Task Analysis

John Stasko

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Agenda

- ## Task Analysis
  - Overview, utility
  - Types of task analysis
  - Sources and use

Task Analysis

- Analyzing and describing how people do their jobs/work
  - -> Go to their environment

- Examine users' tasks to better understand what they need from interface and how they will use it

Components

Review

- Three key components to include in discussing how people work
  - Activities
  - Artifacts
  - Relations

- Don't just focus on computer system artifacts and interactions

- Study related processes and objects in the environment that people may use and involve
  - Example: office env---papers, whiteboards, etc.

Task Analysis Focus

Review

- Focus on <u>observable behaviors</u>
  - What are the practices, methods, steps, objects, …, used?

- Observe users, what they do, less so how they do it

- Not on internal cognitive state of user (more on that in the future)

Input & Output

- Gather data about what users need to do or accomplish

…then…

- Represent data for interpretation and use in design decisions

Input & Output

- Gather data:
  - Documentation
  - Interviews
  - Observation
  - Surveys/questionnaires
  - Automatic data recording/tracking
- Organize Data
- Represent Data:
  - Lists, outlines, matrices
  - Narratives
  - Hierarchies & Networks
  - Flow charts

Last Time

Today

Data to be Gathered

- ## Information about users

- ## Description of environment
  - Where the tasks will be performed

- ## Major goals of the job
  - What will result in a successful end state?

- ## User preferences & needs
  - Before they even start: coffee, pen, notebook, log sheets…

Data to be Gathered ...

- Tasks & Subtasks:
  - Physical
  - Cognitive
  - Communication

- Conditions under which these tasks are done

- Results/outcomes of tasks

- Requirements to perform task:
  - Information
  - Communication with others
  - Equipment

Must include
Should include
Could include
Exclude

Now What?

- You have piles of notes, hours of video, surveys up to here...

- How can you digest and represent the **data**, to turn it into **information?**

Representing Data (=Output)

1. Essential use cases

2. User characteristics + personas

3. Task Outlines

4. Narratives

5. Hierarchies & Network Diagrams
   – Hierarchical Task Analysis (HTA)
   – Entity-Relationship Diagrams

6. Flow Charts

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1. Essential Use Case (Scenario)

- Description of important or frequent user interactions

- Used to evaluate / walkthrough various design alternatives

- Three elements
  – Name
  – User intention
  – System responsibility

- Do NOT make assumptions about the UI design

Essential Use Case Example

Arrange-Meeting

USER INTENTION	SYSTEM RESPONSIBILITY
Arrange a meeting	Request meeting attendees and constraints
Identify meeting attendees and constraints	Suggest potential dates
Choose preferred date	Book meeting

Essential Use Case Example

Get foreign currency	
User's purpose	**System responsibility**
Identify self.	Validate user's identity. Display currencies available.
Select currency required.	Display exchange rate.
Enter amount of foreign currency required.	Calculate exchange (e.g. £ to $).
Confirm amount.	Request initiation of payment. Obtain authorisation for amount. Give money.
Take money and go.	

From *User Interface Design and Evaluation*, The Open University

2. User Characteristics + Persona

- Description of user and what user wishes to do

- Be specific/detailed, even give names and picture

- Three personas for ATM usage follow
  - Adapted from *User Interface Design and Evaluation*, The Open University

- Developed by Cooper (1999)

Characterizing Users

Table 5 ATM user groups (adapted from Stone, 2001)

User characteristic	ATM customer characteristics, by group		
	Teens/Young adults	*Young adults to middle age*	*Middle age to senior citizens*
Age	12 to 25.	25 to 50.	50 to 80+.
Sex	Both male and female.	Both male and female.	Both male and female.
Physical limitations	May be fully able-bodied, or may have some physical limitations in relation to, for example, hearing or sight. Will be of varying heights.	May be fully able-bodied, or may have some physical limitations in relation to, for example, hearing or sight. Will be of varying heights.	May be fully able-bodied, or may have some physical limitations in relation to, for example, hearing or sight; mobility, or use of hands. Will be of varying heights.
Educational background	May have minimal or no educational qualifications.	May have only minimal educational qualifications.	May have only minimal educational qualifications.
Computer/IT use.	Probably have some prior experience of computer or IT use.	May have little or no prior experience of computer or IT use.	May have little or no prior experience of computer or IT use.
Motivation	Probably very motivated to use the ATM, especially in relation to their banking habits.	Could be very motivated to use the ATM, especially if they can do their banking quickly and avoid queuing in a bank.	Could be very motivated to use the ATM, but would probably prefer to stand in a queue in the bank.
Attitude	Attitudes to use may vary, depending on the services the automated teller offers and the reliability of the technology itself.	Attitudes to use may vary, depending on the services the automated teller offers and the reliability of the technology itself.	Attitudes to use may vary, depending on the services the automated teller offers and the reliability of the technology itself.

From *User Interface Design and Evaluation*, The Open University

Felix (representing teenage ATM users)

Felix is 13 and gets pocket money each week. He spends it with his friends, so doesn't make regular deposits. He does receive gifts for his birthday, Christmas, etc. and saves that money for special purchases, such as a computer games console or trendy clothes. He has an ATM card allowing him to make withdrawals when needed for his purchases.

Sandra (representing young adults thru middle age)

Sandra is 30, is married to Jason, has two children Todd(6) and Carly (18 months). They live in a subdivision that is about three miles from the town center, where the bank and stores are located. Jason uses the car for work, and works long hours, leaving at 6:45 am and returning at 8:00 pm. Sandra does not drive, so has to use public transportation. She tries to run errands and shop while Todd is in school, so she does only has to take Carly to town with her. She typically needs to make two trips to town each week to get everything done. She uses a stroller with Carly, and the bank is one flight up via escalator, so she prefers to use the ATM outside the first floor, even though there is no canopy to protect customers from bad weather.

Grandpa Marvin (representing middle age to senior citizens)

Marvin is 68 years old, and his social security is deposited into his bank account at the start of each month. He goes to the bank every week, withdrawing enough cash for the week - for miscellaneous expenditure. Regular bills are paid by check. He stands in line for a live teller, as he prefers the social interaction to using an ATM, even though his new artificial hip makes standing in line uncomfortable. He does not have an ATM card.

3. Task Outlines

- Lists, outlines, matrices
  - Use expanding/collapsing outline tool
  - Add detail progressively
  - Know in advance how much detail is enough
  - Can add linked outlines for specific subtasks

  - Good for sequential tasks
  - Does not support parallel tasks well
  - Does not support branching well

  - Example, next slide

Slide 21

Using a lawnmower to cut grass   Task Outline

Step 1. Examine lawn
- Make sure grass is dry
- Look for objects laying in the grass

Step 2. Inspect lawnmower
- Check components for tightness
  - Check that grass bag handle is securely fastened to the grass bag support
  - Make sure grass bag connector is securely fastened to bag adaptor
  - Make sure that deck cover is in place
  - Check for any loose parts (such as oil caps)
  - Check to make sure blade is attached securely
- Check engine oil level
  - Remove oil fill cap and dipstick
  - Wipe dipstick
  - Replace dipstick completely in lawnmower
  - Remove dipstick
  - Check that oil is past the level line on dipstick
  - ...

Slide 22

4. Narratives

- Narratives
  - Describe tasks in sentences
  - Often expanded version of list or outline
  - More effective for communicating general idea of task
  - Not effective for
    - Details
    - branching tasks
    - parallel tasks

- GREAT as introduction to diagrams or outlines

5. Hierarchies & Networks

- Hierarchical Task Decomposition
  - Goals – what the user wants to achieve
  - Tasks – do these to achieve the goals
    - Sequential dependencies
      - Create new document before entering text
    - Multiple occurrences of tasks
    - Subtasks – lower-level tasks
  - The lowest-level subtasks get mapped onto one or several UI commands
    - ie, *move* done by a *copy* followed by a *paste*

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5. Hierarchies & Networks

- Hierarchical Task Analysis (HTA)
  - Graphical notation & decomposition of tasks
  - Tasks as sets of actions
  - Tasks organized into plans
    - Clusters of subtasks with a preferred order and prerequisite conditions

0. Conduct accident investigation

Plan 0: On instruction from supervisor do 1;
When all evidence is collected do 2 through 5.

| 1. Collect evidence | 2. Analyze facts | 3. Integrate facts and draw conclusions | 4. Validate conclusions | 5. Make recommendations |

Plan 1: First do 1 and 2,
then 3 and 4, then 5;
Repeat 3 and 4 if necessary.

| 1. Walk the accident site | 2. Identify and preserve evidence | 3. Identify witnesses | 4. Interview witnesses | 5. Review records |

Plan 1.4: Do 1, 2, 3;
Do 4 if insufficient data from 3;
Then do 5;
Repeat 3 and 4 to meet conditions of 5.

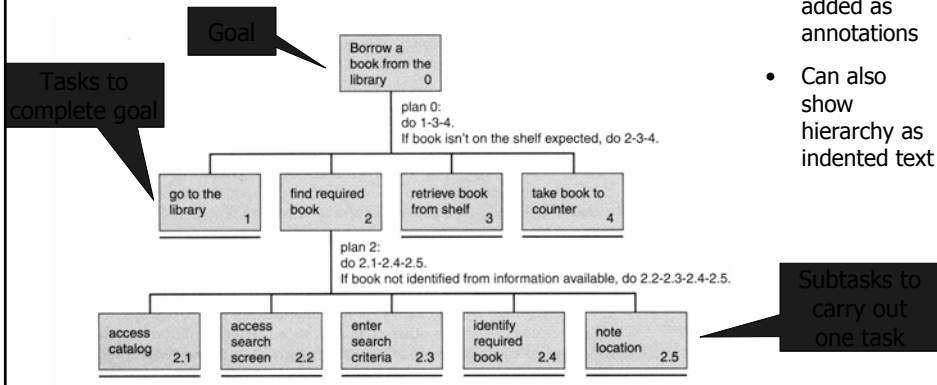| 1. Establish meeting room | 2. State purpose of interview | 3. Let witness describe what happened | 4. Ask open-ended questions | 5. Ensure that what, where, when, who, how, why is covered |

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Example Task Clusters

- Fixed sequence

- Optional tasks

- Waiting events

- Cycles

- Time-sharing

- Discretionary

Task Model - Borrow Book
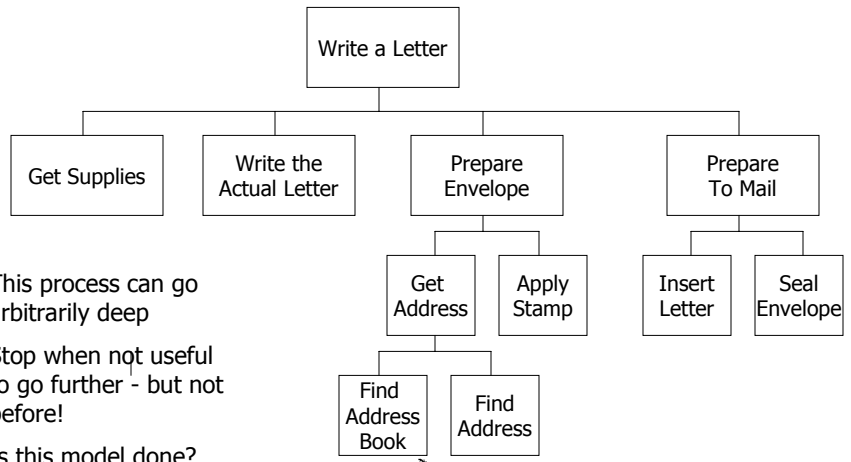
- Sequences added as annotations
- Can also show hierarchy as indented text

Goal

Tasks to complete goal

Borrow a book from the library   0

plan 0:
do 1-3-4.
If book isn't on the shelf expected, do 2-3-4.

go to the library   1

find required book   2

retrieve book from shelf   3

take book to counter   4

plan 2:
do 2.1-2.4-2.5.
If book not identified from information available, do 2.2-2.3-2.4-2.5.

Subtasks to carry out one task

access catalog   2.1

access search screen   2.2

enter search criteria   2.3

identify required book   2.4

note location   2.5

Figure 7.12 A graphical representation of the task analysis for borrowing a book.

From *Interaction Design*, Preece Rogers and Sharp

6750-Spr '07

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Task Model - Write a Letter

Write a Letter

Get Supplies

Write the Actual Letter

Prepare Envelope

Prepare To Mail

Get Address

Apply Stamp

Insert Letter

Seal Envelope

Find Address Book

Find Address

This process can go arbitrarily deep

Stop when not useful to go further - but not before!

Is this model done?

6750-Spr '07

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Can be More than One Sequence

- How X writes a letter
  - Get an envelope, paper, pencil, stamp
  - Write letter
  - Address the envelope
  - Apply stamp
  - Put letter in envelope
  - Seal envelope

- How Y writes a letter
  - Get an envelope, paper, pencil, stamp
  - Address the envelope
  - Write the letter
  - Put letter in envelope
  - Apply stamp
  - Seal envelope

- How does Z do it?
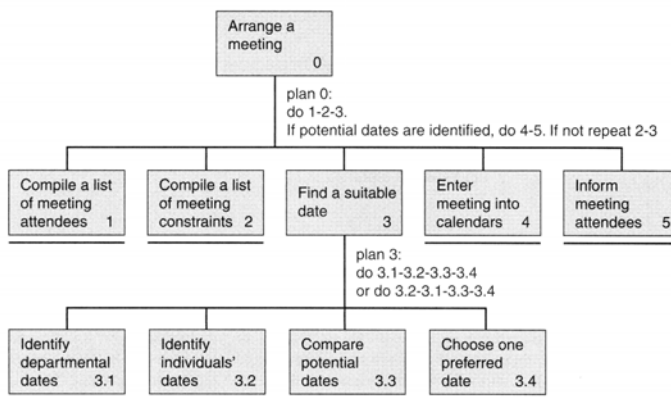

Task Model - Schedule Meeting

Figure 7.13 A graphical representation of the meeting HTA.

From *Interaction Design*, Preece Rogers and Sharp

Networks

- ## Network / Entity-Relationship Diagrams
  - Objects/people with links to related objects
    - Stress relationship between objects and actions
  - Links described functionally and in terms of strength
    - Task: Develop design for final project
      - objects - pens, paper, drawing tools, etc.
      - actors - Mary, Bob, Sally
      - composite objects - the "team"

Object Model: Simple Drawing System

- ## Objects
  - page, line, point
- ## Relations
  - page contains zero or more lines and points
  - Lines defined by two points
- ## Actions on objects
  - Page: clear
  - Points: create, delete, move
  - Lines: create, delete, move
- ## Etc

Object Model: Text Editor

- Objects
  - Files, lines, characters

- Relations
  - File is sequence of lines
  - Line is sequence of characters

- Actions on objects
  - Files: create, delete, rename
  - Lines: create, delete, move, copy
  - Characters: insert, delete, move, copy

Object Model - Other Typical Elements

- Relations
  - X is a set of Y
  - X is a sequence of Y
  - X is made up of (A, B, C)
  - X is geometrically aligned with Y

- Actions on relations
  - Remove X from set or sequence
  - Insert Y into set or sequence

- Actions on attributes
  - Set, modify, inquire

Methodology

- Often list attributes, actions of objects

Object: pen **simple**
   Attribute:
      color: red
      writing: on/off

Object: Mary **actor**
   Actions:
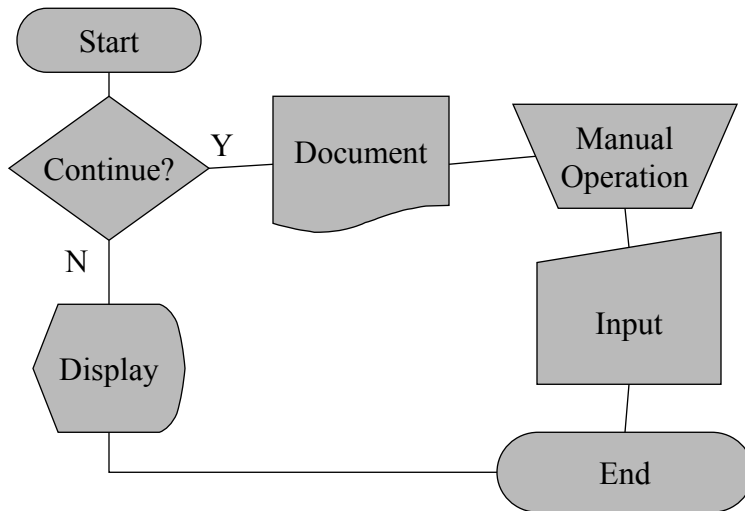   M1: make a sketch
      M2: organize meeting

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6. Flow Charts

- Flow Chart of Task Steps
  - Combines Entity-relationship (network) with sequential flow, branching, parallel tasks
  - Includes actions, decisions, logic, by all elements of the system
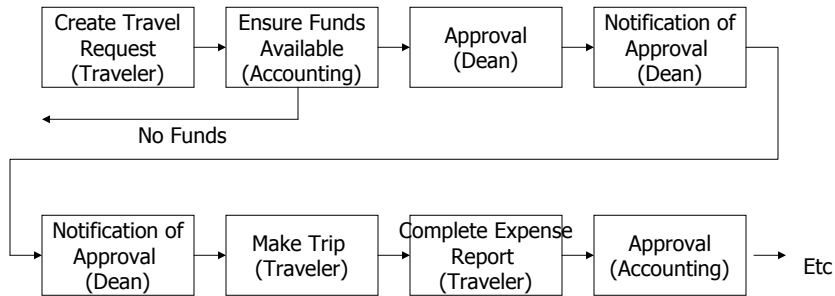 - Abstracted
  - Mature, well-known, good tools

Flow Chart

```
        ┌─────────┐
        │  Start  │
        └─────────┘
             │
             ▼
         ╱─────────╲      Y   ┌──────────┐      ╱──────────╲
        ╱ Continue? ╲────────│ Document │─────│  Manual    │
        ╲           ╱         └──────────┘      │ Operation  ╲
         ╲─────────╱                            ╲────────────╲
             │                                         │
           N │                                         ▼
             ▼                                  ┌──────────────╲
      ┌──────────╲                              │              │
      │           │                             │    Input     │
      │  Display  │                             │              │
      ╲───────────╱                             └──────────────┘
             │                                         │
             │            ┌─────────────┐              │
             └───────────│     End      │──────────────┘
                          └─────────────┘
```

Workflow

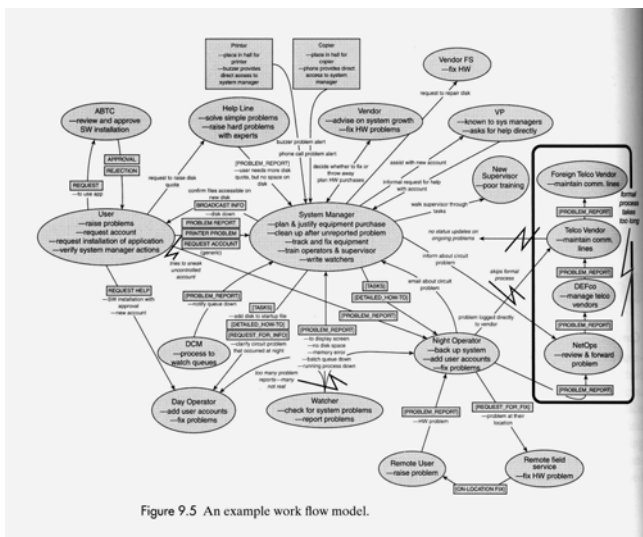- Documents going from one person/organization to another

- Multiple participants in an activity

Workflow Example - Document Flow

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ Create Travel│   │ Ensure Funds │   │   Approval   │   │Notification of│
│   Request    │──▶│  Available   │──▶│   (Dean)     │──▶│   Approval   │
│  (Traveler)  │   │ (Accounting) │   │              │   │    (Dean)    │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
       ◀───────────────────┘
             No Funds

┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│Notification of│  │              │   │Complete Expense│ │   Approval   │
│   Approval   │──▶│  Make Trip   │──▶│    Report    │──▶│ (Accounting) │──▶ Etc
│    (Dean)    │   │  (Traveler)  │   │  (Traveler)  │   │              │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
```

Workflow Example - Multiple Participants

Figure 9.5 An example work flow model.

From *Interaction Design*,
Preece Rogers and Sharp

Summary of Task Analysis

- Determine the data you need

- Gather it using various appropriate methods and techniques

- Represent the tasks and subtasks, plus other related information

- Use this data to improve design

- Note: Be efficient!

Using What You've Learned

- How do attributes of users & their tasks influence the design of user interfaces?

- Are there some design guidelines that we can derive from different attributes?

User Profiles

- Attributes:
  - attitude, motivation, reading level, typing skill, education, system experience, task experience, computer literacy, frequency of use, training, color-blindness, handedness, gender,…

- Novice, intermediate, expert

Motivation

- <u>User</u>
  - Low motivation, discretionary use
  - Low motivation, mandatory
  - High motivation, due to fear
  - High motivation, due to interest

- <u>Design goal</u>
  - Ease of learning
  - Control, power
  - Ease of learning, robustness, control
  - Power, ease of use

Knowledge & Experience

- Experience

- <u>task</u>   <u>system</u>
  - low   low

  - high   high

  - low   high

  - high   low

- <u>Design goals</u>
  - Many syntactic and semantic prompts

  - Efficient commands, concise syntax

  - Semantic help facilities

  - Lots of syntactic prompting

Job & Task Implications

- Frequency of use
  - High - Ease of use
  - Low - Ease of learning & remembering

- Task implications
  - High - Ease of use
  - Low - Ease of learning

- System use
  - Mandatory - Ease of using
  - Discretionary - Ease of learning

Project Part 1

- Let's review the specs...

- Due next Thursday
  - 2 hardcopies brought to class

Upcoming

- John is away Wed-Fri

- Norman: *Design of Everyday Things*
  - Finish reading book
  - G. Abowd guest lecture

- Design