- Friday, November 20, 1998
  Optimized Image Generation Techniques in Computer Graphics

  1.0 Here is:

  (i) an announcement about the next meetings
  (ii) the minutes of the last YORKVIS meeting 2.0 We have the following upcoming talks:
  Dec 11th 1998 (Friday) 2pm 291 Hugh Wilson "Global Processes in Higher Level Form Vision" (Chicago) (abstract on web page)
  Jan 8th 1999 (Friday) 10am 291 Paul Gamlin (Director of the Visual Science Research Centre, University of Alabama) "Neural Control of Vergence and Ocular Accommodation" (abstract on web page)
  The Winter term of 1999 will also see talks, at dates to be announced, by:
  Ian Howard (CRESTech)
  Marty Steinbach (Atkinson)
  Josee Rivest (Glendon)
  Ravi Menon (John P Robarts Imaging Research Lab, University of Waterloo) 3.0 Minutes: Wolfgang Stuerzlinger is the newest member of the computer science dept and the York Vision Group. His talk was called: "Optimized Image Generation Techniques in Computer Graphics".
  3.1 Some of the challenges in computer graphics for virtual reality applications are:

  interactive real-time rendering of massive models
  being able to walk through a model without a preplanned route
  satisfying lots of people at the same time, each of whom might want to see different sets of features 3.2 The example Stuerzlinger used was a large, coal-fired power plant. This model presented some specific challenges:
  lots (and lots) of pipes (50% of the model: 90% of the main building)
  5mm resolution of a 50 storey building
  can't for the most part hide features behind walls because many areas had no walls
  the model size was 15,000,000 triangles. 3.3 The model was implemented on an SGI ONYX that could draw 10,000,000 triangles/s (ie. 500,000 triangles/frame at 20 Hz).
  4.0 The secret of success here is economy. Wolfgang described three 'economizing strategies' that he used in implementing the model.

  4.1 economy 1

  divide the model into cells
  draw a larger box around this cell and don't draw anything outside this 'cull' box
  paint the walls of the cull box with the view as seen from the centre of the cell you are in (precalculated) 4.2 economy 2
  do not draw anything outside the frustrum within the cull box representing the observer's field of view
  reduce detail of further away objects
  cull objects that are occluded by nearer objects 4.3 economy 3
  reduce the complexity of objects (eg. draw trees on flat planes (plane trees, I suppose) and rotate the plane so it always faces the viewer) 5.0 Applying these economies makes the computing possible, but they also introduce problems, in particular when you move from one cell to another (and hence to another cull box). How to minimize the jump of the wall paper on the cull box? By using images with depth and rendering them as a (simplified) textured mesh Stuerzlinger provided correct parallax and occlusion. No holes appeared, instead the mesh "stretched" in regions without information.
  6.0 So why are we, a vision group, thinking about these issues? Well, many of the economies work on the basis of not drawing things that would not be noticed anyway. Can we use our understanding of human vision to state what needs to be drawn and what doesn't? What would be an optimum size for a cull box for example? What are the rules for reducing detail with distance? As an object recedes, its retinal image gets smaller. How small does it have to be before the programmer can ignore it? When the image is moving (as during head movements) what are the appropriate parameters for drawing at each speed?

  6.1 This type of suggested interaction between application and basic science is something that the Centre for Vision Research at York is interested in developing. It is the basis for our application to the Canadian Foundation for Innovation for example.

  Wolfgang Stuerzlinger
  York University