

## 5 Analyzing the Requirements

### 5.1 Context of Requirements Analysis

### 5.2 Analysing Ideas and Concepts: Focus Groups

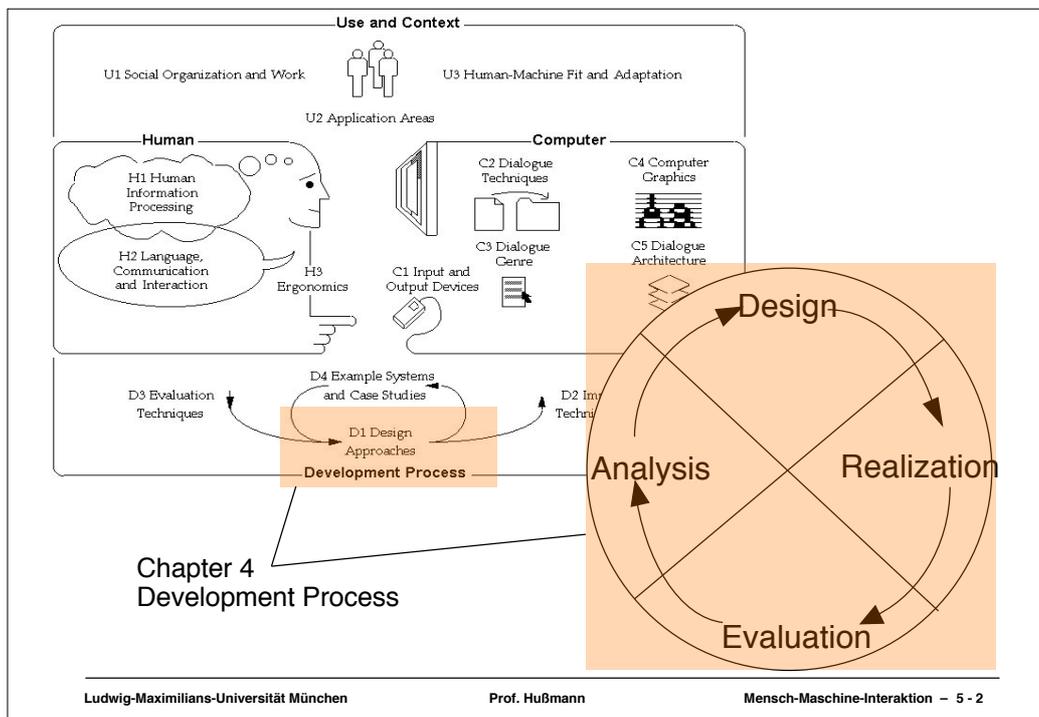
### 5.3 Work Processes Bottom-Up: Ethnographic Observation

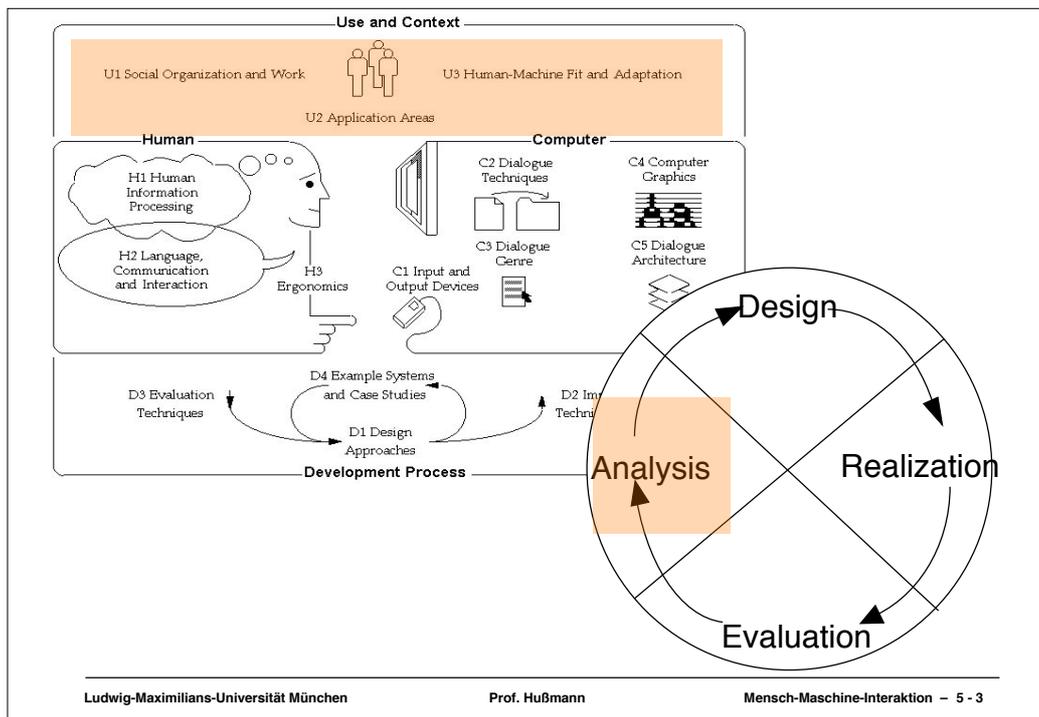
### 5.4 Work Processes Top-Down: Task Analysis

### 5.5 Analysis of Existing Systems

### 5.6 Conceptual Models

### 5.7 Scenarios and Use Cases





## What Do We Need to Analyze?

- Analysis Phase:
  - Access and investigate everything that has a potential impact on the solution
- Most important aspects:
  - Users, their strength and limitations
    - » **People** involved in the operation of the system that is to be build
  - Requirements imposed by the tasks to be supported
    - » **Goals** of the project
  - Available options for the implementation of a system (e.g. technologies)
  - Border conditions for development and deployment
    - » **Processes** that are improved, changed, or replaced
    - » **Economic** constraints
    - » **Organizational** constraints and company/customer policies

## Identifying the Goals of a Development Project

- Why is a new software or system created? What is the main purpose?
  - Replace or improve on an existing system
  - Streamline operation and optimize work processes
  - Introduce a new process or a new option for a process
- In what context is this developed?
  - During continued operation
  - In a restructuring phase
  - In a start-up phase of a company or operation
- What is the role of the software/system?
  - Driver for restructuring
  - Only one issue within a set of changes made in the organization
- How important is the system to the customer?
  - Mission critical, essential for sustaining business
  - Just a nice additional piece to have

## Understanding the People Involved

- Who are the people involved?
  - Who are the decision makers?
  - Who are the users?
  - What relationships exist between users?
  - What relationships exist between users and decision makers?
  - What roles do users have (customer, administrator, controller, supervisor, ...)?
  - Which tasks (in the real world and in the system) are performed by the user?
  - Why do people use a system and what is their motivation?
- Remember Shneiderman's 1st principle: "Recognize User Diversity"

## Processes

- By introducing or changing software we affect processes in the real world, e.g.,
  - People will be able to do certain tasks they could not do before
  - Certain tasks will be automatically done without user involvement
  - Specific tasks will be speeded up and others may be slowed down
  - The quality of tasks and operations will be improved
  - **Certain processes become traceable and people can be made accountable**
  - Some operation will be made easier others will be more complicate
- Often related to rationalization of the workflow
- Change is not always welcome by everyone

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## Focus Group – Basics

- Informal group gathering
  - 6 to 12 people
  - Focus on a specific topic
  - Group discussion as means of communication
- Gather **qualitative** data from a group of people
- Get indication how people think and feel
- Collecting **opinions, attitudes, feelings, perceptions, and ideas**
- Get examples and rich descriptions
- Understand why people act or react in a certain way
- Can be used in different project phases, not suitable for formal evaluation



Foto from <http://www.focusgroupdimensions.com>

## Creating a Focus Group

- Selecting people for a focus group
  - Balance between similarity and productive heterogeneity
  - Usually not representative
  - In general do not mix people that are at different levels in company hierarchy
  - In general do not mix people that have very opposite views
  - Do not set up a group where everyone has the same views
  - Diversity is useful
  - Too small groups do not generate a discussion, too large groups make it hard to involve all participants
- Consider having different focus groups to get information from different angles
  - One group with men and one with women
  - One with managers and one with sales staff
- Expected group dynamics and behavior should allow a constructive discussion

## Planning a Focus Group Discussion

- Organize an appropriate location and time slot (1-2 hours)
  - Unobtrusive audio/video recording facilities
- Prepare a set of open ended questions and discussion points
  - 4 to 10 questions
- Set questions that to allow group dynamics and spontaneity
- Focus groups can take place once or can be run as a program of focus group sessions
- Invite participants individually and explain the concept of the focus group and its purpose
- Prepare material that makes the discussion more tangible
  - e.g. product prototypes, concept video

## Running a Focus Group Session

- Moderator keeps the group focused and the discussion moving
- Start with an introduction and provide name tags to participants
- Explain the rules of the discussion (e.g. confidentiality)
- Start with simple non-controversial questions
- Pose open-ended questions
- Avoid question that lead to specific answers
- Allow for diverse opinions and for equal opportunities in the discussion
- Encourage each participant to express their own point of view
- Consensus between participants is not required
- Capture or record the session (video, audio, note taking)



## Pros and Cons of Focus Groups

- Advantages
  - Wide range of information
  - In-depth information (Why user ...)
  - Possibility to explore related topics or go into more detail
  - Cheap and easy to do
- Disadvantages
  - Sampling of participants is not random nor representative
  - The moderator plays a significant role and can influence the results
  - No quantitative information can be gathered
  - Findings can not be easily generalized

## When to use Focus Groups?

- Generating ideas for a new product or a product improvement
- Comparison of two or more candidate designs for a product
- Explore and generate a hypotheses for a following study
  - <http://www.soc.surrey.ac.uk/sru/SRU19.html>
  - <http://www.bren.ucsb.edu/academics/courses/281/Readings/whatarefocusgroups.pdf>
  - <http://www.useit.com/papers/focusgroups.html>
  - <http://www.usabilitynet.org/tools/focusgroups.htm>
  - <http://www.humanfactors.com/downloads/sep04.asp>

## Focus Groups – Discussion

- Should focus groups be used?
- What focus groups would be appropriate?
- What are the requirements for the moderator?
- Image you have the following project to do...
  - Football championship web page for mobile device access (reporting of the daily results)
  - Micro-payment service on the website of Bravo-TV
  - Information web site on social benefits of the city council of Munich
  - Introduction of advertising on the university main website
  - Age verification (e.g. over 18) on web sites
  - Pay-per-view provision of adult content on mobile devices
  - Streaming video (e.g. selected TV shows) on a mobile phone

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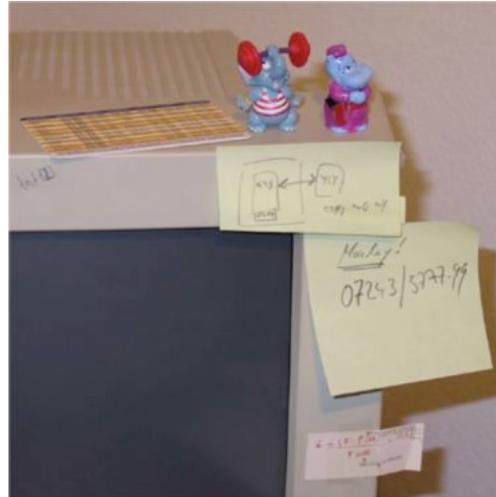


## Contextual Enquiry

- Investigating and understanding the users and their environment, tasks, issues, and preferences
  - Analyzing users' needs
  - Related to task analysis
- Observing and interviewing users in their environment while they do their work
  - Done by visits in context
- Further Information:
  - <http://www.infodesign.com.au/usabilityresources/analysis/contextualenquiry.asp>
  - <http://www.infodesign.com.au/usabilityresources/analysis/userprofileforms.asp>
  - <http://www.sitepoint.com/article/contextual-enquiry-primer>

## Ethnographic Observation in HCI Interviews

- Prepare a set of questions beforehand
  - What do you want to know from the user?
- Tell people what are you doing
- Use capture (audio/video) if your communication partners agree
- If applicable capture (take photos/video) material they use in their work (e.g. a manual, a checklist, the post-its around the screen)
- If possible summarize what your interview partner told you (to minimize misunderstandings)



## Collecting Ideas from People in the Context of their Everyday Life



Figure 1. A cultural probe package.

- Cultural Probes
- Package of materials, e.g.
  - Postcards
  - Disposable camera
  - Maps
  - Photo Album
  - Media diary
- Instructions for actions to be taken
- To provoke (contextual) inspirational responses from the users
- Over a period of time
- User centered inspiration

Gaver, W., Dunne, T., Pacenti, E.: Design. Cultural probes, *ACM interactions* 6(1), 1999

## Cognitive Walkthrough

- Technique for evaluating the design of a user interface
  - In early phases applied to pre-existing systems or early “mock-ups”
  - Special emphasis on how the system supports “explorative learning”
- Prerequisites:
  - General description of intended users and their knowledge
  - Specific description of one or more representative tasks to be performed with the system
  - List of correct actions required to complete each task
- Stepwise walkthrough
  - Often by user interface designer and his peers (at least one person using, one recording)
  - Stepwise examination of whether users easily find the next correct action
    - » Accessibility of control element, match of control element with user's goals, feedback provided after the control is acted on
- John Rieman, Marita Franzke and David Redmiles: Usability Evaluation with the Cognitive Walkthrough, Tutorial at CHI'95

## What and When to Observe



From chapter 12  
[www.id-book.com](http://www.id-book.com)

- Goals & questions determine the paradigms and techniques used.
- Observation is valuable any time during design.
  - Quick & dirty observations early in design
- Observation can be done
  - in the field (i.e., field studies) and
  - in controlled environments (i.e., usability studies)
- Observers can be:
  - outsiders looking on
  - participants, i.e., participant observers
  - ethnographers



## Frameworks to Guide Observation

From chapter 12  
www.id-book.com

- *The person.* Who?
- *The place.* Where?
- *The thing.* What?

The Goetz and LeCompte (1984) framework:

- *Who* is present?
  - What is their role?
- *What* is happening?
- *When* does the activity occur?
- *Where* is it happening?
- *Why* is it happening?
- *How* is the activity organized?



## The Robinson (1993) framework

From chapter 12  
www.id-book.com

- *Space.* What is the physical space like?
- *Actors.* Who is involved?
- *Activities.* What are they doing?
- *Objects.* What objects are present?
- *Acts.* What are individuals doing?
- *Events.* What kind of event is it?
- *Goals.* What do they to accomplish?
- *Feelings.* What is the mood of the group and of individuals?

## Observations & Protocols

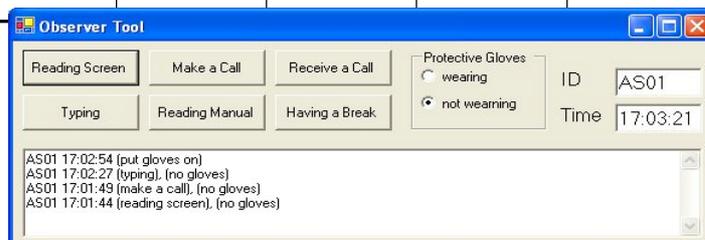
- Paper and pencil
  - Cheap and easy but unreliable
  - Make structured observations sheets / tool
- Audio/video recording
  - Including audio & still picture
  - Cheap and easy
  - Creates lots of data, potentially expensive to analyze
  - Good for review/discussion with the user
- Computer logging
  - Reliable and accurate
  - Limited to actions on the computer
  - Include functionality in the prototype / product
- User notebook/diary
  - Request to user to keep a diary style protocol

## Structured observations

- Observation sheet

time	typing	reading screen	consulting manual	phoning	...
14:00		X		X	
14:01	X		X		
14:02	X				
14:03	X				
14:04				X	
...					

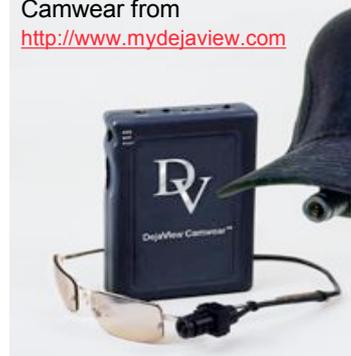
- Electronic version



## Video Observation (1)

- Observation is done with one or more cameras
- Cameras provide pictures of regions important to the task
- Camera attached to the user may be useful
  - Camera embedded into glasses
  - Allow the observer to see “through the eyes” of the user
- Different view points simultaneously
  - Camera overlooking the workplace
  - Camera looking from the screen to the user
  - Camera capturing what the user sees

Camwear from  
<http://www.mydejaview.com>



## Video Observation (2)

- Can be used
  - When only the user can be present
  - In dangerous environments
  - When many users interact and tasks are complex
  - When only selective data is required
  - For tasks that are done very quickly or hard to observe
- To speed up analysis the captured video material should be time stamped and correlated with other events
  - E.g. only look at the video from the moment when a “new mail arrived” notification is issued till the user enters the email client
- Analysis of raw material is very time consuming!
  - 3h to 20h for 1h recording
  - Automatically annotate video recordings (time stamps)

## Using Further Information Sources

- Sensors (e.g. motion, touch, RFID, ...)
  - When did the person leave the room?
  - When did the person get something out of the shelf?
  - When did the person meet another person?
  - Where did the person go?
- Logfile of the interactive devices (e.g. key-logger, application logger)
- Log all the data (video, sensors, key input) with time stamps
- Use sensor information to find the video scenes that are of interest, e.g.
  - Get me all video scenes that show what the user is doing before she/he switches to application X
  - Show me all sequence where users have to input a password

## Data Analysis for Observations



- *Qualitative data - interpreted*
  - & used to tell the 'story' about what was observed.
- *Qualitative data - categorized*
  - using techniques such as content analysis.
- *Quantitative data*
  - collected from interaction & video logs.
  - Presented as values, tables, charts, graphs and treated statistically.
  - To be used with care! (Is the information basis representative?)



## Interpretative data analysis

- Look for key events that drive the group's activity
- Look for patterns of behavior
  - Critical incident analysis
  - Content analysis
  - Quantitative analysis - i.e., statistics
- Test data sources against each other - triangulate
- Report findings in a convincing and honest way
- Produce 'rich' or 'thick descriptions'
- Include quotes, pictures, and anecdotes
- Software tools can be useful

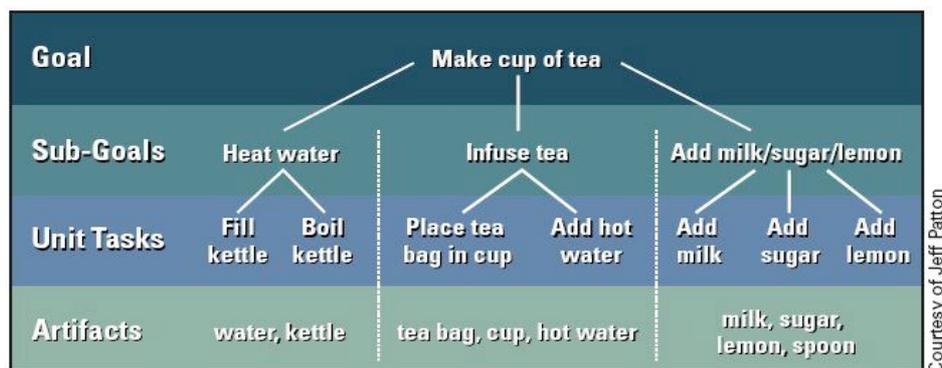
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## Task Analysis - Motivation

- The actions performed by the user to accomplish a task
  - That is what we can observe
  - Does not deal directly with the mental model of the user
- Example – setting up a video projector:
  - unpacking the projector and placing it on the table
  - connecting the power cable to the projector and the socket
  - connecting a data cable between projector and computer
  - switching on the projector
  - waiting for the projector to be ready
  - switching the computer to dual screen mode
- Some issues
  - There is no single way to do that...
  - Granularity and details
  - Order of action

## Task Analysis - Example



William Hudson. HCI and the web: A tale of two tutorials: a cognitive approach to interactive system design and interaction design meets agility. *ACM interactions* 12(1), 2005, 49-51

## Task Analysis – High level Questions

- How do users know their goal is attainable?
- How do users know what to do?
  - Analyze what the user has (or users have) to do in order to get a job done
    - » What (physical) actions are done?
    - » What cognitive processes are required?
    - » What information is used?
    - » What information is created?
- How will users know they have done the right thing?
- How will users know they have attained their goal?
  
- The task analysis is usually in the context of an existing system or for a established procedure
- The analysis is most often hierarchical
  - Task → sub task → sub sub task ...
  - Understand how a task is composed of sub tasks

## Task analysis Set of basic questions

- Who is going to use the system?
- What tasks do they now perform?
- What tasks are desired?
- How often are the tasks carried out?
- What time constraints on the tasks?
- What knowledge is required to do the task?
- How are the tasks learned?
- Where are the tasks performed (environment)?
- What other information and tools are required to do the task?
- What's the relationship between user & data?
- What is the procedure in case of errors and failures?
- Multi-user system: How do users communicate (CSCW Matrix)?

## Task Analysis – How To?

- Task decomposition is at the center of the method
  - Identify high level tasks
  - Break them down into the subtasks and operations
- Task flows and alternatives
  - Identify for elementary subtasks their order (task flow)
  - Identify alternative subtasks
  - Understand and document decision processes (how are alternative subtasks chosen?)
- Present the result of the task analysis as chart
  - Charts may have different levels (overview and detailed subtasks)
  - Show sequences, alternatives, ordering in the diagram
- Questions that help in decomposition of tasks
  - How is the task done?
  - Why is the user doing this task?

See also: <http://www.usabilitynet.org/tools/taskanalysis.htm>

## Hierarchical Task Analysis

- Identify the goals the user wants to achieve
- Relate the goals to tasks (and potentially planning) done by the user
- Task decomposition
  - Ordering
  - Alternative plans
- How to limit the tasks to consider?
  - Defining a threshold based on probability of the task and cost in case of failure
  - If  $(\text{failure\_cost}(\text{task}) * \text{probability}(\text{task})) < \text{threshold}$   
do not further consider this task
- For a detailed discussion on Task Analysis (hierarchical task analysis, knowledge based analysis, entity-relationship based technique, see Dix et. al – chapter 7 )

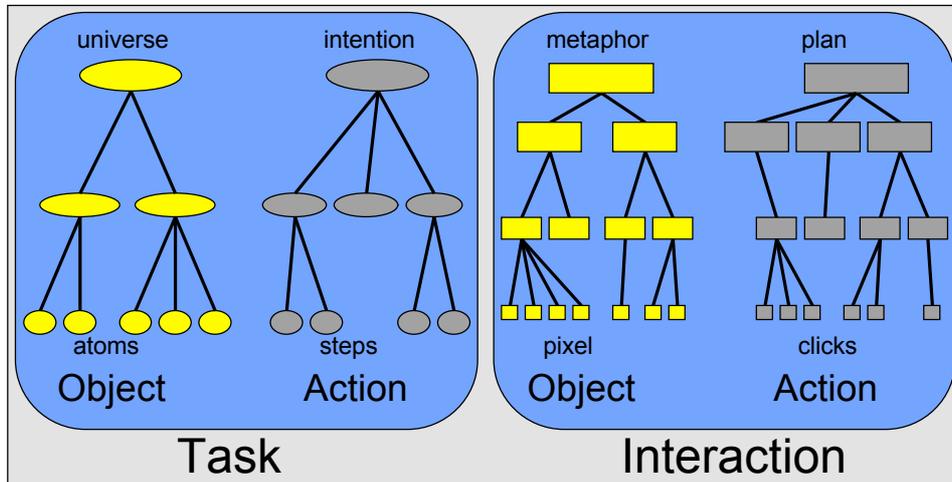
## Alternatives

- Task decomposition
  - Top-down approach
  - Breaking tasks into sequences of actions
- Knowledge based analysis
  - Bottom-up approach
  - Grouping simple actions and objects into classes by similarity
- Entity Relationship based analysis
  - Bottom-up approach
  - Defining objects, actors, actions and their relationship

## Object-Action Interface Model (OAI)

- Targeted at GUIs and applications in real world domains
- Steps
  1. Understanding the task, including
    - » Universe of the real world, objects, atoms
    - » Actions user can apply to objects, intention to steps
  2. Create a metamorphic representation of interface objects and actions
    - » Object representation – metaphor to pixel
    - » Actions – from plan level to specific clicks

## Object-Action Interface Model (OAI)



## Diary Study

- A study that asks people to keep a diary, or journal, of their interactions with a computer system, any significant events or problems during their use of a system, or other aspects of their working life.
- A diary typically asks a user to record the date and time of an event, where they are, information about the event of significance, and ratings about how they feel, etc.
- An interesting alternative for making diary entries is to give users a tape recorder and a list of questions, so that users don't need to write things down as they encounter them.

(Usability glossary from [www.usabilityfirst.com](http://www.usabilityfirst.com))

## Diary study - Discussion

- ... your current homework includes a diary study
- What is a diary study good for?
- What are potential problems with this study type?
- How can technologies such as voice recorders, cameras, mobile phones help?

Image from: John Rieman. The diary study: a workplace-oriented research tool to guide laboratory efforts. Proceedings of the SIGCHI conference on Human factors in computing systems. pp 321-326. 1993.

Day: <u>Tues-9/15</u>		Categories: Fill in at End of Day													
I.D.: <u>7</u>		Talk in Person	Talk on Phone	Write	File	Organize	Fill in Forms	Paper Mail	E-Mail	Process	Spreadsheet	Other Compute	Personal	Reading	Class
Activity Log: Fill in Every Half Hour															
8-8:30	Got coffee Checked e-mail														
8:30-9	Phoned garage about car More e-mail														
9-9:30	Met with student														
9:30-10	AI class														

Figure 1. The beginning of a diary log sheet for one day. The participant records activities on the left as the day proceeds. The researcher assigns categories during the end-of-day debriefing.

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