

# Human-Computer Interaction

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# The Trouble With Computers (and other computer-based devices)

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- Confusion
- Panic
- Boredom
- Frustration
- Inefficient use of system
- Underutilization of system
- Task modification
- Compensatory actions (work-arounds)
- Misuse
- Damage
- Injury
- Death
- etc.

# Riddle

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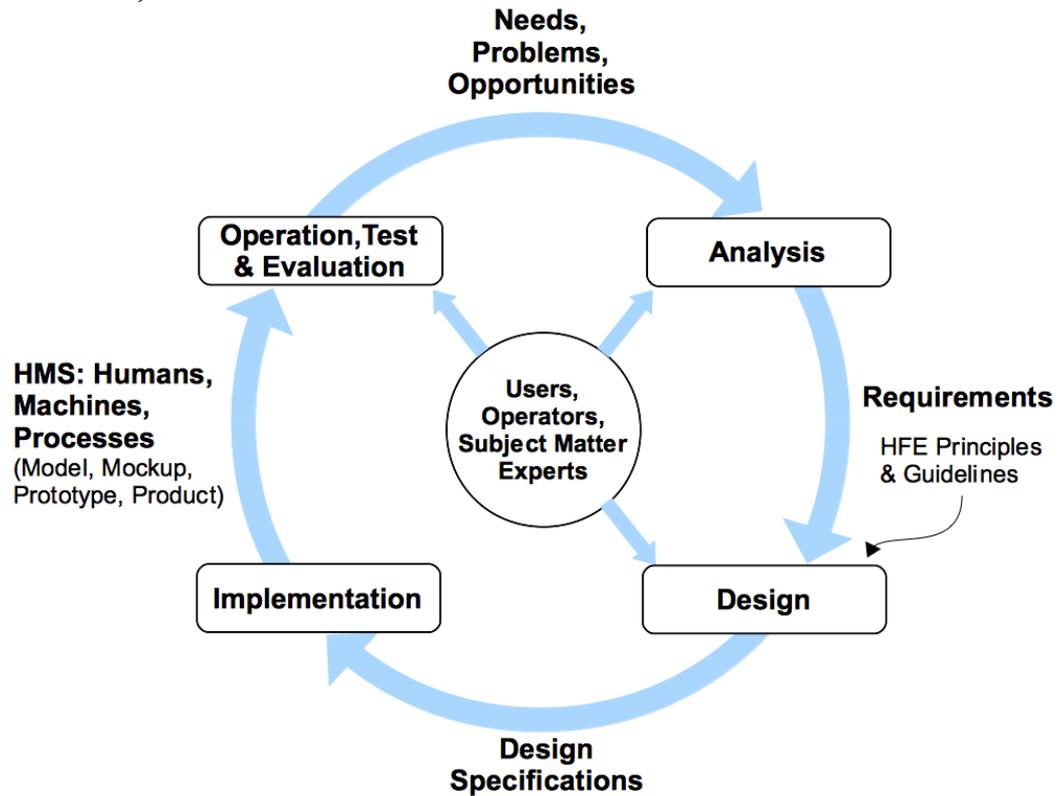
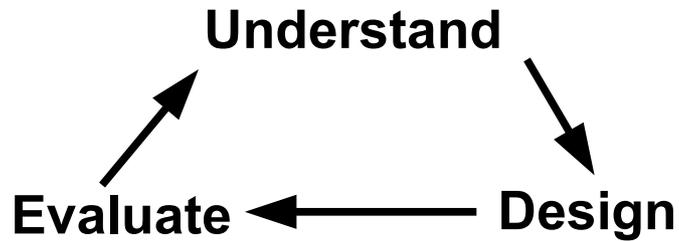
Why is a user interface is like a joke?

# Design Criteria For Usable Software (Usability Attributes)

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- Effectiveness (Accuracy)
  - Accuracy & completeness to reach goals.
- Efficiency
  - Accuracy/completeness vs. resources expended
- User Satisfaction
  - User's comfort & positive attitude toward use.
- Learnability
  - Ease of learning
- Memorability
  - Ease of remembrance, return

# Understand-Design-Evaluate vs. HMSE Process



# Designing For Different Categories of Users

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- Novices
  - Know tasks
  - Don't know system
  - Design: Focus on ease of learning, low reliance on memory.
- Knowledgeable Intermittent Users
  - Know tasks
  - Infrequent use leads to forgetting
  - Design: Reduce memory load.
- Expert Frequent Users
  - Deep knowledge of tasks, goals, actions.
  - Design: Map information & mechanisms onto task.

# Norman's Seven Stages of Action

1. Goal

2. Intention to carry out actions

3. Action Specification  
(→ action sequence)

4. Interface Mechanism

Execution

*Gulf of Execution/Evaluation*

5. Interface Display

6. Interpretation

7. Evaluation

Evaluation

# Design To Support Mental Models

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- Make invisible things visible.
- Provide feedback.
- Be consistent.
- Use familiar metaphors. (But over-reliance on metaphor may obscure possibilities.)

# General UI Design Principles

Wickens et al (2004, p. 398)

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- Match between system and real world
    - Speak the user's language.
    - Use familiar conceptual models and/or metaphors.
    - Follow real-world conventions.
    - Map cues onto user's goals.
  - Consistency and standards
    - Express the same thing the same way throughout.
    - Use color coding uniformly.
    - Use a uniform input syntax (same actions/functions)
    - Functions should be logically grouped, consistent.
    - Conform to platform interface standards.

# General UI Design Principles

Wickens et al (2004, p. 398)

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- Visibility of system status
    - Keep user informed about what goes on (status info).
    - Show that input has been received.
    - Provide timely feedback for all actions.
    - Indicate progress in task performance.
    - Use direct manipulation: visible objects/results.
  - User control and freedom
    - Forgiveness: obvious way to undo, cancel, redo.
    - Clearly marked exits.
    - Allow user to initiate/control actions.
    - Avoid modes, when possible.

# General UI Design Principles

Wickens et al (2004, p. 398)

- 
- Error prevention, recognition, and recovery
    - Prevent errors from occurring in the first place.
    - Help users recognize, diagnose, and recover from errors.
    - Use clear, explicit error messages.
  - Memory
    - Use see-and-point instead of remember-and-type.
    - Make the repertoire of available actions salient.
    - Provide lists of choices and picking from lists.
    - Direct manipulation: visible objects, visible choices.

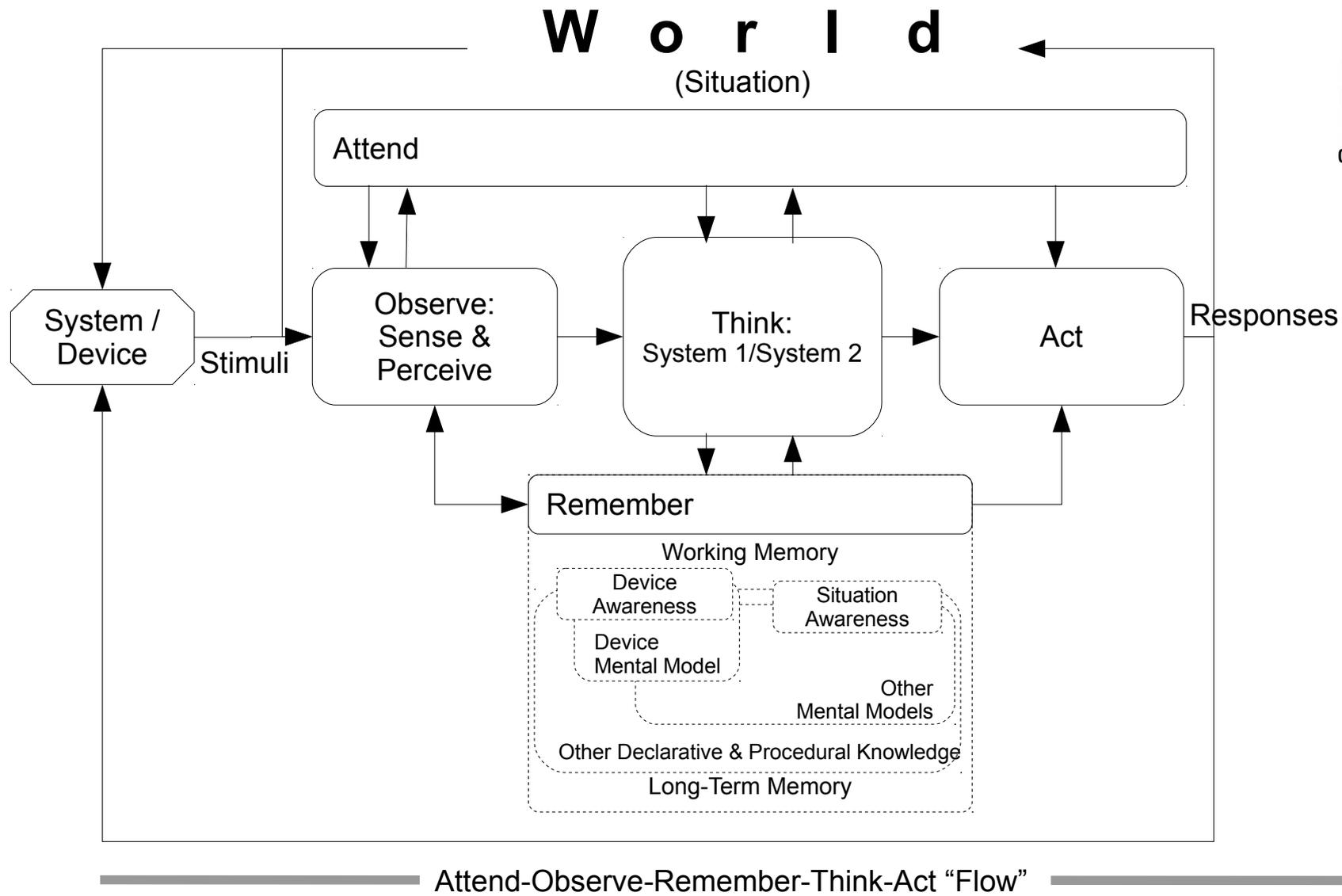
# General UI Design Principles

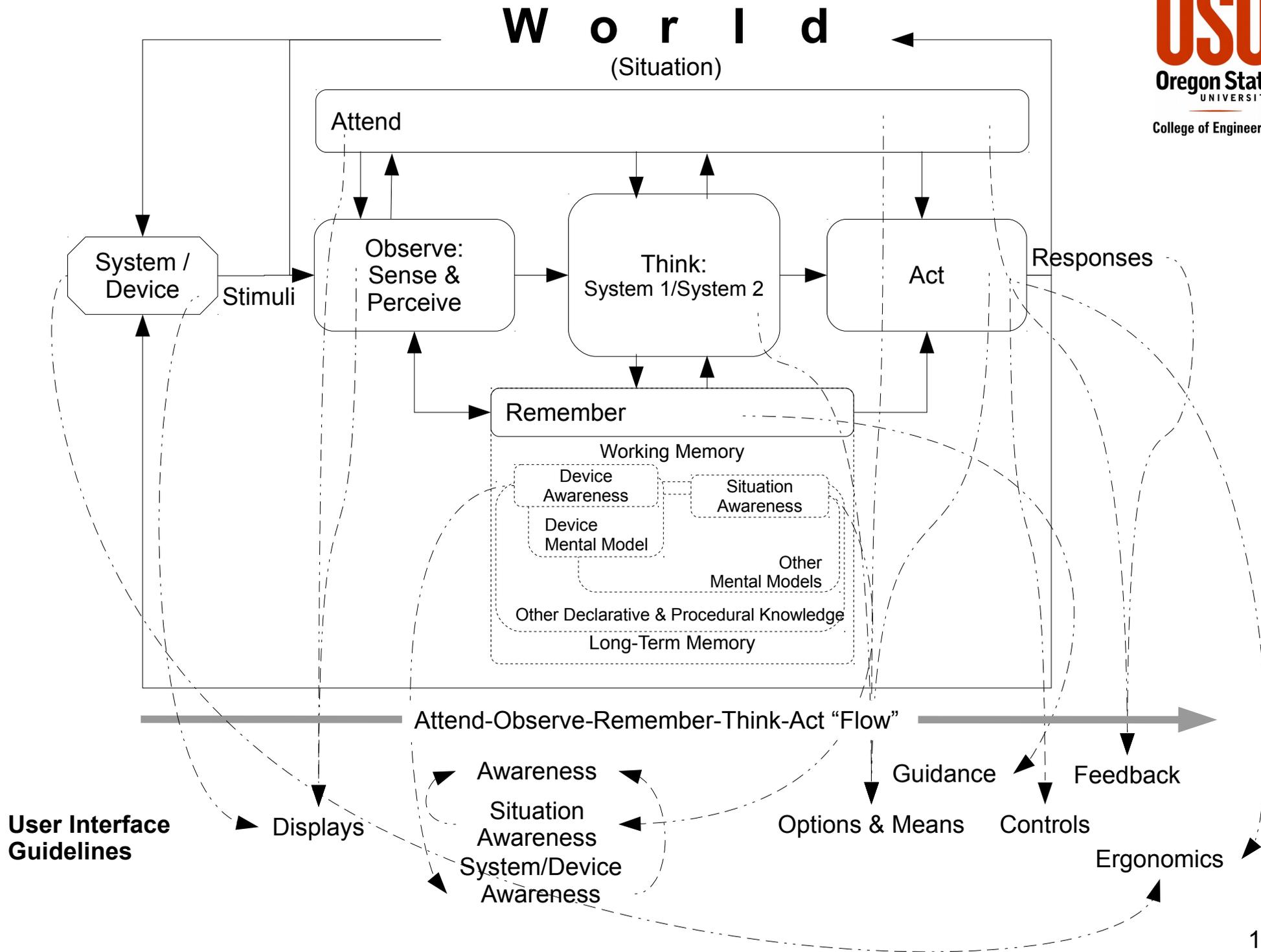
Wickens et al (2004, p. 398)

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- Flexibility and efficiency of use
    - Provide shortcuts and accelerators.
    - Give user options to speed up frequent actions.
    - Make system efficient to use.
  - Simplicity and aesthetic integrity
    - Things should look good, with simple graphic design.
    - Use simple and natural dialog; eliminate extraneous words, graphics.
    - All information should appear in a natural, logical order.

# More UI Guidelines

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# More UI Guidelines

- Displays
  - Make display representations accessible, legible, & meaningful.
  - Make representation salient in proportion to their frequency of use and immediate importance & urgency.
  - Apply the 13 Principles of Display Design.
- Awareness
  - Situation
    - Provide relevant situation information via representations located in consideration of its frequency of use and immediate importance & urgency.
  - System/Device
    - Keep the user informed of the S/D's current state & function.
- Options & Means
  - Inform the User of what can be done with/to the S/D & how to do it.
- Guidance
  - Provide additional guidance information, especially for complex procedures.
- Controls
  - Apply HF principles of control design, selection, placement, & orientation.
- Feedback
  - Inform the User of what he/she has just done & what the S/D is doing in response.
- Ergonomics
  - Design & locate controls & affordances in consideration of smallest & largest Users.
  - Design/select controls & affordance so as to minimize the risk of musculoskeletal disorders from sustained use.

# User Interface Evaluation

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- Heuristic Evaluation
  - Design specifications/mockups/prototypes
  - Usability expert(s)
  - Usability guidelines/checklists (earlier slides)
- Usability Testing
  - Mockups/prototypes
  - Representative users (3 – 6)
  - Usability metrics: effectiveness, efficiency, user satisfaction, learnability, memorability
  - Observation & data collection
  - Usability questionnaires

# 'SUS - A quick and dirty usability scale'

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- System Usability Scale
- John Brooke, Redhatch Consulting Ltd.

# System Usability Scale

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>				
	1	2	3	4	5
2. I found the system unnecessarily complex	<input type="checkbox"/>				
	1	2	3	4	5
3. I thought the system was easy to use	<input type="checkbox"/>				
	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	<input type="checkbox"/>				
	1	2	3	4	5
5. I found the various functions in this system were well integrated	<input type="checkbox"/>				
	1	2	3	4	5

# System Usability Scale

	Strongly disagree				Strongly agree
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>				
	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	<input type="checkbox"/>				
	1	2	3	4	5
8. I found the system very cumbersome to use	<input type="checkbox"/>				
	1	2	3	4	5
9. I felt very confident using the system	<input type="checkbox"/>				
	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	<input type="checkbox"/>				
	1	2	3	4	5

# SUS Scores

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- Scoring
    - 1.Score answers 1, 3, 5, 7, 9 (positive questions): answer - 1
    - 2.Score answers 2, 4, 6, 8, 10 (negative questions): 5 – answer
    - 3.Sum the scores
    - 4.Multiply the sum by 2.5
    - 5.Gives score in range 0 – 100.
  - Mean score (over many UIs): 68

# Post Study System Usability Questionnaire (PSSUQ)

## Interface 1

Please check the box that reflects your immediate response to each statement about Interface 1. Don't think too long about each statement. Make sure you respond to every statement. If you don't know how to respond, simply check the box for "NA".

	Strongly Agree			Strongly Disagree				NA
	1	2	3	4	5	6	7	
1. Overall, I am satisfied with how easy it is to use this system	<input type="radio"/>							
2. It was simple to use this system	<input type="radio"/>							
3. I could effectively complete the tasks and scenarios using this system	<input type="radio"/>							
4. I was able to complete the tasks and scenarios quickly using this system	<input type="radio"/>							
5. I was able to efficiently complete the tasks and scenarios using this system	<input type="radio"/>							
6. I felt comfortable using this system	<input type="radio"/>							
7. It was easy to learn to use this system	<input type="radio"/>							
8. I believe I could become productive quickly using this system	<input type="radio"/>							
9. The system gave error messages that clearly told me how to fix problems	<input type="radio"/>							

# PSSUQ

10. Whenever I made a mistake using the system, I could recover easily and quickly	<input type="radio"/>								
11. The information (such as on-line help, on-screen messages, and other documentation) provided with this system was clear	<input type="radio"/>								
12. It was easy to find the information I needed	<input type="radio"/>								
13. The information provided for the system was easy to understand	<input type="radio"/>								
14. The information was effective in helping me complete the tasks and scenarios	<input type="radio"/>								
15. The organization of information on the system screens was clear	<input type="radio"/>								
16. The interface of this system was pleasant	<input type="radio"/>								
17. I liked using the interface of this system	<input type="radio"/>								
18. This system has all the functions and capabilities I expect it to have	<input type="radio"/>								
19. Overall, I am satisfied with this system	<input type="radio"/>								

**Comments and Suggestions:**

PSSUQ score is mean of the 19 answers.

# Some Other Usability Questions

Adapted from W3C's WAI Site Usability Testing Questions:  
<http://www.w3.org/WAI/EO/Drafts/UCD/questions.html>

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- What are your overall impressions of the system?
  - If you had to give the system a grade, from A to F, where A was exemplary and F was failing, what grade would you give it, and why?
  - Name three words or characteristics that describe this system.
  - What are the three things you like best about the system?
  - What are the three things you like least about the system?
  - If you could make one significant change to this system, what change would you make?
  - Would you recommend this system to a colleague? To a friend?
  - Do you have any other questions or comments about the system or your experiences with it?

# Some More Usability Questions

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- What are the three best things about this UI?
- What are the three worst things about this UI?
- What should we do to improve it?