Common Industry Format for Usability Requirements and Documentation

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Agenda

1. Introduction to the Common Industry Format
   - Relationship between the CIF and international standards
2. Context of use
   - Specifying users, tasks and environments
3. Task scenarios
   - Writing meaningful scenarios
4. Estimating task time
   - Why this matters: common mistakes
5. Accuracy and completeness
   - Estimating business impact
6. Satisfaction
   - Setting satisfaction criteria
7. Using requirements to improve communication
   - Internal communication and contractual requirements
Part 1

Introduction to the Common Industry Format
The importance of user requirements

- Standish Group found that
  - 15% of projects failed
  - 51% 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
Human centred design process for interactive systems: ISO 13407

1. Plan the human centred process
2. Specify the context of use
3. Specify user and organisational requirements
4. Produce design solutions
5. Evaluate designs against user requirements

Meets requirements
# System lifecycle (TRUMP)

<table>
<thead>
<tr>
<th>Plan Process</th>
<th>Specify Context of Use</th>
<th>Specify Requirements</th>
<th>Design Solutions</th>
<th>Evaluate against Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>feasibility</strong></td>
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<tr>
<td><strong>requirements</strong></td>
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<tr>
<td><strong>design</strong></td>
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<td><strong>implement</strong></td>
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<td><strong>release</strong></td>
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[www.usabilitynet.org/trump/ucdmethods](http://www.usabilitynet.org/trump/ucdmethods)
Why is summative usability testing important?

- **Usability**: The 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.

- 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
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%
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
Common Industry Format usability tests

Objectives

- Raise the profile of usability in procurement
- Encourage suppliers to work more closely with purchasers to understand user needs
- A common format for sharing usability data
- Reduce uncontrolled overhead costs of usability problems
- Enable purchasers to compare usability
How it should work

- Purchaser requests supplier to provide a CIF report
  - initially as part of agreed trials

- The supplier may already be planning a usability test
  - may have to adapt the test plan to be suitable for CIF report or

- The supplier asks the purchaser to carry out the test or

- The supplier asks a third party to carry out the test

- The test results help the purchaser decide
  - whether to purchase
  - whether to request changes
CIF objectives

Supplier

Usability requirements

Product usability

Consumer

Usability requirements

Purchase decision

CIF
CIF-R contents

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
Example: CIFWorks Web Software Delivery

• Product Objective
  – The objective of the product is to ultimately replace mailing DVD’s as the default mechanism for shipping software.

• Product Details
  – Name and Version: CIFWorks Web Software Delivery Release 1
  – Intended user groups/populations: System Administrator
  – The product should not require any special training or documentation for its target user audience (System Administrators experienced with server software installation)
  – Type of user work supported by product: Downloading and preparing Site Guard software for installation.
  – Usage environment: Medium to large size corporate and public sector companies.
  – Support for groups with special needs: Product needs to be coded to standards of section 508 of the Americans with Disabilities Act.
CIF Requirements

• Context of use
  – Users
    ◆ Key characteristics and capabilities of each user group for which requirements are provided
  – Goals
    ◆ Main goals for each group with scenarios of use
  – Equipment: technical environment
    ◆ Computer hardware and software
  – Physical and social environments
  – Scenarios of use for most important goals
  – Training scenarios

• Usability measures
  – Effectiveness: unassisted completion rate
  – Efficiency: mean time to achieve goals
  – Satisfaction: mean score on a satisfaction scale
  – Relative user efficiency (optional)
Practical exercise

- Brainstorm situations where usability requirements would be useful
ISO 9241-11 Guidance on Usability

**Usability**: The 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.

**Effectiveness**: The accuracy and completeness with which users achieve specified goals.

**Efficiency**: The resources expended in relation to the accuracy and completeness with which users achieve goals.

**Satisfaction**: The comfort and acceptability of use.
ISO/IEC 9126-1 Software Product Quality Model

**quality in use**

- **functionality**
  - accuracy
  - suitability
  - interoperability
  - security

- **usability**
  - understandability
  - learnability
  - operability
  - attractiveness

- **reliability**
  - maturity
  - fault tolerance
  - recoverability
  - availability

- **efficiency**
  - time behaviour
  - resource utilisation

- **maintainability**
  - analysability
  - changeability
  - stability
  - testability

- **portability**
  - adaptability
  - installability
  - co-existence
  - replaceability
Quality in Use


quality in use

the extent to which a product used by specified users meets their needs to achieve specified goals with effectiveness, productivity and satisfaction in a specified context of use
CIF requirements: Part 2. Context of Use

• Context of use
  – Users
    ◆ Key characteristics and capabilities of each user group for which requirements are provided
  – Goals
    ◆ Main goals for each group with scenarios of use
  – Equipment: technical environment
    ◆ Computer hardware and software
  – Physical and social environments
  – Scenarios of use for most important goals
  – Training scenarios

• Usability measures
  – Effectiveness: unassisted completion rate
  – Efficiency: mean time to achieve goals
  – Satisfaction: mean score on a satisfaction scale
  – Relative user efficiency (optional)
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
Example: Users

• System Administrators are experienced computer professionals whose primary roles are the installation, configuration and administration of multi-user, production, software. These users are typically administrators of other enterprise software products such as operating systems, databases and web servers.

• The most important characteristic of a System Administrator is on the job experience. There are typically two routes by which these users gain experience as a System Administrator:
  – They extend their background from being a PC administrator or power user into the role of a System Administrator by industry training,
  – They grow their skills in an organization under the tutelage of a Senior System Administrator.

• For Web Software Delivery we expect System Administrators to have 1-10 years of experience in their job.
Example: Goals

- The goal is to obtain the appropriate version of the CIFWorks Site Guard software for the appropriate platform in a form ready for installation. There are three tasks associated with electronic delivery.

1. Finding and downloading the Site Guard software via Web Software Delivery
2. Create DVD’s from the downloaded Site Guard software and begin the install, or:
3. Prepare the software for an electronic install and begin the install
Example: Equipment, physical & social environments

- **Equipment**
  - Internet Explorer (6.0 and higher)
  - 10 gigabytes of disk space to download and install
  - 500 megabytes of RAM
  - A 10mbs or faster internet connection.
  - A SVGA compatible monitor.
  - A DVD Burner

- **Physical and Social Environment**
  - Office type environment
  - Typically system administrators multi-task. It is expected that using web software delivery will be mixed in with other support tasks they are completing.
  - There is typically a time lag between acquiring and installing the software and rolling out the software into production. Because of that acquiring and installing the software will likely be part of a planning exercise without mission criticality pressure.
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
CIF requirements: Part 3. Scenarios

• Context of use
  – Users
    ◆ Key characteristics and capabilities of each user group for which requirements are provided
  – Goals
    ◆ Main goals for each group with scenarios of use
  – Equipment: technical environment
    ◆ Computer hardware and software
  – Physical and social environments
  – Scenarios of use for most important goals
  – Training scenarios

• Usability measures
  – Effectiveness: unassisted completion rate
  – Efficiency: mean time to achieve goals
  – Satisfaction: mean score on a satisfaction scale
  – Relative user efficiency (optional)
Task scenarios

• Purpose
  – To provide examples of usage as an input to design, and to provide a basis for subsequent usability testing.

• Benefits
  – It encourages designers to consider the characteristics of the intended users, their tasks and their environment.
  – Usability issues can be explored at a very early stage in the design process (before a commitment to code has been made).
  – Scenarios can help identify usability targets and likely task completion times.
  – The method promotes developer buy-in and encourages a user-centred design approach.

• Similar to essential use cases
Produce scenarios for the context of use

- Choose important examples of usage
  - Include real world details: time pressures, uncertainties, interruptions, etc
  - Base characters on real life users (personas)
  - Include different types of users and goals
  - Try to generate scenarios to cover a wide range of situations, not just the most common ones or those of most interest to the design team.
  - Try to include problem situations that will test the system concept, not just straightforward scenarios.
  - Prioritise by frequency, user importance and/or business importance

- Choose self-contained tasks
  - sequence of activities by an individual that meet a business goal

- What the user wants to do, not how
  - Exclude or minimise references to any technology or product features
Example: Scenario

- Winston is a Senior System Administrator for the University of South-East North Dakota. He administers the systems that run the school’s websites.
- Today he received the email from CIFWorks with his license number and instructions for downloading the software. He has designated a system called “stage_guard” to be the stage for Site Guard. He prints out the email (he can’t access it from stage_guard) and walks over to the stage_guard machine. He logs onto the CIFWorks website. He sees the software that he needs to download and begins the first download. While the first download is completing he looks around on the website for instruction on building a staged install. He sees a link to instructions for staged install on the side of the web page.
- He follows the instructions and begins creating the directories he will need for the install. He unzips the files from the downloads and puts them into the appropriate directories. He goes to the first directory and runs the installer.
Practical exercise

- Define the context of use
- Produce scenarios for the chosen example
CIF requirements: Part 4. Usability measures

- Context of use
  - Users
    - Key characteristics and capabilities of each user group for which requirements are provided
  - Goals
    - Main goals for each group with scenarios of use
  - Equipment: technical environment
    - Computer hardware and software
  - Physical and social environments
  - Scenarios of use for most important goals
  - Training scenarios

- Usability measures
  - Effectiveness: unassisted completion rate
  - Efficiency: mean time to achieve goals
  - Satisfaction: mean score on a satisfaction scale
  - Relative user efficiency (optional)
Case study: Hewlett Packard

User-centred design methods were applied to redesign software used for identifying network problems:

<table>
<thead>
<tr>
<th></th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>time to finish task</td>
<td>9.4 min</td>
<td>4.1 min</td>
</tr>
<tr>
<td>problems identified</td>
<td>16%</td>
<td>78%</td>
</tr>
<tr>
<td>average length of call</td>
<td>30 min</td>
<td>10 min</td>
</tr>
<tr>
<td>size of manual</td>
<td>25 pages</td>
<td>4 pages</td>
</tr>
<tr>
<td>people needing the manual</td>
<td>53%</td>
<td>3%</td>
</tr>
<tr>
<td>user satisfaction rating</td>
<td>3.5</td>
<td>6.8</td>
</tr>
</tbody>
</table>

In addition to the benefits to customers, HP recovered their costs in 18 months
Usability Requirements

- **Purpose**
  - To establish usability requirements which can be tested later in the development process.

- **Benefits**
  - Highlights the importance of usability early in development
  - Provides concrete objectives for usability
  - Provides usability criteria that can be tested.
Usability measures (quality in use)

A ‘black box’ approach
Usability requirements

Volumetrics → Estimate values → Existing system

Requirement

- Effectiveness
- Efficiency
- Satisfaction

Business prototyping

Usability test

- Effectiveness
- Efficiency
- Satisfaction

Actual

- Effectiveness
- Efficiency
- Satisfaction

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Part 4.1 Efficiency

- The resources expended in relation to the accuracy and completeness with which users achieve goals.
Efficiency: mean transaction times

- Depositing Cash
- Withdrawing Cash
- Depositing Cheques
- Withdrawing Cheques

Old system vs. New system comparison in minutes.
Part 5. Accuracy and completeness

- **Effectiveness**: The accuracy and completeness with which users achieve specified goals.

- **How well a user achieves the goals of a task**

- **Does not take into account:**
  - time taken
  - effort required
  - difficulties encountered
Assessing effectiveness

Requirements for goal-oriented approach:

• tangible output
  – evaluation tasks must be chosen to provide tangible output, which can be studied without the presence of the user

• identified goals
  – the goals of the evaluation tasks, and how they are represented in the task output, must be identified prior to the evaluation session
Scoring effectiveness

- Identify elements in task output

- Decide what constitutes an acceptable representation of each element

- Specify a scoring procedure to measure how good each element is compared to what is required
  - Relative importance of each element
  - Inter-dependencies
  - Critical elements
  - Undesirable elements or effects
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
Task scenario: Business process example
[to be presented if there is time]

Ian receives a phone call from Mr Patel complaining that he is currently in receipt of child benefit and is claiming for 2 children, however he is only receiving benefit for 1 child.

Ian looks at Mr Patel's application and award details and finds that the date of birth of one child is wrong. He corrects the date of birth and generates a revised award and payment. Ian records receipt of the phone call and sends a notification of the changed award to Mr Patel.
Effectiveness example

- Input:
  - Phone call

- Output:
  - Corrected date of birth
  - Revised award: payment made
  - Acknowledgement
## Effectiveness calculation

<table>
<thead>
<tr>
<th>Output element</th>
<th>Error scenario</th>
<th>Impact</th>
<th>Business value</th>
<th>Frequency</th>
<th>Value x frequency</th>
<th>Impact x frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgement</td>
<td>Not sent</td>
<td>10%</td>
<td>90%</td>
<td>1%</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>Corrected d.o.b</td>
<td>Wrong d.o.b.</td>
<td>50%</td>
<td>50%</td>
<td>2%</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Payment made</td>
<td>No payment</td>
<td>100%</td>
<td>0%</td>
<td>1%</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>No errors</td>
<td>0%</td>
<td>100%</td>
<td>96%</td>
<td></td>
<td>9600</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
<td>9790</td>
</tr>
<tr>
<td>Mean value</td>
<td></td>
<td></td>
<td>97.9%</td>
<td></td>
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</tbody>
</table>

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Identify usability issues

- Calculate the impact = cost x frequency

- If > 100 identify how the design could be improved to reduce the errors
  - e.g. > 1% chance of unusable output
  - Compile a list of these usability issues
Efficiency as productivity

- Efficiency = effectiveness / resources

- Is it better to be 90% accurate in 10 minutes or 100% accurate in 15 minutes?
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)
Part 6 User satisfaction: SUMI questionnaire

- Software Usability Measurement Inventory, developed by HFRG at UCC (MUSiC), provides a means of analysing the subjective opinions of users of a product
  - requires a working system or prototype and representative tasks
  - 50 item questionnaire answered by end-users following use of system
    - Deliverable: Global measure of usability, plus measures of: perceived efficiency, affect, control, learnability, helpfulness and which responses differed most from expected values
    - Benefits
      - can be easily administered as part of other approaches
      - can make comparisons based on the standardisation database
    - Limitations
      - does not identify specific usability defects
      - requires some skill to interpret and minimum sample size of 8 users
User satisfaction: SUMI questionnaire

[Graph showing the comparison between the Old System and the New System across various dimensions: Global, Efficiency, Affect, Helpfulness, Control, and Learnability. The graph indicates a general trend where the New System outperforms the Old System in most dimensions.]

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1. This software responds too slowly to inputs.
2. I would recommend this software to my colleagues.
3. The instructions and prompts are helpful.
4. The software has at some time stopped unexpectedly.
5. Learning to operate this software initially is full of problems.
6. I sometimes don't know what to do next with this software.
7. I enjoy my sessions with this software.
8. I find that the help information given by this software is not very useful.
9. If this software stops, it is not easy to restart it.
10. It takes too long to learn the software commands.
Example: Usability measures

- Task 1: Download SITE guard software
  - Effectiveness: 90% unassisted task completion rate.
  - Efficiency: 10 minutes of user time.
  - Satisfaction: Total SUMI score of 50.

- Task 2: Burn SITE guard software to DVD and launch installer
  - Effectiveness: 90% unassisted task completion rate.
  - Efficiency: 15 minutes of user time.
  - Satisfaction: Total SUMI score of 50.

- Task 3: Prepare SITE guard software for staged install and launch installer
  - Effectiveness: 70% unassisted task completion rate.
  - Efficiency: 25 minutes of user time.
  - Satisfaction: Total SUS or SUMI score of 50.
Practical exercise

• Specify the requirements for the chosen system
  – Effectiveness
  – Efficiency
  – Satisfaction
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

<table>
<thead>
<tr>
<th>Diagnostic</th>
<th>Measurement</th>
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<tbody>
<tr>
<td>3-4 users</td>
<td>at least 8 users</td>
</tr>
<tr>
<td>think aloud</td>
<td>natural</td>
</tr>
<tr>
<td>prompted</td>
<td>not assisted</td>
</tr>
<tr>
<td>informal</td>
<td>controlled</td>
</tr>
<tr>
<td>qualitative results</td>
<td>quantitative results</td>
</tr>
</tbody>
</table>
Part 7. Using requirements to improve communication

The CIF-R format provides a means for:
1. Customers to discuss their usability requirements with suppliers
2. Customers to specify their usability requirements contractually
3. Supporting communication among members of the development team
   - Reduces risk of product failure
   - Reduces the development effort
   - Supports enhancement and iteratively refining the product
4. Iterative development of requirements
5. Providing a basis for testing and verification
More information and future of the CIF

- ANSI standard: ANSI/NCITS 354
- ISO standard: ISO DIS 25062
- IUSR plans
  - Improved version of the CIF and CIF-R
  - www.nist.gov/iusr
- PRUE web site
  - www.usability.serco.com/prue
- Measuring usability
  - www.measuringusability.com
Discussion

• Can you apply this to systems you deal with?
  – Internal systems
  – Custom designed systems
  – Products