3D User Interface Evaluation I

Lecture #15: Evaluating 3DUIs – Part I
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User Evaluation in 3DUIs

- Was missing component for many years
  - novelty
  - limitless possibilities
  - exploration of design space
- Field has matured
  - Need to compare
    - devices
    - interaction techniques
    - applications
    - etc...

Purposes of Evaluation

- Evaluation – analysis, assessment, and testing of an artifact
- Problem identification and redesign
- General usability understanding
- Performance models

Some Terminology

- Usability – everything about an artifact and what affect a person's use of an artifact
- Evaluator – person who designs, administers, implements, or analyzes an evaluation
- Subject – person who takes part in the evaluation

Evaluation Tools

- User task analysis
  - generates list of detailed task descriptions, sequences, user work, and information flow
- Scenarios
  - built from task analysis
  - important for experiment design
- Taxonomy
  - science of classification
  - break techniques into components
  - used in evaluation process
- Prototyping
  - need to have something to test
  - paper-based sketches
  - Wizard of Oz approach
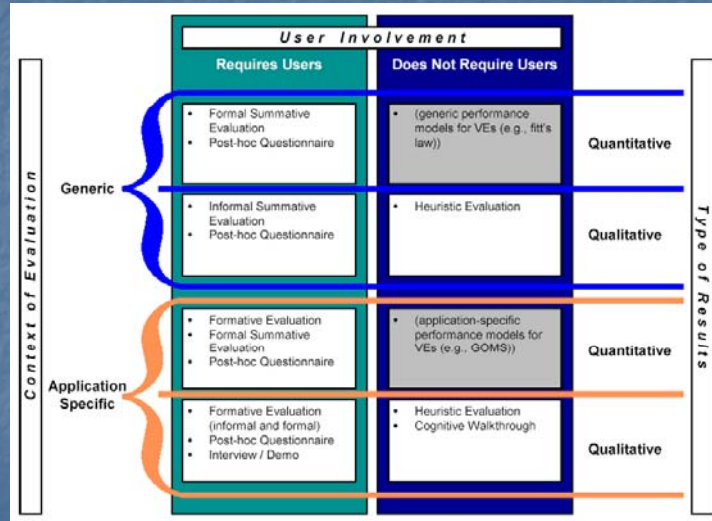
Evaluation Methods

- Cognitive walkthrough
- Heuristic evaluation
- Formative evaluation
  - observational user studies
  - questionnaires, interviews
- Summative evaluation
  - task-based usability evaluation
  - formal experimentation
- Questionnaires
- Interviews and Demos

Sequential evaluation

Testbed evaluation

Evaluation Classification

Evaluation Metrics – System Performance

- System performance metrics
- Avg. frame rate (fps)
- Avg. latency / lag (msec)
- Variability in frame rate / lag
- Network delay
- Distortion

- Only important for its effects on user performance / preference
  - frame rate affects presence
  - net delay affects collaboration
- Necessary, but not sufficient

Evaluation Metrics – Task Performance

- Speed / efficiency
- Accuracy
- Domain-specific metrics
  - education: learning
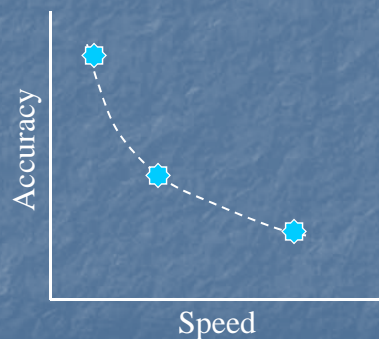 - training: spatial awareness
  - design: expressiveness

Speed-Accuracy Tradeoff

- Subjects <u>will</u> make a decision
- Must explicitly look at particular points on the curve
- *Manage* tradeoff

Evaluation Metrics – User Preference

- Ease of use / learning
- Presence
- User comfort
- Usually subjective (measured in questionnaires, interviews)

User Preference in the Interface

- UI goals
  - ease of use
  - ease of learning
  - affordances
  - unobtrusiveness
  - etc.

- Achieving these goals leads to *usability*
- Crucial for effective applications

User Comfort

- Simulator sickness
- Aftereffects of VE exposure
- Arm/hand strain
- Eye strain

Measuring User Comfort

- Rating scales
- Questionnaires
  - Kennedy - SSQ
- Objective measures
  - Stanney - measuring aftereffects

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Characteristics of 3DUI Evaluation

- Physical environment
- Evaluator issues
- User issues
- Evaluation type issues
- Misc. issues

Physical Environment Issues

- Utilizes nontraditional input and output devices
- Many displace do not allow multiple simultaneous viewers
- Think-aloud and voice recognition
- Mobility and video recording
- Collaborative UIs and network behavior

Evaluator Issues

- May require more than one
- Breaking presence
- No evaluator intervention means robust software
  - instructions must be detailed
- Challenges with multimodal interfaces

User Issues

- Selection of subject pool
  - 3DUIs may not be well understood
- Novice vs. expert users
- Number of subjected needed may be larger than normal (novelty)
- Users must adapt to wide variety of situations
- Effects of cybersickness

Evaluation Type Issues

- Heuristic evaluation difficult due to lack of guidelines
- Not many performance models for 3DUIs
- Automated tools are important
  - not many of them for 3DUIs
  - Multi-attribute Usability Evaluation Tool for Virtual Environments (MAUVE) – Stanney et al. 2000
- Statistical validity and 3DUI hardware
  - many factors to consider

Miscellaneous Issues

- Focus at a lower level
  - difficult to evaluate on application level
  - no set 3DUI standards
- Generalization of results

Next Class

- Augmented/Mixed Reality
- Readings
  - 3DUI Book – Chapter 11, 349-367