VIRTUAL ENVIRONMENTS

Exam Materials

Part I – 10% of total 30%

THEORETICAL TOPICS

1. The Illusion of Reality

- What is the perceptual "illusion" we experience as we interact with the real world?
- What is our "mind's eye" and what is the "blind spot"?
- What are some physiological, stereoscopic, static and motion cues that let us perceive immersion in a 3D environment?

2. History and Applications

- How does media like painting, theatre and books relate to Virtual Environments?
- How did cinema and television revolutionize virtual experiences?
- What is the "Sensorama"?
- What does Ivan Sutherland mean by "The Ultimate Display"?
- What are examples of non-entertainment applications of Virtual Environments?

3. Presence and Immersion

- What is the difference between Presence and Immersion?
- How could one measure Presence?
- What is meant by a "perceptual illusion of nonmediation"?
- What seems to contributes to the sense of Presence (Structure of Presence)?

4. Action and Cinematography

- What is Flow and how is an interface a threat to that?
- Guidelines for making interfaces invisible.
- How and why would you use implicit and explicit constraints?
- What role does context play?
- What are some of the pros and cons of different camera perspectives?

5. Actors

- What are some of the character / people archetypes? Examples?
- How are archetypes useful for Virtual Environments?
- What is a Perception Action Loop?
- Why is the visible movement of an actor important?

6. Avatars and Control

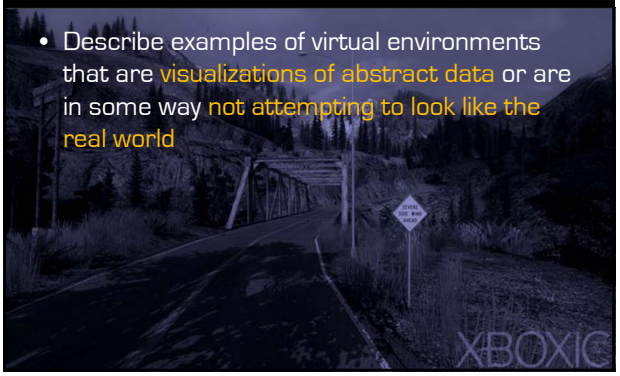
- What solution is proposed for addressing avatar control overhead?
- Where do we see this solution in action today?
- What are some of the behaviors we should expect to see in a social situation?
- By what general process could an avatar try to automate that (or similar) behavior?

7. Visual Realism and Shaders

- What was the RenderMan Language and where was it used?
- What is in a general 3D rendering pipeline?
  - Transformation from model coordinates to camera coordinates, Culling and Clipping, View Projection, Rasterization, Fragment Coloring
- What are programmable Vertex and Pixel/Fragment Shaders?
- What different kinds of shaders are often programmed?

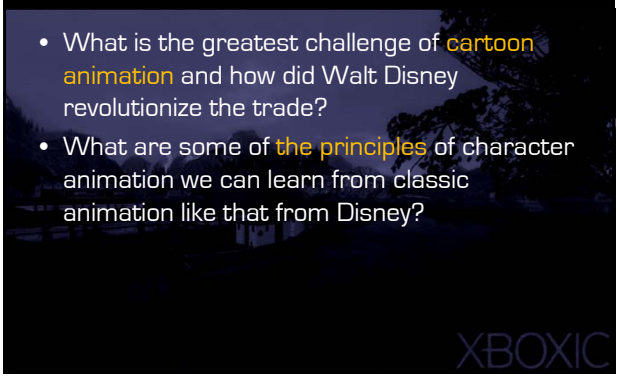
8. Abstract Environments

- Describe examples of virtual environments that are visualizations of abstract data or are in some way not attempting to look like the real world



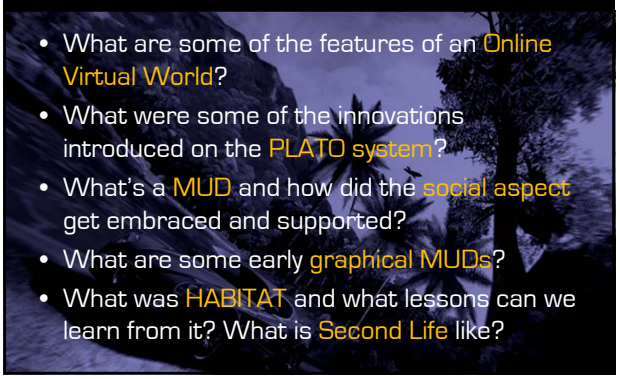
9. Character Animation

- What is the greatest challenge of cartoon animation and how did Walt Disney revolutionize the trade?
- What are some of the principles of character animation we can learn from classic animation like that from Disney?



10. Online Virtual Worlds

- What are some of the features of an Online Virtual World?
- What were some of the innovations introduced on the PLATO system?
- What's a MUD and how did the social aspect get embraced and supported?
- What are some early graphical MUDs?
- What was HABITAT and what lessons can we learn from it? What is Second Life like?



11. Input and Output Devices

- Briefly explain methods for position tracking, gesture tracking, facial tracking, biosignal usage and haptic input
- How does a CRT work vs. an LCD display?
- What is the difference between a reflective vs. a refractive head-mounted display?
- What are some 3D display technologies?
- What's a BOOM and a CAVE?

Part II – 10% of total 30%

PRACTICAL TOPICS

Practical Topics

- Complete Demo and Lab Material mastery from number 1 through 6
- Read basic Cg / Panda 3D shader code
- Understand the general process of rigging a character and animating it for Panda 3D

Part III – 10% of total 30%

DESIGN SCENARIO

Design Scenario

- This is an open ended essay question where you are given a particular application design scenario (e.g. "An exhibit on Mars exploration at a family museum").
- You describe the design of a Virtual Environment that would do a good job of delivering this application
- Include relevant theoretical topics

Design Scenario

- Be ready to answer:
  - Why this virtual environment provides a useful solution to the design scenario (contrasted with other kinds of interfaces).
  - What user experience you envision in your design and how you intend to guide the user.
  - What user interface challenges you might have and how you would start addressing them.

Design Scenario

- Be ready to answer (cont…):
  - What environment implementation challenges you might face and how you would start addressing those.
  - Any interesting opportunities for novel hardware or software solutions?