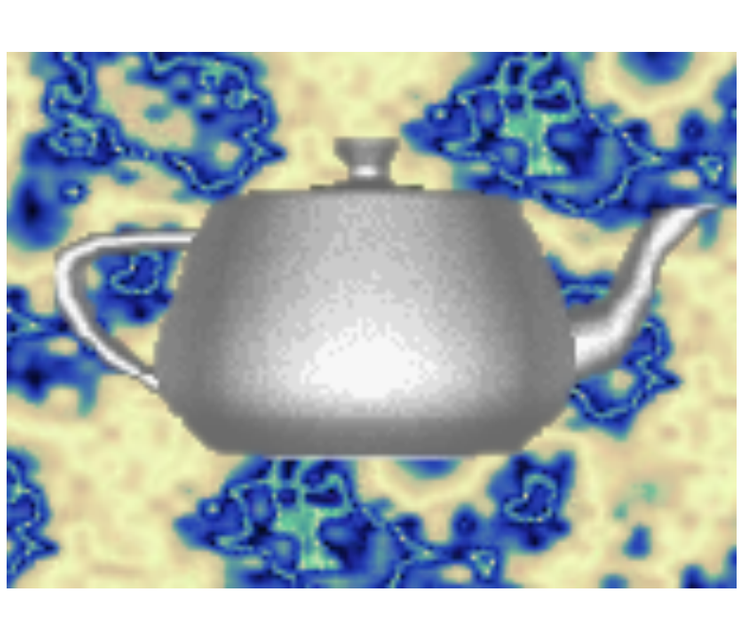
The History of The Teapot



As anyone who is into 3D computer graphics knows, there is something mysterious and special about **The Teapot**. It's not just any teapot - it's "**The**" teapot.

Contents [hide]

Disclaimer

I initially wrote this page (mostly from memory) in response to a query from the OPENGL-GAMEDEV mailing list. Since then many people have helped me expand and correct the information presented here.

If you know better - or can add information, then please take the time to correct me. Thanks.

Is There An Actual Teapot?

Yes, there is. It's a plain white teapot. A bit of an anticlimax actually.

The History.

The teapot was made by Melitta in 1974 and originally belonged to Martin Newell and his wife, Sandra - who purchased it from ZCMI, (a department store in Salt Lake City).

The teapot was eventually donated to the Boston Computer Museum but now resides in the Ephemera collection of the Computer History Museum. It's cataloged as "Teapot used for Computer Graphics rendering" and bears the catalog number X00398.1984.

It turns out that the idea for modeling the teapot was brought up over concerns that Martin didn't have enough interesting computer models. Sandra suggested modelling the tea service (they were sitting down to tea at the time). He got some graph paper and a pencil, and he modeled the entire tea service by eye. Then, he went back to the lab and edited Bezier control points on a Tektronix storage tube, again by hand.

Hence, he also digitized a spoon and a cup and saucer.

I had previously heard that the data for those other items was lost forever. To my great suprise, Kari Kivisalo kindly pointed out that the "teaset.tgz" entire original dataset still exists here].

The last time I saw the teapot was at the SigGraph course party in 1989, it was sitting in a case in the Boston Computer Museum. Here is the photo I took at the time:

As you can see, the exhibit at the museum had the real teapot in the case on the left with some coloured lights that you could turn on and off. Next to it, a monitor showed a computer-generated version of the same thing. The simulated lights on the computer version switched to match the real lights in the box. Cute!

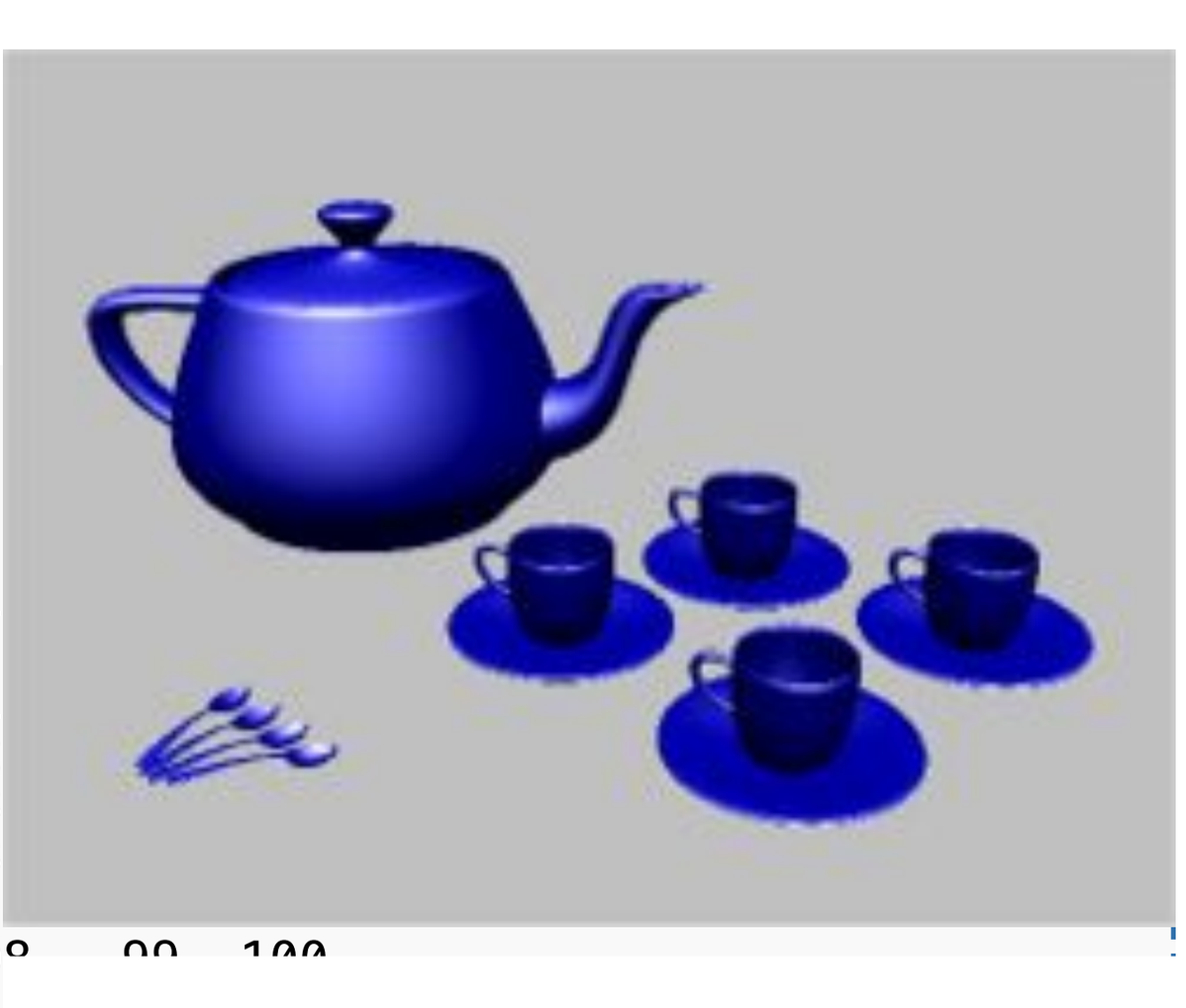
Surrounding the exhibit was a huge collection of computer-generated teapots. They are rendered with a variety of textures, rendering algorithms etc - but they are all THE SAME TEAPOT! You can see Newell's original image in the photo above. It's the third from the left on the top row.

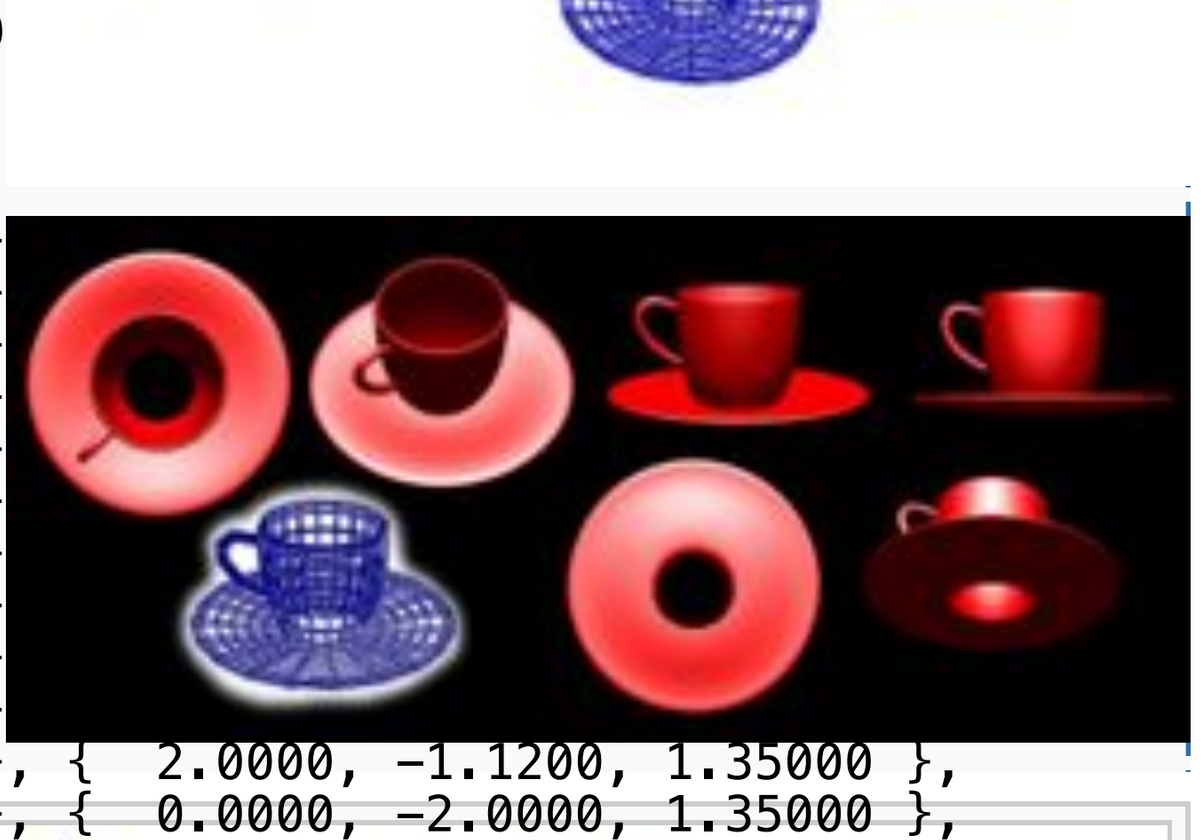
Images of the Complete Dataset.

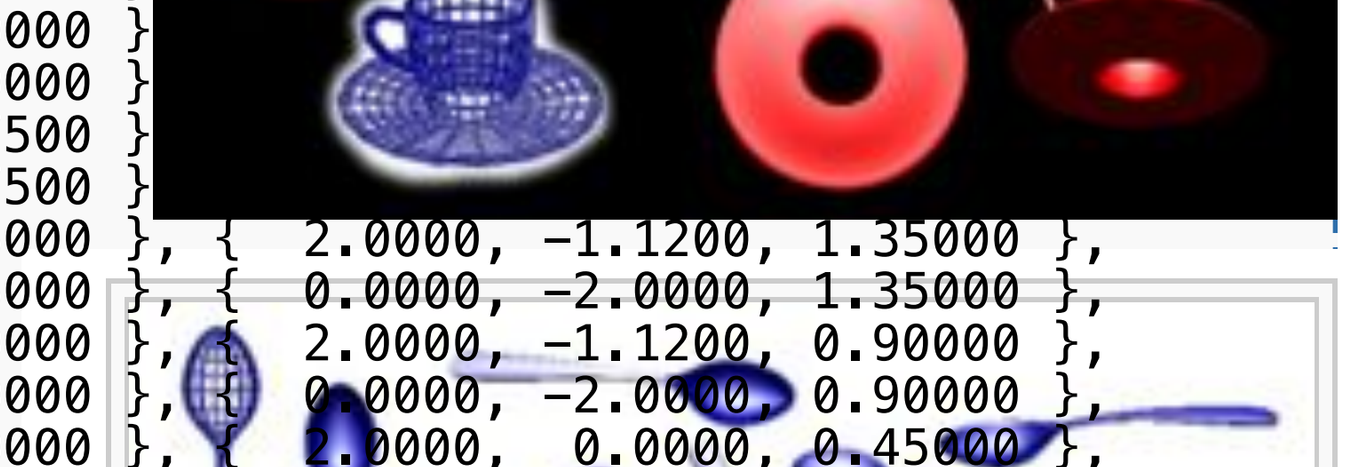
Jing Li (A Research programmer with the graphics group at the University of Auckland) has rendered the complete teaset including the cup and spoon. The original Newell image contains a milk jug but that data isn't in the funet archive. Notice that the cup doesn't have a bottom either!

The Teapot DataSet

The teapot is made from nine patches - some reflected in two axes, others in one axis only.







"There is no spoon"

```
Rim:
  { 102, 103, 104, 105,   4,
      8,   9,  10,  11,  12,  1
Body:
  {  12,  13,  14,  15,  16,  1
     20,  21,  22,  23,  24,  2
  {  24,  25,  26,  27,  29,  3
     33,  34,  35,  36,  37,  3
Lid:
  {  96,  96,  96,  96,  97,  9
    101, 101, 101, 101,   0,
  {   0,   1,   2,   3, 106, 10
    110, 111, 112, 113, 114, 11
Handle:
  {  41,  42,  43,  44,  45,  4
     49,  50,  51,  52,  53,  5
  {  53,  54,  55,  56,  57,  5
     61,  62,  63,  64,  28,  6
Spout:
  {  68,  69,  70,  71,  72,  7
     76,  77,  78,  79,  80,  8
  {  80,  81,  82,  83,  84,  8
     88,  89,  90,  91,  92,  9

Vertices:

  {  0.2000,  0.0000, 2.70000 }
  {  0.1120, -0.2000, 2.70000 }
  {  1.3375,  0.0000, 2.53125 }
  {  0.7490, -1.3375, 2.53125 }
  {  1.4375,  0.0000, 2.53125 }
  {  0.8050, -1.4375, 2.53125 }
  {  1.5000,  0.0000, 2.40000 }
  {  0.8400, -1.5000, 2.40000 }
  {  1.7500,  0.0000, 1.87500 }
  {  0.9800, -1.7500, 1.87500 }
  {  2.0000,  0.0000, 1.35000 }, {  2.0000, -1.1200, 1.35000 },
  {  1.1200, -2.0000, 1.35000 }, {  0.0000, -2.0000, 1.35000 },
  {  2.0000,  0.0000, 0.90000 }, {  2.0000, -1.1200, 0.90000 },
  {  1.1200, -2.0000, 0.90000 }, {  0.0000, -2.0000, 0.90000 },
  { -2.0000,  0.0000, 0.90000 }, {  2.0000,  0.0000, 0.45000 },
  {  2.0000, -1.1200, 0.45000 }, {  1.1200, -2.0000, 0.45000 },
  {  0.0000, -2.0000, 0.45000 }, {  1.5000,  0.0000, 0.22500 },
  {  1.5000, -0.8400, 0.22500 }, {  0.8400, -1.5000, 0.22500 },
  {  0.0000, -1.5000, 0.22500 }, {  1.5000,  0.0000, 0.15000 },
  {  1.5000, -0.8400, 0.15000 }, {  0.8400, -1.5000, 0.15000 },
  {  0.0000, -1.5000, 0.15000 }, { -1.6000,  0.0000, 2.02500 },
  { -1.6000, -0.3000, 2.02500 }, { -1.5000, -0.3000, 2.25000 },
  { -1.5000,  0.0000, 2.25000 }, { -2.3000,  0.0000, 2.02500 },
  { -2.3000, -0.3000, 2.02500 }, { -2.5000, -0.3000, 2.25000 },
  { -2.5000,  0.0000, 2.25000 }, { -2.7000,  0.0000, 2.02500 },
  { -2.7000, -0.3000, 2.02500 }, { -3.0000, -0.3000, 2.25000 },
  { -3.0000,  0.0000, 2.25000 }, { -2.7000,  0.0000, 1.80000 },
  { -2.7000, -0.3000, 1.80000 }, { -3.0000, -0.3000, 1.80000 },
  { -3.0000,  0.0000, 1.80000 }, { -2.7000,  0.0000, 1.57500 },
  { -2.7000, -0.3000, 1.57500 }, { -3.0000, -0.3000, 1.35000 },
  { -3.0000,  0.0000, 1.35000 }, { -2.5000,  0.0000, 1.12500 },
  { -2.5000, -0.3000, 1.12500 }, { -2.6500, -0.3000, 0.93750 },
  { -2.6500,  0.0000, 0.93750 }, { -2.0000, -0.3000, 0.90000 },
  { -1.9000, -0.3000, 0.60000 }, { -1.9000,  0.0000, 0.60000 },
  {  1.7000,  0.0000, 1.42500 }, {  1.7000, -0.6600, 1.42500 },
  {  1.7000, -0.6600, 0.60000 }, {  1.7000,  0.0000, 0.60000 },
  {  2.6000,  0.0000, 1.42500 }, {  2.6000, -0.6600, 1.42500 },
  {  3.1000, -0.6600, 0.82500 }, {  3.1000,  0.0000, 0.82500 },
  {  2.3000,  0.0000, 2.10000 }, {  2.3000, -0.2500, 2.10000 },
  {  2.4000, -0.2500, 2.02500 }, {  2.4000,  0.0000, 2.02500 },
  {  2.7000,  0.0000, 2.40000 }, {  2.7000, -0.2500, 2.40000 },
  {  3.3000, -0.2500, 2.40000 }, {  3.3000,  0.0000, 2.40000 },
  {  2.8000,  0.0000, 2.47500 }, {  2.8000, -0.2500, 2.47500 },
  {  3.5250, -0.2500, 2.49375 }, {  3.5250,  0.0000, 2.49375 },
  {  2.9000,  0.0000, 2.47500 }, {  2.9000, -0.1500, 2.47500 },
  {  3.4500, -0.1500, 2.51250 }, {  3.4500,  0.0000, 2.51250 },
  {  2.8000,  0.0000, 2.40000 }, {  2.8000, -0.1500, 2.40000 },
  {  3.2000, -0.1500, 2.40000 }, {  3.2000,  0.0000, 2.40000 },
  {  0.0000,  0.0000, 3.15000 }, {  0.8000,  0.0000, 3.15000 },
  {  0.8000, -0.4500, 3.15000 }, {  0.4500, -0.8000, 3.15000 },
  {  0.0000, -0.8000, 3.15000 }, {  0.0000,  0.0000, 2.85000 },
  {  1.4000,  0.0000, 2.40000 }, {  1.4000, -0.7840, 2.40000 },
  {  0.7840, -1.4000, 2.40000 }, {  0.0000, -1.4000, 2.40000 },
  {  0.4000,  0.0000, 2.55000 }, {  0.4000, -0.2240, 2.55000 },
  {  0.2240, -0.4000, 2.55000 }, {  0.0000, -0.4000, 2.55000 },
  {  1.3000,  0.0000, 2.55000 }, {  1.3000, -0.7280, 2.55000 },
  {  0.7280, -1.3000, 2.55000 }, {  0.0000, -1.3000, 2.55000 },
  {  1.3000,  0.0000, 2.40000 }, {  1.3000, -0.7280, 2.40000 },
  {  0.7280, -1.3000, 2.40000 }, {  0.0000, -1.3000, 2.40000 },
```

As you can probably guess, the numbers in the patch array index into the vertex array.

If you look again at the photo of the real teapot, you can see that it's quite a bit taller than the classic computer teapot.

In fact, the original teapot is about 30% taller than the one that people always use in graphics. The reason for this appears to be that Jim Blinn was one of the early users of the Teapot data set and he was rendering the teapot on an Evans and Sutherland frame buffer. Unfortuately, the pixels were not square, so in order to make the model conform to the pixel raster, he squashed the model rather than scaling the image.

He chose to scale all the Z coordinates by dividing them by 1.3. His data was more widely distributed than the original - so it has become the standard.

It is noticable that the original teapot data has no bottom. Some of the data sets that are out there (depressingly, this includes the one in the GLU and GLUT distributions) have added a bottom - but that is definitely 'impure'. Here is the data for the bottom:

```
Bottom:
  { 118, 118, 118, 118, 124, 122, 119, 121,
    123, 126, 125, 120,  40,  39,  38,  37 }

Vertices 118..126:
  {  0.0000,  0.0000, 0.00000 }, {  1.4250, -0.7980, 0.00000 },
  {  1.5000,  0.0000, 0.07500 }, {  1.4250,  0.0000, 0.00000 },
  {  0.7980, -1.4250, 0.00000 }, {  0.0000, -1.5000, 0.07500 },
  {  0.0000, -1.4250, 0.00000 }, {  1.5000, -0.8400, 0.07500 },
  {  0.8400, -1.5000, 0.07500 }
```

Why is it so Popular?

Well, back in the early days, there were no 3D modelling packages and everything was digitized by hand or sketched on graph paper and the numbers typed in using a text editor. If you were working on texture mapping algorithms, ray tracing or some such work, then any source of free data was welcome.

Aside from that, people have pointed out that it is a useful object to test with. It's instantly recognisable, it has complex topology, it self-shadows, there are hidden surface issues, it has both convex and concave surfaces - as well as 'saddle points'. It doesn't take much storage space - it's rumoured that some of the early pioneers of computer graphics could type in the teapot from memory.

Random Memories.

One famous ray-traced image (by Jim Arvo and Dave Kirk, from their '87 SIGGRAPH paper `Fast Ray Tracing by Ray Classification.') shows six stone columns five of which are surmounted by the platonic solids (tetrahedron, cube, octahedron, dodecahedron, icosahedron) - and the sixth has a teapot. The image is titled "The Six Platonic Solids" - which has lead some people to call the teapot a "Teapotahedron". This image appeared in on the covers of several books and journals.

Jim Blinn (in one of his excellent "Mathmatics!" videos) proves an interesting version of Pythagoras' theorum: Construct a (2D) teapot on each side of a right triangle and the area of the teapot on the hypotenuse is equal to the areas of the teapots on the other two sides. This is somehow satisfying.

Martin Newell spoke at a SigGraph presentation in the late '80s and mentioned that of all the things he has done for the world of 3D graphics, the only thing he will be remembered for is "That Damned Teapot".

I'm also told that there is a good history of the Teapot in Appendix D of Watt's "3D Computer Graphics", and in Frank Crow's 1987 article in Computer Graphics & Applications magazine entitled "The origins of the teapot".

Teapot Spotting.

- [http://www.eeggs.com/pc/other/egg_11.html Spotting the Teapot (at Tea-Time!) in the 3D tubes screen saver.
- [http://www.okino.com/slidshow/teapotx1.htm Gold Teapot
- [http://www.okino.com/slidshow/teapotx2.htm Bump Mapped Teapot
- [http://www.okino.com/slidshow/teapotx3.htm Transparency Mapped Teapot
- [http://www.okino.com/slidshow/teapot3.htm ">Bump Mapped Teapot
- In the movie Toy Story, you can spot the teapot in the scene after Buzz loses his arm and has tea with the headless dolls. You have to wonder if they put that scene in just so that a gratuitous Teapot could be inserted. (Thanks to Graeme Devine for pointing that one out).

Other Graphics Cliche's.

There are several other images and 3D models that have come close to the universal recognition of the Teapot:

The VW Bug.

This model is possibly even older than the Teapot. I have heard it referred to as the first real-world 3D object ever to be modelled inside a computer. It's not anywhere near as popular as the teapot since it has no wheels, no interior detail and really isn't that nice to look at. You can get a copy of the model by clicking here.

The Easter Bunny.

This little guy is a relative newcomer - and seems to be popular with the 3D triangle mesh generation gurus. He doesn't (yet) have quite the noteriety of the Teapot. Matt Pharr tells me that the original bunny was made out of clay. That's suprising, it looks just like one of those hollow chocolate Easter Bunnies - and quite a few of the renderings that I've seen have been done in that semi-glossy dark-brown material that looks just like chocolate.

Lenna (1977?)

(aka "The Lady in the Floppy Hat"). This image is widely used by image compression people - and it has quite a story to it - check it out the link!

The Mandrill (1977?)

I think this one comes from the same original source as Lenna - The University of Southern California Signal and Image Processing Institute (USC-SIPI). It seems to be more widely used for texture mapping tests than for image processing - but you see it in a lot of places. Many references to the image call it "Baboon" - but this is incorrect. It is definitely a Mandrill. Just like the Teapot, there are several interesting variations on the original image. There is at least one image out there of the Mandrill wearing Lenna's hat textured onto a teapot. The bunny was (mercifully) absent.

Some Unusual Teapots.

- Jan C. Hardenbergh has been involved in an effort to produce a CT scan of the original teapot - which could then be rendered using volume-rendering techniques.
- Out of Focus Teapots in OpenGL.
- Teapots made of different materials in OpenGL.
- ">Teapots at the speed of Light.
- ">Teapot Player?!?

Thanks to...

Thanks go to Dr. Terry S. Yoo, Michael Halle and Jan C. Hardenbergh for several corrections and insights. Thanks to Michael Plitkins for the recent teapot photo. Also special thanks to Sandra Newell who took the time to tell me the story of how her humble teapot rose to fame.

Pretenders to the Throne.

There are other teapots out there. None of them are "The Teapot". Accept no substitutes - and PLEASE...

Leave off the Bottom!