The Design of Interactive Computational Media

Class 3: 25 Sept. 2002

Requirements Analysis: Understanding Users and their Needs

Thanks to Marilyn Mantei for some of the material on Questionnaires and Interviews

Outline (2 hours)

- The concept ("root concept") in Rosson and Carroll)
  - Vision, rationale, goals, requirements, and assumptions
  - Stakeholders
- Understanding users: information gathering in field studies
  - Questionnaires
  - Interviews
  - Ethnography and interaction analysis
- Summarizing and analyzing field data
  - Stakeholder and artifact analysis
  - Task analysis
- Scenarios describing users ("problem scenarios")
- Claims about scenarios

Class Discussion

- *Have you ever designed for users before?*
- *How did you go about doing this?*
- *How were you sure that you met user needs?*

Goals and Requirements

- User needs
  - Start from what users do, how they do it (using field studies)
- Goals, e.g.,
  - Productivity
  - User satisfaction
  - Reliability, safety
- Functional requirements
  - What the new system is to do in general terms
  - What specific capabilities are therefore required
- Technical requirements, constraints, assumptions
  - Price, size, weight, etc.
  - Compatibility with other technologies, adherence to standards

Goals and Requirements

- Measures of success
  - *Absolute*, *objective*, quantifiable, measurable, e.g.,
    - "Productivity" improvement of 10% within 1 year
    - Error-free performance in 1 hour without use of manual
  - *Subjective*
    - Satisfaction expressed by 95% of operators after 6 months
  - *Relative* to current method, e.g., alternative technology
- Priorities and tradeoffs (think of cars, stereos, etc.)
  - High-end in functionality and price vs. low-end
  - General-purpose vs. special-purpose
  - Ease of use and ease of learning
  - Power and simplicity
  - High-speed and error-free performance

Stakeholders — Class Discussion

- *Define stakeholder*
- *Give examples of stakeholders in the case of interactive computational media for*
  - *Elementary school children*
  - *Virtual science fairs*

Understanding Users: Gathering Information in Field Studies

- Talking to users as a means to understanding them
  - Questionnaires about user characteristics, attitudes, skills, tasks, and work practices
  - Interviews about these issues, talking to users to understand who they are and what they do
- Observation of users in their work or social environment, paying particular attention to users, their interactions, their tools, the artifacts they create, the space in which they work

Understanding Users: Analyzing information

- Interpretation of results and synthesis into a description of the users and of the tasks that they do
- More on this later

Questionnaires and Interviews: General Principles

- Talk to a number of representative users
  - Sampling to ensure this
  - Think about social categories — Age, education, socio-economic class, job skills, etc.
  - Sampling broadly or focusing narrowly on a subset of individuals defined in terms of these categories
- Design and test questionnaire; plan and test interview
  - Ask clear questions
  - Ask questions that can be answered validly and reliably
    - Not, for example, when did you stop beating your spouse?
- Be sure that every question has a purpose
- Keep the number of questions low

Questionnaires Can be Used to Measure

- Data about users
  - Demographic information
  - Personality traits
  - Cognitive abilities
- Prior knowledge
  - Task domain
  - Computers
- Attitudes and experiences, including with computers
  - User satisfaction
  - Other perceptions of user experience

Questionnaires CANNOT be Used to Measure

- How fast the user can accomplish tasks
- Where the user will make errors
- What command names to use
- How to organize items in the menu
- Which colors enhance visibility
- How a user learns commands

- In short, questionnaires cannot assess information that the user is unaware of

Questionnaires

- Can be administered in person, or via phone/email/mail
- Must be designed and pre-tested with small samples
- Importance of avoiding bias in question design
- Open-ended versus closed-ended questions
- Advantage: “Precise,” allowing good control and comparability over a set of users
- Disadvantage: Therefore not as adaptable to individual characteristics or specific situations

Design of Questions

- Question formats
  - Check boxes and ranges
    - Gender: Male female
    - Age: 0-20 21-30 31-40 41-50 51-60 71+
  - Likert scales
    - Strongly agree Agree Undecided Disagree Strongly disagree
  - Semantic differential scales
    - Picking numerical value along axis
- Avoiding response bias through poorly worded questions
- More on this topics in tutorial of Oct. 3

Example (due to David Abrams) World Wide Web Survey

The Computer Science Department at the University of Toronto is exploring ways in which people use the World Wide Web (WWW). Please assist us by filling out the following survey. Your answers will be kept strictly confidential. You may contact David Abrams (abrams@cs.toronto.edu) if you have any questions. Thank you for your participation.

Win A New Computer Book

Your completed survey will be part of a drawing for five new computer books complements of Prentice Hall Canada, PTR Division Marketing Department. Enter your ticket number in the space provided below to win.

Ticket Number:	

1)General Usage Characteristics

1.1)How do you describe your WWW experience?

No Experience — Highly Experienced

1 2 3 4 5 6 7

[circle a number]

1.2) On average, how many times do you make use of the WWW per week?_____

1.3) On average, how much time do you spend during each WWW session?

	☐ under 10 min	☐ 10-30 min	☐ 30 min-1hr	☐ 1-2 hrs	☐ 2-3 hrs	☐ 3+ hrs

1.4) How many WWW bookmarks (hotlist items) do you have?

	☐ none	☐ 1-10	☐ 11-25	☐ 26-100	☐ 101-300	☐ 300+

1.5) How do you organize your bookmarks?

☐ I don't organize - they stay in the order which I created them.
☐ I manually re-arrange bookmarks in a list.
☐ I create folders to group together related bookmarks.
☐ I create folders within folders to create a hierarchy of bookmarks.
☐Other (describe)_____

1.6) When do you usually organize your bookmarks?

☐ I store each new bookmark in its place when I create it.
☐ I re-organize my bookmarks at the end of each browsing session.
☐ I organize bookmarks occasionally/sporadically.
☐ I never organize bookmarks.
☐ Other (describe) _____

2) Your Typical WWW Browsing Patterns

Think back to a typical WWW browsing session, for example, the last time when you browsed the WWW for 20 minutes or more.

2.1) Indicate how often you use the following techniques to organize bookmarks on a scale from 1 to 7.

Never — Very Often

1 2 3 4 5 6 7

	___create a new bookmark ___ manually re-arrange bookmarks in a list ___create folders to group together related bookmarks ___create sub-folders within folders to manage a hierarchy	___ change the title of a bookmark ___annotate a bookmark ___delete a bookmark

2.2) Approximately how many new bookmarks do you create during a typical session?

	☐ none	☐ 1-5	☐ 6-10	☐ 11-20	☐ 21 or more

2.3) Rank the importance of each reason for creating bookmarks on a scale of 1 to 7.

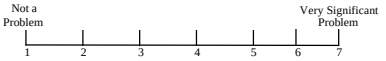
Not Important — Very Important

1 2 3 4 5 6 7

_____ *Temporary Bookmark*: a temporary navigational landmark to come back to later during this session
_____ *Archival Bookmark*: a reference to store for use in future WWW sessions
_____ *Publishing Bookmark*: a hypertext link to add to my own WWW site
_____ *Collaborative Bookmark*: an item to give to a friend or third person
Other (describe)_____

3) Rate Problems You Find with Existing Bookmarks

How significant/bothersome are each of the following possible bookmark problems?



____I have trouble finding a bookmark stored somewhere in my hotlist/archive.
____I open a bookmarked page to remember what's in it because the title doesn't describe the content.
____There's no good way to organize my bookmarks.
____I cannot see all my bookmarks on the screen at one time.
____I cannot easily tell when the content of a bookmarked page changes on the WWW.
_____There's no quick and easy way to store a new bookmark in the correct place and continue browsing the WWW.
Other (describe) _____

4) What do you like most and/or least about WWW bookmarks?

_____
_____
_____

5) Personal Attributes

Gender:	☐ Male	☐ Female

Age:	☐ under 20	☐ 20-29	☐ 30-39	☐ 40-49	☐ 50-59	☐ 60+

THANK YOU FOR YOUR SUPPORT

Interviews

- Best done face-to-face
  - Adaptable to individual characteristics or specific situations
  - But still require careful planning and pre-testing
  - But can also be done over the phone, or the Internet
- How many people to interview
  - Minimum of 3-4 interviews, ideally more
  - More (at least 2 per category) if sampling broadly
- What questions to ask depends on situation
  - Questions about user characteristics, attitudes, skills, tasks, work practices, likes, dislikes, problems

Interviewing Techniques

- Make the interviewee feel comfortable, relaxed (e.g., start with innocent subject)
- Make the interviewee feel important
- Make the interviewee feel safe (e.g., confidentiality)
- Help the interviewee understand what the interview is about (e.g., context, motivation, importance)
- If discussing a system under design, show a prototype
- Keep the interview on track
- Follow leads given by the interviewee
- At end, ask if there is anything else interviewee would like to add
- Be gracious, respectful, and thankful

Recording the Interview

- Notetaking is good, but...difficult to talk and write, consider a two person team
- Audio recording better, but problems to overcome...
  - Poor audio quality
  - Interviewee reluctance — allow turning off tape recorder
- Video recording even better, but problems to overcome...
  - Technical complexity
  - Intrusiveness, possible impact on interviewee

Design of interviews

- Unstructured
  - Conversations, but guided by a plan
- Structured, very similar to asking questions via a questionnaire
- Semi-structured (elements of both styles)
- See Reading #3

Example: Collaborative Writing Interview Protocol of Ilona Posner

- "I am studying how people write together. I would like to talk to you about the most recent (one especially memorable) joint authoring project you participated in. Be assured that all the information you will give in this interview will remain strictly confidential.
- Background
  - *Time:* When did this take place? How long did the entire project take?
  - *Document:* What type of document were you working on? How long was the final document?
  - *People:* Who were the participants? Were these people peers or subordinates or superiors? How were they chosen? Describe the other people's personalities. Did these people possess special skills? (known previously, not, ?) How important was it for everyone to work together?
  - What were you doing at that point in your life? (type of job, educational training?)
  - Describe in detail one day that you were working together on the project (the time of year, weather, location, purpose of meeting, productiveness of meeting, outcome of the meeting…)

Posner Protocol … cont.

- Process
  - Did the writing proceed in stages or steps? What were these stages (planning/writing/revising)? What happened at each stage of the writing process?
  - How did you share the work? Who did what? Was the work evenly divided? How was this decided on? Which stages of the writing (planning, drafting, revising) involved groups of people and which were done by individuals (Q2)?
  - Was the process planned at the start or decided on over time? Was the plan followed?
  - Was the process explicit? (Decide to do A,B,C then do A, B,C, or did individuals just do things?)
  - Was the process used in this joint writing project, similar to your usual writing style when writing alone/ when writing with others?
  - Would you say the process used was a success? Why/why not?

Posner Protocol … cont.

- Control
  - Sometimes one or more persons take charge of the document, often this isn't a bad thing and it may improve the efficiency of the writing. Did this type of thing happen during your writing? Who was this person? How were they chosen?
  - How did you find the errors? How did you fix the errors? Did everyone take part in reviewing the document and suggesting changes? How were the changes done? (permissions?)
  - How was the final document compiled? Was anyone in charge of this stage?
  - Afterwards, how was the credit divided? Was this discussed early on during the writing (How many authors? Who's first?)
- Problems
  - How did the relationships work out?
  - How did you handle/settle your disagreements?
  - What other types of problems did you encounter during the writing?

Posner Protocol … cont.

- Technology
  - What is your educational/technical background (Q1)
  - What type of technology was used in the project? (Computers/typewriters/ telephone/fax/bus?) At what stages of the project was technology used? (Q2)
  - What did you like about the technology you had available to work on this project? What did you dislike about the technology? Did it ever get in the way? What would have make the technology easier to use (Q1)
  - What type of technology would have facilitated the writing process?
  - What else would you like to be able to do with the available technology (Q1)
- Is there anything else? Have I covered everything?
  - Would you say this project was a success?
  - Would you choose these people to work with again?
  - What is you attitude to joint writing? (positive/negative)

Using questionnaire/interview data for design

- User characteristics
- Use scenarios
- Market potential
- Functionality
- Interface design approaches, metaphors

Break

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- The concept ("root concept") in Rosson and Carroll)
  - Vision, rationale, goals, requirements, and assumptions
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- Scenarios describing users ("problem scenarios")
- Claims about scenarios

Ethnography (Suchman & Trygg, 1991, p. 75)

- "Ethnography, the traditional method of social and cultural anthropology, involves the careful study of activities and relations between them in a social setting. Such studies require extended participant observation of the internal life of a setting, in order to understand what participants themselves take to be relevant aspects of their activity. Importantly, this may include things that are so familiar to them as to be unremarkable (and therefore missing from their accounts of how they work), although being evident in what they can actually be seen to do."

Interaction Analysis (Suchman & Trygg, 1991, p. 75)

- "Interaction analysis is concerned with detailed investigation of the interaction of people with each other and with the material environment. Our use of interaction analysis is inspired by prior work in anthropology and sociology, particularly ethnomethodology and conversation analysis... In work settings, where our studies have been centered, our analysis focus on the joint definition and accomplishment of the work at hand, through the organization of interaction and the use of supporting technologies and artifacts."

Key Concepts of Observations

- Focus on observing user behaviour
- Focus on non-verbal behaviour
- How one works is as important as what one accomplishes
- Focus on the use of artifacts

*** VIDEO: Xerox PARC Workplace Project

- A study of airline flight operations at an airport
- Key themes
  - Spaces
  - Centers of coordination
  - Technologies
  - Artifacts

QuickTime™ and a Sorenson Video decompressor are needed to see this picture.

- Included in the video is a scenario describing current practice, Rosson and Carroll's "problem scenario"

Summarizing the Data

- Stakeholder analysis
  - Describing the users and other key groups
- Artifact analysis
  - Describing the environment, facilities, objects, documents, …
- Task analysis
  - Describing the work people do and how they do it

Stakeholders

- Users
- Their spouses
- Their families
- Their caregivers
- …

Characteristics of Users

- Physical characteristics
  - Age, gender
  - "Handicaps", e.g., left-handed, glasses, colour-blind
- Knowledge and experience
  - Computer literacy
  - Domain or task literacy
  - Education
  - Native language, reading level, typing skill
  - System/application background: expert, experienced, novice

Characteristics of Users

- Psychological characteristics
  - Attitude and motivation, e.g., committed, alienated
  - Cognitive style: verbal-analytic, spatial-intuitive
- Job and task characteristics
  - Mandatory vs. discretionary use; regular vs. casual use
  - Level of training, turnover rate
  - Task importance, task structure (see below)
- "Beyond characteristics" —> Surveys, interviews, observation, reflection

Sample User Profiles

Artifact Analysis

- Describing
  - The environment, e.g., rooms, buildings
  - Facilities, e.g., dining rooms, kitchens
  - Objects, e.g., tables, telephones, computers
  - Documents, e.g., schedules, records
- Techniques of artifact analysis
  - Observation
  - Written descriptions
  - Photographic records
  - Video records
  - Copies of artifacts

Task Analysis

- A user/task analysis seeks to uncover:
  - What the user skill sets are
  - What the user's work environment is like
  - How users perform their tasks now
  - What language, mental models users employ in their work
  - What objectives they might have for a product
  - How users might actually use a product
- We seek to learn about user characteristics
  - Task experience and domain knowledge, e.g., by radiologists, telephone switchboard operators
  - Computer literacy, e.g., systems & application experience

Task Analysis

- We seek to understand the users' conceptual model
  - Task structures and organizational patterns, e.g., order taking, order entry, shipping, billing
  - Artifacts or objects used in tasks, e.g., files, forms
  - Organization of artifacts, e.g., page->section->chapter->book->library
- We seek to understand work flow patterns
  - Who performs which tasks and how often
  - Communication patterns among workers

Task Analysis

- We seek to understand relationships between tasks & artifacts
  - How specific forms and files are used in order entry
- We seek to understand use of information in the environment in carrying out a task
  - Things perceived visually, e.g., materials on hand
  - Things perceived acoustically, e.g., conversations of co-workers, opening of door
- We seek to understand the use of other technologies, e.g., phones, voice mail, fax

Task Analysis

- We use the observational methods mentioned above...
  - Notetaking
  - Audio recording
  - Video recording
  - Think-aloud protocols
- ...in order to
  - Observe, describe, and understand current work practice
  - Observe, describe, and understand system usage
  - Listen to users thinking and talking about their work
  - Collect qualitative data, e.g., mental models, emotions
  - Collect quantitative data, e.g., how many? how often? how long?

Scenarios

- A scenario is a description of users and stakeholders using artifacts within environments carrying out tasks or activities
- See examples in Chapter 2 of the text
- Consider example in Xerox PARC video

Scenarios — Class Discussion

- *Imagine a scenario for an electronic classroom*

Features of Scenarios and Claims

- A feature is an aspect of the scenario or solution that is most critical for design
- Example: Electronic classroom
  - Use of technology
  - Use of Powerpoint

Claims Analysis

- Use of technology
  - Allows projection of varieties of materials (+)
  - Causes stress and delays when not working properly (–)
- Use of Powerpoint
  - Students have record of class, need not take detailed notes (+)
  - Students can annotate instructor's notes in their own style (+)
  - Instructors have tendency to present too much material (–)
  - Instructors cannot easily sketch answers to questions (–)

Summary

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