CS325
USER INTERFACE AND USER EXPERIENCE DESIGN
Week 4

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Recap from last week
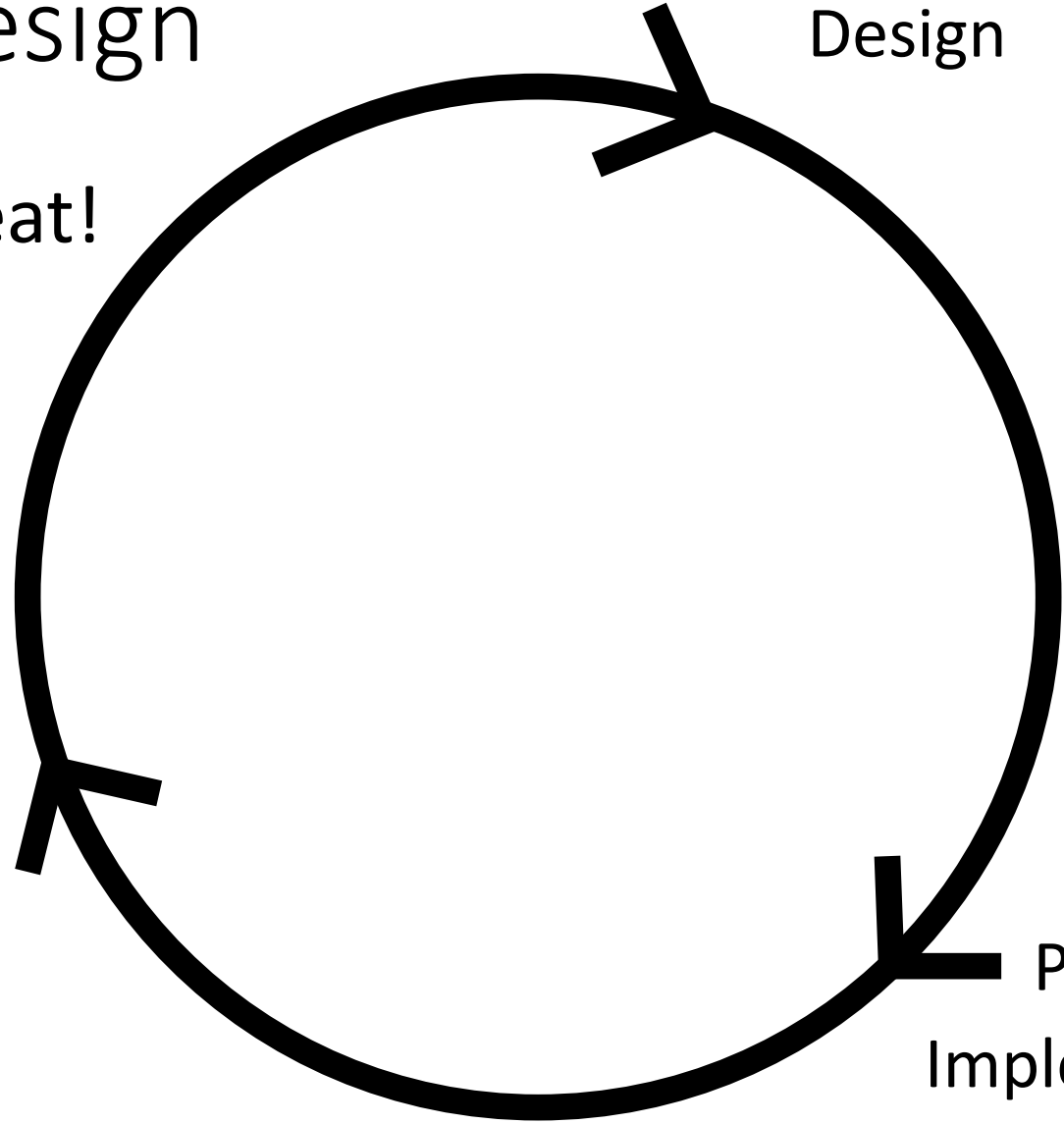
Iterative design

Rinse, lather, repeat!

Design

Prototype/
Implementation

Evaluation

User centered design

- Iterative design
    - Product designed, modified and tested repeatedly
    - Early testing of conceptual models and design ideas
    - Allow for complete overhaul and rethinking of design by early testing

- Early focus on users and tasks
    - Structured and systematic information gathering
        - User analysis: who the users are
        - Task analysis: what they need to do
    - Approach users early and often
        - Involving users as evaluators, consultants, and sometime designers

- Constant evaluation
    - Users are involved in every iteration
    - Every prototype is evaluated somehow

Usability Activities per Stage

Concept
- Usability goals & objectives
- User profiles & personas
- interviews, field studies, task analysis, etc.

Design
- Lo-fi paper prototypes
- Heuristic evaluations
- Focus groups, interviews, etc.

Develop
- Prep, planning and execution of: pre product release heuristic evaluations
- Usability testing

Release
- Formal usability testing
- Surveys, interviews for feedback on system
- Site visits

Agenda for this lecture

- User Analysis
  - who is the user?

- Task Analysis
  - what does the user need to do?

- Domain Analysis
  - what is the context the user works in (the people and things involved)?

- Requirements Analysis
  - what requirements do the preceding three analyses impose on the design?

User Analysis

Know your target user

- Identify characteristics of your target user population
  - Age, gender, culture, language
  - Education
  - Physical Limitation
  - Computer experience
  - Motivation, attitude
  - Domain experience
  - Application experience
  - Work environment and other social context
 - Relationships and communication patterns
  - …

Categorize your user

- Classes of users
  - By role (student, teacher)
  - By characteristics (age, motivation)
- Example: 1984 Olympic Messaging System
  - Athlete
  - Friends and family
  - System admin
  - …
- Another example: a rehabilitation computer game at elderly care center
  - Elderly
  - Care giver
  - Physiotherapists
  - …

Personas

- A Persona is a fictitious character used as a specific representative of a user class
  - Xiao Ming is a 30-year-old restaurant manager in Singapore
  - Peter is a software engineer working in Facebook
  - Jess is a 50-year-old primary school English teacher in Japan
- Advantages:
  - Convenient handle for talking about user classes
  - Focus on a typical user, rather that an extreme
  - Encourage empathy
- Disadvantages:
  - May be misleading
  - Stereotype trap
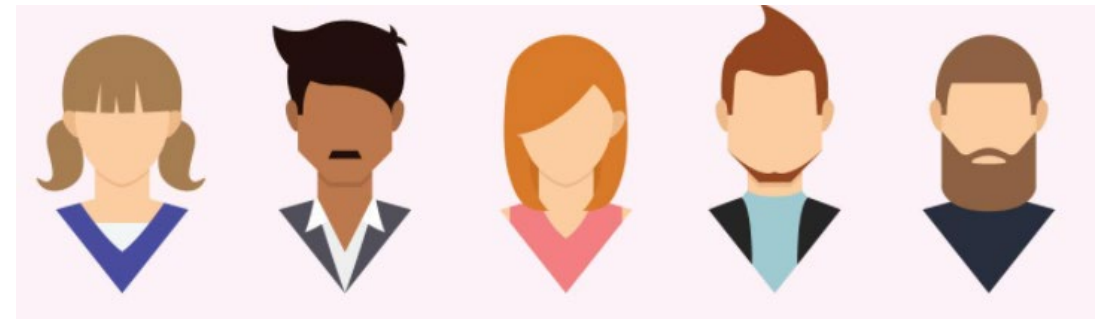
How to do User Analysis

- Techniques
  - Questionnaires
  - Interviews
  - Observation

- Obstacles
  - Developers and users are sometimes systematically isolated from each other
    - Tech support shields developers from users
    - Marketing shields users from developers
  - Some users are expensive to talk to
    - Doctors, executives, etc.

Common errors in user analysis

- Describing what your ideal users should be, rather than what they actually are.

- For the 1984 OMS:
  - "Users should be literate in English, familiar with telephone usage, right-handed, and color-blind"
  - Correct or not?

Task Analysis

Task Analysis

- Identify the individual tasks the system solves

- Each task is a goal

- Analyzing how users do their tasks
  - Go to their environment
  - Learn about, analyze and describe their tasks

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

- **Gather data** about what users need to do or accomplish and then **represent data** for interpretation and use in design decisions

Essential parts of Task Analysis

- What needs to be done?
  - Goal

- Who are the users that accomplish the task?
  - The one who will accomplish the task

- What must be done first to make it possible?
  - Preconditions
    - Tasks on which this task depends
    - Information that must be known to the user

- What steps are involved in doing the task?
  - Subtasks
  - Subtasks may be decomposed recursively

Example of 1984 Olympic Messaging System

- Goal
  - Retrieve the recorded message if any
- User
  - An athlete
- Preconditions
  - Must know: my country code, my username, my password
- Subtasks
  - Pick up the phone
  - Enter the country code
  - Enter the user name
  - Enter the password
  - Listen to the message
  - Hang up

https://www.youtube.com/watch?v=W6UYpXc4czM

Other questions to ask about a task

- Where is the task performed?
  - In classroom, sitting on the chairs
  - In surgery room, stand up
  - …
- What is the environment like?
  - Noisy, dirty, dangerous?
  - Outside
  - …
- What are the time or resource constraint?
  - 1 second for one piece of product
  - …

How is the task learned?
  - By trying it
  - By watching others
  - By training
  - …

What can go wrong?
  - Exceptions
  - Errors
  - Emergencies

Who else is involved in the task?
  - Think about the group project

Example: 1984 Olympic Messaging System

- Task: Retrieve the recorded message if any
- Where is the task performed?
  - At a kiosk
- What is the environment like?
  - Outside room but inside the Olympic village
- What are the time or resource constraint?
  - Normally a few minutes but can be done a few times
- How is the task learned?
  - By watching how others do
  - By reading manuals
- What can go wrong?
  - Enter wrong country code
  - Enter wrong user id/password
- Who else is involved in the task?
  - None.

How to do task analysis?

Task Analysis techniques

1. Observation
2. Interviews
3. Ethnography
4. Surveys & Questionnaires
5. Competitive Product Review
6. Documentation mining
7. Data logging

1. Observation

- Watch users do what they do
  - Typically from a distance
- Record with videotape
  - May require coding video later
- Take lots of notes, sketches
- Focus on *specific* task-relevant behaviors in notes, but later convert to abstract subtasks

2. Interviews

- Engage the user more than just watching
- **Structured** interviews
  - Efficient, but requires training
- **Unstructured**
  - Inefficient, but requires no training
- **Semi-structured**
  - Good balance
  - Often appropriate

Structured Interview

- A structured interview may assume a definite format involving:
  - charting a job-holder's sequence of activities in performance
  - an inventory or questionnaire may be used
- Structured Interview with groups of individuals
  - 3 to 10 persons
  - Use several different groups with different roles or perspectives
  - Manage the interaction
    - Avoid few people dominating the discussion
- Audio or video record, with permission

Unstructured interview

- A conversation with no prepared questions or predetermined line of investigation

- However, the interviewer should explain:
    - the purpose of the interview is and
    - the particular focus of this interview

- Involves question and response and may be free flowing

Semi-structured Interviews

- Predetermine data of interest
- Plan for effective question types
  - **How** do you perform task x?
  - **Why** do you perform task x?
  - What **information** do you need to…?
  - **Who** do you need to communicate with to…?
  - What do you **use** to…?
  - What happens **after** you…?
  - What is the result or consequence of **NOT**…?

Interview preparation

- Objectives, goals, *research* questions
- Methods
  - E.g. phone, in person, email, etc.
- Interview questions
  - Design questions carefully, to get good data (not too vague)
  - Test questions before asking
- People: Moderator/interviewer; participant(s); scribe(s)

Interview Phases

- Introduction
- Warm-up (ramp up)
- Interview "proper"
- Cool-down (glide)
- Summary and wrap-up
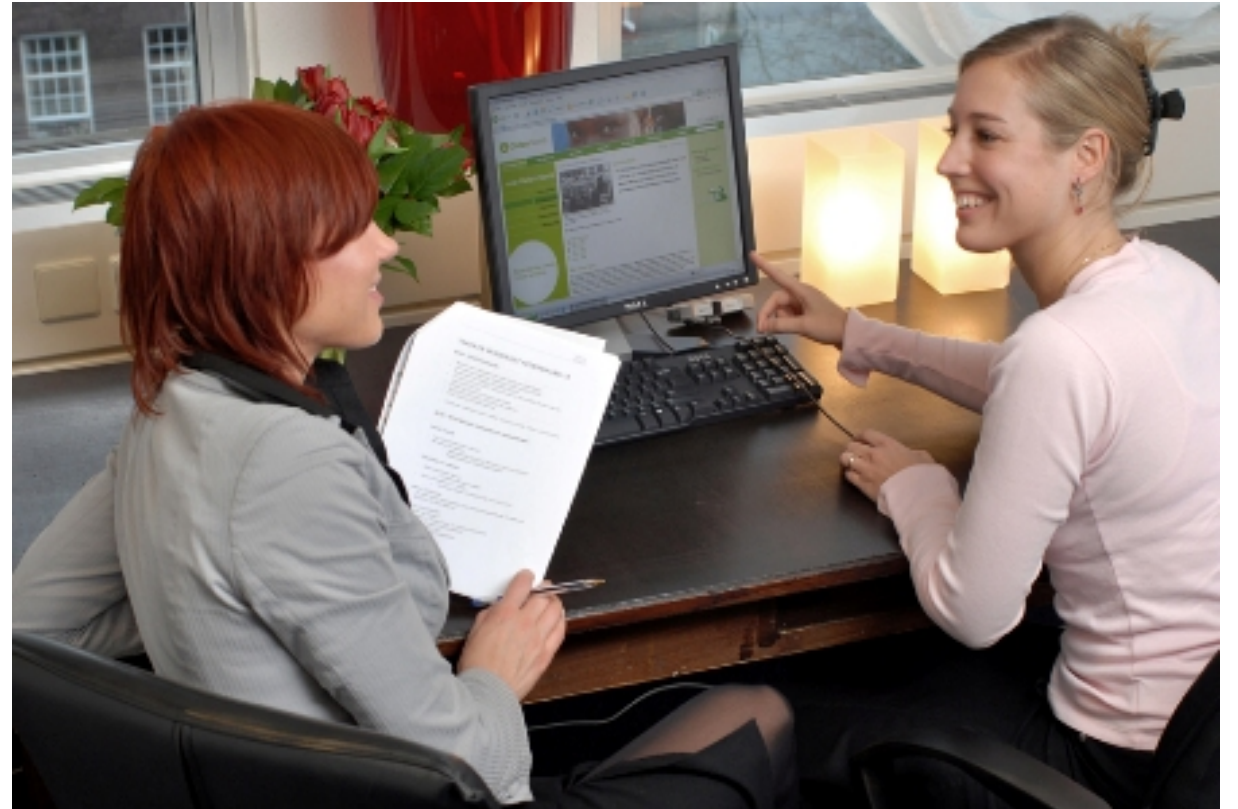
Interviewing Tips

- Manage the conversation
- Focus on data, stay on track
- Listen more, talk less
- Use examples, but not too long
- Set expectations and boundaries, establish trust and comfort ("safe zone"), then get to the tough questions
- Always meta-monitor the situation

3. Ethnography

- Techniques based in sociology and anthropology – the study of humans

- Deeply contextual inquiry
  - "Live among" the users
  - "Wallow in the data"

- Understanding the full complexity of behavior, in its complete social context

Comment

- Techniques 1-3 are similar, but differ in how "plugged in" or engaged the observer gets

- Usually task analysis involves an examination of an existing system, process or practice

- Watch what they do and how they do it

4. Surveys & Questionnaires

- Subjective answers in a quantitative format
  - What does this mean?

- Questions:
  - Exploratory vs. confirmatory
  - Open-ended vs. categorical (exhaustive)

  - *NB: If you ask it, use it. If you won't/can't use it, don't ask it.*

Typical survey questions

- Rank the importance of each of these tasks (give a list of tasks)
- List the four most important tasks that you perform (this is an open question)
- List the pieces of information you need to have before making a decision about X, in order of importance
- Are there any other points you would like to make? (open-ended opinion question; good way to end)

Question Formats

- Objective Questions
  - Quantifiable, countable
  - Check boxes to select one or more options
  - Multiple-Choice questions
  - Yes/No, True/False questions
- Subjective questions
  - Response open ended, in one or more sentences
- Semantic Scales
  - 1- lowest score to 5- highest score
- Likert Scale
  - Agree Strongly - Agree Somewhat - Indifferent - Disagree Somewhat - Disagree Strongly

Sematic Differential Scale

Please place an X in the area that best fits your beliefs about Nike shoes:

Well made   ___ : ___ : ___ : ___ : ___ : ___ : ___ : Poorly made

Inexpensive   ___ : ___ : ___ : ___ : ___ : ___ : ___ : Expensive

Uncomfortable ___ : ___ : ___ : ___ : ___ : ___ : ___ : Comfortable

Durable   ___ : ___ : ___ : ___ : ___ : ___ : ___ : Non-durable

- ❑ A type of itemized rating scale
- ❑ Common in marketing surveys especially when measuring brand image, product, company images
- ❑ Try to avoid "halo effect" by rotating positive & negative sides
- ❑ Respondents often confused how to respond
- ❑ Requires researcher to identify bi-polar adjectives (often difficult to be exactly opposite)

Likert Scale

		Strongly Disagree				Strongly Agree	Scale Position	Calculation	Score Contribution
1.	I think that I would like to use this mobile app frequently.	☐	☐	☐	☒	☐	4	4-1	3
2.	I found this mobile app unnecessarily complex.	☐	☒	☐	☐	☐	2	5-2	3
3.	I thought this mobile app was easy to use.	☐	☐	☐	☐	☒	5	5-1	4
4.	I think that I would need assistance to be able to use this mobile app.	☒	☐	☐	☐	☐	1	5-1	4
5.	I found the various functions in this mobile app were well integrated.	☐	☐	☐	☒	☐	4	4-1	3
6.	I thought there was too much inconsistency in this mobile app.	☐	☒	☐	☐	☐	2	5-2	3
7.	I would imagine that most people would learn to use this mobile app very quickly.	☐	☐	☐	☐	☒	5	5-1	4
8.	I found this mobile app very cumbersome/awkward to use.	☒	☐	☐	☐	☐	1	5-1	4
9.	I felt very confident using this mobile app.	☐	☐	☐	☒	☐	4	4-1	3
10.	I needed to learn a lot of things before I could get going with this mobile app.	☒	☐	☐	☐	☐	1	5-1	4

TOTAL 35

x 2.5 87.5

Online Surveys

- Responses can be tracked
- Data analysis is easier
- Reach a wider audience easily
- Errors can be corrected

- Survey Monkey
  https://www.surveymonkey.com/
- Google Forms
  https://www.google.com.sg/forms/about/

Surveys & Questionnaire Tips

- Do not make questionnaire very long
- Use fewer but better questions
- Ensure anonymity and clear motivation
- Start from research goals

Surveys & Questionnaire Issues

- Which users to target, how to target?
- Cheap but difficult to administer
- Response rate may be low
- Response bias
- Data entry or analysis issues
- Questions may be ambiguous
- Users may be dishonest

5. Competitive Products

- Looking for both good and bad ideas
  - Functionality
  - UI style
- Why are they successful or unsuccessful?
- What does successful really mean?
  - (Note: Successful does not equal usable)
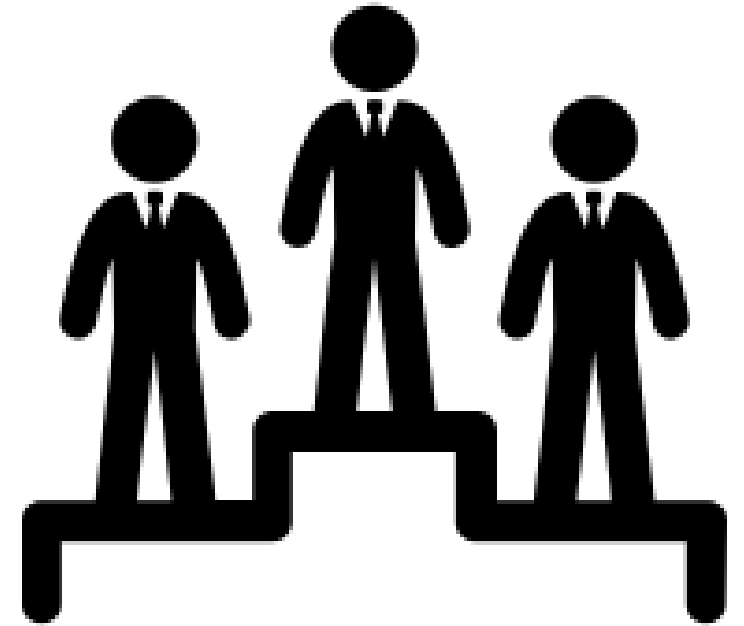
If No Existing System

- Gather documents, talk with knowledgeable people, etc.

- Can still be useful to help generate requirements

6. Document Mining

- Documentation
  - Often contains description of how the tasks *should* be done
  - Standards docs
  - Manuals
  - Histories
  - Best Practices

7. Data Logging

- Automatically tracking:
  - Keystroke/mouse clicks
  - Timers
  - Logs of transactions
  - Physical location/movement trackers
    - Cell phones
    - GPS

Task Analysis Focus

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

- Focus on <u>observable behaviors</u>
  - Observe users, what they do, and how they do it
  - What are the practices, methods, steps, objects, …, used?

Task Analysis – Task Describing

Now ...

- 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?**

Describe Tasks

1. Task Outlines and Narratives

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

3. Flow Charts

4. Knowledge Based Analysis

1. Task Outline and Narrative

- Describe tasks in sentences

- Often expanded version of task outline

- More effective for communicating general idea of task

  - Example:

  - Goal
    - Retrieve the recorded message if any

  - User
    - An athlete

  - Preconditions
    - Must know: my country code, my username, my password

  - Subtasks
    - Pick up the phone
    - Enter the country code
    - Enter the user name
    - Enter the password
    - Listen to the message
    - Hang up

2. Hierarchies & Networks

- Decompose task into
 - Subtasks
    - Multiple levels
  - Plans describing ordering and conditions

- Hierarchical Task Analysis (HTA)
  - Graphical notation & decomposition of tasks
  - Tasks as sets of actions
  - Tasks organized into **plans** (describes sequence)

- Entity-Relationship Diagrams
  - Objects/people with links to related objects
  - Links described functionally and in terms of strength
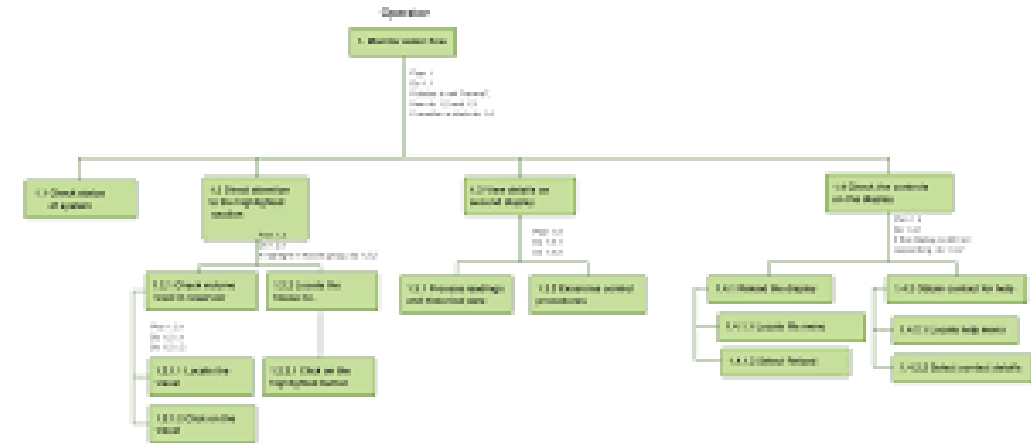
Hierarchical Task Analysis (HTA)

Generating the hierarchy:

1. get list of tasks
2. group tasks into higher level tasks
3. decompose lowest level tasks further
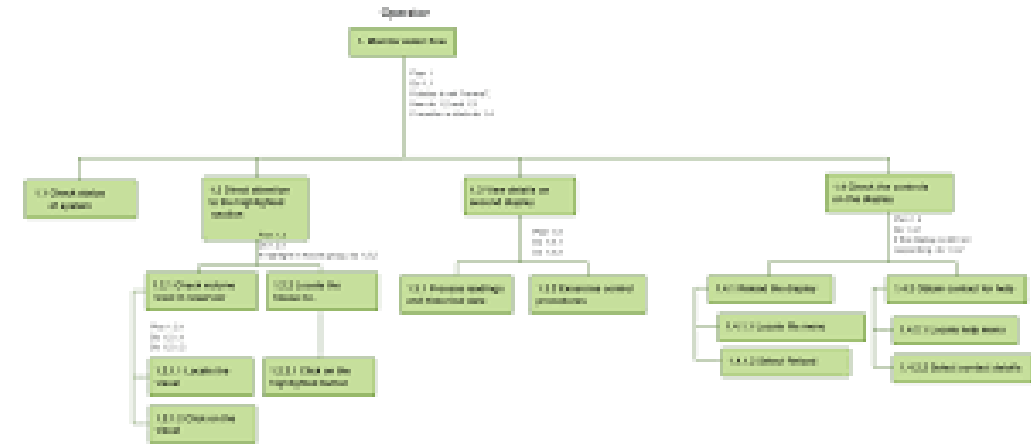
Stopping rules

- How do we know when to stop?
- Is "empty the dust bag" simple enough?

Purpose: expand only relevant tasks
Motor actions: lowest sensible level

Make a cup of tea

Diagrammatic HTA: Make cup of tea

0. make a cup of tea

plan 0.
    do 1
    at the same time, if the pot is full 2
    then 3 - 4
    after four or five minutes do 5

1. boil water

2. empty pot

3. put tea leaves in pot

4. pour in boiling water

5. wait 4 or 5 minutes

6. pour tea

plan 1.
    1.1 - 1.2 - 1.3
    when kettle boils 1.4

1.1. fill kettle

1.2. put kettle on stove

1.3. wait for kettle to boil

1.4. turn off gas
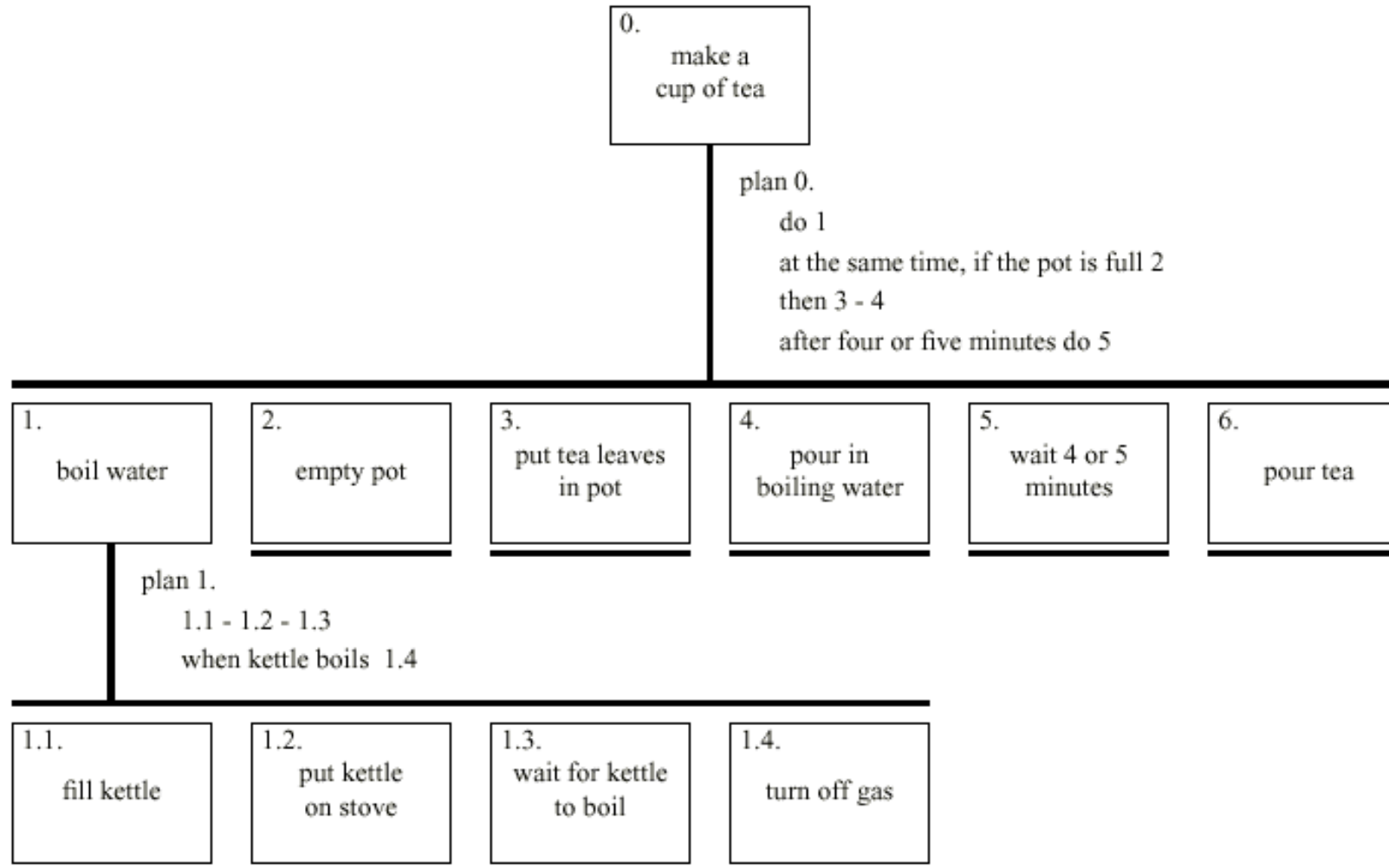
Refined HTA for making tea

How to check or improve the initial HTA?

Some heuristics are:
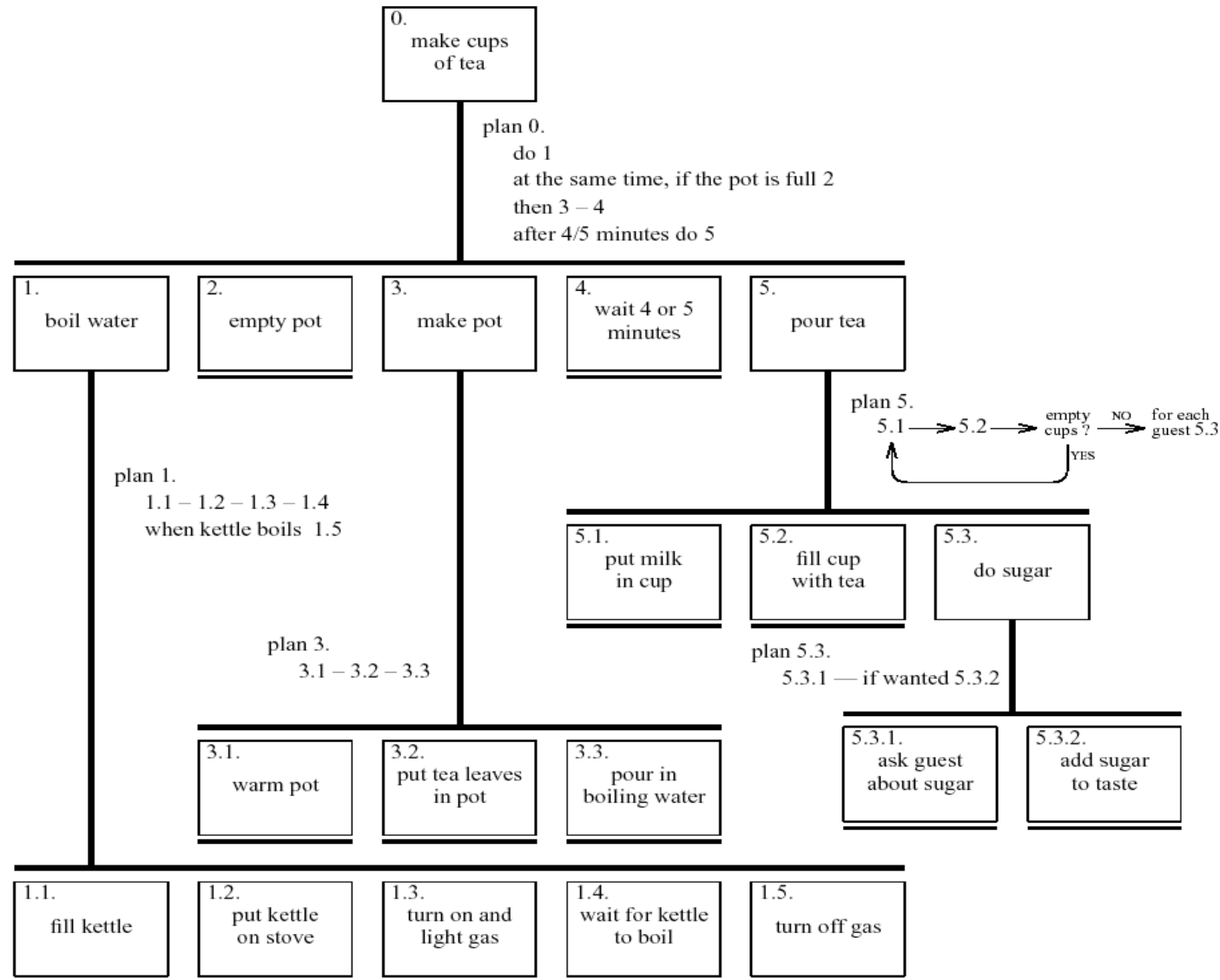
- paired actions where is "turn on gas"?

- restructure generate task "make pot"

- balance is "pour tea" simpler than "make pot"?

- generalize make one cup . . . or more

Refined HTA for making tea

Entity-Relationship Diagram

- Object-based methodology, with a real stress on relationship between objects and actions

- Involves
  - Concrete objects
  - Actors
  - Composite objects

- Example:
  - Task: Develop design for final project
    - Objects   -   Pens, paper, drawing tools, etc.
    - Actors   -   Mary, Bob, Sally
    - Composite objects   -   The "team"

Entity-Relationship Example

- Firm: 'Vera's Veggies' – a market gardening firm
- owner/manager: Vera Bradshaw
- employees: Sam Gummage and Tony Peagreen
- tools:
  - various tools including a tractor `Fergie`
  - two fields and a glasshouse
  - new computer controlled irrigation system

3. 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
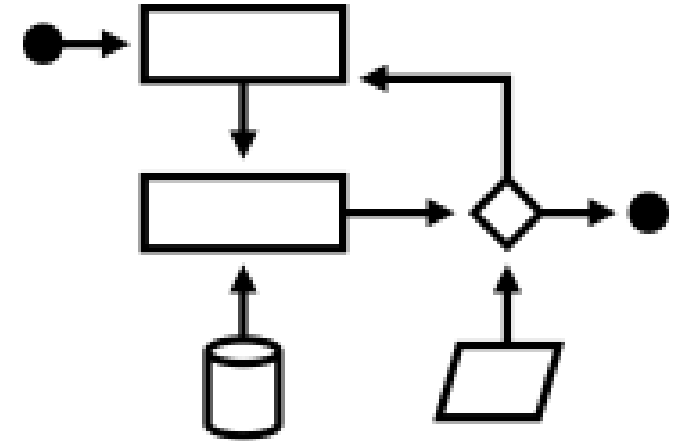
4. Knowledge based analysis

- Aim to understand knowledge required for a task
  - provide training material, how-to manuals
  - take advantage of common knowledge across tasks
- Focus on
  - objects used in the task
  - actions performed
- Use taxonomies (a scheme of classification):
  - to represent levels of abstraction
  - organization (grouping) depends on purpose

Car Control Taxonomy

Car Control Taxonomy

motor controls		
steering	steering wheel, indicators	
engine/speed	direct	ignition, accelerator, foot brake
	gearing	clutch, gear stick
lights	external	headlights, hazard lights
	internal	cabin light
wash/wipe	wipers	front wipers, rear wipers
	washers	front washers, rear washers
heating	temperature control, air direction, fan, rear screen heater	
parking	hand brake, door lock	
entertainment system	numerous!	

Task Descriptive Hierarchy (TDH)

Task Analysis for Knowledge Description (TAKD)

TAKD uses three types of branches in TDH taxonomies:

- XOR — object in exactly one branch

- AND — object must be in both

- OR — can be in one, many or none

Task Descriptive Hierarchy (TDH)

motor controls		
wash/wipe **AND**		
	function **XOR**	wipers front wipers, rear wipers
		washers front washers, rear washers
	position **XOR**	front front wipers, front washers
		rear rear wipers, rear washers

Task Descriptive Hierarchy (TDH) Example

```
kitchen item AND
/____shape XOR
/      |____dished  mixing bowl, casserole, saucepan,
/      |                soup bowl, glass
/      |____flat     plate, chopping board, frying pan
/____function OR
       {____preparation    mixing bowl, plate, chopping board
       {____cooking     frying pan, casserole, saucepan
       {____dining XOR
               |____for food   plate, soup bowl, casserole
               |____for drink  glass
```

N.B. '/ | {' used for branch types

Domain Analysis

Domain Analysis

- Identify important things in the domain
  - People (user classes)
    - Athletes, family and friends, system admin
  - Physical object
    - Name card, telephone
  - Information object
    - Message, account

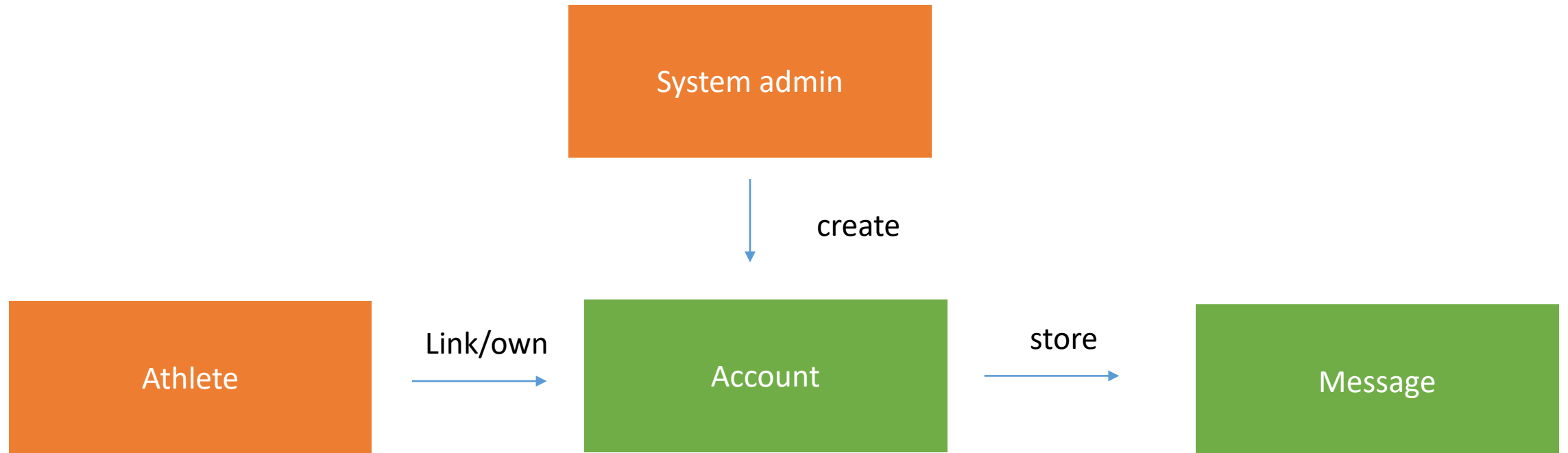System admin

Account

Athlete
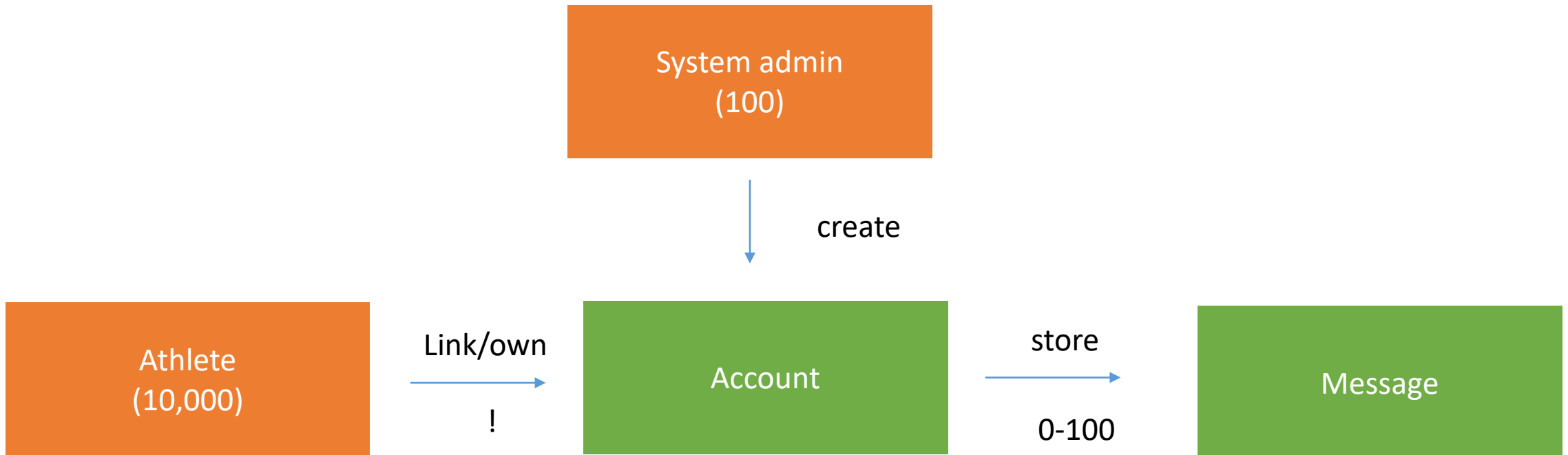
Name card

Message

Domain Analysis

- Determine important relationships between the identified important things
  - Athletes have accounts
  - Accounts have messages
  - System admin registers athletes or create account

Domain Analysis

- Identify multiplicities of things and relationships
  - Numbers are best, but simple multiplicity indicators (+, *, !) also help
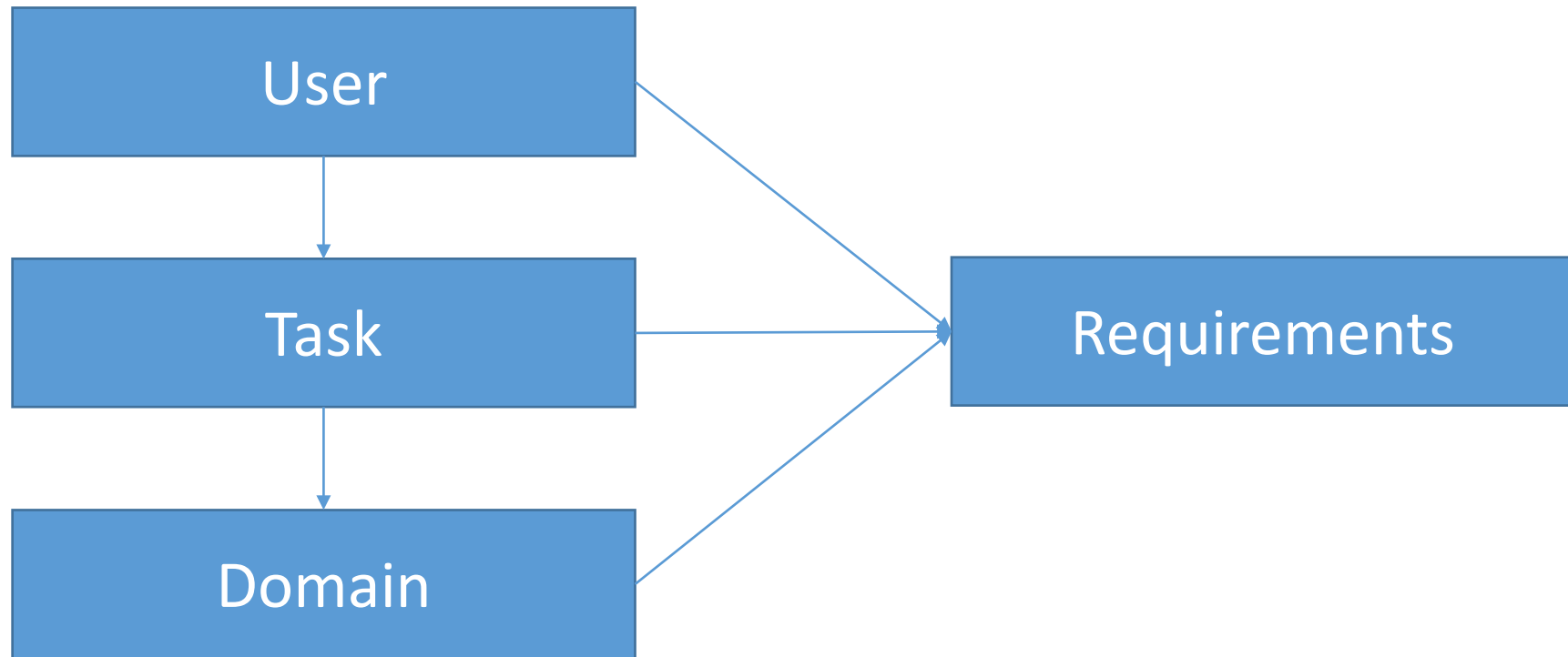
Other benefits of Domain Analysis

- Identify new users

- Identify missing tasks

Requirements Analysis

- Requirements: what should the system do?

Hints for better User and Task Analysis

- Questions to ask
  - Why do you do this? (goal)
  - How do you do it? (subtasks)
- Look for weakness in current situation
  - Goal failure, wasted time, user irritation
- Contextual inquiry
- Participatory design

Contextual inquiry

- Observe users doing real work in the real work environment

- Be concrete

- Establish a master-apprentice relationship
  - Users show how and talk about it
  - Interviewers watch and ask questions

- Challenge assumptions and probe surprises

Participatory design

- Include representative users directly in the design team

- For example:
  - The 1984 OMS included an athlete as a consultant

Summary

- User Analysis
  - who is the user?

- Task Analysis
  - what does the user need to do?

- Domain Analysis
  - what is the context the user works in (the people and things involved)?

- Requirements Analysis
  - what requirements do the preceding three analyses impose on the design?