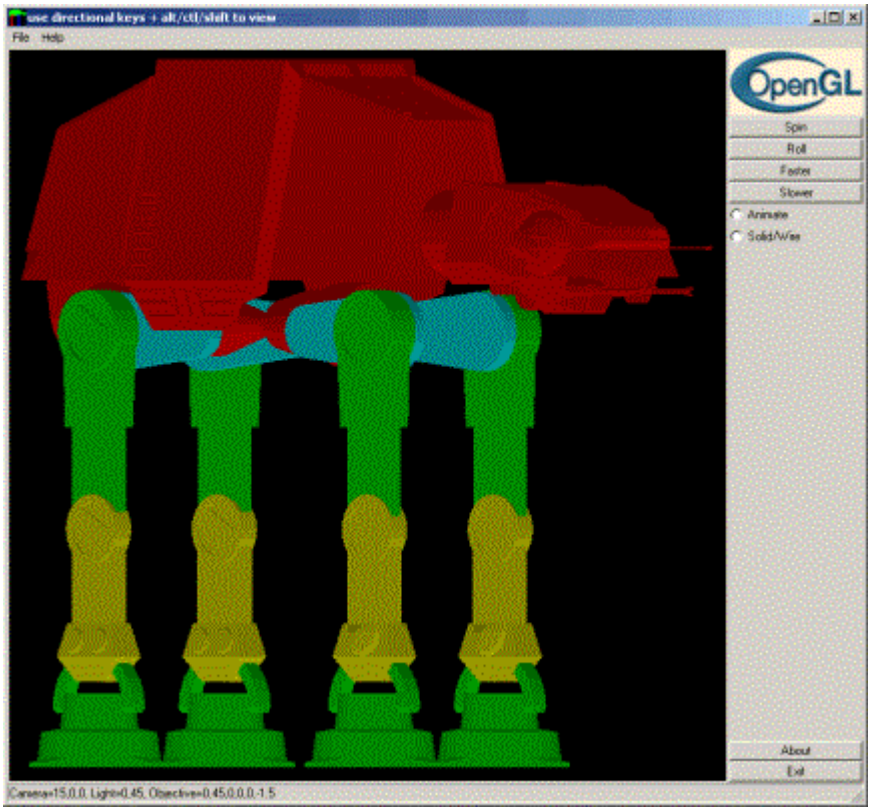
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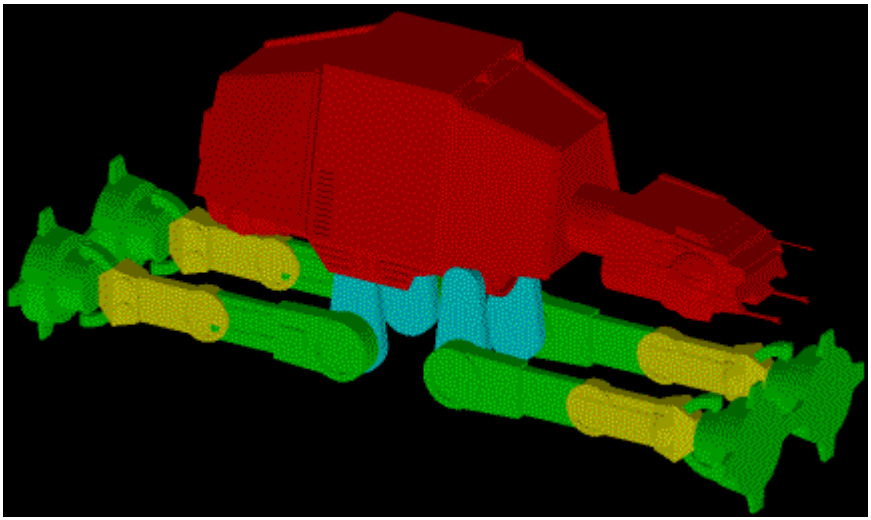

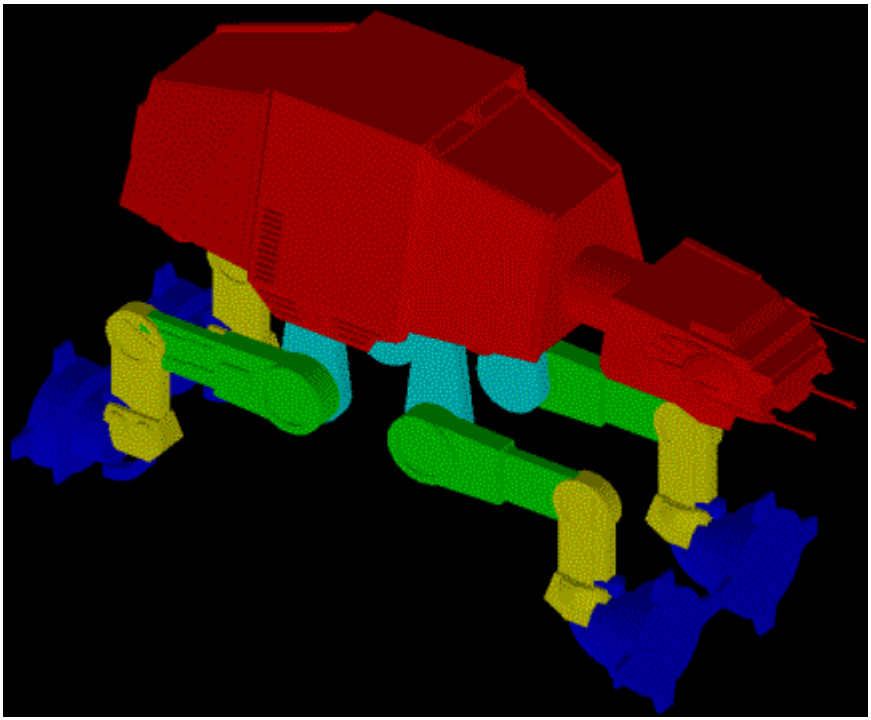

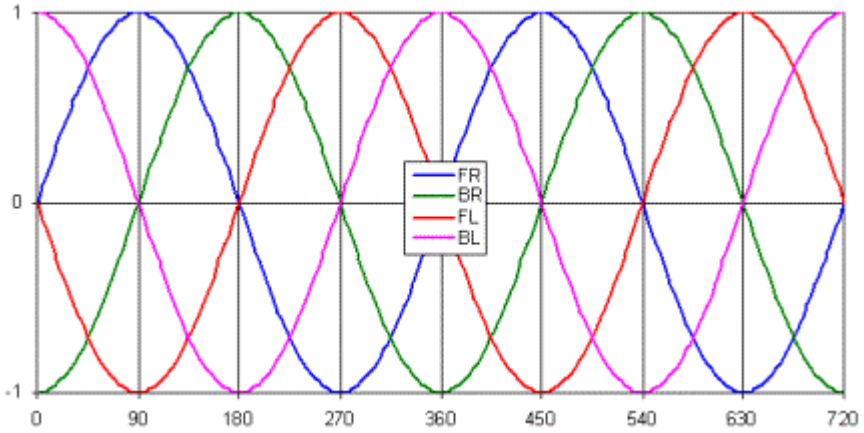
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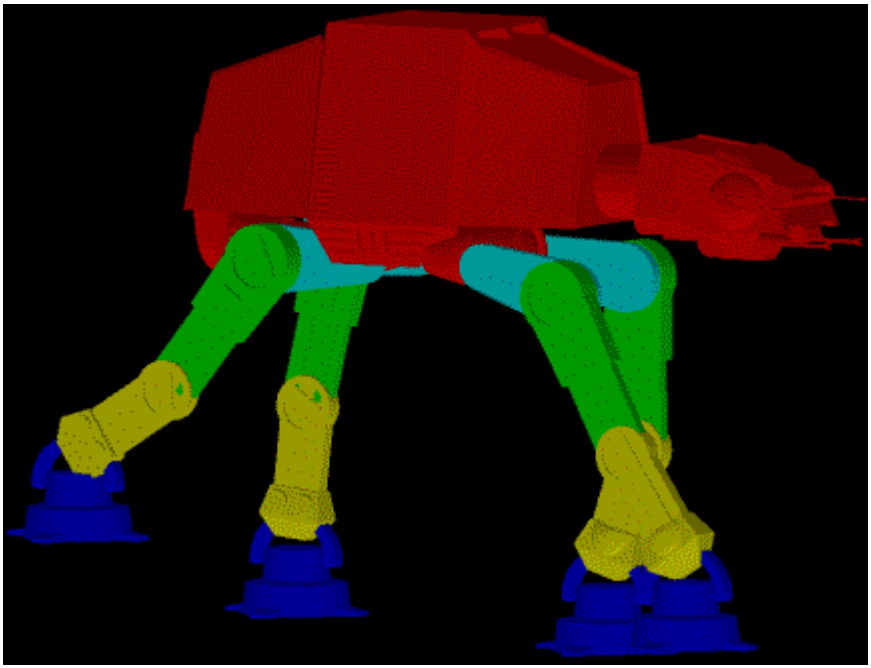

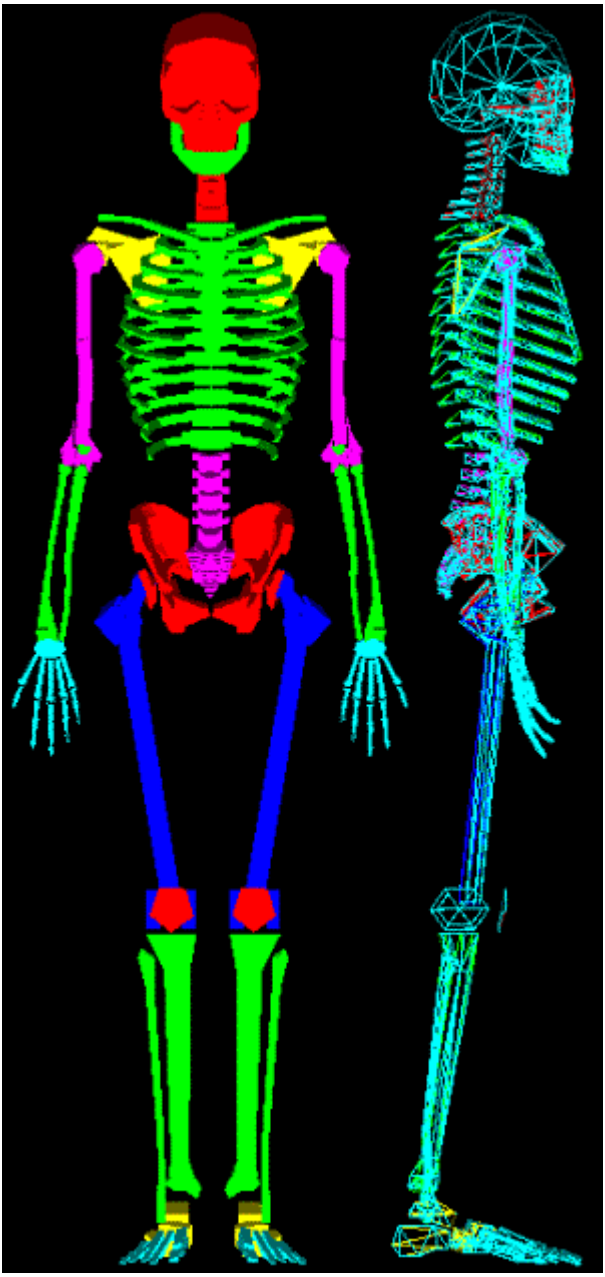

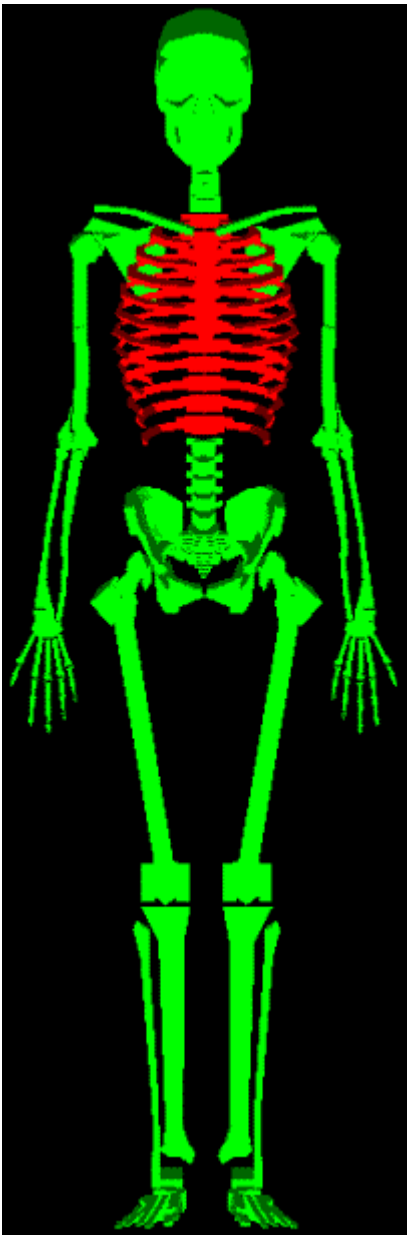

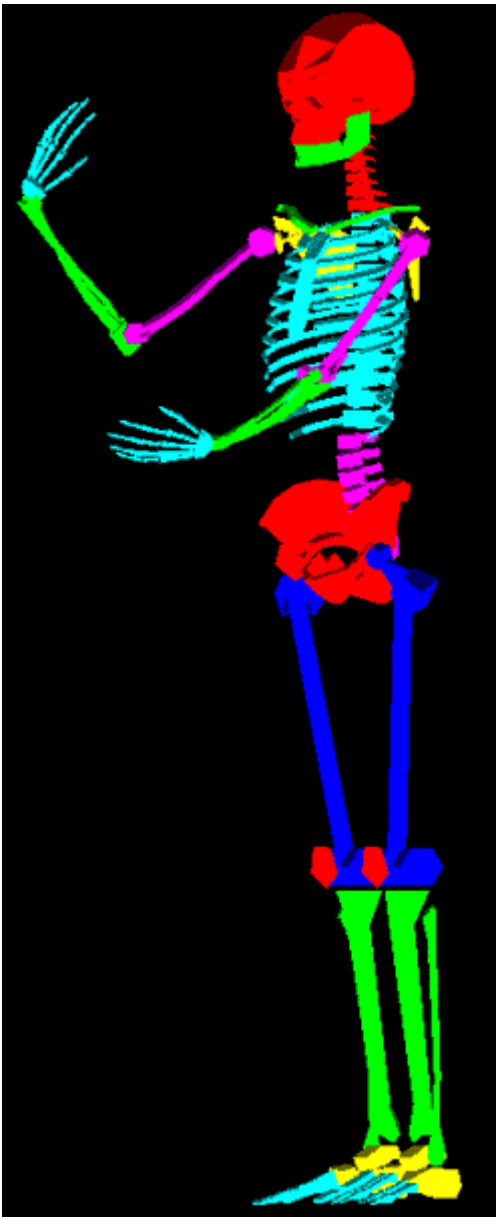

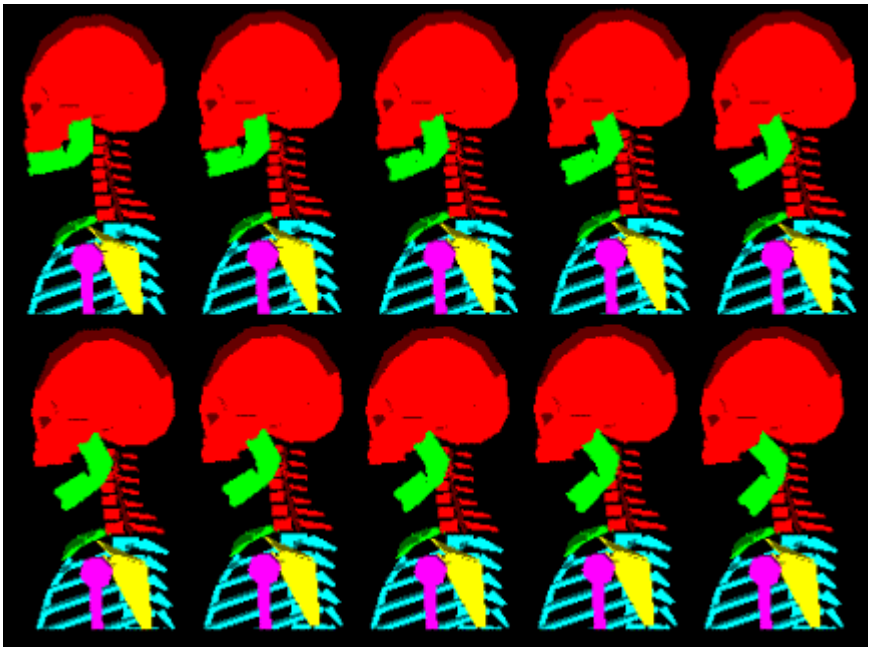

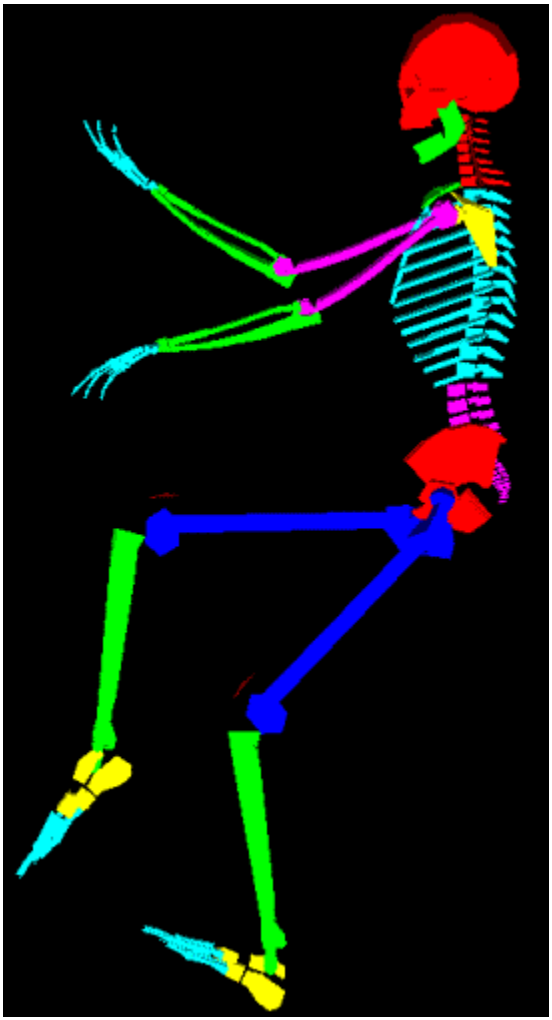

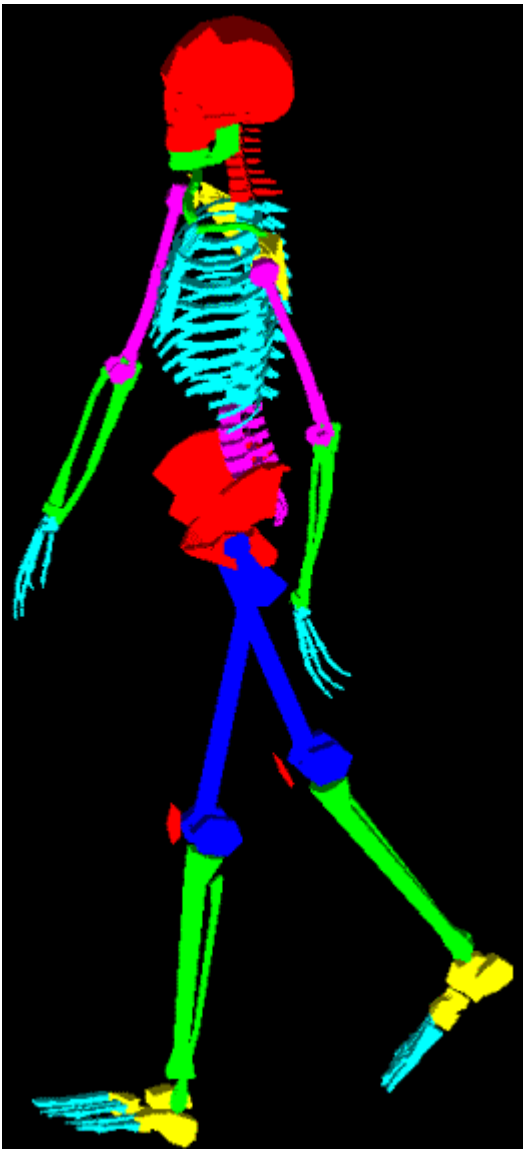

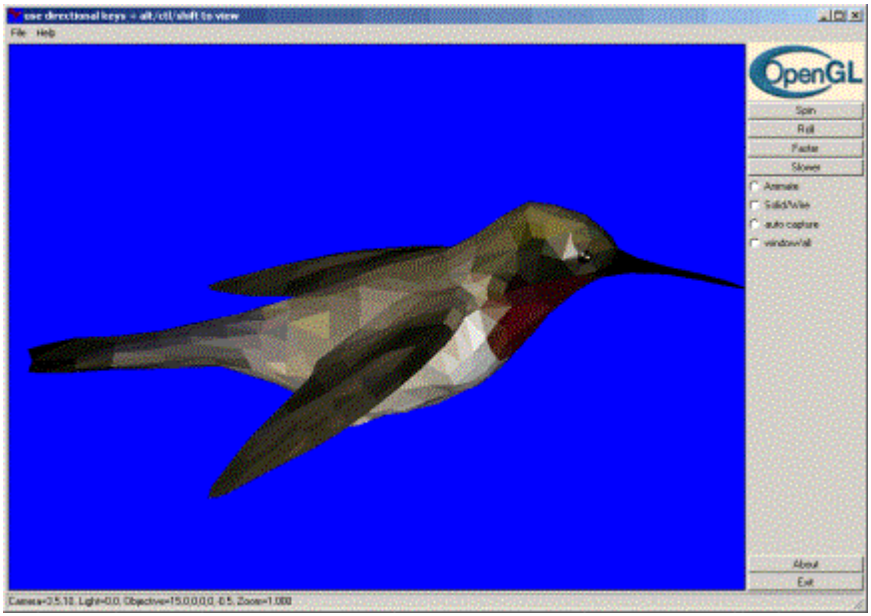
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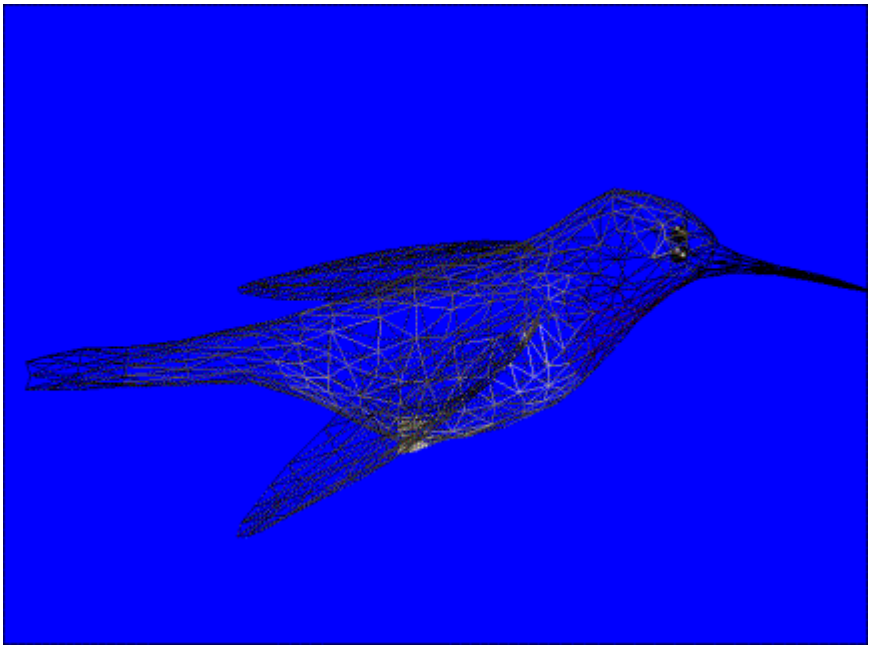

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0.008764	0.003345	-0.01081
0.010443	0.002267	-0.00972
0.008883	0.001366	-0.00957
0.008764	0.003345	-0.01081
0.010253	0.004064	-0.01099
0.010443	0.002267	-0.00972
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0.010611	0.004983	-0.01085
0.008933	0.005485	-0.01032
0.011404	0.004693	-0.0086
0.008883	0.001366	-0.00957
0.007447	-0.00212	-0.00947
0.005838	0.001083	-0.01022
-0.00613	-0.00136	-0.00692
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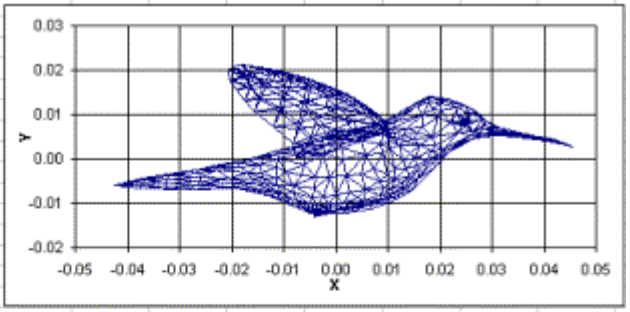

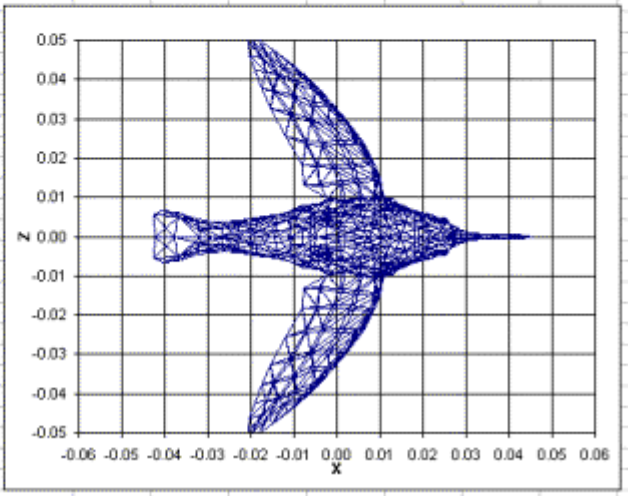

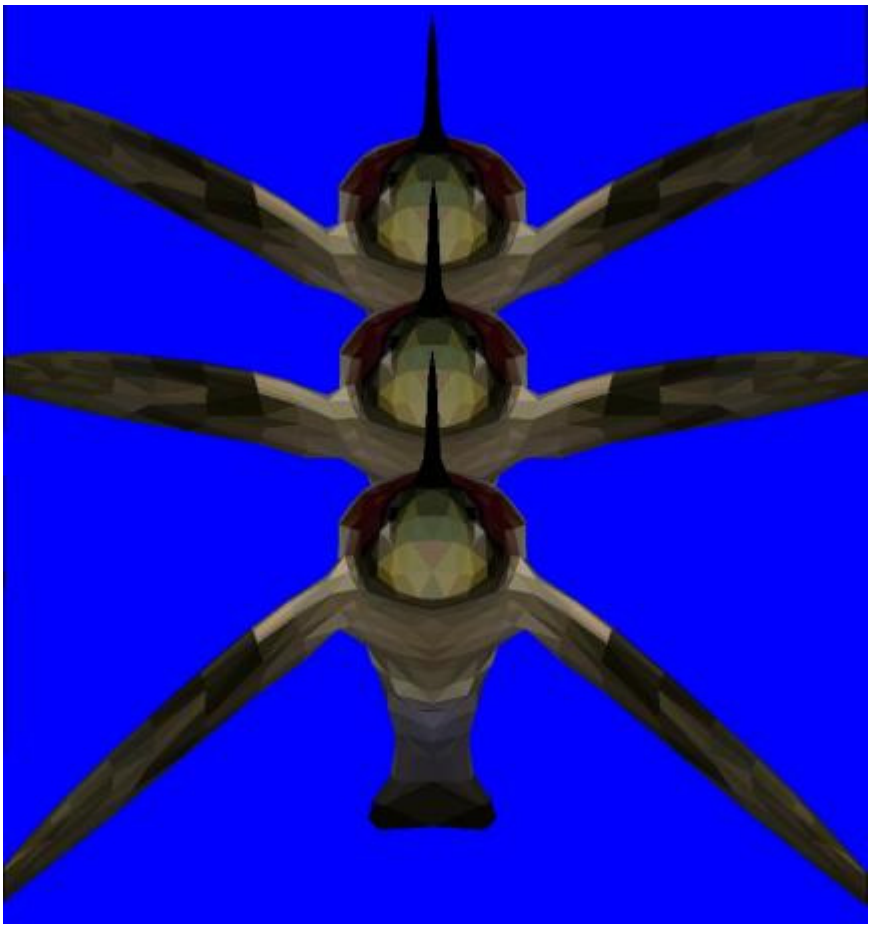

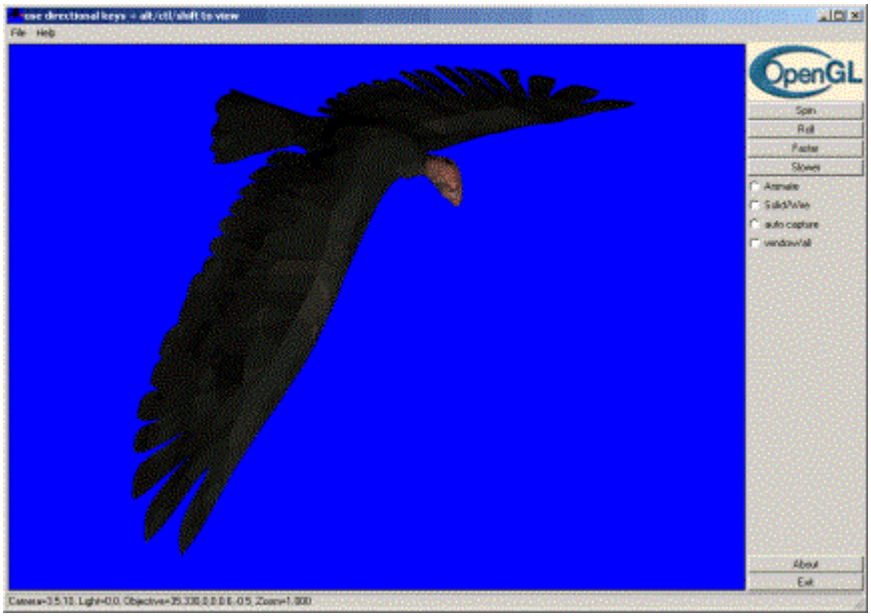
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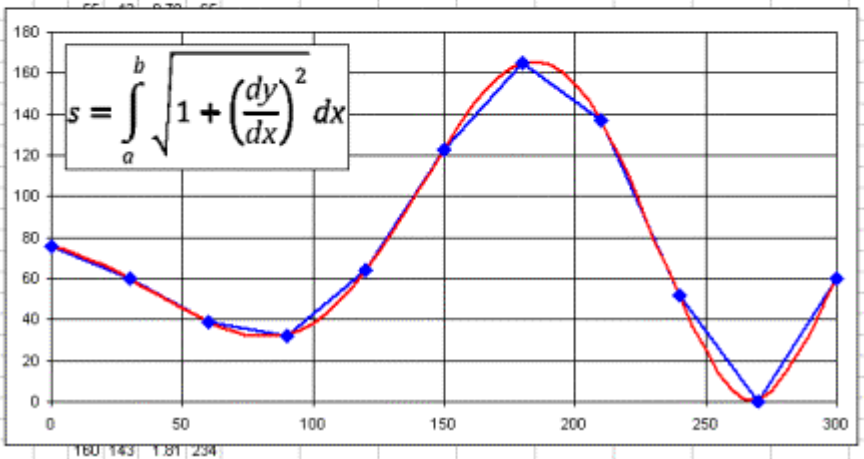
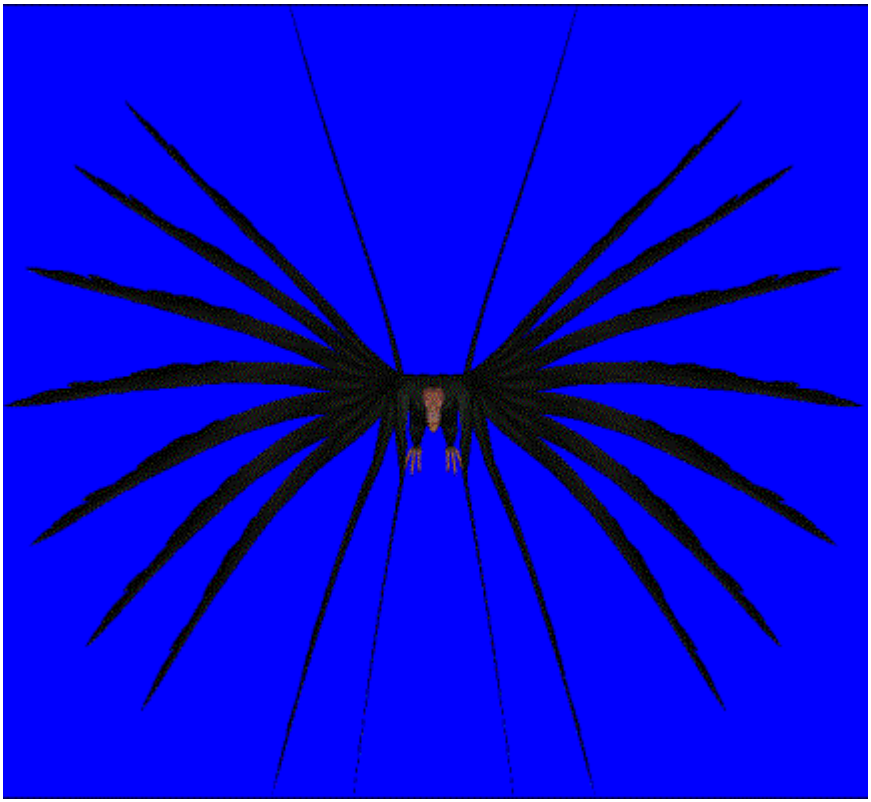
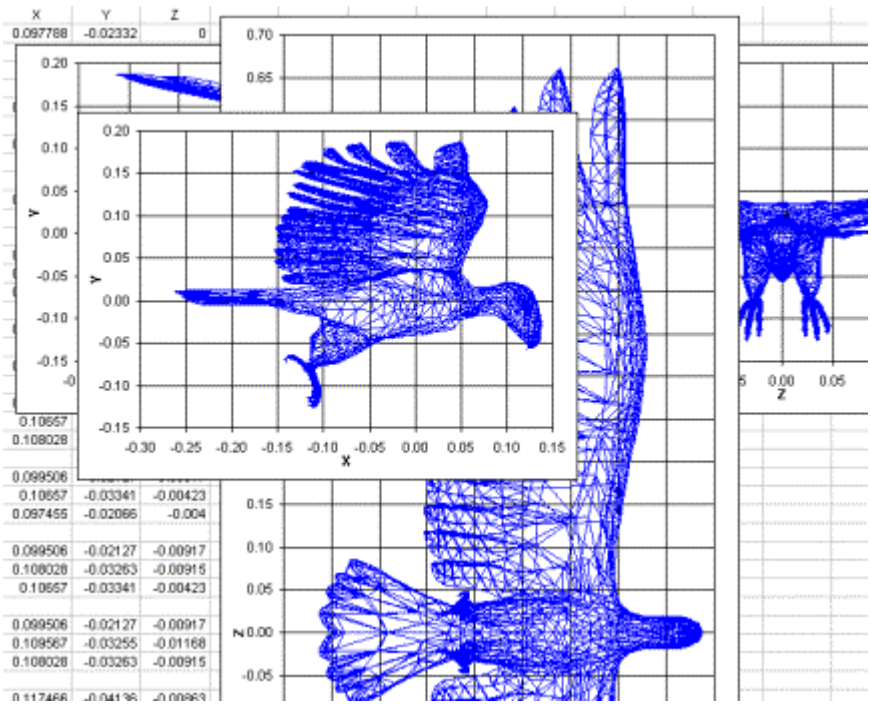
Arc Length Calculus

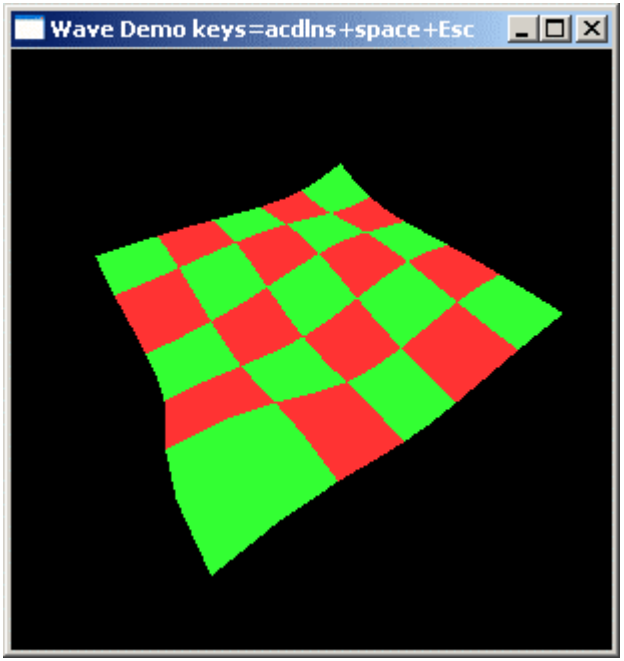
typical curve

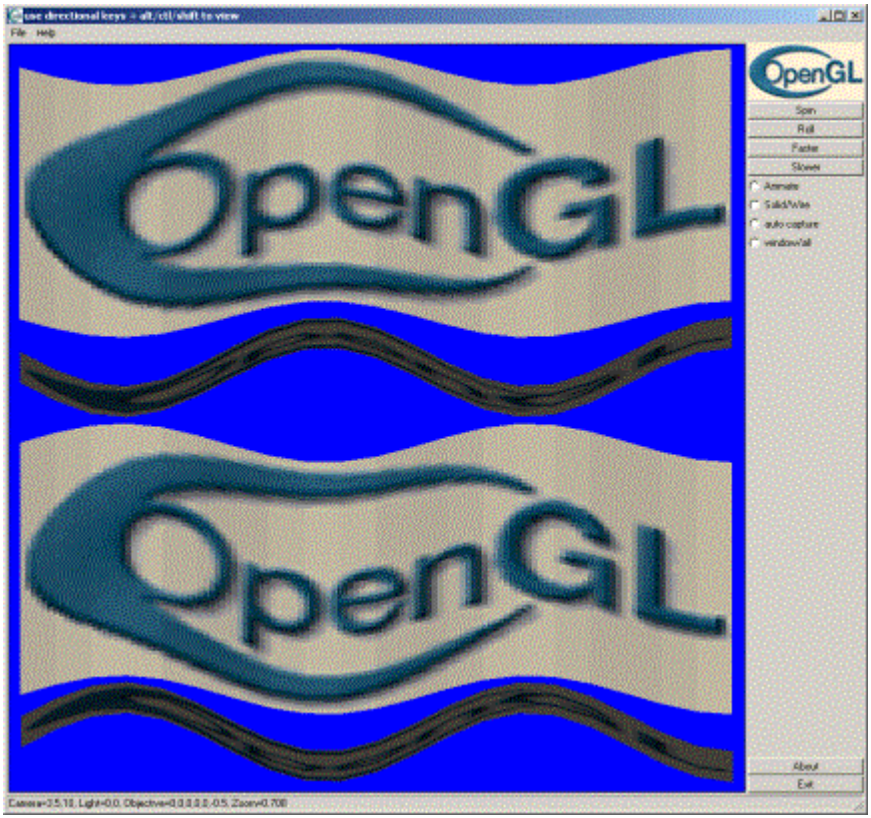
discrete		smooth			
x	y	x	y	dy/dx	s
0	76	0	76	-0.40	0
30	60	5	74	-0.45	5
60	39	10	72	-0.50	11
90	32	15	69	-0.50	17
120	64	20	67	-0.58	22
150	123	25	63	-0.68	28
180	165	30	60	-0.70	34
210	137	35	56	-0.70	40
240	52	40	53	-0.70	46
270	0	45	49	-0.70	53
300	60	50	46	-0.70	59
		160	143	1.81	234






X
Y
Z
0.097788 -0.02332 0
0.10657 -0.03341 -0.00423
0.097455 -0.02066 -0.004
0.099506 -0.02127 -0.00917
0.108028 -0.03263 -0.00915
0.10657 -0.03341 -0.00423
0.099506 -0.02127 -0.00917
0.109567 -0.03255 -0.01168
0.108028 -0.03263 -0.00915
0.70
0.65
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
Y
X
-0.30 -0.25 -0.20 -0.15 -0.10 -0.05 0.00 0.05 0.10 0.15
Z
0.00 0.05


Wave Demo keys=acdlns+space+Esc


use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
windowAll
About
Exit
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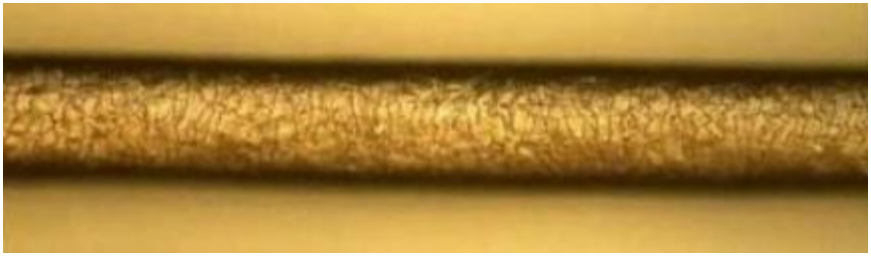
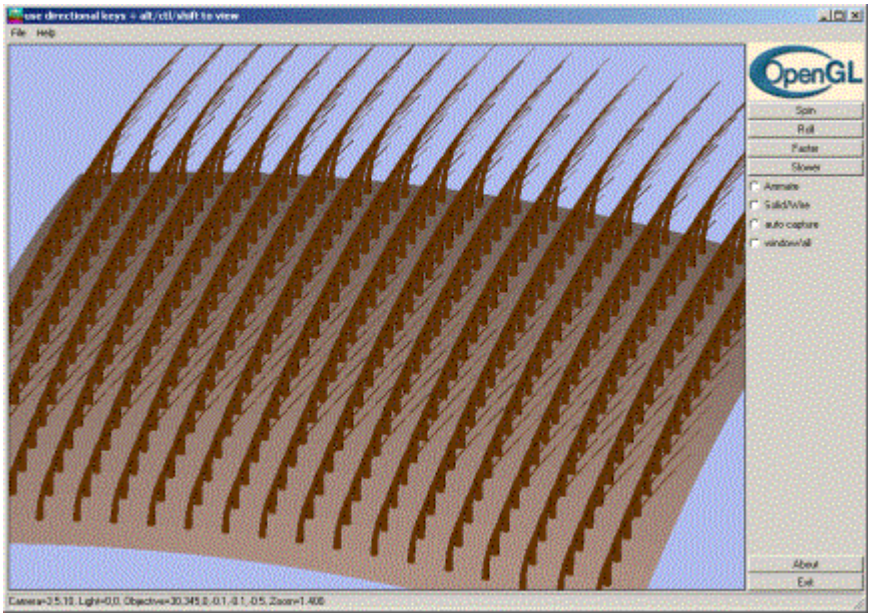
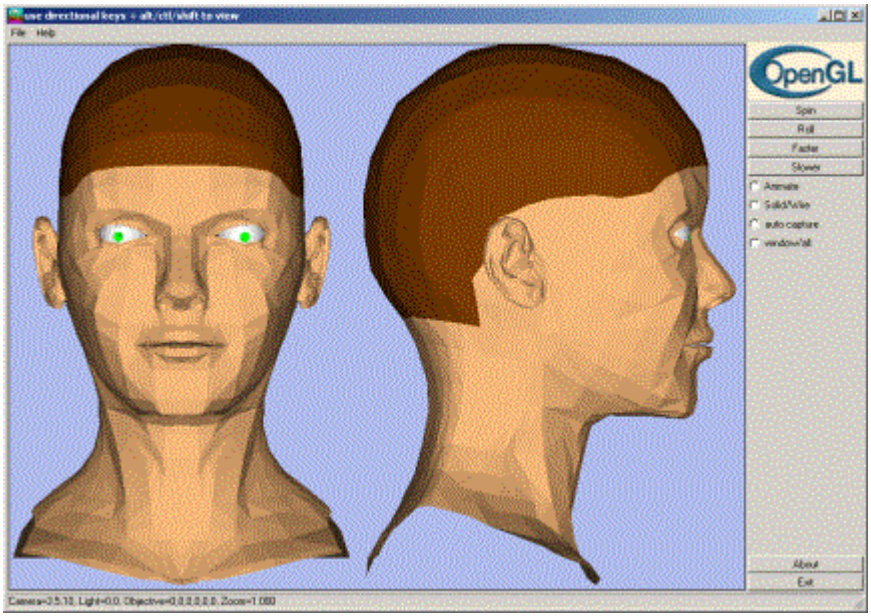
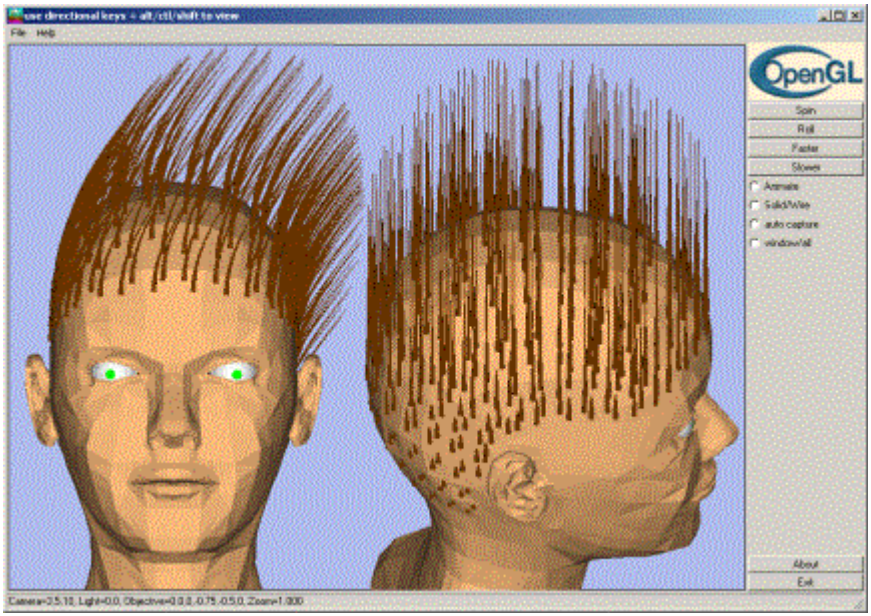



use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
windowAll
About
Exit


use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
windowAll
About
Exit


use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
windowVal
About
Exit
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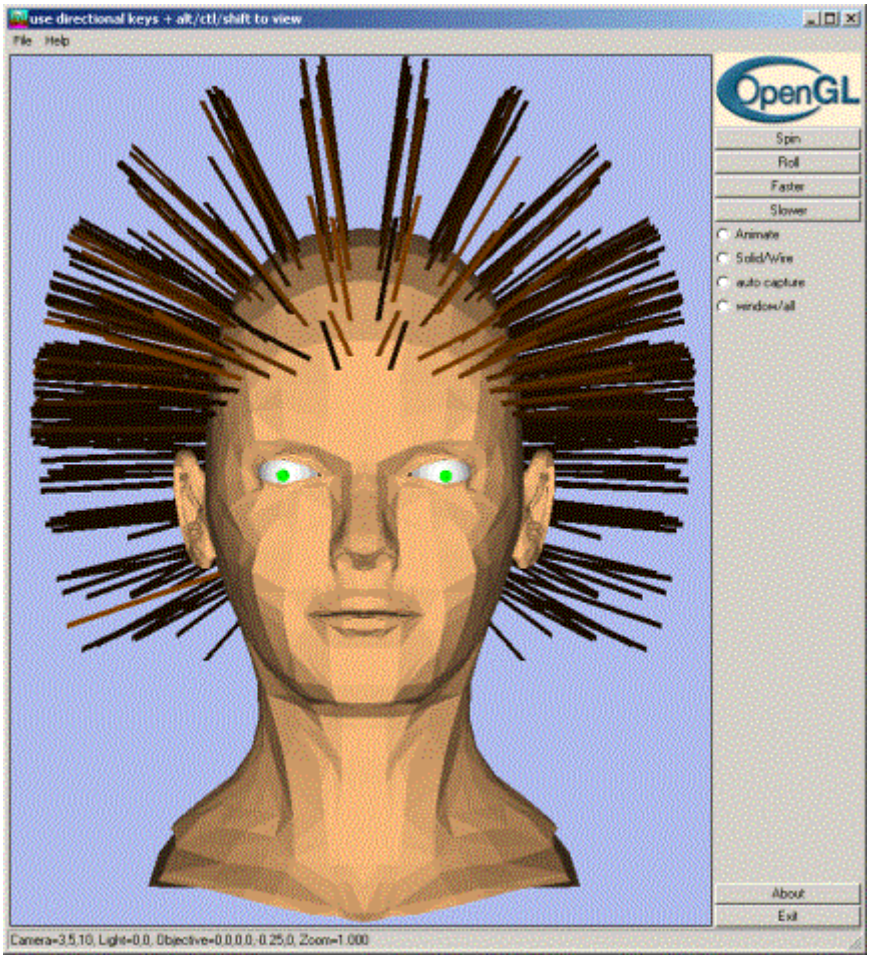
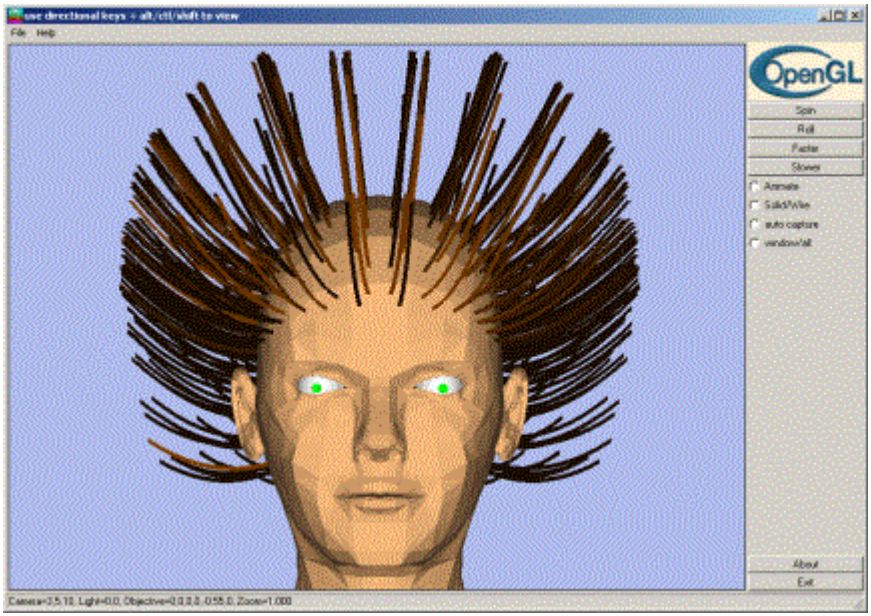
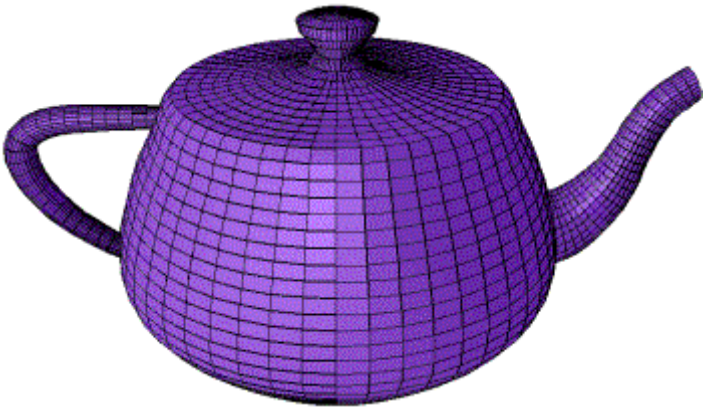
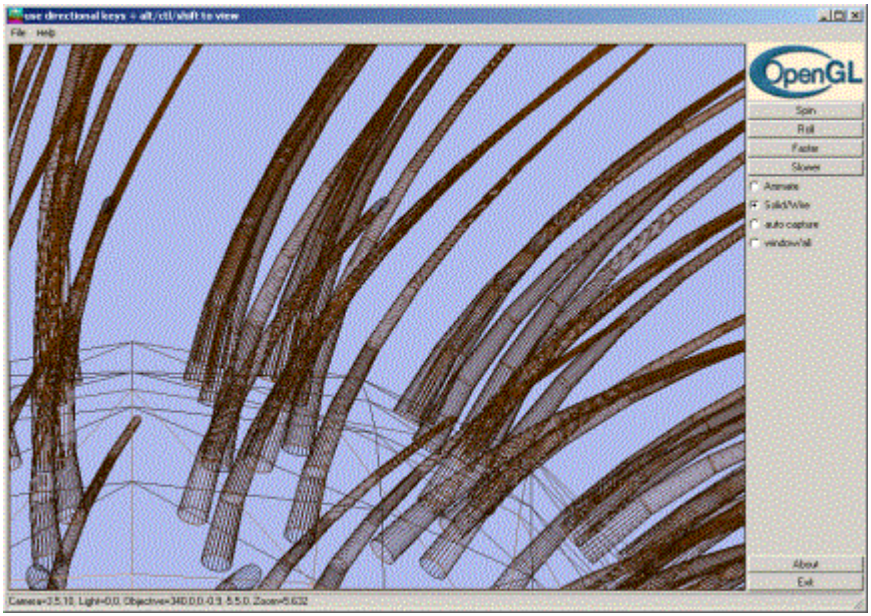

use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
window/all
About
Exit
Camera=3.5,10, Light=0,0, Objective=0.0,0.0,-0.25,0, Zoom=1.000


use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
window/all
About
Exit
Camera=3.5,10, Light=0,0, Objective=0,0,0,3,-0.55,0, Zoom=1.000




use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
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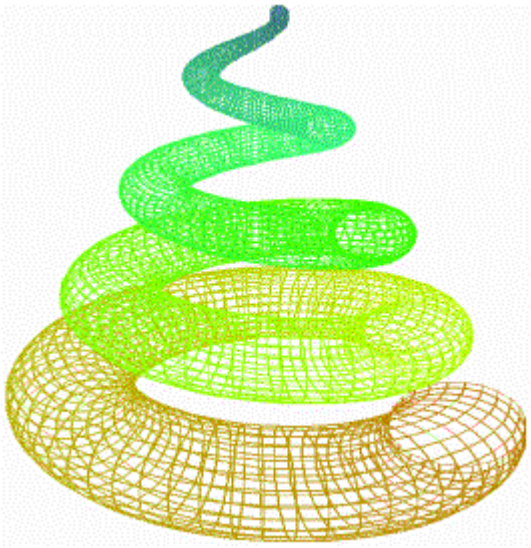
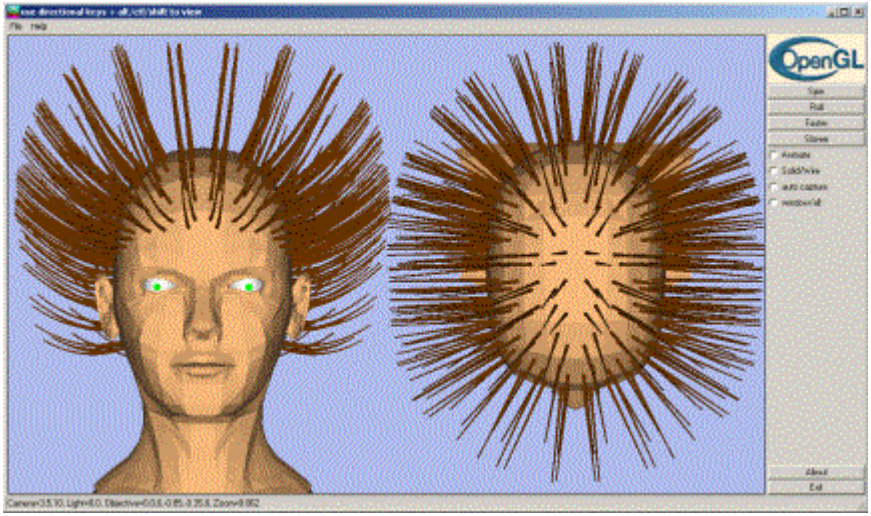
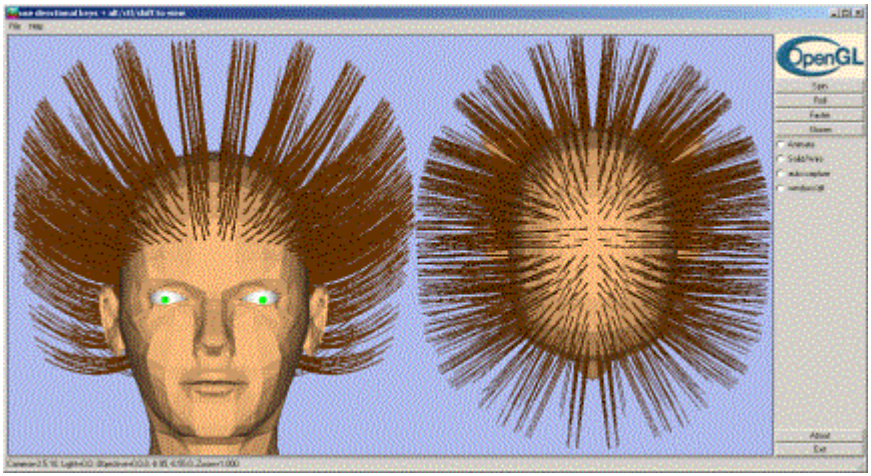
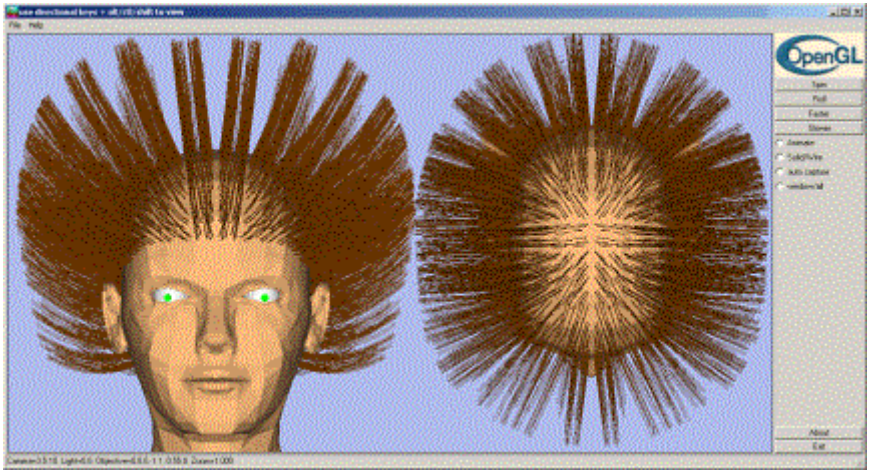
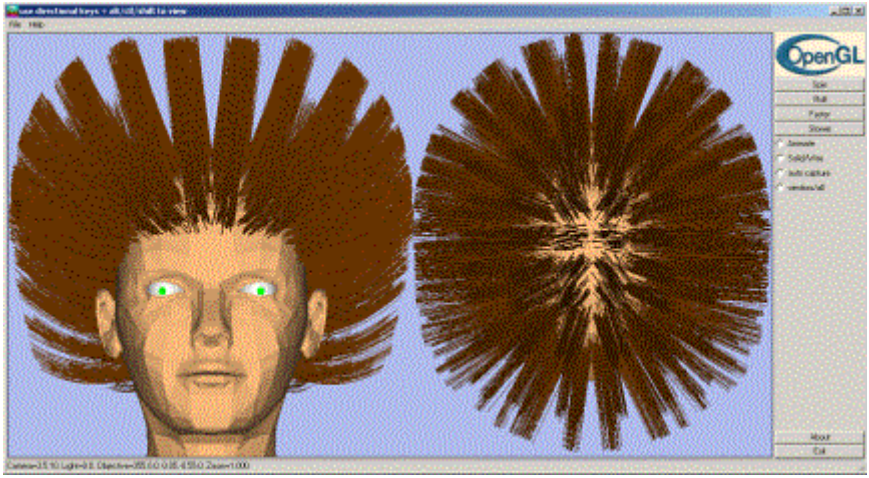
Faster
Slower
Animate
Solid/Wire
auto capture
window'all
About
Exit

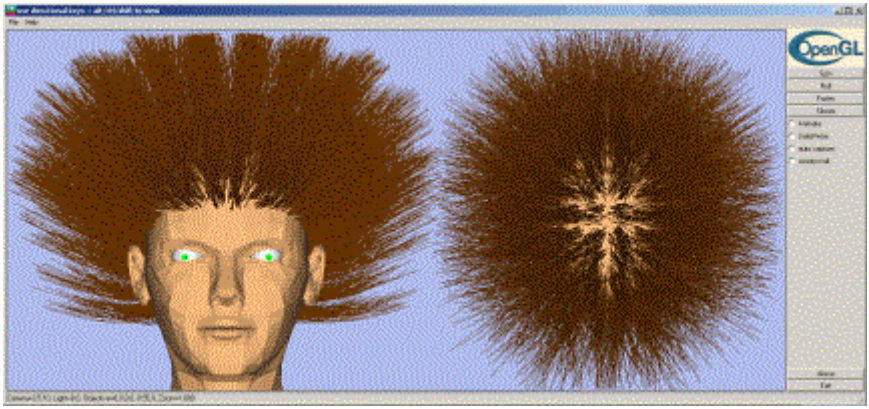


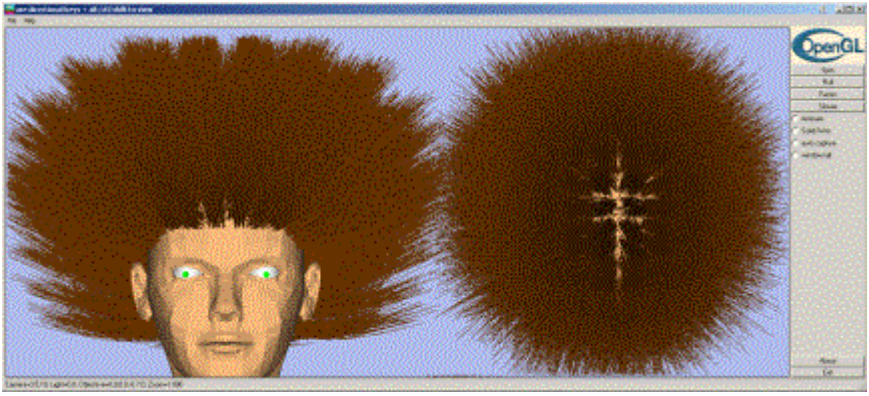

OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
Reset
About
Exit

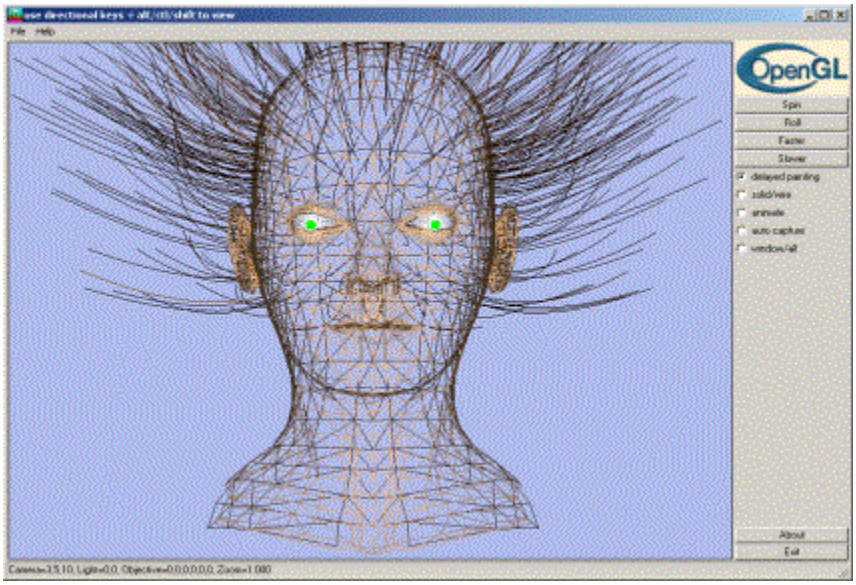

OpenGL
Spin
Roll
Faster
Slower
Animate
Solid/Wire
auto capture
Reset
About
Exit

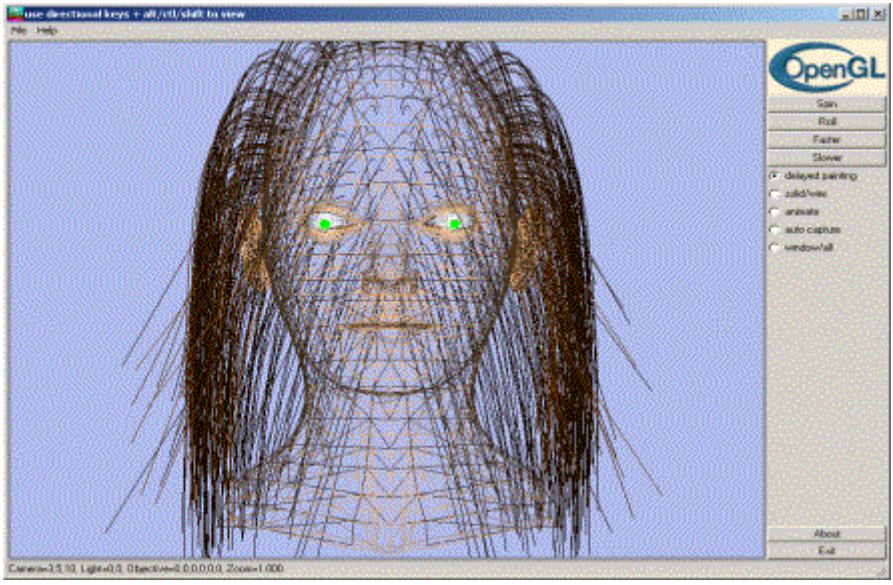

OpenGL

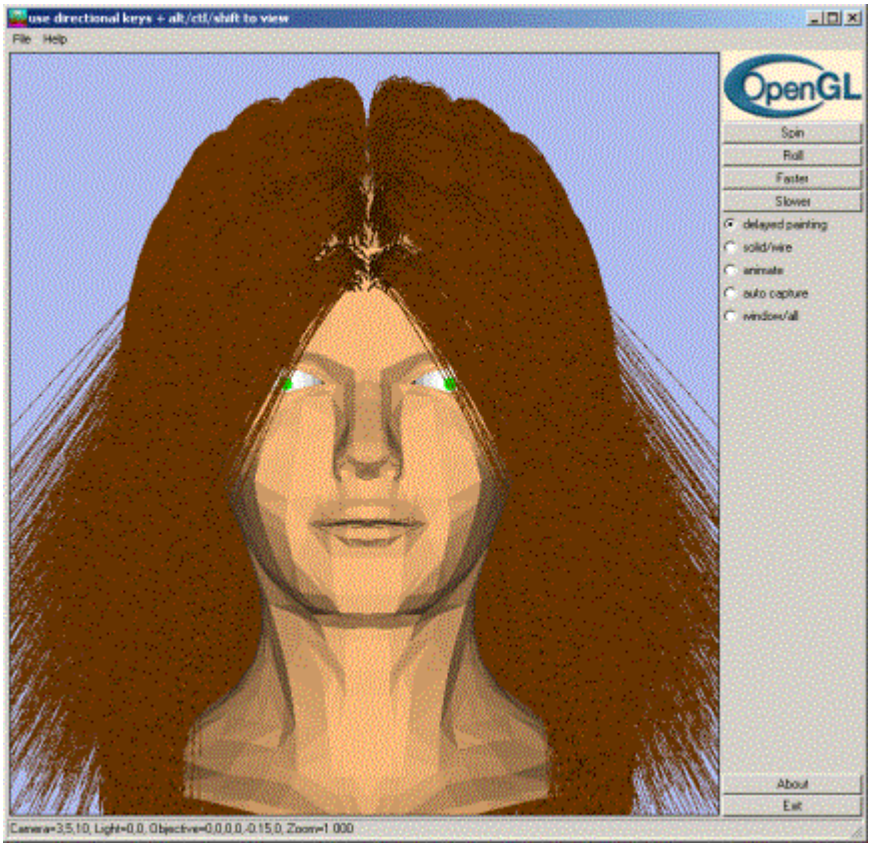

OpenGL

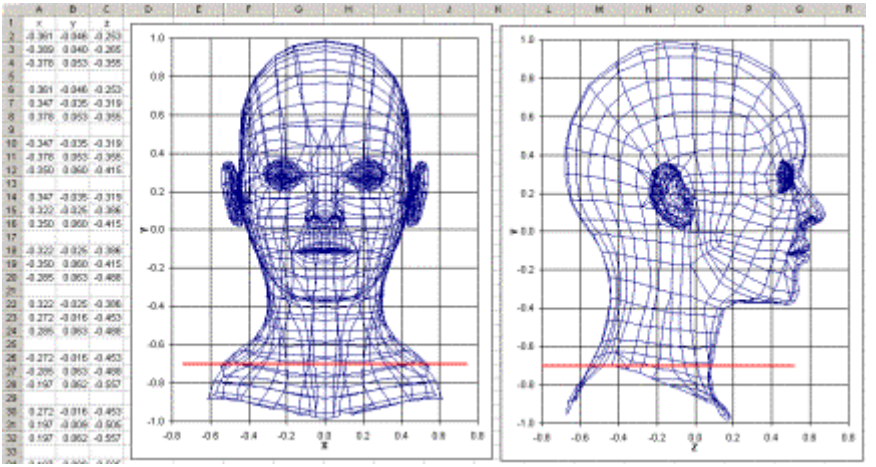

OpenGL


OpenGL

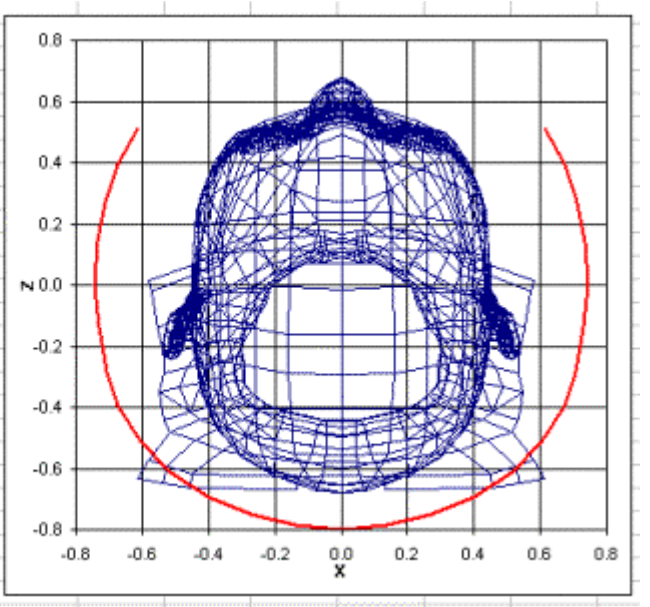

use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
delayed painting
solid/wire
animate
auto capture
window/all
About
Exit

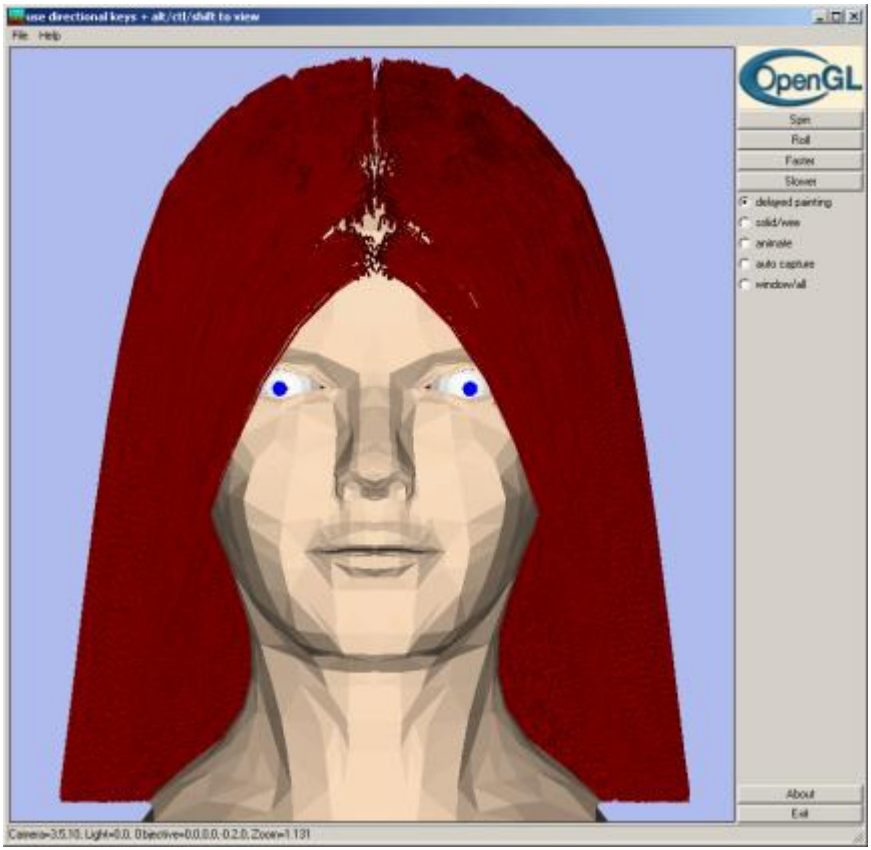

use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
delayed painting
solid/wire
animate
auto capture
window/all
About
Exit

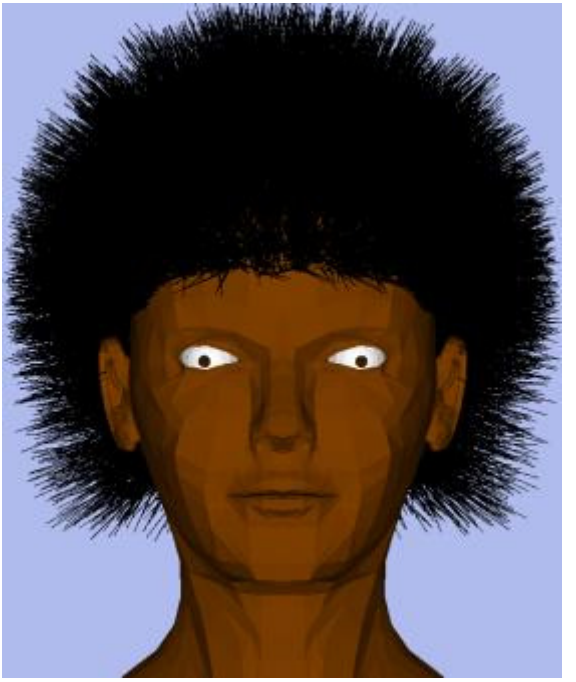

use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
delayed painting
solid/wire
animate
auto capture
window/all
About
Exit
Camera=3,5,10, Light=0,0, Objective=0,0,0,0,-0.15,0, Zoom=1.000



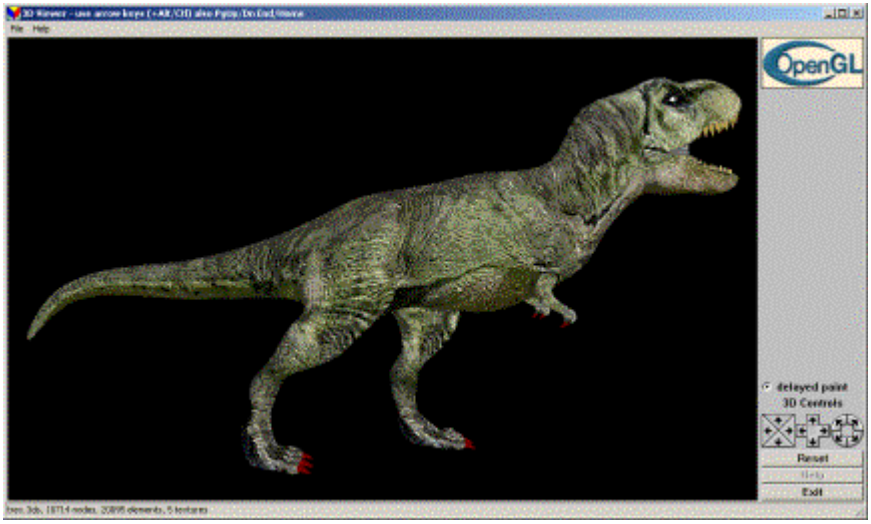
34	-0.197	-0.009	-0.505
35	-0.197	0.062	-0.557
36	-0.049	0.065	-0.592
37			
38	0.197	-0.009	-0.505
39	0.043	-0.015	-0.532
40	0.049	0.065	-0.592
41			
42	-0.043	-0.015	-0.532
43	-0.049	0.065	-0.592
44	0.000	0.065	-0.598
45			
46	0.043	-0.015	-0.532
47	0.000	-0.017	-0.537
48	0.000	0.065	-0.598
49			
50	-0.389	0.040	-0.265
51	-0.413	0.128	-0.283
52	-0.390	0.140	-0.378
53			
54	0.389	0.040	-0.265
55	0.378	0.053	-0.355
56	0.390	0.140	-0.378
57			
58	-0.378	0.053	-0.355
59	-0.347	-0.035	-0.319

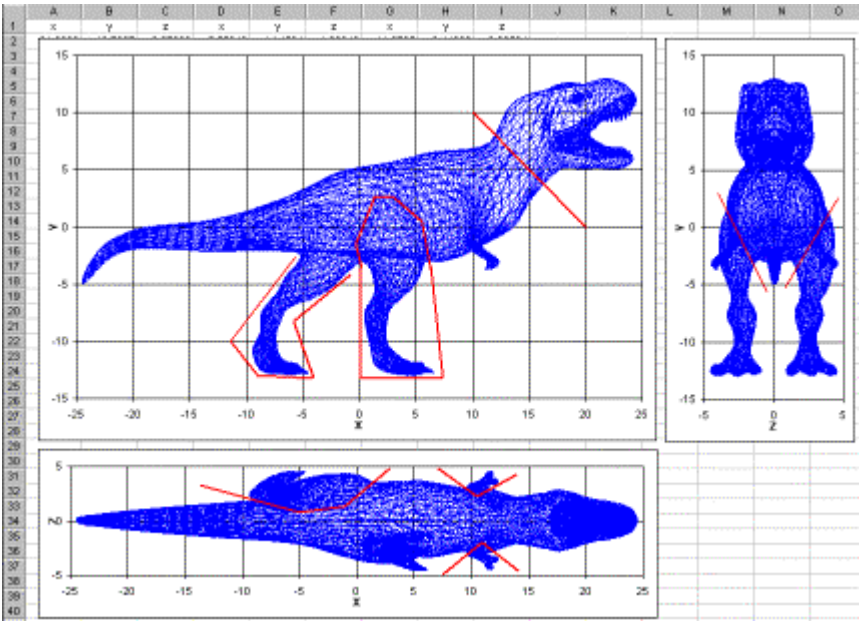


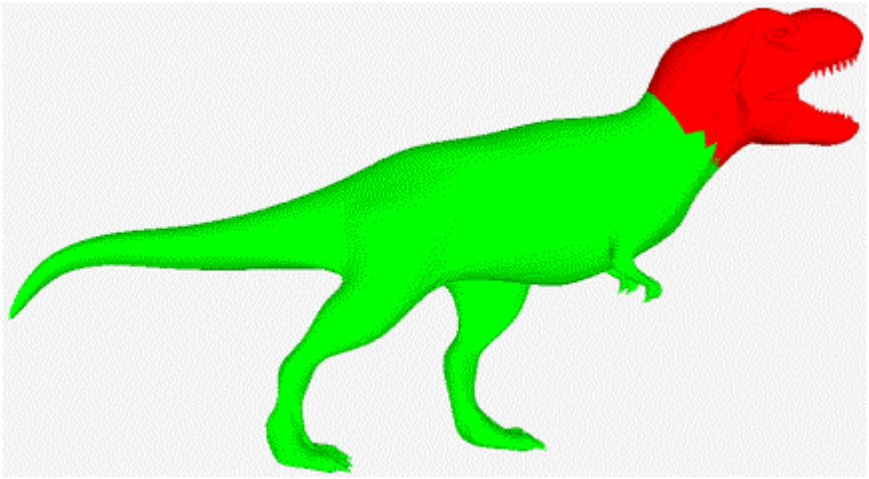

use directional keys + alt/ctl/shift to view
File Help
OpenGL
Spin
Roll
Faster
Slower
delayed painting
solid/wire
animate
auto capture
window/all
About
Exit
Camera=3.5,10, Light=0,0, Objective=0.0,0.0, 0.2,0, Zoom=1.131

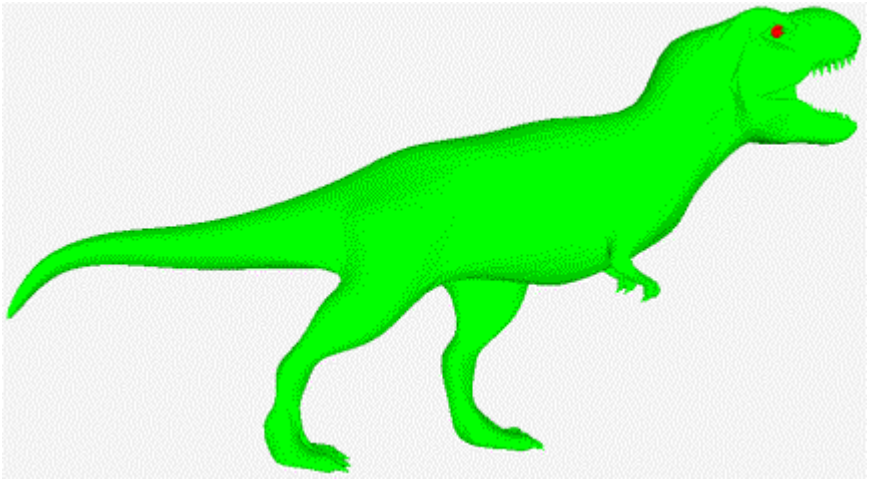


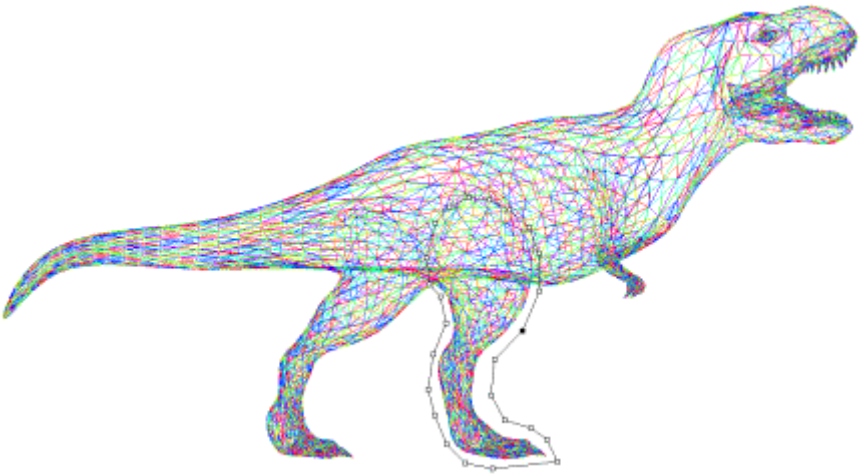
Chess Version 0.10 by Dudley J. Benton
3D
Knight's Tour
Reset Board
Set Options
About
Help
Exit
white king's rook


OpenGL
3D Controls
Reset
Exit









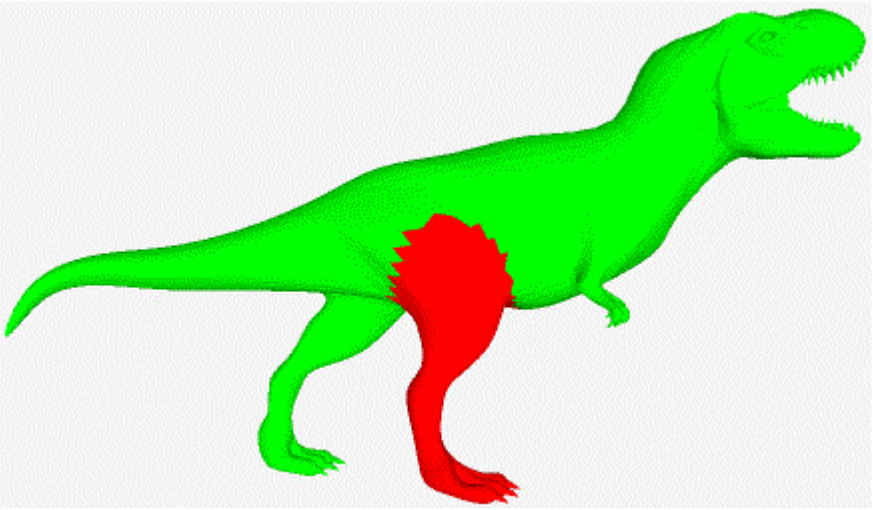


Figure 69. Leg Polygon Selection