Task Analysis, Alternative Views of Contextual Inquiry

Challenges with Successful Design

One Laptop Per Child

- Estimated 150 million laptops would be shipped by 2007

- What happened?
  - Aggressive response by PC industry (Intel/Asus – EeePC and Microsoft – $3 for Windows)
 - Failure to understand the developing country environment

OLPC

- Couldn't get cost down to $100 – cost $199 excluding deployment costs – say 10% per machine
- Geared toward education, but neglects cost of teacher training, additional software, maintenance and support
  - OLPC never had resources to provide any of these things
- Requirement to buy minimum 1 million units also caused many governments problems
  - Reduced number to 250 000
- Finally, teachers current culture resists introduction of laptops
  - I'm not convinced there is any value to computer in elementary school classroom for lessons (research, yes)

Lessons from OLPC

- Diffusing a new technology requires understanding the local environment
  - Not all governments function the same
  - Social , economic, and cultural environments affect penetration
- Innovative IT does not stand alone
  - Complimentary assets to be valuable
  - A work system (more on this today)

Lessons from OLPC (2)

- Assumptions:
  - Ref Benjamin Cohen's blog
  - More laptops/child => more progress
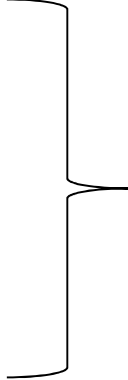 - Value of technology
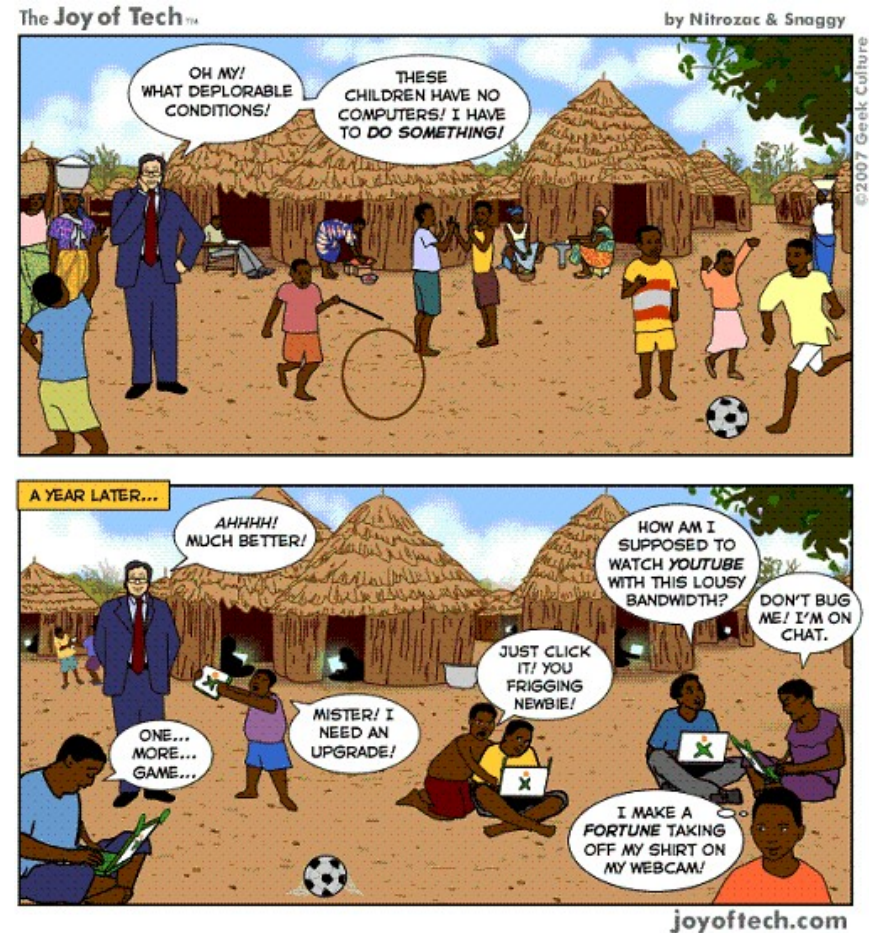
Lessons from OLPC (3)

- Smartphone in 3rd world
 - Good or bad idea and why?

Task Analysis

Contextual Design: Stages

- Interviews and observations
  - Done this
- Work modeling
  - Five Models
- Consolidation
  - Affinity diagrams + consolidated models

Contextual inquiry

- Work redesign
- User environment design
- Prototypes
- Evaluation
- Implementation

Contextual Inquiry: Questions we must answer

- Who is going to use the new system?
- What tasks does the user now perform?
- What tasks are desired in the redesign?
- How will the new tasks be learned?
- What other tools does the interviewee have that will still exist?
- How does interviewee communicate with others involved?
- How often will the new tasks be performed?
- What are the time constraints on the new tasks?
- What happens when things go wrong in performing the new tasks?

Contextual Inquiry

Task Analysis

Model of User

Data Collection

Contextual Inquiry
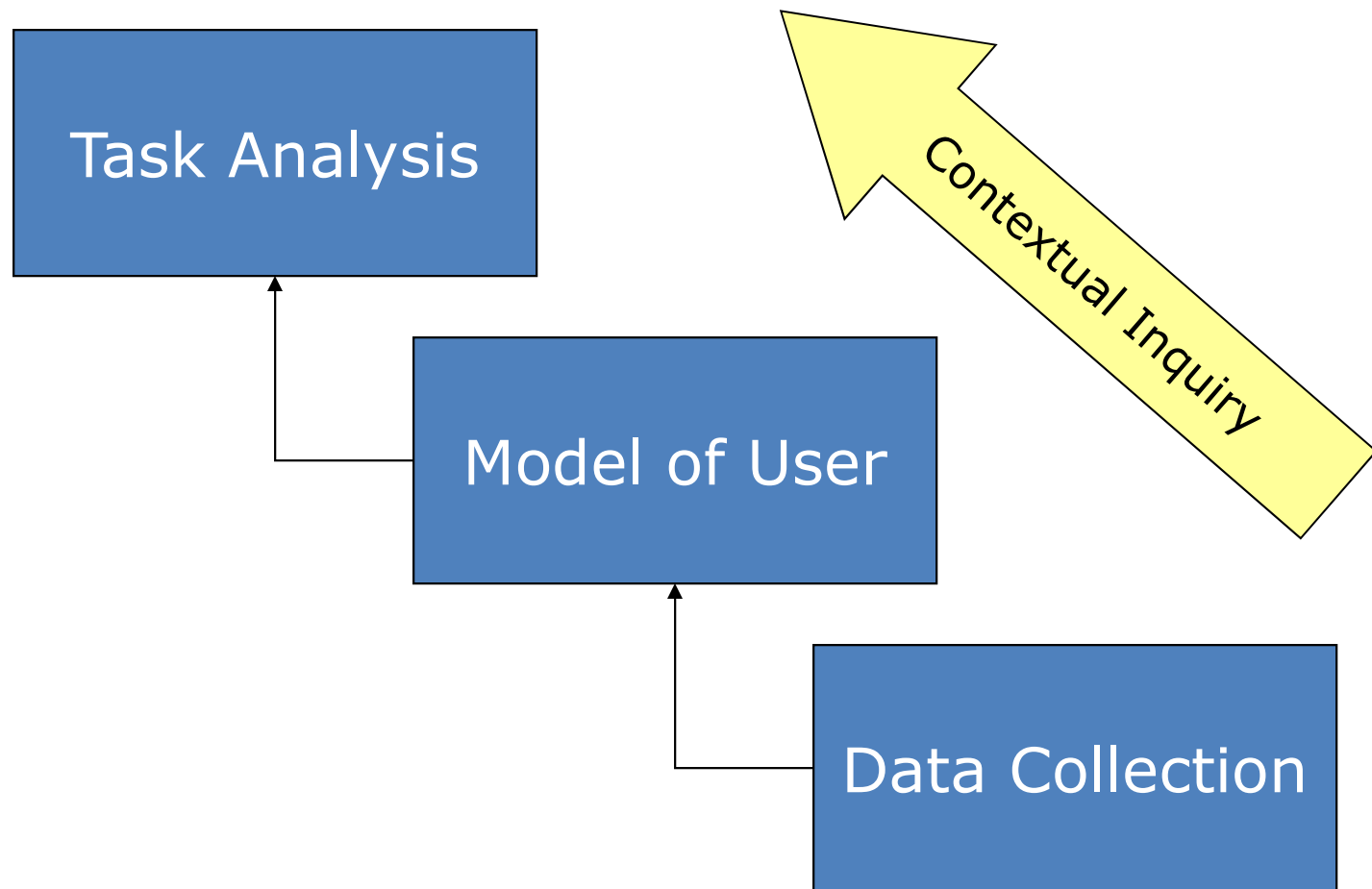
Task Analysis

- Contextual inquiry is all about understanding and redesigning a set of *tasks*
- Task analysis = a view of people interacting with technology to achieve change in an application domain
- Application domain = abstraction of real world
  - E.g. a database system, the cloud
- Work system = people plus technologies
  - E.g. a smartphone user and his or her phone
- Definition of a *task*:
  - A goal together with some ordered set of actions

Goals

- *A goal is a state of the application domain that a work system wishes to achieve. Goals are specified at particular levels of abstraction*
  - Designing Interactive Systems, p. 505

- Note:
  - Goals can be achieved in a variety of ways
  - Individual users can have goals, but so can groups, organizations, or even work systems (e.g. autonomous agents)

Tasks and Actions

- A task is a set of actions
- A task is typically an abstraction of the actions that are required to complete a task
  - i.e. a task has a level of abstraction associated with it
  - Examples
    - Get a cup of tea
    - Schedule a meeting
- An action is a low-level task
  - No problem solving
  - No control structure

User Modeling/Task Analysis

- Challenging issue due to wide variety of user tasks
- Many techniques for modeling user using a specific piece of software
- Two different alternative views
  - Action-centric, i.e. those concerned with the steps involved in completing a task
    - Hierarchical Task Analysis
  - Cognition-centric, i.e. how users think, solve problems, learn, remember, and visualize/model/understand to accomplish the task
    - GOMS

What

How

Starting Work Redesign

- Need to pick a specific task that you want to redesign
  - You don't want to solve every problem a subject has
  - You may have some idea of the problem you want to solve already
- Need to find the correct level of task
  - Not adding name to a form
  - Not providing the SAP version of pharmacy management tools
  - Somewhere in between

Task Decomposition

–Aims:

  describe the actions people do
  structure them within task subtask hierarchy

–Focus on Hierarchical Task Analysis (HTA)

  text and diagrams to show hierarchy
  plans to describe order

Textual HTA description

Hierarchy description ...

    0. in order to clean the house

        1. get the vacuum cleaner out

        2. get the appropriate attachment

        3. clean the rooms

            3.1. clean the hall

            3.2. clean the living rooms

            3.3. clean the bedrooms

        4. empty the dust bag

        5. put vacuum cleaner and attachments away

... and plans

    Plan 0: do 1 - 2 - 3 - 5 in that order. when the dust bag gets full do 4

    Plan 3: do any of 3.1, 3.2 or 3.3 in any order depending
        on which rooms need cleaning

N.B. only the plans denote order

Generating the hierarchy

①   get list of tasks

②   group tasks into higher level tasks

③   decompose lowest level tasks further
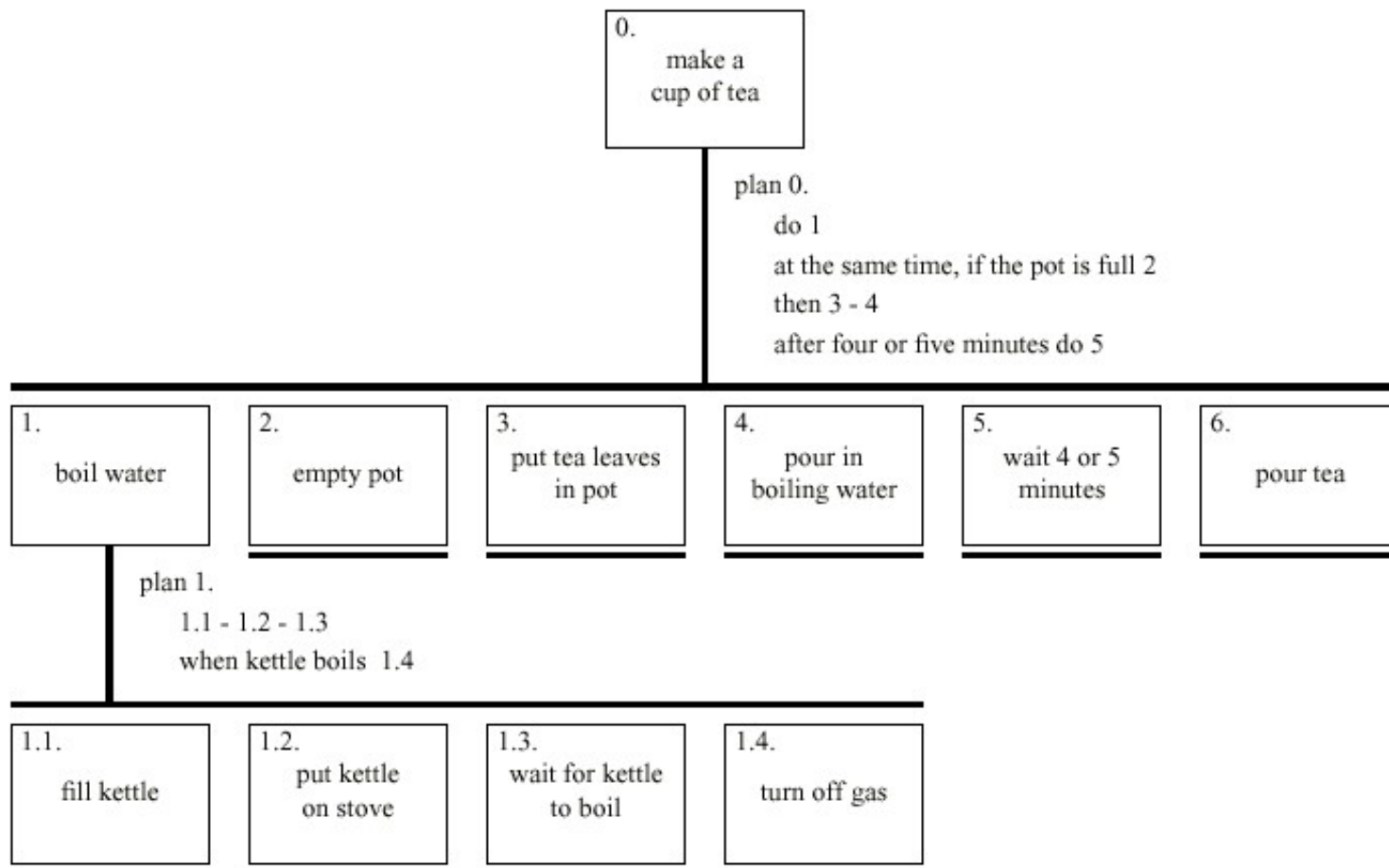
Stopping rules - How do we know when to stop?

      Is "empty the dust bag" simple enough?

      Purpose: expand only relevant tasks

      Motor actions: lowest sensible level

Diagrammatic HTA

Refining the description

Given initial HTA (textual or diagram)
How to check/improve it?

Some heuristics:
paired actions
e.g., where is `turn on gas'
restructure
e.g., generate task `make pot'
balance
e.g., is `pour tea' simpler than making pot?
generalize
e.g., make one cup or two
….. or more

Using HTA

- Need a task at high enough level that it can be redesigned
  - But not too high
- Very domain dependent
  - If it feels difficult to re-engineer how something is done, move up
  - If it feels that your system is pervasive in work practice, move down

Goal Hierarchies (GOMS)

- Original technique for modeling tasks in HCI
- Many problems with it to describe real world tasks
  - Focus is on specific actions performed in software
  - Does a poor job of describing interaction of tasks
- Still works well within software application

GOMS

- Goals what the user wants to achieve

- Operators basic actions user performs

- Methods decomposition of a goal into subgoals/operators

- Selection means of choosing between competing methods

GOMS example

GOAL: ICONISE-WINDOW
.   [select GOAL: USE-CLOSE-METHOD
        .   MOVE-MOUSE-TO-WINDOW-HEADER
        .   POP-UP-MENU
        .   CLICK-OVER-CLOSE-OPTION
    GOAL: USE-L7-METHOD
        .   PRESS-L7-KEY]

For a particular user:

Rule 1: Select USE-CLOSE-METHOD unless another rule
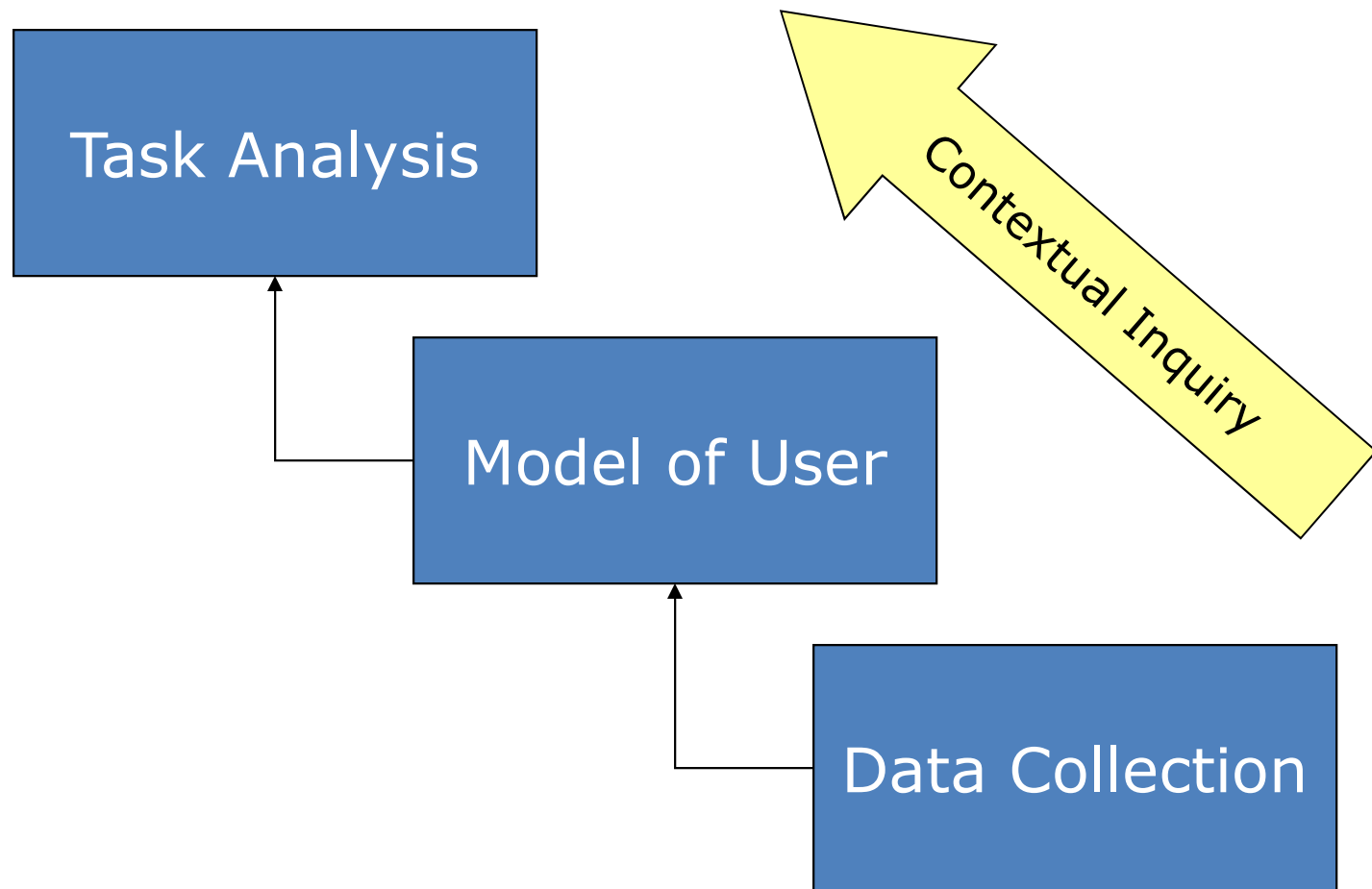   applies
Rule 2: If the application is GAME, select L7-METHOD

Problems with Goal hierarchies

- A post-hoc technique
  - Starting with goals (i.e. tasks) to model user
- Expert vs. novice

- How representative of people are they?
  - See example …

Alternative Views of CI

Contextual Inquiry

Task Analysis

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Contextual Inquiry

Alternative Views of Contextual Inquiry

- User-Centered Design
  - Participatory Design/Cooperative Design
- Socio-Technical Models of System Design
  - USTM/CUSTOM
  - OSTA
  - Ethics
- Try to encompass the technical, social, organizational and human aspects of design
- Soft Systems Methodology
  - Explicit recognition of distinction between real world and system

User-Centered Design

- Users are taken as center of the design process
- Contextual Design, Participatory Design are types of user-centered design
- Answer questions before design:
  - Who are the users?
  - What are their goals?
  - What is the user's background/experience level?
  - What functions do users need?
  - What information do users need?
  - How do users think system should work?
- And USE the answers in design

Participatory Design

- Originally developed as cooperative design in Scandinavia
  - When cooperative design was moved to U.S., term "cooperative" didn't resonate
  - Implied managers and workers on equal footing
- Tries to move end-users into the world of developers
- Many use term user-design as opposed to user-centered design
  - User-centered design does not imply user-design

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USTM/CUSTOM

- Uses diagrammatic task models and English descriptions
  - Goal is to combine structured methods like HTA with human factors
- USTM is larger version
- CUSTOM is a variant used by small organizations
  - CUSTOM also has a very short version represented by a set of questions

CUSTOM

- Goal of CUSTOM is to establish stakeholder requirements
  - Anyone who is impacted by the system's success or failure
- Separated into four levels:
  - Primary: Direct users
  - Secondary: Those who don't use system but receive output or provide input
  - Tertiary: Those who are also affected but won't necessarily ever have direct contact with system
  - Facilitating: Designers and developers of the system

CUSTOM

- Applied early in design
  - Product opportunity stage
- Manual including forms and questions
- Set of questions such as:
  1. Describe the organizational context
  2. Identify stakeholders
  3. Identify work-groups
  4. Identify task-object pairs
  5. Identify stakeholder needs
  6. Consolidate and check requirements

CUSTOM

- Fairly straightforward
- Gives good overview of system tasks from all perspectives
- Time consuming and cumbersome for many systems
  - Secondary and Tertiary stakeholder lists can get huge
  - Also bogged down in facilitator tasks …

Shortened custom

- Given a stakeholder
  - What does stakeholder have to achieve?
  - Sources of satisfaction and dissatisfaction
  - Knowledge and skills
  - Attitude towards work and technology
  - Work group attributes that might affect success of technology with stakeholder
  - What task in terms of frequency, fragmentation, and choice of actions
  - Responsibility, security and privacy issues?
  - Physical conditions where work is performed.
- Basically just understand the person you are designing for!

What can you do with CUSTOM?

- Can be useful for creating *personas* for design
- Persona:
  - A fictitious end-user of a system you are building
  - Consists of a name ('Robert')
  - A picture
  - Textual description of person
  - A quote or two
- CUSTOM can be used to generate all of the above.
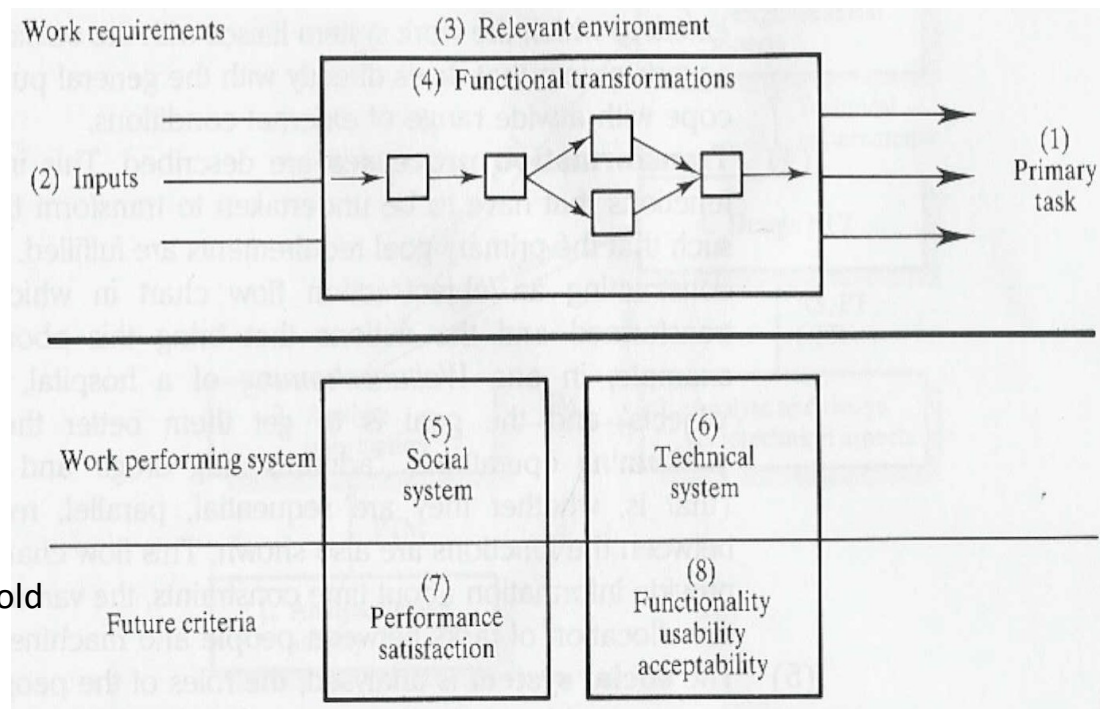
From creativecommons.org

OSTA

- Open Systems Task Analysis
- Specifies social aspects of system with technical aspects
- Goal is to understand how a computer will transform the workplace
- Results are depicted in flow charts and descriptions (prose)

OSTA steps

1. Specify primary task
2. Identify task inputs
3. Analyze external environment
   - Physical, economic, political, demand for output
   - Importance varies – e.g. public or private system
4. Transformation processes are described
   - Inputs to outputs
5. Social system is analyzed
   - Roles of people
6. Technical system is analyzed
   - How new system integrates with old work practices
7. Performance satisfaction
   - Social system requirements
8. Technical requirements stated
   - Functionality, usability criteria, etc.

Work requirements   (3) Relevant environment
(4) Functional transformations

(2) Inputs

(1) Primary task

Work performing system | (5) Social system | (6) Technical system

Future criteria | (7) Performance satisfaction | (8) Functionality usability acceptability

What you can do with OSTA

- It's like a simpler form of sequence, flow, and cultural models
- Basically organizes similar information so it can serve as data during design discussions
  - Understand work requirements, transformations, primary task of system (above the line)
  - Understand the constraints on system design and development (below the line)

ETHICS

- Addresses social and technical issues using separate design teams
  - Design teams work separately and then attempt to merge solutions
- Tries to generate multiple solutions and select solution which does well in both technical and social aspects

ETHICS

1. Problem is identified. Objectives and tasks identified. Job satisfaction requirements specified
2. Two design teams are established
3. Alternative solutions against criteria established in (1)
4. Solutions checked for compatibility
5. Compatible solutions ranked against criteria
6. Detailed designs developed
- The bridge-building problem:
  - Meeting in the middle

Summary of Socio-Technical

- Many different models but one focus
  - Understand both the social and technical aspects of the system
  - Human and technology perspective on all solutions
- In some ways, technical gets in the way
  - Emphasizes designing a solution rather than understanding the situation
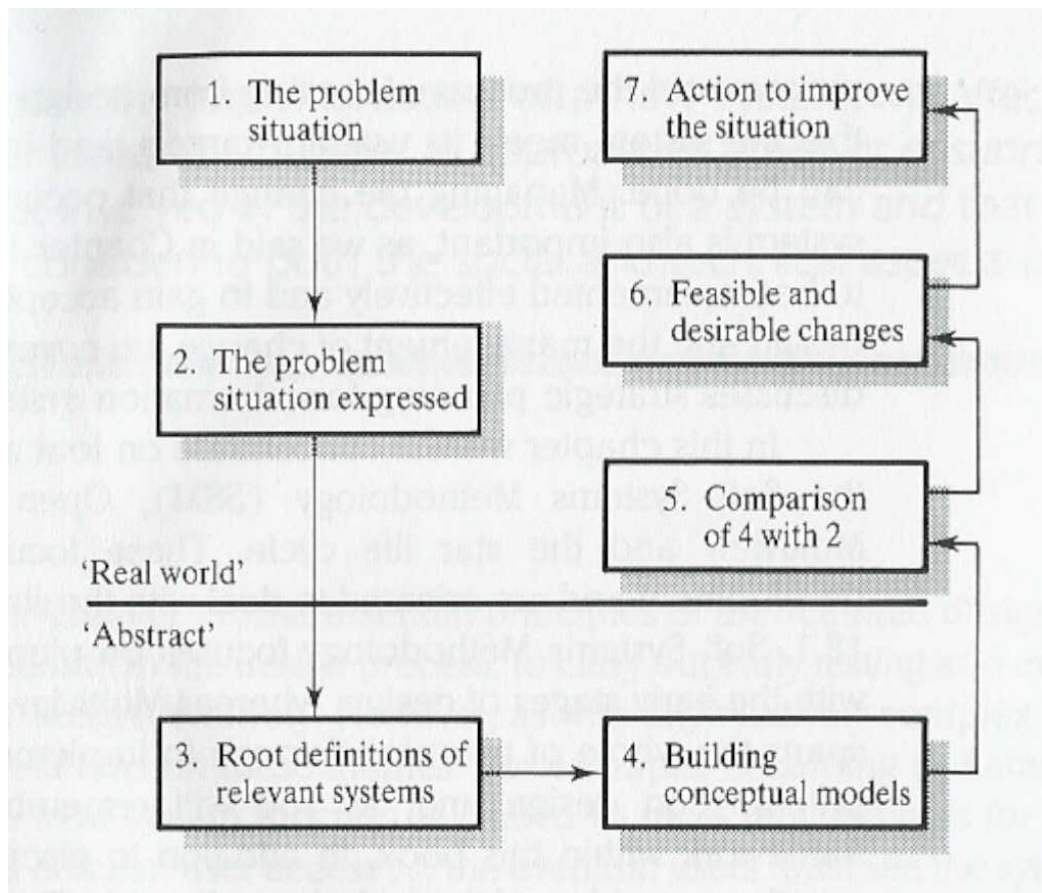
Alternative Views of Contextual Inquiry

- Socio-Technical Models of System Design
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- Try to encompass the technical, social, organizational and human aspects of design
- **Soft Systems Methodology**
  - Explicit recognition of distinction between real world and system

Soft Systems Methodology

- Focuses on understanding situation
- Views technology and people as components
- Flexible approach to detailed consideration of context
- "Soft"
  - No single answer
  - Takes practice to use effectively
- Only useful if it helps developer understand the wider system

SSM

1. The problem situation
2. The problem situation expressed
3. Root definitions of relevant systems
4. Building conceptual models
5. Comparison of 4 with 2
6. Feasible and desirable changes
7. Action to improve the situation

'Real world'
'Abstract'

- First recognize problem and develop a rich picture
  - Stakeholders, tasks, groups, organizational structure, etc.
  - Lots of contextual inquiry
- Move to system world and generate a "root definition"
  - Can be from any (or each) stakeholders perspective
- Build conceptual model
  - What system must do
  - Hierarchical modeling of transformations and activities
- Check the system for compatibility and make improvements

Other Views of CI: Redux

- Many useful concepts embedded in these other views
  - Stakeholders
  - User-Centered Design vs User-Design
- Similar thread
  - Combine an understanding of real world interactions of users with the design of technology

Why Contextual Design?

- I like the explicit aspects of contextual design
  - First interview
  - Then model users
  - Then identify task for redesign
- CD supports distributed cognition through artifacts
  - Models, affinity, UED
  - Not commonly part of other methods (though there's nothing wrong with using them)
- I find CD more useful from an educational perspective
  - Techniques can be adopted in any environment

Why talk about other techniques

- Waterfall problem with CD
  - Things don't always move forward in nice sequences
- Some information in other models can aid CD
  - Think stakeholders in CUSTOM
  - Think above/below the line in OSTA
  - Think assessing models against breakdowns as described in SSM