Requirements Analysis

Goal: understand users’ current activities well enough to reason about technology-based enhancements

Analyzing Users’ Requirements

- Understanding the work being done now
  - Offer function that meets real needs

- Learn about the people themselves
  - Offer function in a way that is convenient and satisfying
Iterative Requirements Specification

- UCSD recognizes
  - It is impossible to fully specify requirements in advance
    - Options reveal real needs
    - Work processes evolve

- Thus
  - Requirements analysis is an on-going process

Analyzing Work

- Observe and describe people’s activities
  - What goals do they pursue, how?

- Collect and study artifacts used in these activities
  - Tools, documents, features of the work setting

- Capture the social context of the work
  - Groups and organizations, roles and relationships
Hierarchical Task Analysis (HTA)

- Decomposition of complex activity
  - Goals and subgoals, with control logic
  - Documents how things are ‘supposed’ to work
  - Much like an algorithm or program for the task
- Then can carefully study the implications
  - Does task really happen this way? If not, why?
  - Are there sources of complexity, bottlenecks? Why?

Plan 0: Do 1 2 3

0. Check class roll

Plan 1: Do 1 1 1 3

1. Navigate to registrar.vt.edu
   - 1.1 Open browser
   - 1.2 Enter URL

Plan 2: Do 1.2 1 1 2 2

2. Open faculty access tool
   - 2.1 Select link
   - 2.2 Logon
     - 2.2.1 Enter PID
     - 2.2.2 Enter password

Plan 3: Do 3 1 3 2 3 3

3. Display roll for CS 3724
   - 3.1 Select ‘summary class info’
   - 3.2 Select semester
   - 3.3 Select class CRN
Examining an Artifact

- What does it tell you about the task it supports?
  - If at all possible, observe it in use
  - Objects are not always used as intended!
- Try to extract task information and procedures
  - What task attributes are apparent or can be inferred?
  - What action sequences are required or possible?
  - What seems likely to be simple or difficult to do?
- Practice on some familiar examples:
  - Ex: wristwatch, phone, appointment book, badge

Artifacts Support Tasks?
Artifact – Pencils

- Shape suggests information about human hands (size, grasping)
- Importance of real-world use
  - School pencils – good erasers
  - Artists / Engineers – sharp points
  - Social aspects – brand?

Appointment Books and PDAs

- Apple Newton
  - Do-it-all product tries to do lots of things
  - Unfocused market -- who wants a $700 personal organizer
  - Smaller than previous PDAs but still too large for a pocket
  - Did not consider why people use handheld artifacts and how technology could help
The Doonesbury Effect

Time Tradeoffs
A Successful Design: Palm

- Evolution helped by requirements analysis
  - Developer “used” wood block as a PDA
  - Each meeting centered around a prototype
- Well-targeted audience
  - Four basic applications
  - Inexpensive
  - Data synchronization led to multiplatform

Artifacts and Use

- Ethnographic observation of a control room
  - Status slips served as rich “work sites”
  - Critical attribute is that they were shared objects
Analyzing the Larger Context

Using an approach like activity theory to examine relations among tasks, artifacts, conventions, and shared goals of a community.

Artifacts: Flyers, calculator, coupons, shelves, etc.

Actor: Me

Task: Purchase groceries

Activity goal: Satisfied customer

Rules: Sale dates, payment, item limits, etc.

Community: Krogers and its customers

Division of labor: I browse, cashier rings up, manager oversees, and bagger bags, etc.

Law firm example

- For each legal proceeding, thousands of documents identified by junior attorneys.
  - Online index is created by litigation support workers (date, sender, recipient, type)
    - Date encoding requires understanding of document role
    - “Document” definition required judgment
    - Some details were “invisible” to the attorneys
Getting Users Involved

- Usually there will be multiple “stakeholders”
  - E.g., workers, but also support staff, management
  - Each with knowledge, preferences, perspectives
- Observe and/or interview representatives from all relevant groups
  - Discuss their typical tasks, their role in the organization
  - As well as technology background and expectations
- Participatory analysis: videotapes or other records of activities that participants view and discuss

User knowledge

- People “rationalize” their own behaviors
- May describe “procedures manual” versions of behaviors
- Much expertise and process knowledge is held as tacit knowledge
- Users may not realize these behaviors until specific situations are presented
Tacit versus Explicit

**Organizational Explicit View**
- Training
- Tasks
- Position in hierarchy
- Procedures and techniques
- Work flow
- Methods and procedures
- Teams

**Activity-Oriented Tacit View**
- Learning
- Know-how
- Informal systems, contacts
- Conceptual understanding
- Work practices
- Rules of thumb, judgment
- Communities

Affordances

- “Perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used” – D. Norman, DOET, p.9
- Chair affords sitting
- Glass affords seeing thru (and breaking)
- Wood affords support (and carving)
More Affordances

- Plates → pushing
- Knobs → turning
- Slots → inserting
- Balls → throwing, bouncing

“When affordances are taken advantage of, the user knows what to do just by looking... no instruction is required.” – D. Norman, DOET, p.9.

Poor Affordances
Non-Obvious Affordances?

Example:
Fire Exits

- Push, not pull
  - Affordances
  - Visibility
- Which side?
  - Constraints
- Ease of use
  - No hands!

This slide is from a presentation by Miranda Capra
Window Affordances

- Rolling down the window:
  - Up?
  - Down?
  - Automatic?

Wiper Affordances

- Turning on the windshield wipers
  - Front wipers?
  - Rear wipers?
  - Speed controls?
**Affordances in User Interfaces**

**Conceptual Models**
- Internal model of how a device will work
- Includes both design model and user’s model
- Informs us of why a design will (or will not) work
### Design Model

- The conceptual model of the system to be built, held by the designer based on expected:
  - User goals & intentions
  - User background & experience
  - User limitations (cognitive or system resources)

### User’s Model

- Mental model held by the user about the system resulting from:
  - Interpretation of the System Image of the physical implementation
  - Actual goals, experience, limitations

Looking Ahead

Activity design
- Designing effective activities
- Designing comprehensible activities
- Designing satisfying activities

Information design (make things visible)
- Perceiving information
- Interpreting information
- Making sense of information

Interaction design (the principle of mapping)
- Selecting a goal
- Planning and executing an action sequence