Why do current systems fail?

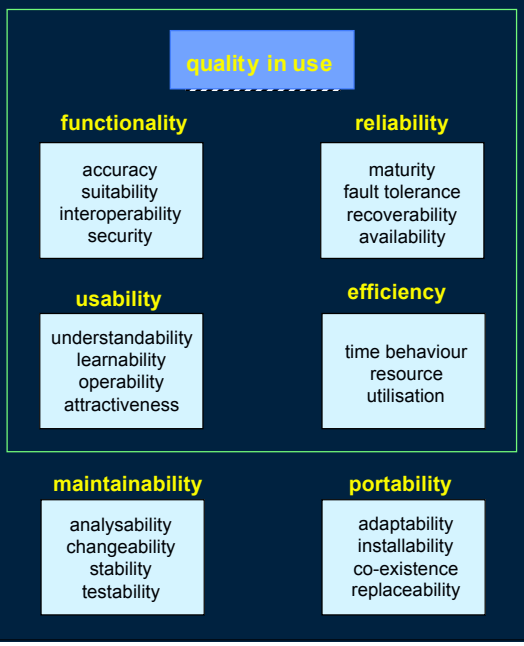
- Standish Group found that

51%	of projects failed
31%	were partially successful

- Main causes were poor user requirements:

13.1%	**Incomplete requirements**
12.4%	**Lack of user involvement**
10.6%	Inadequate resources
9.9%	**Unrealistic user expectations**
9.3%	Lack of management support
8.7%	**Requirements keep changing**
8.1%	Inadequate planning
7.5%	**System no longer needed**

ISO/IEC 9126-1 Software Product Quality Model



Usability Requirements: Quality in use
ISO/IEC TR 9126-1: Quality in use metrics

- User performance
  - "all data entry clerks will be able to complete the task with at least 95% accuracy in under 10 minutes"
- User satisfaction
  - "the mean score on the SUMI scale will be greater than 50" More information on quality in use requirements

Usability Requirements: external usability
ISO/IEC TR 9126-2: External metrics

Requirements (which can be tested by using a prototype)

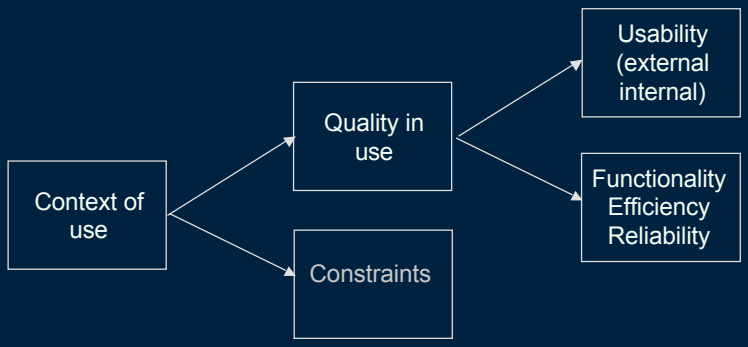
- Understandability
  - Product description and demonstrations
  - Interface functions (e.g. menus) easy to understand
- Learnability
  - Functions learnt quickly
  - Effective user documentation and help
- Operability
  - Understandable messages, undoability, customisability
- Attractiveness
  - Screen layout and colour

Usability Requirements: internal usability
ISO/IEC TR 9126-3: Internal metrics

Requirements (which can be tested by inspecting the specification)

- Understandability
  - Product description complete
  - Interface functions (e.g. menus) easy to understand
- Learnability
  - Complete user documentation and help
- Operability
  - Consistency, self explanatory messages, undoability, customisability
  - GUI style guide
- Attractiveness
  - Screen layout and colour

Types of user requirements



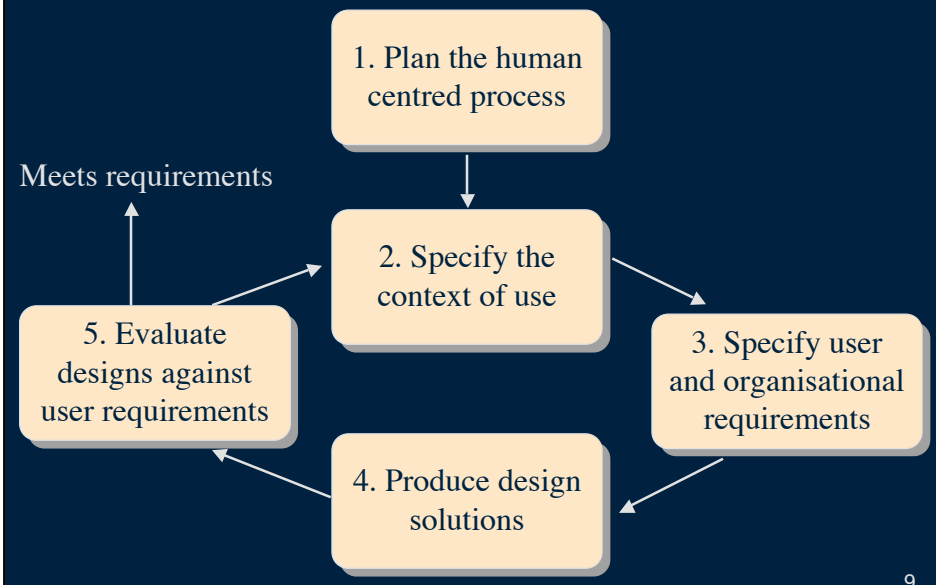
Types of user requirements

- Context of use
  - Users groups and other stakeholders
  - Tasks and scenarios that the system should support
  - Environment: physical and organisational
- Usability: quality in use (summative goals)
  - Task performance scenarios: effectiveness and efficiency
  - Satisfaction
- Usability: detail (summative goals)
  - Interface behaviour
    - External and internal
- Functions to support usability (formative design)
  - General principles to be followed
    - Specific system features to enhance usability
- Efficiency
- Reliability

ISO/IEC CD 25030: Software quality requirements and evaluation – Quality requirements

- Define quality requirements
  - Identify stakeholders
    - end users, developers, producers, trainers, maintainers, disposers, acquirer, supplier organisations and regulatory bodies
  - Elicit requirements from stakeholders
    - Quality in use, External and Internal Quality
  - Analyse the set of requirements
  - Resolve problems
  - Confirm requirements
  - Record requirements
- Formalise quality requirements
  - Specify target values for measures
  - Demonstrate traceability
  - Maintain requirements

Human centred design process for interactive systems: ISO 13407



ISO 13407: Usability requirements

The specification of user and organizational requirements should

- identify the range of relevant users and other personnel in the design,
- provide a clear statement of the human-centred design goals,
- set appropriate priorities for the different requirements,
- provide measurable criteria against which the emerging design can be tested,
- be confirmed by the users or those representing their interests in the process,
- include any statutory or legislative requirements, and
- be adequately documented.

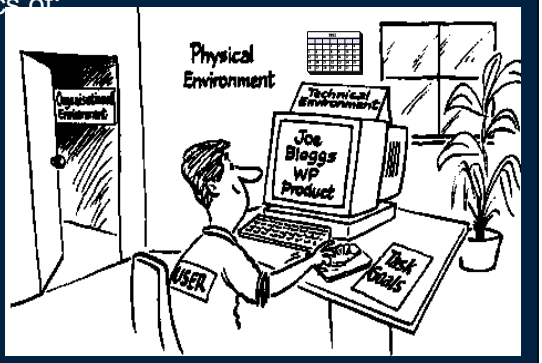
System lifecycle (TRUMP)

Plan Process	Specify Context of Use	Specify Requirements	Design Solutions	Evaluate against Requirements
System lifecycle				
feasibility		requirements	design	implement / release
1. Stake-holder meeting	2. Context of use 3. Scenarios	4. Usability requirements 5. Evaluate existing system	6. Prototyping 7. Style guide	8.Evaluation 9. Usability testing 10.Collect feedback

www.usability.serco.com/trump/ucdmethods

Context of Use

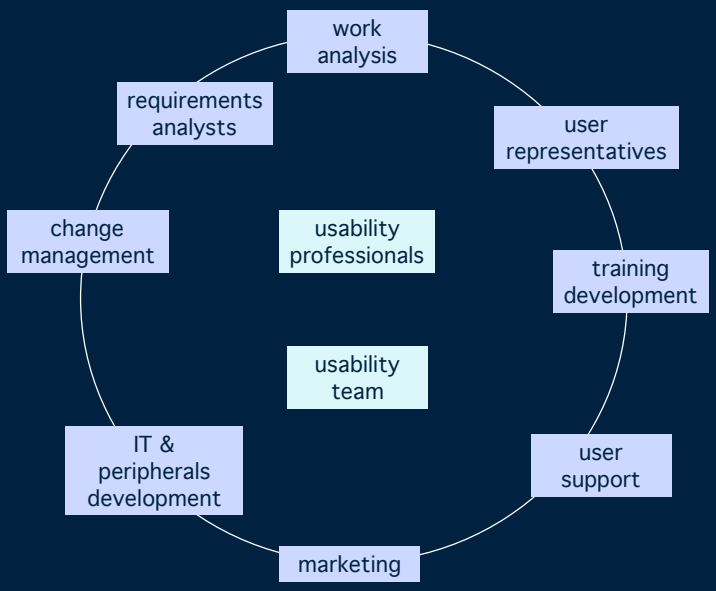
- The usability of a product is affected not only by the features of the product itself but also by its Context of Use
- Context is the characteristics of:
  - the users of the product
  - the tasks they carry out
  - the technical, organisational and physical environment in which the product is used
  - the date and time when the product is being used



Usability Context Analysis (UCA)

- Structured method
  - for documenting key aspects of a system which affect usability
- Provides support for:
  - Identifying the (intended) context of use
  - Specifying the context in which usability should be measured
- Helps with problem of generalising from findings
  - Some laboratory studies have been so remote from conditions of actual system use that the relation of the data to life was at best irrelevant and at worst distorting (Whiteside et al., 1988)

Who should be involved?



Context structure

1 Users
1.1 User types
1.2 Skills & knowledge
1.3 Physical attributes
1.4 Mental attributes
1.5 Job characteristics
1.6 List of tasks
2 Task characteristics
3 Organisational environment
4 Technical environment
5 Physical environment

Example: A bank ATM

Context description:

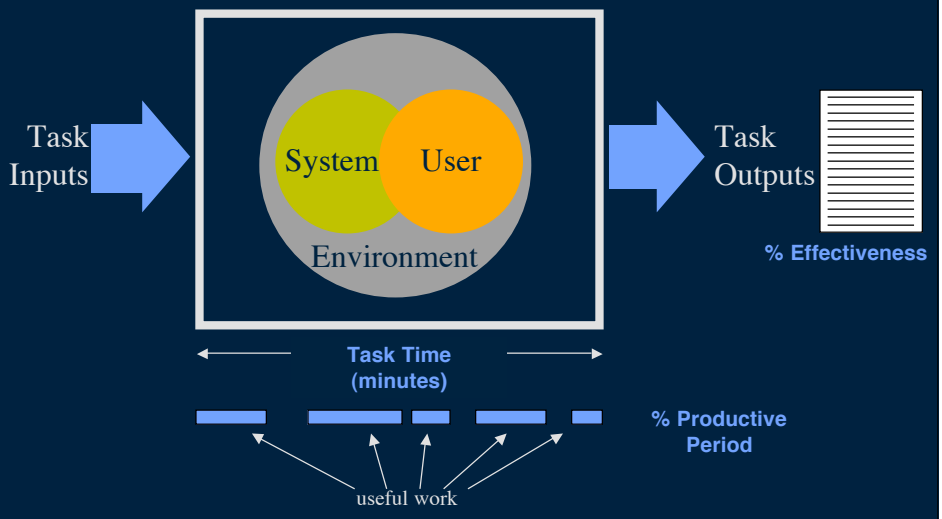
- The users
- The user characteristics
- The tasks users perform
- The technical environment (hardware and software to support system)
- The physical environment
- The social or organisational environment

New design features to meet contextual needs

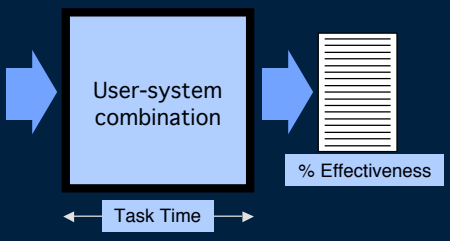
- Recess for wheelchair access.
- Speech output for visually impaired users.
- Customisation features for rapid access.
- Finger print for identification.
- Visor appears during sunny weather.
- Buttons light during darkness.
- Alarm button for security alert.

Loughborough University

Usability measures (quality in use)



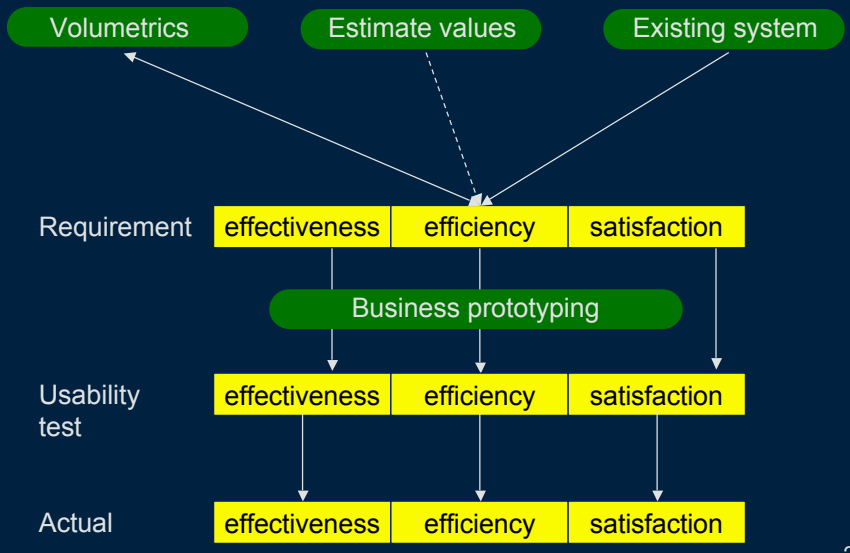
Effectiveness and Efficiency



$$\text{Efficiency} = \frac{\text{Effectiveness}}{\text{Task Time}}$$

- We use a 'black box' approach
  - goal-centred and relates to performance objectives
  - process-independent, enabling comparison of different systems, workflows, task allocations, etc. to achieve same goal

Usability requirements



Effectiveness costs

Measure consequences, not causes, e.g.:

- Minor inconsistencies 1-10%
- Administrative consequences 10-50%
- Financial implications 1-100%
- Negative business consequences 100%

Effectiveness scores

- An acceptable task output is 100% effective
- Consider each element in the task output in turn, e.g.:
  - What plausible errors could occur in each element?
  - What impact would each type of error have on the stakeholders?
  - How much does this reduce the value of the output?
  - Assign a percentage to each possible error type in each task element
  - For example the inconvenience associated with an error that would be detected later and corrected might reduce the effectiveness by 20%
  - A serious undetected error might reduce the value by 80%
  - The inconvenience of a typo might be judged to reduce the value by 5%
  - Some errors may invalidate the whole output, reducing the value to 0%

Specifying effectiveness

- Choose a user/business task
  - sequence of activities by an individual that meet a user/business goal
- What is the input and the output?
- Consider each element of the output
- What could go wrong with each element?
  - What output errors occur using existing systems and procedures?
  - What types of mistakes might users make?
- Estimate the user/business impact of each error situation
  - For each element of the task output that has an error, subtract the appropriate percentage
  - Subtract each percentage from 100 to give the overall effectiveness
  - If the sum of errors greater than 100, the effectiveness is 0%
- Calculate the average effectiveness
  - What is the relative frequency of correct results and each error scenario?
  - Multiply each effectiveness scenario by the frequency and calculate the average

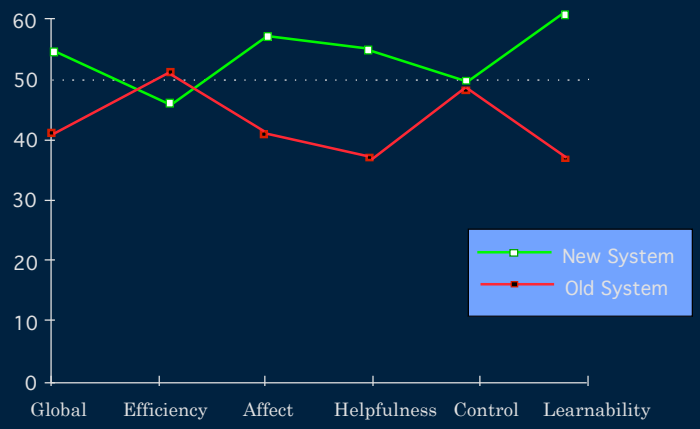
Effectiveness calculation

Output element	Error scenario	Impact	Business value	Frequency	Value x frequency	Impact x frequency
Acknowledge-ment	Not sent	10%	90%	1%	90	10
Corrected d.o.b	Wrong d.o.b.	50%	50%	2%	100	100
Payment made	No payment	100%	0%	1%	0	100
	No errors	0%	100%	96%	9600	0
Total				100%	9790	
Mean value			97.9%			

Setting effectiveness and efficiency targets

- What assumptions about task time and accuracy have been made in the Volumetrics, Performance and Staffing models?
- What is known about the time and accuracy of existing similar procedures
  - The new system should be at least as good as the existing systems
- Set a target range
  - Objective for effectiveness and efficiency
  - Worst case (e.g. must be at least as good as existing systems)

User satisfaction: SUMI questionnaire



Detailed usability requirements

- Understandability
  - Interface elements (e.g. menus, controls) should be easy to understand
  - For a walk up and purchase or use system, the purpose of the system should be easily understandable
- Learnability
  - The user documentation and help should be complete
  - The help should be context sensitive and explain how to achieve common tasks
  - The system should be easy to learn
- Operability
  - The interface actions and elements should be consistent
  - Error messages should explain how to recover from the error
  - Undo should be available for most actions
  - Actions which cannot be undone should ask for confirmation
  - The system should be customisable to meet specific user needs
  - A style guide should be used
- Attractiveness
  - The system design and screen layout and colour should be appealing

Other usability metrics

- Number of errors
  - Interesting to measure, but what does it mean?
- Number of assists
  - Would there be assists in real life?
- Preference for features
  - A formative measure

Why is summative usability testing important?

- Summative testing is about meeting business and user needs
  - Effectiveness: success in achieving goals
  - Efficiency: productivity, staffing, waiting time in line
  - Satisfaction: willingness to use the system

Differences between summative and formative testing

- Formative: diagnosis
  - Identify usability defects
  - Understand user problems
  - Early in design
  - Fast iteration
  - Eliminate as many problems as possible
- Summative: measurement
  - How usable is the product?
  - Does it meet the usability requirements?
  - Does it need further improvement?

Measurement needs a more rigorous procedure

Diagnostic	*Measurement*
3-4 users	at least 8 users
think aloud	natural
prompted	not assisted
informal	controlled
qualitative results	quantitative results

The danger of not setting usability requirements

- New software for issuing UK passports
  - Installed in passport issuing offices
  - Took operators twice as long
  - Caused delays of up to 3 months in obtaining a passport
  - Huge cost of additional clerical staff
- E-commerce web sites
  - User success in purchasing ranges from 25%-42%

Summative testing

- Summative testing is unfashionable
  - Much early usability work used summative methods
    - Whiteside et al, 1988
  - Not always supported by other user centred design activities
  - Gained the reputation for being an expensive way to identify problems when it was too late to fix them!
- The emphasis moved to formative evaluation
  - So-called “discount” usability methods that can be used earlier in development
- Without subsequent summative testing, it is difficult to judge the effectiveness of the usability work

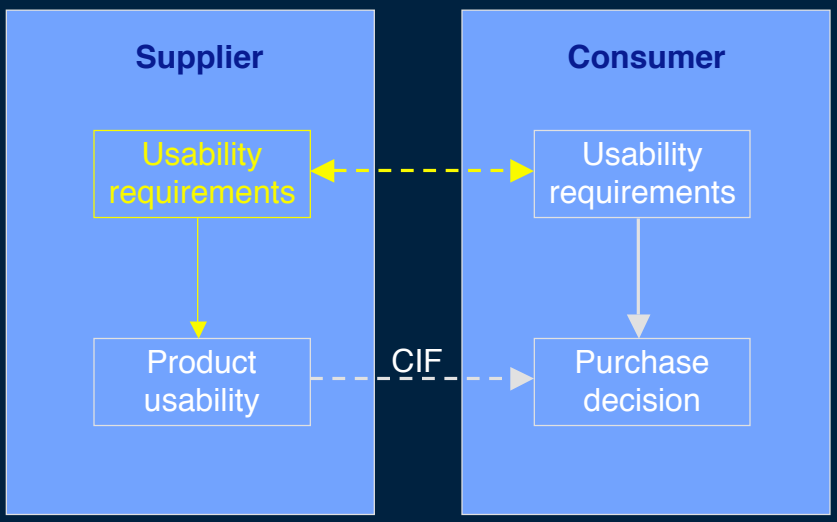
Part 5. Common Industry Format for usability test reports

- NIST initiative
  - National Institute of Standards and Technology
- Suppliers provide standard test reports to purchasers
- Suppliers include:
  - IBM, Microsoft, HP, Sun, Oracle, Compaq
- Purchasers include:
  - Boeing, Northwest Mutual Life, State Farm Insurance, Fidelity, Kodak
- Reports provided in confidence
- Could permit comparisons

CIF motivation

- Boeing
  - "We traditionally have had little visibility of how usable a product will be or how much training and support users will need. This has made it difficult to compare products, to plan for support, or estimate total cost of ownership."
- US WEST
  - "US WEST has been actively participating in [the CIF] initiative and will clearly benefit from the results of this effort such as a standard testing process for usability, a standard specification for reporting usability tests, and other techniques to enable us to partner more effectively with our vendors."
- State Farm Insurance
  - "We have found it difficult to identify software products that meet our needs without contributing to excessive overhead, increasing support costs, or negatively impacting employee productivity or morale. If successful the [CIF] initiative should result in the development of better, more usable software for all of industry."

CIF objectives



Usability test report format

1. Title page
2. Executive summary
3. Introduction
   - 3.1 Product description
   - 3.2 Test objectives
4. Method
   - 4.1 Participants
   - 4.2 Context of use in the test
   - 4.3 Experimental design
   - 4.4 Usability metrics
5. Results
6. Appendices

Product usability requirements format

1. Title page
2. Executive summary
3. Product details
   - 3.1 Product description
   - 3.2 Product objectives
4. Requirements
   - Users, tasks, scenarios, metrics, computer, display, environment

Usability test requirements format

1. Users
2. Context of use in the test
3. Test procedure
4. Usability metrics
5. Appendices

Usability as part of procurement

- Evaluate existing system to establish a baseline
  - Completion rate, task time, user satisfaction
- Specify usability requirements
  - At least as good as the baseline
  - Design issues arising from Baseline evaluation
- [need to use UCD methods in development]
- Evaluate first working prototype of the new system
  - Negotiate solution if targets are not being met

Benefits of the CIF

Problem	Solution
Usability costs money	Usability saves money
Usability is an interface issue	Usability is a business issue
Usability is not part of the process	ISO 13407 user centred design process
No usability requirements	**Use Common Industry Format for requirements**
Customers don't ask for usability	**Provide Common Industry Format usability results**
Buyers can't assess usability	**Ask for Common Industry Format usability results**

Planning & Feasibility	Requirements	Design	Implementation	Test & Measure	Post Release
Getting started	User Surveys	Design guidelines	Style guides	Diagnostic evaluation	Post release testing
Stakeholder meeting	Interviews	Paper prototyping	Rapid prototyping	Performance testing	Subjective assessment
Analyse content	Contextual inquiry	Heuristic evaluation		Subjective evaluation	User surveys
ISO 13407	User Observation	Parallel design		Heuristic evaluation	Remote evaluation
Planning	Context	Storyboarding		Critical Incidence Technique	
Competitor Analysis	Focus Groups	Evaluate prototype		Pleasure	
	Brainstorming	Wizard of Oz			
	Evaluting existing systems	Interface design patterns			
	Card Sorting				
	Affinity diagramming				
	Scenarios of use				
	Task Anaysis				
	Requirements meeting				

www.usabilitynet.org