Approaches to Developing Usable Systems

Anthony J. Hornof
University of Oregon

Overheads adapted with permission from materials prepared by David E. Kieras, University of Michigan

Ensuring Usability: All-Too-Common Industrial Approach

What's Good and Bad about the All-Too-Common Industrial Approach

Ensuring Usability: Standard Human Factors Process

What's Good and Bad about Standard Human Factors Process

Ensuring Usability: Expert Reviews

Ensuring Usability: The Engineering Model Approach

Engineering Model Process

Ensuring Usability:

All-Too-Common Industrial Approach

Depend on the intuitions of the designer
Use feedback from the marketplace and the users

Start
Specify Interface Design

Finish Development

Deliver System

Wait for feedback from customers

Usability Problems?

No

Ignore problems and hope product is otherwise good enough to survive

Yes

Good guessing? Try it again?

Decide what to do

Plan to fix in next version and hope you're still in business

Attempt to fix and reship system without going bankrupt

What's Good and Bad about the All-Too-Common Industrial Approach

What's good

Many exceptional designers in industry
  • Might as well rely on them!
  • Most relevant measure of success is success in the marketplace
  • Market, user feedback is realistic and relevant

What's bad

Results not guaranteed
  • No quality control methodology
  • Very risky for large-scale, critical implementations
  • Feedback comes too late for major changes
  • May discover basic design is flawed after making full investment
  • Marketplace does not always distinguish usability from functionality
  • Functionality is always the customer's first criterion
  • Once competitors have same functionality, then usability can become the criterion
  • So can have early market success due to functionality win, later market failure due to usability problems
Ensuring Usability: Standard Human Factors Process

Early use of guidelines, empirical user testing of prototypes

Goal of empirical user testing:
- Compare user performance to a specification
- Identify problems that impair learning or performance

Specify/Revise Interface Design
- Choose Benchmark Tasks
- Implement Prototype
- Evaluate Usability with Empirical User Testing
- Problems?
  - No
  - Yes
- Finish Development
- Deliver System

What's good about Standard Human Factors Process
- Definitely works if used thoroughly enough
- Straightforward, known methodology
- Many success stories
- Much accumulated experience
- HF guidelines are very comprehensive

What's bad about Standard Human Factors Process
- Slow and expensive
- Focus of R&D effort: tighten the iterative design loop
- Crucial role of better interface development technology
- "Discount" usability assessment methods - "expert evaluation"
- But, there are unavoidable time and cost demands in behavioral data collection and analysis!
- In expert domains, subjects are too few and their time is too valuable for thorough user testing to be done.
- No systematic way to accumulate or analyze design experience
- No representation of how the design "works" to ensure usability
- Any change to product or user's task might produce a new usability situation
- What aspects of design are still valid?
- Usability knowledge resides heavily in the intuitions of user interface experts.
  - Cf. Master Builders during the Middle Ages
- Guidelines are usually too vague for non-experts.
- Only psychology used: Experimental methodology
- How to run experiments on human behavior and draw valid conclusions - critical to success.
- But surely something else would be useful from 100+ years of research!

Ensuring Usability: Expert Reviews

What are they?
- Formal examinations of the system by people well-versed in the task domain, application domain, or user-interfaces.
- Expert reviews can be conducted any time during the design phase.

There are many kinds of expert reviews that can be conducted.

Cognitive Walkthrough
- A formalized method for stepping through all of the screens (or other stopping points) of a system and asking questions, at each screen, that relate to the execution of a specific task.
- Good for evaluating ease-of-learning, not so good for revealing potential subtle improvements to ease-of-use.

Guidelines Review
- Check the interface for conformity to organizational or other guidelines.
- Guidelines will help ensure consistency, but not necessarily good usability.

Heuristic Evaluation
- Expert reviewers critique an interface with respect to a short list of design heuristics (rules of thumb)
- The experience and expertise of the reviewers has an enormous impact on the success of such an evaluation.

Ensuring Usability: The Engineering Model Approach

Use analytic models instead of results from user testing.
- Engineering model process:
  1. Describe the interface design in detail.
  2. Build a model of the user's task, in detail.
  3. Use the model to predict execution or learning time.
  4. Revise or choose design depending on prediction.
- No need to implement prototype or test with human subjects
  - Saves time and money!
  - A critical issue in expert domains, transfer of training
  - Can be applied during initial design stages
  - Before interface is fully specified.

But, current models can only predict a few aspects:
- Time required to execute specific tasks
- Relative ease of learning of procedures
- Degree of a certain kind of consistency

Current models require substantial analysis effort
- In critical applications, definitely worth the return
- Shortcuts possible - e.g. "cognitive walkthrough"

Some user testing still required
- Assess aspects not dealt with by an analytic model
- Protection against errors, oversights, in the analysis
Engineering Model Process

Use model first, user testing for final check

Start
Choose Benchmark Tasks
Specify/Revise Interface Design
Construct/Revise Engineering Model
Evaluate Usability with Model on Benchmark Tasks
Problems?
Yes
No
Implement/Revise Prototype
Evaluate Usability with Empirical User Testing
Problems?
Yes
No
Major Problems?
Yes
No
Design Complete

May need to loop all the way back, but model-based evaluation will help then also

Overview of the Course

Standard Techniques for Designing for Usability
Iterative design based on user testing
Based on human factors methodology
Demonstration/Exercise of User Observation
Cognitive Walkthrough Analysis

Background on human psychology relevant to user interface design
Human information-processing concepts
Phenomena relevant to user interface design

Engineering models for user interface design
Keystroke Level Model
The GOMS model
Using the GOMS Model in Design

Interface Engineering: Specific design issues
Contextual Inquiry
Task Analysis and the Design of Functionality
Display design
User interface styles
Documentation and on-line-help
Human error and system design