5 Analyzing the Requirements

Use and Context

U1 Social Organization and Work

U3 Human-Machine Fit and Adaptation

U2 Application Areas

Human

H1 Human Information Processing

H2 Language, Communication and Interaction

H3 Ergonomics

Computer

C2 Dialogue Techniques

C4 Computer Graphics

C3 Dialogue Genre

C5 Dialogue Architecture

C1 Input and Output Devices

D3 Evaluation Techniques

D4 Example Systems and Case Studies

D1 Design Approaches

D2 Im... Techni...

Development Process

Chapter 4
Development Process

Design

Analysis

Realization

Evaluation

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What Can Keep Projects From Failing?

- Study by Standish Group, 1995
- Interviews with IT executive managers
- What causes projects to succeed?

Project Success Factors	% of Responses
1. User Involvement	15.9%
2. Executive Management Support	13.9%
3. Clear Statement of Requirements	13.0%
4. Proper Planning	9.6%
5. Realistic Expectations	8.2%
6. Smaller Project Milestones	7.7%
7. Competent Staff	7.2%
8. Ownership	5.3%
9. Clear Vision & Objectives	2.9%
10. Hard-Working, Focused Staff	2.4%
11. Other	13.9%

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

5 Analyzing the Requirements

How to Perform a Requirements Analysis?

(From a user-centered point of view...)

- General methods, before knowing user community in detail:
  - Surveys, opinion polls
  - E.g. Internet polls
- Methods applicable when user groups are roughly known:
  - Focus groups
  - Interviews
  - Diary studies
- Methods targeting very specific user groups:
  - Ethnographic observation
  - Task analysis

Focus Group – Basics

- Informal group gathering
    - 6 to 12 people
    - Focus on a specific topic
    - Group discussion as means of communication
- Gather *qualitative* date 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

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

5 Analyzing the Requirements

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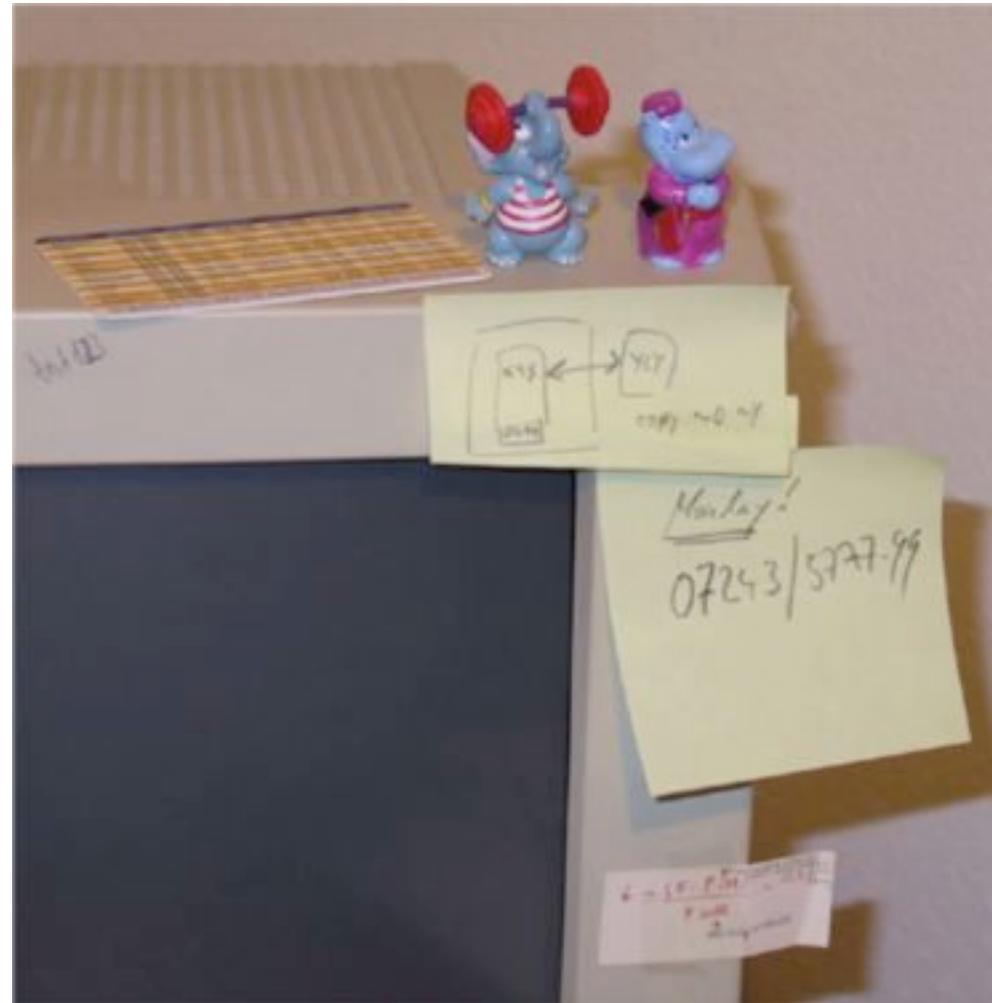
Collecting Ideas from People in the Context of their Everyday Life

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

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 ("5W+H"):
- *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?

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
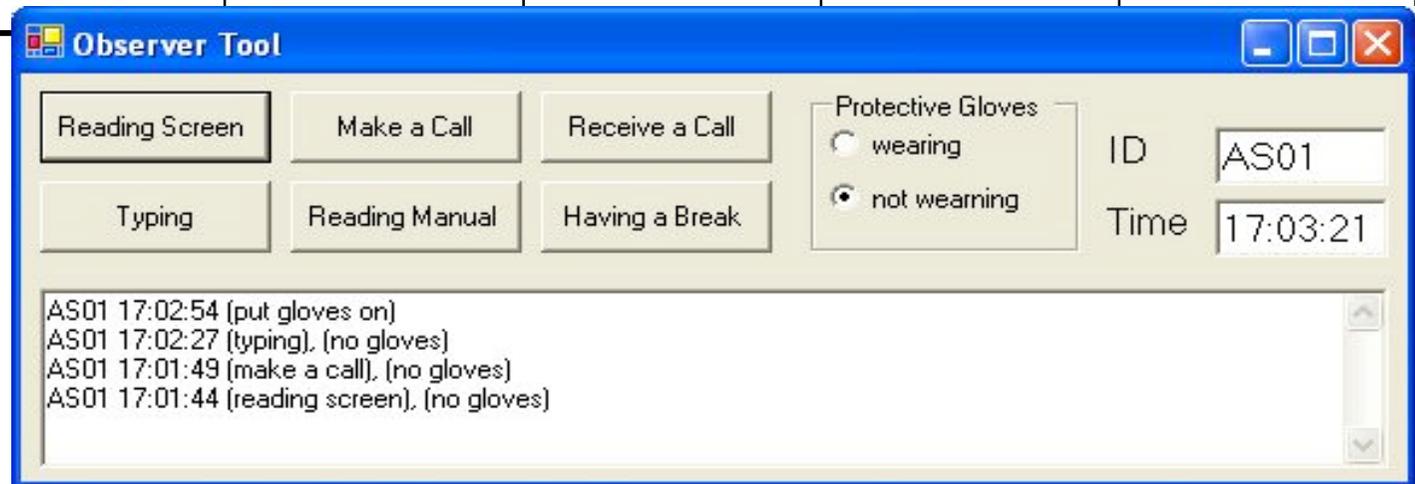
Video Observation

- 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
- Analysis of raw material is very time consuming!
    - 3h to 20h for 1h recording
    - Automatically annotate video recordings (E.g. time stamps, possibly triggered by events)
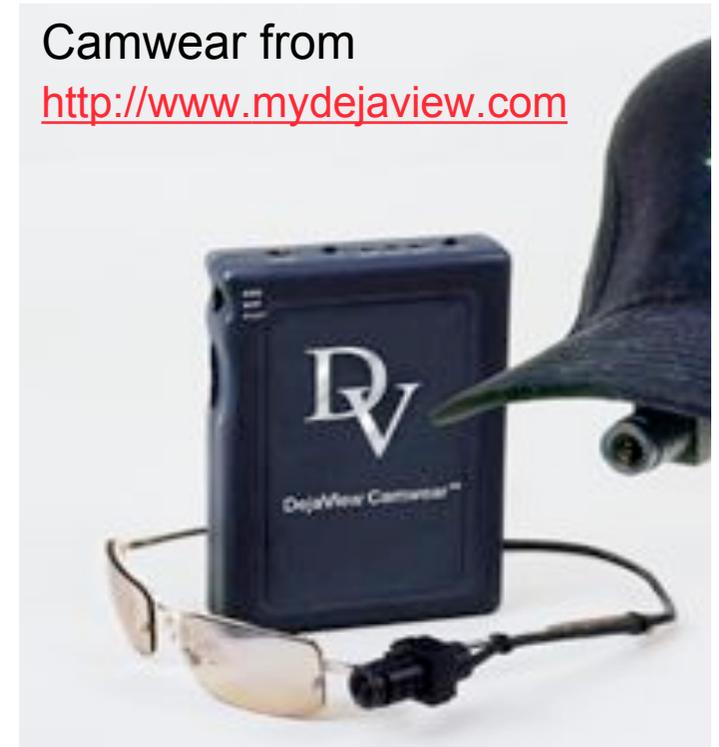
Using Further Information Sources

- 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

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 (or a mobile phone...) 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)

Data Analysis for Observations

- *Qualitative data - interpreted*
  - Used to tell the 'story' about what was observed
  - Key events, patterns of behavior
  - Include quotes, pictures, anecdotes in report

- *Qualitative data - categorized*
  - Using techniques such as content analysis
  - "Triangulation" between different data sources

- *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?)

5 Analyzing the Requirements

Task Analysis - Motivation

- Activities in daily life are driven by goals
  - E.g. "I want to show the pictures on my computer screen to the whole audience"
- Sequences of actions can be quite detailed
  - E.g. for 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
- Pure observation may miss key points
  - Equivalent sequences of actions, variants in order of actions, granularity ...

Task Analysis - Example
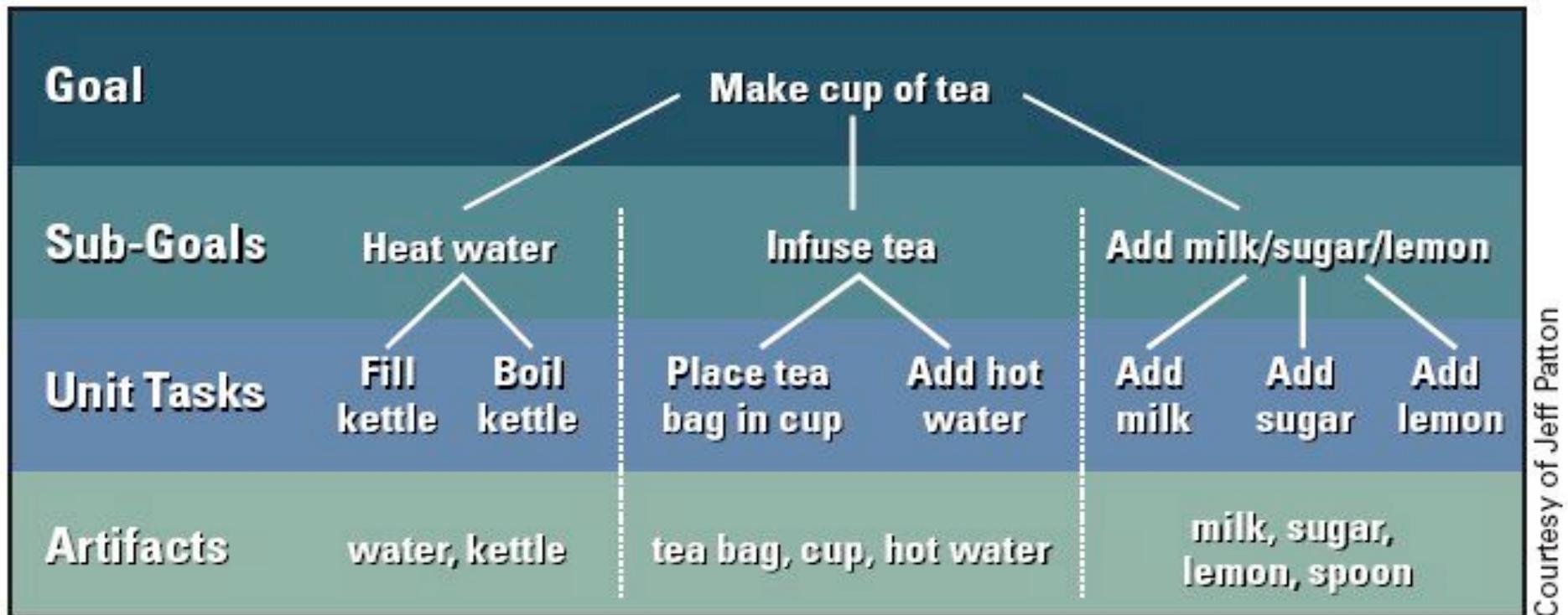
Courtesy of Jeff Patton

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?
- 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 – 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

Action-Object vs. Object-Action

- Universal duality between Object & Action
  - Shall we name the object first and look for an adequate action?
  - Shall we name the action first and look for an adequate object?
  - Two different ways to structure the world...

- For "task analysis":
  - Implicit assumption of action-first approach?
  - More "object-oriented" alternative?

- Advantages of an object-based approach:
  - Easier to adapt to new tasks
  - Tasks are in general more easily changed/removed/added than objects we are working with
  - Better fit with human techniques for structuring complex situations
    - » Generalization/specialization, Part-of hierarchies

Mapping Human Tasks to Man-Computer Interaction
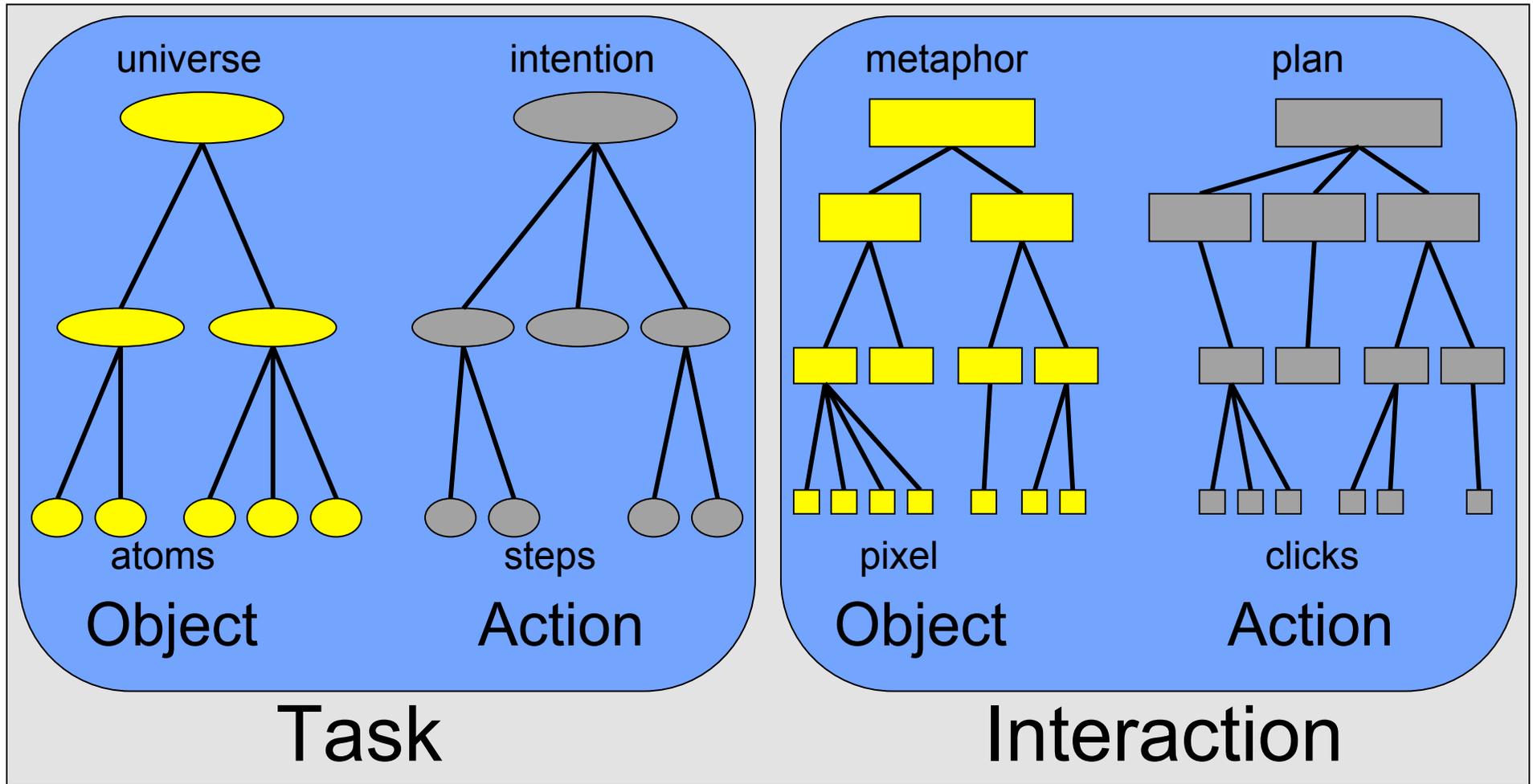
From Shneiderman

References

- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale: Human Computer Interaction (3rd edition), Prentice Hall 2003

- Jennifer Preece, Yvonne Rogers, Helen Sharp: Interaction Design, Wiley 2002

- M. D. LeCompte, J. Preissle: Ethnography and qualitative design in educational research (2nd ed.), Academic Press 1993

- Gary Gaffney: Contextual enquiry - a primer, www.sitepoint.com

- 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

- C. Wharton, J. Rieman, C. Lewis, P. Polson: The cognitive walkthrough method - A practitioner's guide. In: J. Nielsen & R. L. Mack (eds.), Usability inspection methods, Wiley 1994

- A. Khella: Objects-Actions Interface Model
http://www.cs.umd.edu/class/fall2002/cmsc838s/tichi/oai.html