USABILITY

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EARLY USABILITY

Lucy Suchman filmed dozens of hours of use of Xerox copiers in 1970's

- complex machines allow magnification, reduction, two-sided copying, collation
- most users couldn't operate machines easily
- most uses involved single copies of 1-2 pp.

Solution → "green button"

Lesson: analyze task, frequency

RESEARCH TERMINOLOGY

Human Factors (US + …)

Cognitive Ergonomics (Europe)

Human-Computer Interaction

Usability

USABILITY PRINCIPLES

Design:

- with the user in mind
- with the user's **usage** in mind
- to make errors hard, if not impossible
- to provide proper feedback

Logical but not **obvious**

WHY USABILITY AS CS RESEARCH?

Early computer users were the programmers themselves

- Aware of illogical design
- Aware of cause of misbehaviour by application

Nowadays computer programmers are hardly ever the intended users

- Illogical design cannot be explained
- Misbehaviour cannot be explained

USABILITY FOCUS

Intuitive interface

- **<u>User</u> does not care about programming issues**

Usability Expert ensures

- Program purpose, status clear
- User is guided through application
- User is given proper feedback
- Consistency with co-operating interfaces
- …

“THE INTERFACE IS THE SYSTEM.”

Interface provides/conveys the ***only*** view of the “underlying” system

- Provides:
  - Model of task, system capabilities … more later

User interface strongly affects perception of software

- Usable software sells better
- Unusable web sites are abandoned

Perception is sometimes superficial

- Users blame themselves for UI failings
- People who make buying decisions are not always end-users

ACTUALLY, USER INTERFACES ARE HARD TO DESIGN

Software designers (let alone coders!) are not the user

- As we've discussed
- Most software engineering is about communicating with other programmers
- UI is about communicating with users

The user is always right

- Consistent problems are the system's fault

…except when the user is not right

- Users aren't designers

USABILITY

Is it a “good” interface?

- In what ways?

Usability:

- How well users can use the system’s functionality

Dimensions of usability (quick look):

- Learnability: is it easy to learn?
- Efficiency: once learned, is it fast to use?
- Memorability: is it easy to remember what you learned?
- Errors: are errors few and recoverable?
- Satisfaction: is it enjoyable to use?

USABILITY DIMENSIONS VARY IN IMPORTANCE

So, what are the elements of usability?

… It depends on the user

- Novice users need *learnability*
- Infrequent users need *memorability*
- Experts need *efficiency*

But no user is uniformly novice or expert

- Domain experience
- Application experience
- Feature experience

USABILITY IS ONLY ONE ATTRIBUTE OF A SYSTEM

BTW, in developing large systems, development process entails a (often large) team

Software designers have a lot to worry about:

- Functionality
- Performance
- Cost
- Security

– **Usability**

– Size

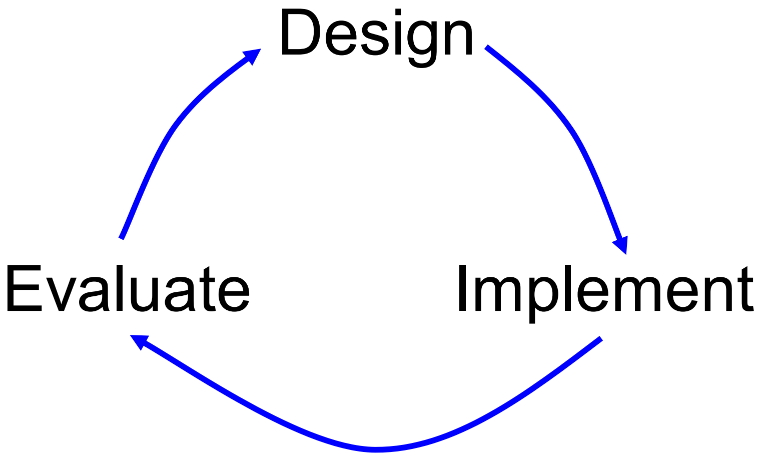
– Reliability

– Standards

Many design decisions involve *tradeoffs* among different attributes which is the essence of the design process

USABILITY ENGINEERING IS A PROCESS

… an iterative process



Analysis/Design

Implementation

Evaluation

Will later look at the "spiral" model of software engineering, which systematically incorporates iteration and change

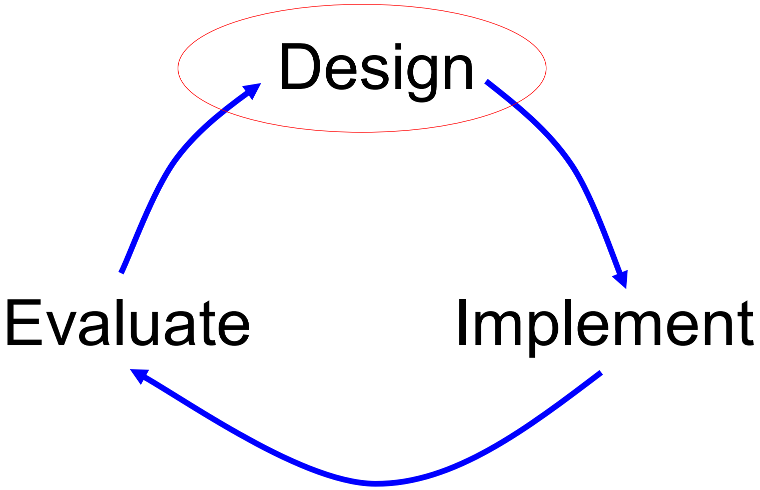
USABILITY ENGINEERING IS A PROCESS

Design

Task analysis
- "Know the user"
- "Know the domain"

Design principles
- Overarching

Design guidelines
- Avoid obvious mistakes
- May be vague or contradictory



USABILITY ENGINEERING IS A PROCESS

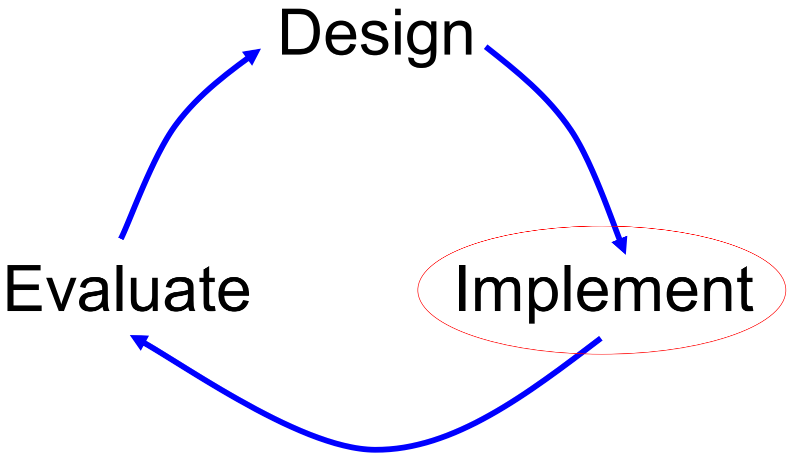
Implement

Prototyping

- Cheap, throw-away implementations
- Low-fidelity: paper, Wizard of Oz
- Medium-fidelity: HTML, Visual Basic

GUI implementation techniques

- Input/output models
- Toolkits
- UI builders



USABILITY ENGINEERING IS A PROCESS

Evaluate

Evaluation tests prototypes, using …

Expert evaluation

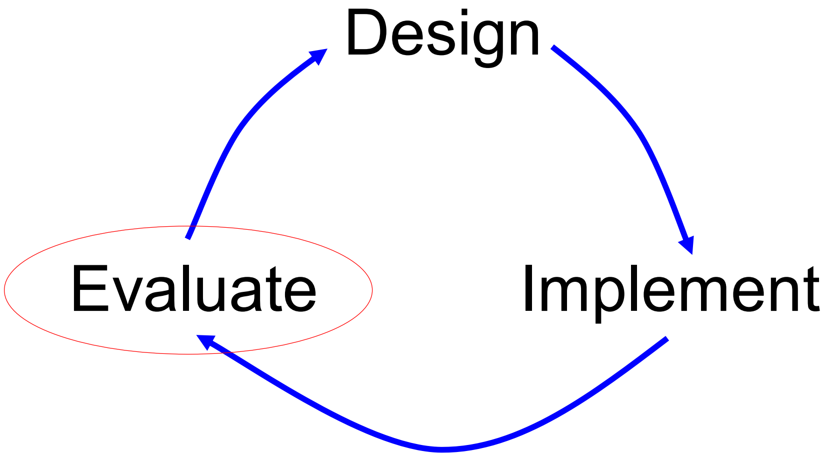
- Heuristics and walk-throughs

Predictive evaluation

- Testing against an engineering model (simulated user)

Empirical evaluation

- Watching users do it



WHAT DOES "USABILITY" MEAN?

ISO 9126

"A set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users"

ISO 9241

"Extent to which a product can be used by specified users to achieve specified goals with **effectiveness, efficiency** and **satisfaction** in a specified context of use."

WHAT DOES “USABILITY” MEAN? (CONCLUDED)

For Jakob Nielsen

- Satisfaction
- Efficiency
- Learnability
- Low Errors
- Memorability

For Ben Shneiderman

- Ease of learning
- Speed of task completion
- Low error rate
- Retention of knowledge over time
- User satisfaction

USABILITY TESTING IS…

Any of a number of methodologies used to try to determine how a product's design contributes or hinders its use when used by the intended users to perform the intend tasks in the intended environment

Most common forms include

- Modeling & analysis (e.g. GOMS, …)
- Expert Review/Heuristic Evaluations
- User-based testing

SOME METHODS …

COGNITIVE WALKTHROUGH

Specific review to ensure the correct information is available for the task being performed

Also low cost usability testing

Highly dependent on the qualifications of the reviewer(s)

EXPERT REVIEW

Aka: **Heuristic Evaluation**

One or more usability experts review a product, application, etc.

Free format review or structured review

Subjective but based on sound usability and design principles

Highly dependent on the qualifications of the reviewer(s)

THINK ALOUD PROTOCOL

Most widely used

No reliable evidence of its efficacy

When used on existing systems or interactive prototypes/mockups

- Issues of the ability for users to be introspective
- Issues of distraction (split attention)
- Issues of verbal overshadowing
- Issues of increased anxiety
- Issues of projected responding

Suitability for concept presentation and cognitive walkthroughs on non-operational products (e.g., story boards, static screen flows, Wizard of Oz walkthroughs)

DEFINING TASK SCENARIOS

Scenarios are contrived for testing, may not be representative of real world usage patterns, and are NOT always required

Short, unambiguous tasks to explore areas of concern, redesign, or of interest

Wording is critical

- In the user’s own terms
- Does not contain “seeds” to the correct solution

Enough to form a complete test but able to stay within the time limit

- Flexibility is key
- Variations ARE allowed

USABILITY MEASURES – 5 OFTEN USED

Measurement in usability a key notion

Define target user community and class of tasks associated with interface

Communities evolve and change

- e.g. the interface to information services for the U.S. Library of Congress

5 human factors (usability measures) central to evaluation:

- Time to learn
- Speed of performance
- Rate of errors by users
- Retention over time
- Subjective satisfaction

USABILITY MEASURES – 5 OFTEN USED

Time to learn

- How long does it take for typical members of the community to learn relevant task?

Speed of performance

- How long does it take to perform relevant benchmarks?

Rate of errors by users

- How many & what kinds of errors are made during benchmark tasks?

Retention over time

- Frequency of use and ease of learning help make for better user retention

Subjective satisfaction

- Do they like it?
- Allow for user feedback via interviews, free-form comments and satisfaction scales

SYSTEM USABILITY SCALE (SUS)

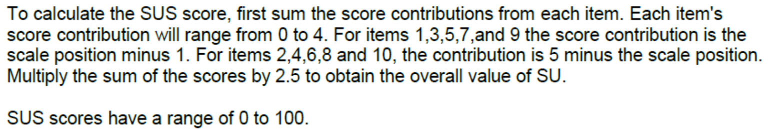
https://hell.meiert.org/core/pdf/sus.pdf

Quick & dirty!

10 statements to which users rate their level of agreement

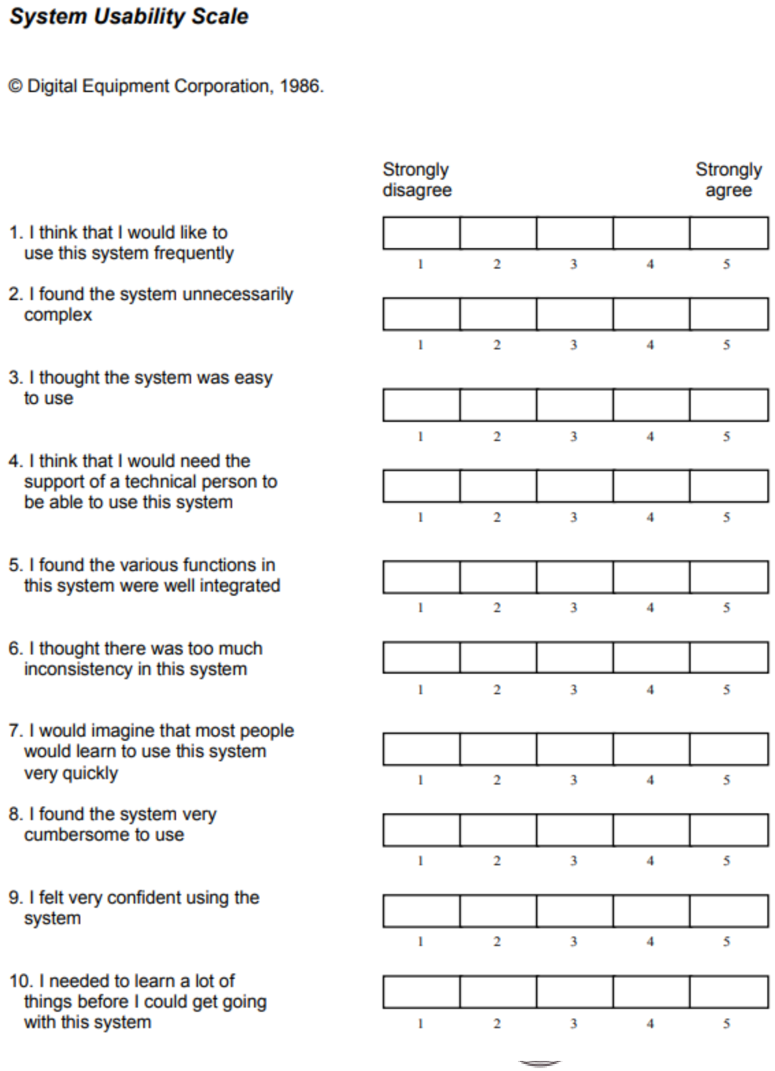
Half positive, half negative

5-pt scale of agreement



To calculate the SUS score, first sum the score contributions from each item. Each item's score contribution will range from 0 to 4. For items 1,3,5,7,and 9 the score contribution is the scale position minus 1. For items 2,4,6,8 and 10, the contribution is 5 minus the scale position. Multiply the sum of the scores by 2.5 to obtain the overall value of SU.

SUS scores have a range of 0 to 100.



System Usability Scale

© Digital Equipment Corporation, 1986.

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	□ 1	□ 2	□ 3	□ 4	□ 5
2. I found the system unnecessarily complex	□ 1	□ 2	□ 3	□ 4	□ 5
3. I thought the system was easy to use	□ 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	□ 1	□ 2	□ 3	□ 4	□ 5
5. I found the various functions in this system were well integrated	□ 1	□ 2	□ 3	□ 4	□ 5
6. I thought there was too much inconsistency in this system	□ 1	□ 2	□ 3	□ 4	□ 5
7. I would imagine that most people would learn to use this system very quickly	□ 1	□ 2	□ 3	□ 4	□ 5
8. I found the system very cumbersome to use	□ 1	□ 2	□ 3	□ 4	□ 5
9. I felt very confident using the system	□ 1	□ 2	□ 3	□ 4	□ 5
10. I needed to learn a lot of things before I could get going with this system	□ 1	□ 2	□ 3	□ 4	□ 5

SYSTEM USABILITY SCALE (SUS)

SUS SCORE 0-60 GRADE = F

SUS SCORE 60-70 GRADE = D

SUS SCORE 70-80 GRADE = C

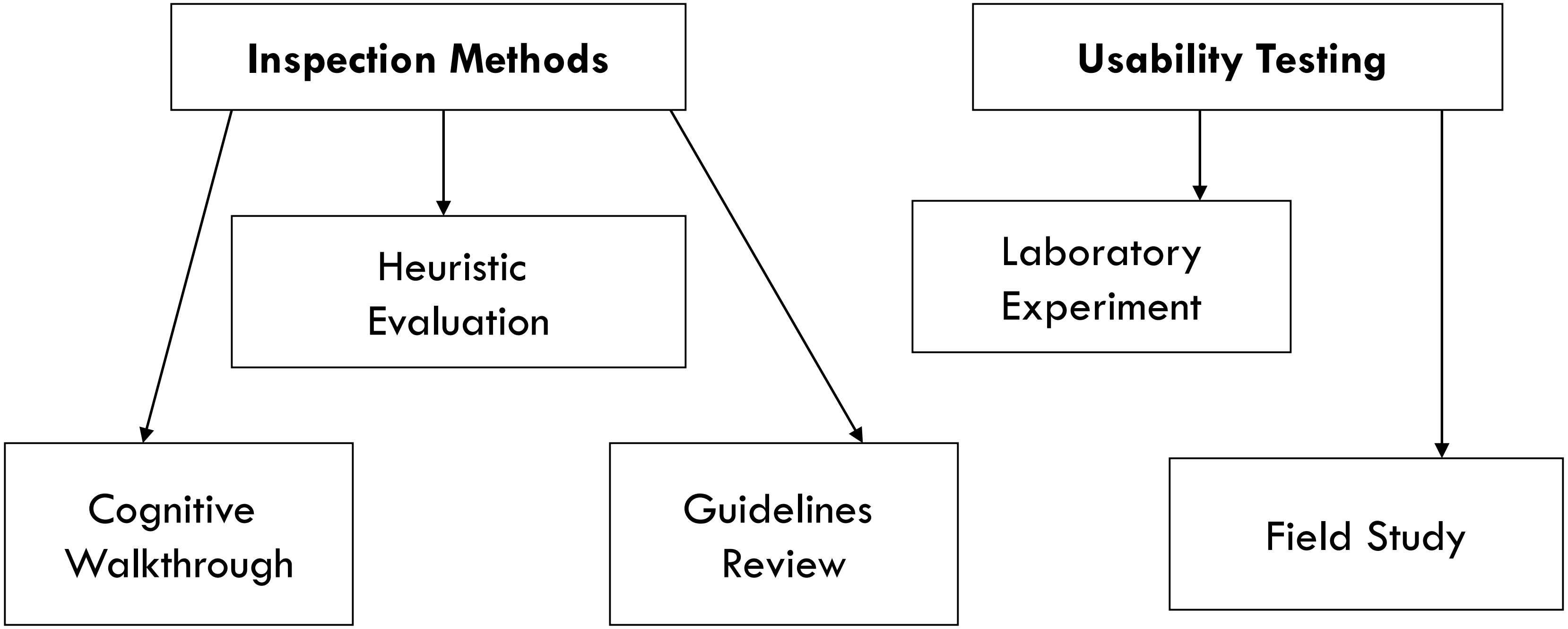
SUS SCORE 80-90 GRADE = B

SUS SCORE 90-100 GRADE = A

SYSTEM USABILITY SCALE (SUS)

- Nice for comparing systems
- Short questionnaire
- Easy to calculate
- Doesn’t work across all systems

TO CONCLUDE


Inspection Methods
Heuristic Evaluation
Cognitive Walkthrough
Guidelines Review
Usability Testing
Laboratory Experiment
Field Study

EXERCISE

→ Perform some SUS questionnaire to our system.

→ Propose some solutions for improvements.