SUN USABILITY LABS AND SERVICES
What is Usability Engineering?

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What Is Usability Engineering?

Usability engineering is an approach to product development that is based on customer data and feedback. Usability engineering is based on direct observation and interactions with customers to provide more reliable data than self-reporting techniques. Usability engineering begins in the conceptual phase with field studies and contextual inquiries to understand the functionality and design requirements of the product.

Too many products are difficult to learn, require manuals, or are simply counter-intuitive. These problems increase support and maintenance costs, decrease sales, productivity, and customer satisfaction.

Usability engineering is iterative design and evaluation to provide customer feedback on the usefulness and usability of a product's functionality and design throughout the development cycle. This results in products that are developed to meet the customers' needs.

Usability is comprised of six general attributes:

1. Utility
2. Learnability
3. Efficiency
4. Retainability
5. Errors
6. Satisfaction

Usability Activities Throughout the Development Cycle

Include usability engineering as early as possible, from the moment you know that an application or product needs to be

developed or revised. One of the biggest problems that groups have is asking for a usability test late in the development cycle, when very little can be changed. Another problem is in teams thinking that they don't need a professional interface designer to help design the application or product.

Usability engineering emphasizes direct observation, including:

- Knowing your customers
- Knowing other products
- Customer feedback early and throughout the development cycle
- Direct observation of customers both in their workplace and in a usability lab

Usability Engineering Methods

- Evaluations of existing or similar products
  Learn from earlier design success and failures.

- Customer field studies and contextual inquiry
  Understand customers' work flows, tasks, profiles, environments, and how much they vary.

- Support call data and customer feedback
  This research should usually be performed by the development team to understand past issues and problems with the product.

- Participatory methods
  Understand customers' tasks and generate design directions through collaboration among developers, users, and usability engineers.

- Interface design
  A key to producing usable products is to have a professional interface designer work on the project.

- Interative usability tests
  Multiple usability tests should be performed on the prototypes and developing product.

- Worldwide usability tests
  Usability tests can either be done in the countries or from the Sun Usability Labs via remote usability testing.

Product Development Phases and Usability Activities

The following are some of the recommended activities to

perform. Optimally, consult a usability expert to discuss which of the activities are recommended for your product and goals.

- Concept Phase
  - Review previous usability reports.
  - Review existing data on usability problems from records (bug system, support calls) and feedback.
  - Perform field studies and contextual inquiries.
  - Create user profiles.
- Requirements and Planning Phase
  - Identify any user interface design standards or guidelines.
  - Usability test previous version.
  - Perform user surveys.
  - Develop user profiles.
  - Perform field studies.
  - Perform comparative usability tests.
  - Perform participatory methods.
  - Perform task analysis.
  - Define usability goals.
  - Create a user model.
  - Write usability requirements.
- Design and Prototype Phase
  - Designer creates designs
  - Prototype interface
  - Usability inspection
  - Multiple rounds of usability testing
  - Redesign
  - International usability test
  - Global use review
  - Standards inspection
  - Error message review
  - Design review
- During Alpha
  - Iterative usability tests
  - Redesign
- During Beta
  - Field observation
  - Measure if usability goals and requirments are met

Summary

Performing usability engineering helps in many ways:

- Cost-effective
- Reduces work by focusing design and direction early

- Helps to prioritize functionality and identify unnecessary functionality
- Increases customer and user satisfaction
- Decreases support and maintenance costs
- Increases sales
- Increases profits

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Benefits of Usability Engineering

Usability engineering offers many benefits. Among them are reduction of failed products, reduction in development time and costs, reduction in training and support costs, increased sales and revenues, and increased productivity.

Every year, millions of dollars are lost in the production and usage of unusable products. This money is wasted due to:

- Lost productivity
- Failed products
- Training and support costs
- Hidden costs of computers
- Unnecessary features
- High development costs
- Lost revenue
- Dissatisfied users
- Schedule slips

Why Projects and Products Fail

More than 30% of software development projects are cancelled before completion, primarily because of inadequate user design input. The result is a loss of approximately $80 billion annually to the economy [Standish Group 1995].

The top two reasons projects fail are lack of user involvement and lack of requirements [Standish Group 1995].

46% of all new product development costs go to failures [Business Week], including:

- IBM PCjr: Failed product with a $40 million marketing cost alone
- RCA Videodisk: loss of $500 million

Usability studies can improve your successes.

How Did This Occur?

Companies and agencies do not typically track the total cost of producing, supporting, and maintaining product.

Development teams are usually only tracked and goaled on the initial completion date and initial development costs.

Companies and agencies typically only prioritize usability if they "feel the pain" with lost revenues, lost bids, dissatisfied customers, and high support costs.

A means to convince management that usability engineering is important is to track the costs (both in dollars and qualitative measures) for the total cost of producing, maintaining, and selling the product, comparing costs before usability engineering against costs after usability engineering.

Decreased Support and Maintenance Costs

- 80% of maintenance is due to unmet or unforeseen user requirements; only 20% is due to bugs or reliability problems [Martin and McClure 1993; Pressman 1992].
- Microsoft tracks its support call costs and has seen a significant cost savings resulting from improving the usability of its products, such as Word [Reed 1992].
- Design changes due to usability work on one project at IDS/American Express resulted in estimated savings of $45 million [Chalupnik and Rinehart 1992].
- In order to meet its customer support call needs, WordPerfect had to employ over 900 customer response specialists [1992].
- Design changes from one usability study at Ford Motor Company reduced the number of calls to the help line from an average of 3 calls to none, saving the company an estimated $100,000 [Kitsuse 1991].
- 80% of software life cycle costs occur during the maintenance phase [Pressman 1992].
- The cost of change is 1 unit in the definition phase, 1.5-6 units during the development phase, and 60-100 units after release [Pressman 1992].

Lost Productivity

- While investment in information technology has increased 10,000 times, the productivity of white-collar workers in the service sector has declined [Landauer 1995].

- $500 Billion is spent annually in the U.S. on computers, networks, and information technology, with a resulting decrease in productivity [Stephen Roach, Morgan Stanley, 1992; from Landauer, 1995].

- The average software program has 40 design flaws that impair employees' ability to use it. The cost in lost productivity is up to 720% [Landauer 1995].

- An analysis of IT budgets from 138 big US firms between 1988 and 1994 indicated that a 67.4% gain in IT budgets increased much more rapidly than revenue, which was 29.6%, and profit, which was 39.7%. These differences reflect unfavorably on the contributions of IT [Strassmann 1996].

- Design changes due to usability work at IBM resulted in an average reduction of 9.6 minutes per task, with a projected internal savings at IBM of $6.8 Million in 1991 alone [Karat 1990].

- A recent commentary in Fortune Magazine:
"The trouble with software is. . . it sucks. That's not a nice thing to say. . . but it is a fundamental truth. Software customers--you, me, CIO's of multibillion-dollar companies. . . have learned to live with mediocre software. We do not count on software to be intuitively easy to understand or to work consistently. Instead, we make do." [Alsop 1996].

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Cost Savings of Usability Engineering

Usability engineering helps product developers finish their projects on-time and on-budget.

- Cost-Benefit Example
- Usability Engineering Decreases Development Time and Costs
- Usability Engineering Increases Product Sales

Cost-Benefit Example

The following example shows the benefits of doing a usability study. This example is based on reducing the number of support center calls and increasing employee productivity by producing a better engineered, usability tested product.

Cost of a Usability Study

To calculate the cost of a usability study, consider:

- Inhouse usability staff
- Time spent by staff (usability people, developers) x wage rate (same units)
- Additional variable costs (contractors, usability lab rental, travel)

Cost of inhouse usability staff:	
Loaded headcount (salary, benefits, vacation time, office space, phones, equipment)	$120,000/year
Hours per work year (40 hours/week x 48 weeks)	1,920 hours/year
Hourly wage ($120,000/1,920)	$62.50/hour
Time spent on usability test by usability engineer (planning, implementation, analysis, recommendations)	160 hours
Time spent by interface designer on redesign	60 hours

Time spent by development engineers for usability activities	22 hours
Total staff costs (160 + 60 + 22 = 242 x $62.50)	$15,125
Costs of a fully-equipped lab:	
Participant recruiting @ $100/participant (9 participants x $100)	$900
Participant compensation @ $50/participant (9 x $50)	$450
Videotapes @ $5/each (9 x $5)	$45
Percentage of lab and equipment costs = amortized cost of lab/hour ($200/hour x 20 hours)	$4,000
Total lab costs	$5,095
TOTAL COST of doing a usability study:	
Staff cost + lab costs = $15,125 + $5,095 = $20,220	

Cost Savings After Doing a Usability Study

To calculate the cost savings after doing a usability study, consider the following:

Calculate support call costs:	
Support call	$200/call
200,000 product Version 1 sold	
Support calls due to usability problems = 580,000 x $200/call	$116 million
Support calls/product sold	2.9 calls/product
Usability engineering done on Version 2	
300,000 product Version 2 sold	
Support calls to to usability problems = 260,000 x $200	$52 million
Support calls/product sold	0.87 calls/product
Reduction on support calls	2.03/product
Support call cost savings due to increased usability: 2.03 calls/product x 300,000 x $250/call	$152.25 million
Calculate increased productivity (inhouse):	
Task A improved by 3 minutes	

Task A performed 5 times/day	
200 users perform Task A	
Hourly wage (from loaded head count)	$62.50/hour
200 users x 3 minutes x 5 = 3,000 minutes saved/day	50 hours saved/day
50 hours x $62.50/hour	$3,125
Annual amount saved through increased productivity: $3,125 x 240 work days/year	$750,000/year

Summary:

Cost of usability study:	Cost savings after doing a usability study (support call cost savings + increased productivity): = $152.25 million + $750,000 =
$20,220	$153 million

Usability Engineering Decreases Development Time and Costs

A common myth is that usability engineering adds to development time and costs, but, in fact, the opposite is true:

- Usability engineering has demonstrated reductions in the product-development cycle by over 33-50% [Bosert 1991].
- 63% of all software projects overran their estimates, with the top 4 reasons all related to usability [Lederer and Prassad 1992].
- The percentage of software code that is devoted to the interface has been rising over the years, with an average of 47-60% of the code devoted to the interface [MacIntyre et al. 1990].
- Ricoh found that 95% of the respondents to a survey never used three key features deliberately added to the product to make it more appealing. Customers either didn't know these features existed, didn't know how to use them, or didn't understand them [Nussbaum and Neff 1991].

Usability Engineering Increases Product Sales

Press coverage and product reviews are moving from functionality checklists to usability factors.

- An increased average of 11.2 usability-related comments per software review article [Anderson 1990].

- InfoWorld assigns between 18-30% of its software review articles on 3 usability factors: ease of learning, ease of use, and quality of the documentation [Nielsen 1993].

At Digital, 20 of the most serious usability problems were fixed in the second release of a product. The revenues grew by 80%, which was 66% greater than the projected growth. The customers repeatedly pointed to usability as one of the most significant changes in the product [Wixon and Jones 1991].

The European Community has passed a directive stating:

- "software must be suitable for the task"
- "software must be easy to use"
- "the principles of software ergonomics must be applied" [EEC 1990]

Usability studies can help accomplish these goals.

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Document contents:

Readings

- Bias, R.G. and Mayhew, D.J. (Eds.). Cost-Justifying Usability. Academic Press, Boston, 1994
- Bosert, J.L. (1991). Quality Functional Deployment: A Practitioner's Approach. ASQC Quaility Press, New York
- Landauer, Thomas. The Trouble with Computers. MIT Press, 1995

Pressman, R.S. (1992). Software Engineering: A Practioner's Approach. McGraw-Hill, New York

References

- Alsop, Stewart. The problem with Software. Fortune, June 16, 1996.
- Anderson, T.F. (1990). Usability and Software Reviews. Unpublished report in Danish. Computer Science Department, Technical University of Denmark. Reported in Nielsen, J. Usability Engineering, Academic Press, Boston, 1993
- Bias, R.G. and Mayhew, D.J. (Eds.). Cost-Justifying Usability. Academic Press, Boston, 1994
- Bosert, J.L. (1991). Quality Functional Deployment: A Practitioner's Approach. ASQC Quaility Press, New York
- Bulkeley, W.M. (1992). Study finds hidden costs of computing. The Wall Street Journal, 2 November, B4

- EEC. Council Directive of May 29, 1990 (90/270/EEC), Official Journal of the European Communities No. L 156, 21.6.1990, 14-18

- Ehrlich, K. and Rohn, J.A. Cost-Justification of Usability Engineering: A Vendor's Perspective. In Cost-Justifying Usability. Bias, R.G. and Mayhew, D.J. (Eds.). Academic Press, Boston, 1994

- Gibbs, W.W. (1997). Command and Contol: Inside a hollowed-out mountain, software fiascos--and a signal success. Scientific American (August)

- Kitsuse, A. Why aren't computers... Across the Board (October) 28, 44-48

- Landauer, Thomas. The Trouble with Computers. MIT Press, 1995

- Lederer, A.L. and Prasad, J. (1992). Nine management guidelines for better cost estimating. Communications of the AMC 35(2) (February), 51-59

- MacIntyre, F. Estep, K.W., and Sieburth, J.M. (1990). Cost of user-friendly programming. Journal of Forth Application and Research 6(2), 103-115

- Pressman, R.S. (1992). Software Engineering: A Practioner's Approach. McGraw-Hill, New York

- Reed, S. (1992) Who defines usability? You do! PC Computing (Dec), 220-232

- Standish Group, reported in Forbes, 1995

- Strassmann, Paul. Spending without results? Computerworld, April 15, 1996 v30 n16 p88(1)

- Telles, M. (1990). Updating an older interface. Proceedings of the ACM CHI '90 Conference (Seattle, WA, 1-5 April), 243-247

- Wixon, D. and Jones, S. (1991). Usability for fun and profit: A case study of the re-design of the VAX RALLY. Proceedings Workshop on Human-Computer Interface Design: Success Cases, Emerging Methods and Real-World Context. University of Coloradi, 23-26

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