

# 3D User Interface Evaluation I

Lecture #15: Evaluating 3DUIs – Part I  
Spring 2015  
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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...

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## 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
- Participant – person who takes part in the evaluation

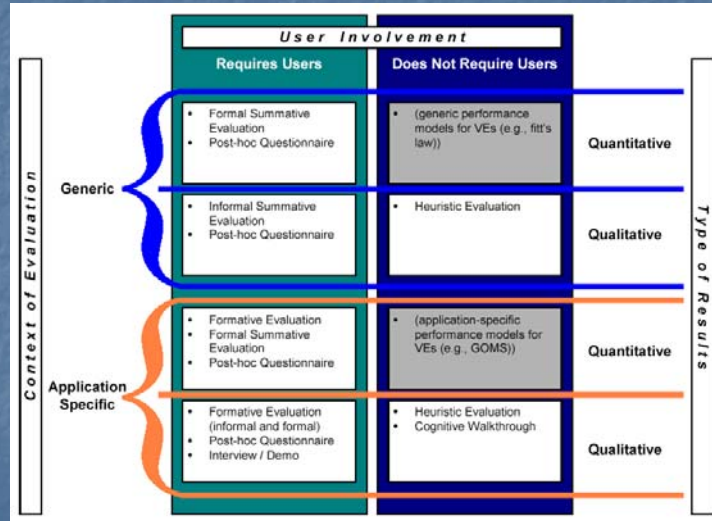
# Evaluation Tools

- 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
- 
- The diagram uses two large curly braces on the right side of the list to group the methods. The top brace groups 'Formative evaluation' and 'Summative evaluation' under the label 'Sequential evaluation'. The bottom brace groups 'Summative evaluation' (specifically 'task-based usability evaluation' and 'formal experimentation') and 'Interviews and Demos' under the label 'Testbed evaluation'.

# Evaluation Classification



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## 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

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## Evaluation Metrics – Task Performance

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

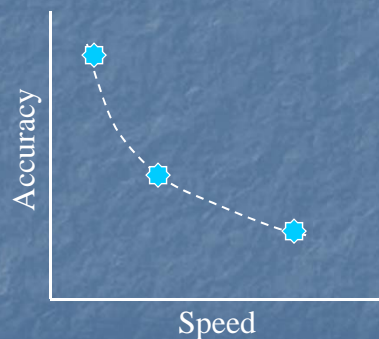
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## Speed-Accuracy Tradeoff

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



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## 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

## 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 displays 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

- 3DUI Evaluation
- Readings
  - 3DUI Book – Chapter 11, 349-367