CS 563 Advanced Topics in Computer Graphics
Adaptive Graphics

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Introduction

- Recent Technological Advances
- New Problems
- Adaptive Graphics
- Data Transmission
  - Data Representations
  - Resource Monitoring
  - Selection Heuristics
  - Interaction
- Other Considerations
- Other forms of Adaptive Graphics

Recent Technological Advances

- Cell Phones
  - Small, Almost full color LCD displays
  - Wall papers, screen savers, video cameras
- PDAs
  - Medium sized, Full color LCD displays
  - Network Capable
- Tablet PC's, Laptops, Desktop Computers
  - Common sized, full color displays
  - Network Ready
- Computer Clusters & Power Walls
  - Incredible processing power
  - Giant Displays [4]

New Problems

- Large variations in ..
  - Processing power
  - Screen resolution
- New scanning and imaging technologies
  - Incredibly detailed models
  - More information than needed
- Need a way to adapt these models to advances in technologies with graphic displays

Adaptive Graphics

- “When small, large and everything in between coexist in the same networked environment, we are faced with the challenge of providing customized access to information” [1]
- “... a unifying framework that allows visual representations of information to be customized and mixed together into new ones.” [1]
- Customizing a single model to be rendered on multiple networked devices of varying capabilities.

Data Transmission

- Data sent is dependent on client capabilities
  - A networked PC
    - full data set to render locally
  - A wireless PDA
    - low resolution model
    - Billboard cloud
    - Point-based model
    - textured box
  - A text-only cell phone
    - ASCII image
- Transcoding – converting between different representations based on client capabilities.

Data Representations

- Simple models
- Complex models
  - Breakdown into simple components
    - At creation time (CAD models)
    - On the fly (using spatial partitioning)
- Metadata
  - Relate model components
  - Geometric information (bounding boxes)
  - Representation information

Resource Monitoring

- Maintain continuous stream
- Determine optimal representation for transmission
- Four general areas to monitor
  - Client's rendering abilities
  - Servers rendering abilities
  - Load on the server
  - Communication link performance

Selection Heuristics

- Goal: mimic partitioning made by human eye
  - In practice this is difficult
- Example: projected screen size
  - Based on metadata
  - Histogram of colored bounding boxes made
  - Download larger components
  - Render and send the rest as context image

General Heuristic

- Three characteristics to consider
  - T: ~time to generate, send, and deliver data
  - Q: quality of representation to full-resolution data
  - I: level of interaction
- Of all representations such that
  - T less then allotted transfer budget
    - Highest Q is selected
    - Highest I is tie-breaker

Interaction

- Two datasets
  - View-independent (cube map)
  - View-dependent (ply model)
- Impractical to generate every frame
  - Remove view-dependent data until movement complete
  - Use downloaded data to generate new view
  - Predict model's position and send corresponding data
- Real-time visualizations, simulations, games

Other Considerations

- Transfer protocol
- Scalability
  - more networked devices
  - Need for proxies
- Data security
  - Encryption
  - Watermarks
- Database management

Other Forms of Adaptive Graphics

- “...not every man-made surface is a display yet” [1]

- Philips new mirror ?

Other Forms of Adaptive Graphics

- “...not every man-made surface is a display yet” [1]

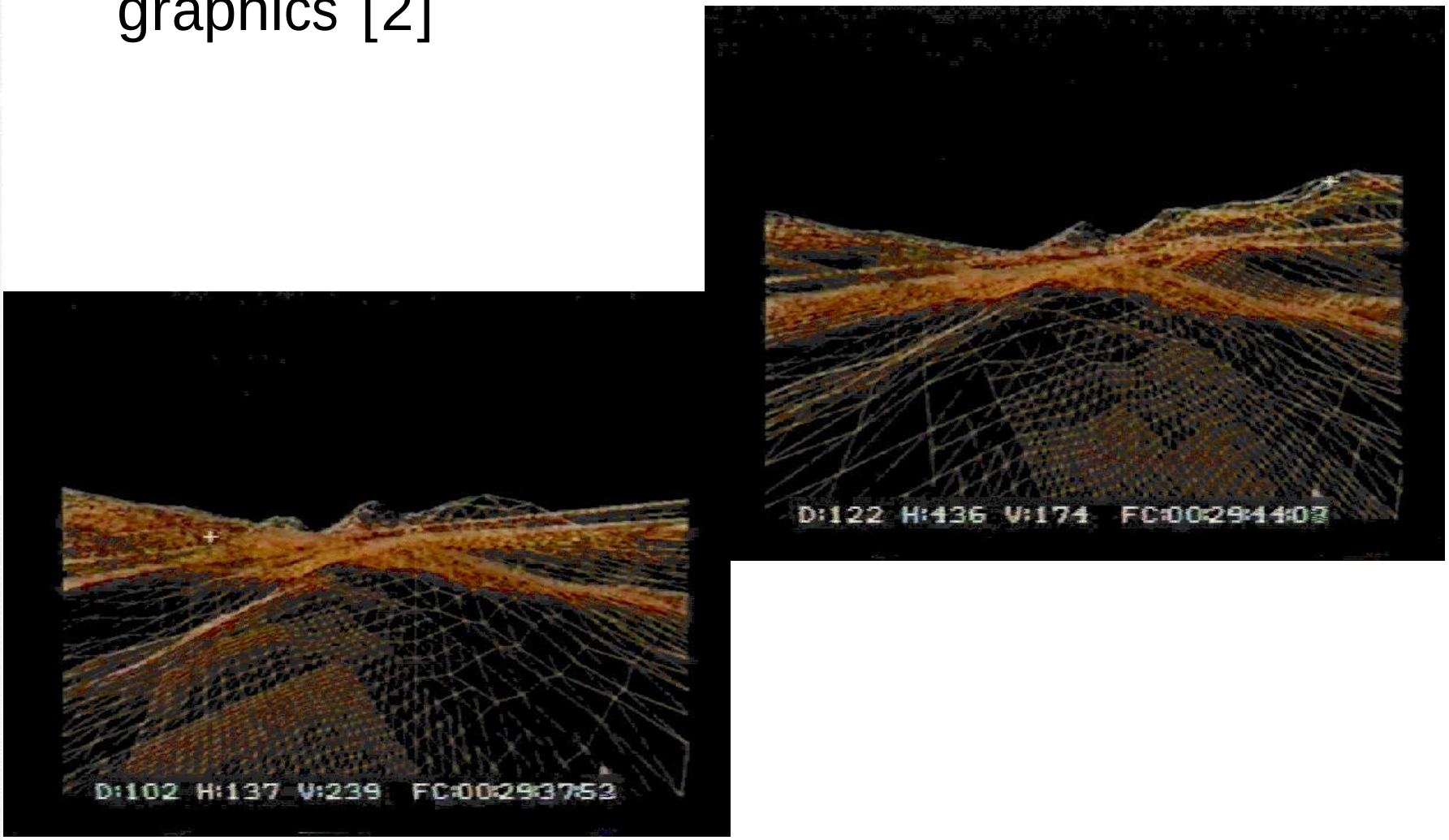
- Philips new TV !

Other Forms of Adaptive Graphics

- Eye tracking for perceptually adaptive graphics [2]

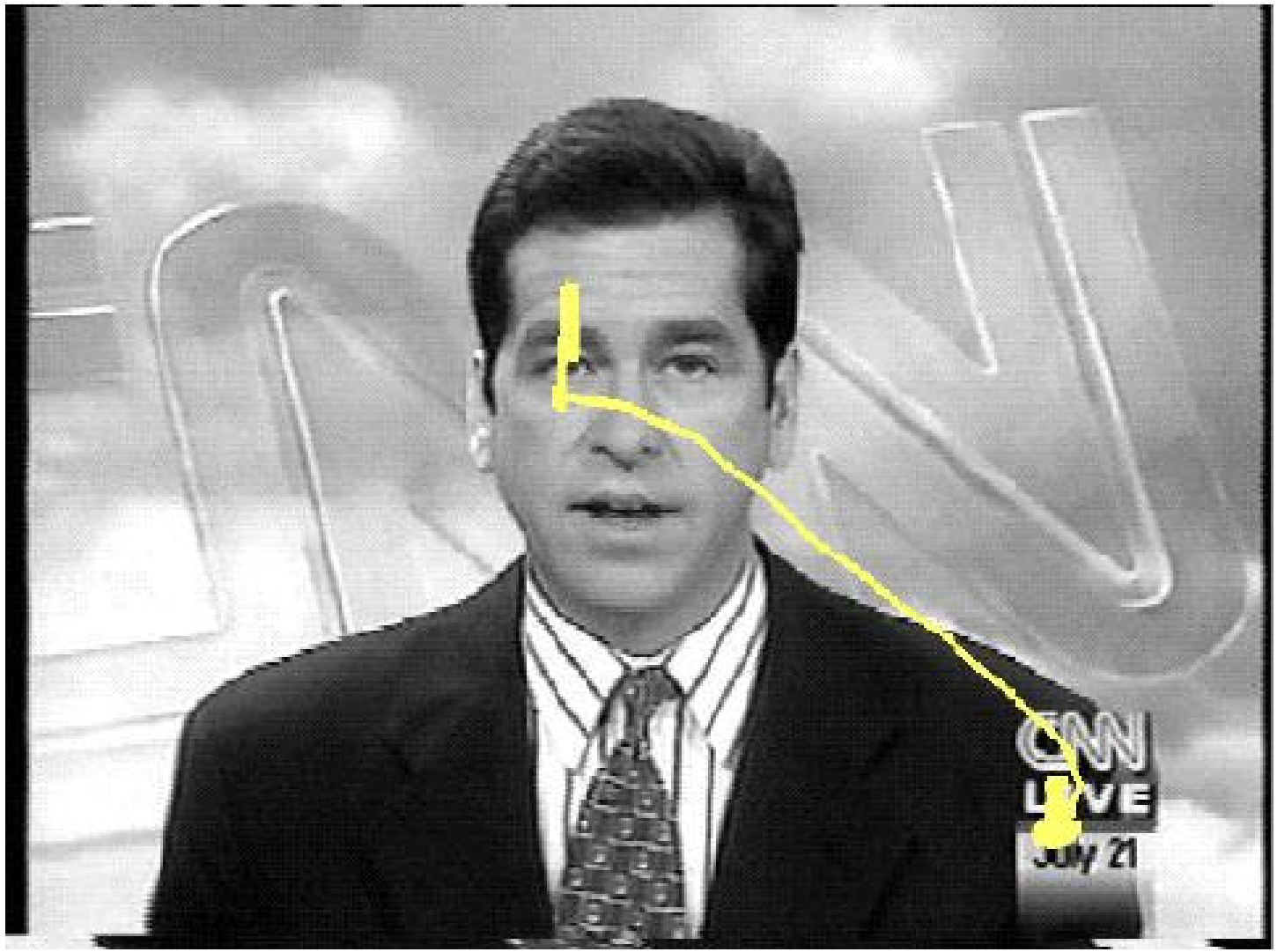
Other Forms of Adaptive Graphics

- Eye tracking for perceptually adaptive graphics [2]



Other Forms of Adaptive Graphics

- Perceptually adaptive graphics cont'd



Other Forms of Adaptive Graphics

- Perceptually adaptive graphics cont'd

Other Forms of Adaptive Graphics

- The Invisible Man!

  ....or...

  The Coat of Invisibility. [3]

References

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