# Designing Interactive Systems I

DIA Cycle, Observing Users, Brainstorming, Storyboards, and Sketching

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Winter Semester '25/'26



## Review

- What are different phases of the technology lifecycle?
- What were the key advances of
  - Put That There?
  - Apple Knowledge Navigator?
  - Starfire?
- What were the lessons learned from producing the Starfire video?
- What were different device classes of PARC's Ubicomp?



# Ubicomp vs. PC, VR ... Continued

- Ubicomp = disappearing computer = augmented reality = calm computing
- Goal is to activate the world, putting computers into everything
- "PC" is just a transition towards real potential of computing, which will focus on human environment
  - Carrying a super-laptop is like owning just one very important book.
     Even customizing or having millions of it doesn't unleash literacy.
  - Multimedia as used today makes machines even more attention-grabbing, not disappearing
  - Psychological reasons for disappearing technology: Heidegger's hammer, compiling
- ≠VR: VR lets you explore unreachable worlds but tries to simulate infinite variety of reality instead of augmenting it.



# Ubicomp Predictions

- Small displays, faster CPUs: correct
- Battery prediction too optimistic (days of use at 1000x800)
- Memory underestimated
- High-resolution walls (80+dpi, 10s of Mpix) over several feet: Achieved recently with 8K screens
- OSs today assume fixed hardware configuration, but in Ubicomp, devices come and go
- Window systems assume fixed base computer
- Ubicomp diversity of input devices not being dealt with well
- Network: Bluetooth LE, problem of multiple connections



# Ubicomp Today

- HUC'99 workshop
  - → Ubicomp Conference
- Commercial Tabs, Pads and Boards
  - Hardware, but often still clinging to the desktop metaphor, and not "plentiful"
- One of the most intriguing visions for the future of HCI and CS
- "As calm as a walk in the woods"





# Roadmap



- Performance
- Models of interaction
  - Affordances
  - Mappings
  - Constraints
  - Types of knowledge
  - Errors
- Design principles
- Visual Design

### Case Studies

- History of HCI
- HCI Visions
- Technology Phases

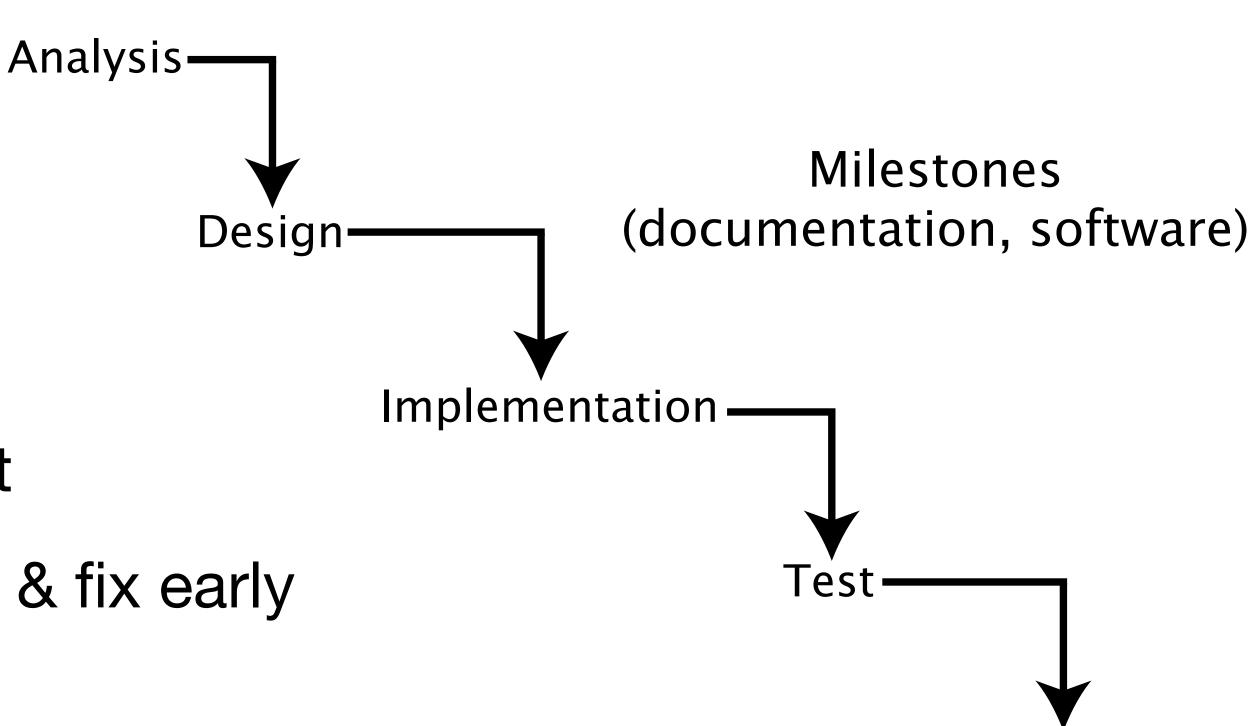
## Development Process

- Iterative design
- User observation
- Ideation
- Prototyping
- User studies and evaluation
- Interaction design notations



# The Wrong Way: Waterfall Model (1956)

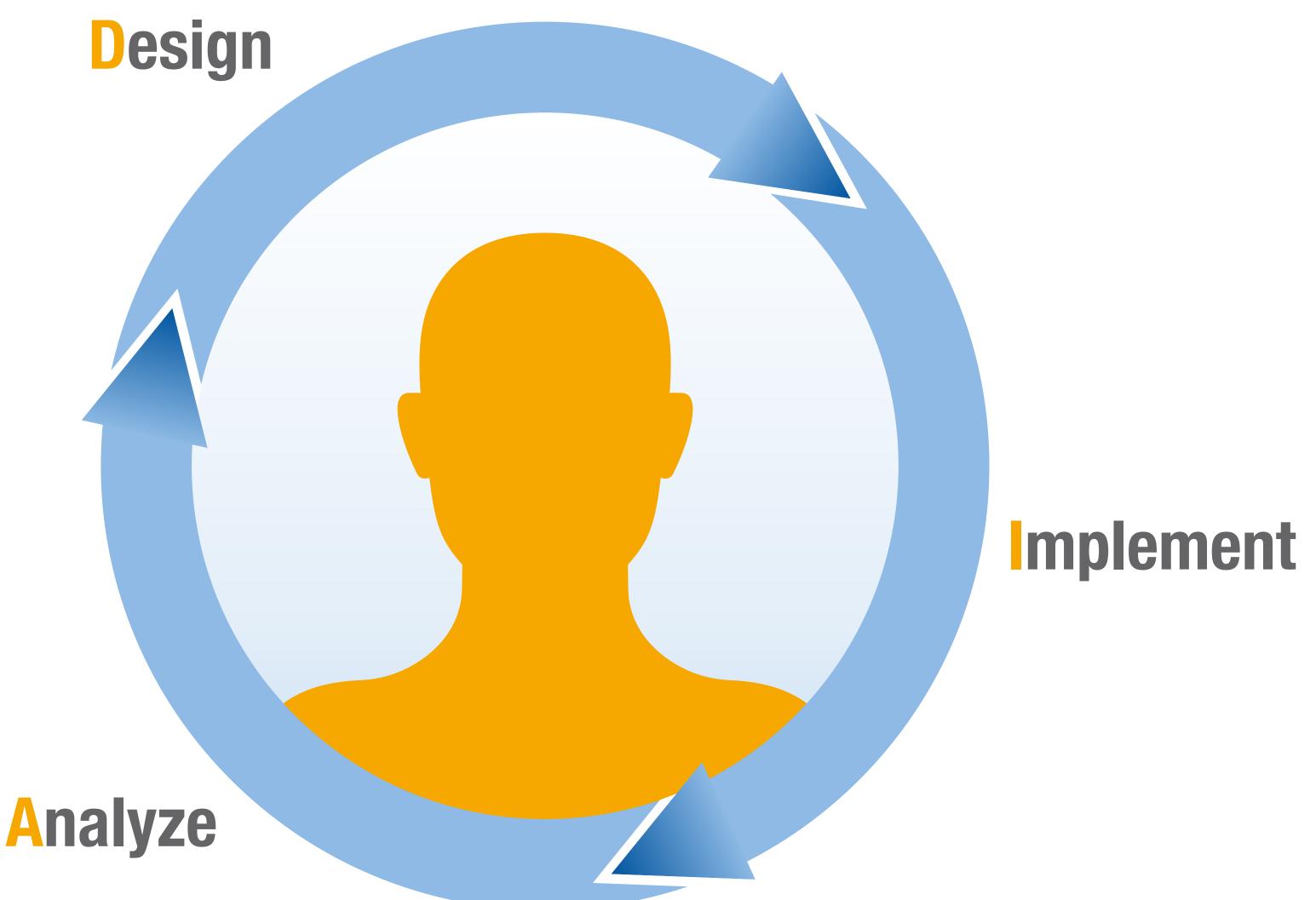
- Widely used in software development, but
  - Phases idealistic, reality requires backtracking (insights grow, plans change)
  - Usage scenarios often too abstract
  - Wrong assumptions hard to detect & fix early
- Since the 80s, we know better...





Maintenance

# The Right Way: DIA Cycle





# DIA Cycle

- Usually many iterations necessary
- With each iteration:
  - Design becomes more concrete & precise
  - Analysis and user feedback focuses on smaller and smaller problems
  - Implementation (prototype) gets more detailed and technically complex
- Fix big design bugs first, small ones later



# Unrolling the DIA Iterations

#### **Project start**

D: Brainstorm different representations

D: Choose a representation

D: Rough out interface style

Low fidelity paper prototypes

A/D: Task-centered walkthrough & redesign

A/D: Fine tune interface, screen design

A/D: Heuristic evaluation and redesign

A/D: Usability testing and redesign

A: Limited field testing

A: Alpha/Beta tests

: Medium fidelity prototypes

: High fidelity prototypes

!: Working systems

**Project End** 

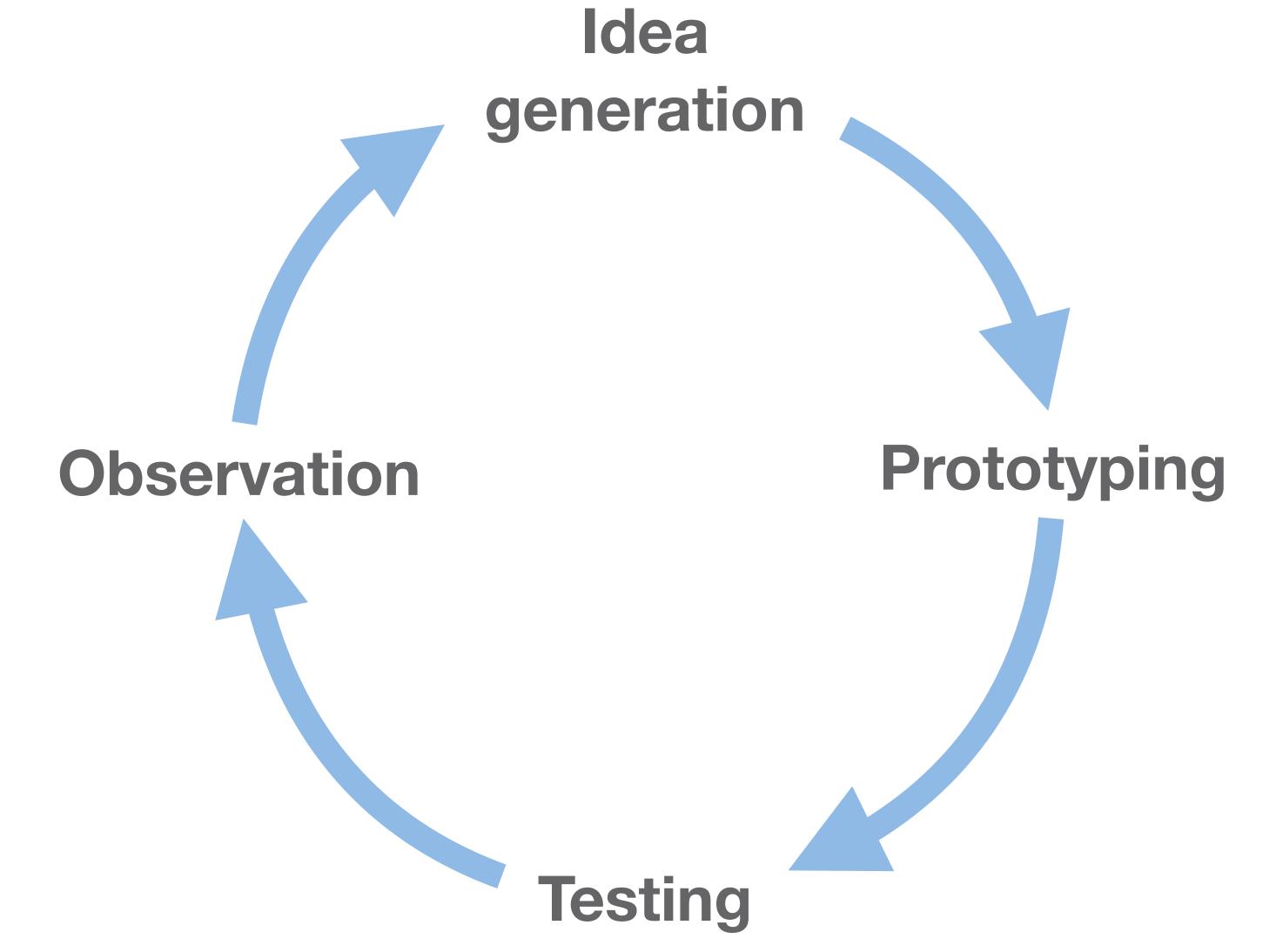


# DIA Cycle in Our Projects

- Milestones for brainstorming, storyboarding, prototyping, user observation, and testing
- Feeding back into project design
- Real projects would require many more iterations



## DIA Cycle in Norman's Book: Human-Centered Design Process





# "One of my rules in consulting is simple: never solve the problem I am asked to solve."

— Donald Norman



# Root-Cause Analysis

- In the real world, problems need to be discovered
- We rush to solving a given problem without questioning if it is the *correct* problem to solve.
- Instead:
  - A. Find the right problem (root-cause analysis to find the root problem)
  - B. Find the right solution to it



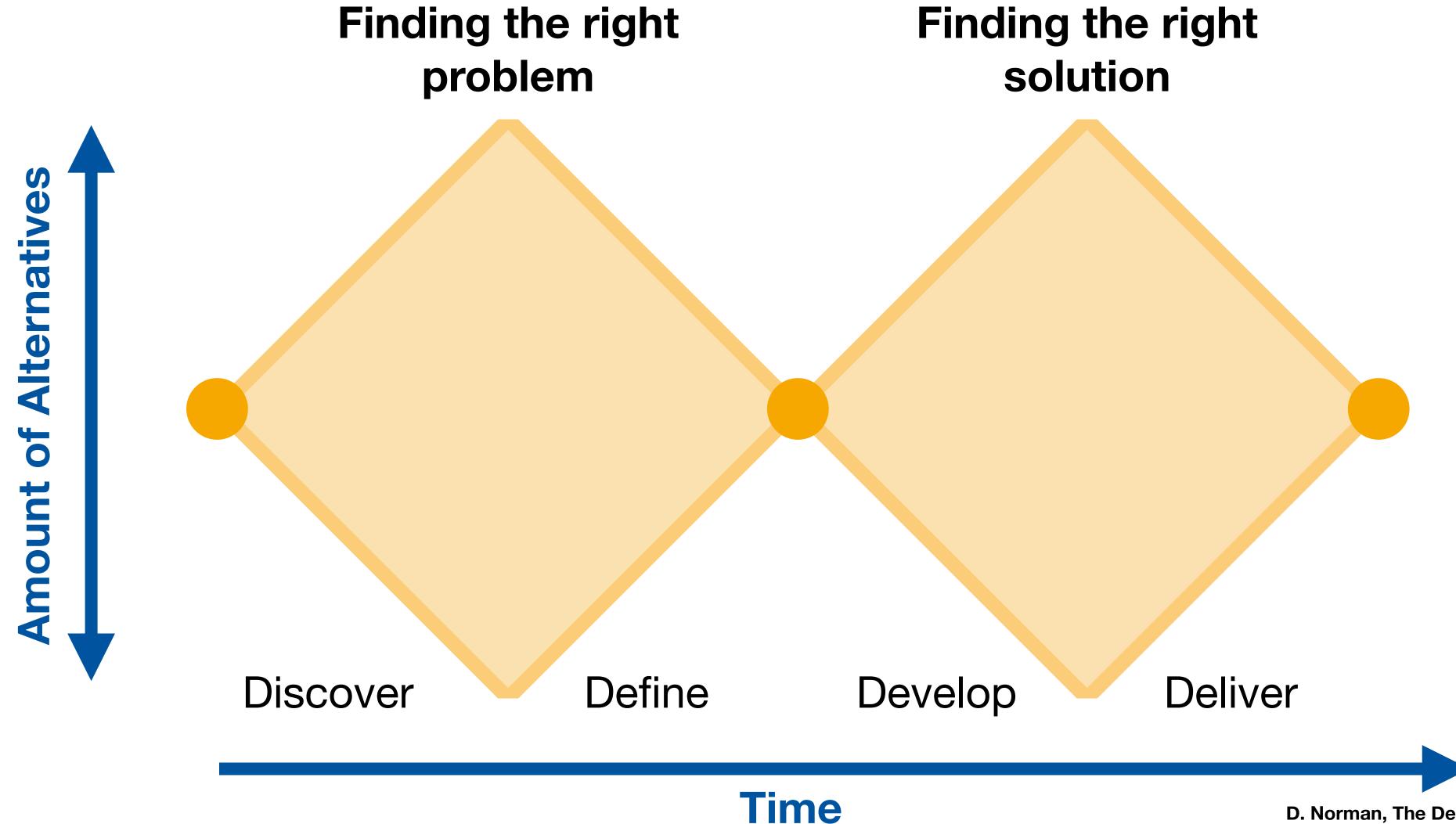
## In-Class Exercise



- Think about a daily problem people face. Use root-cause analysis to identify the actual root problem behind it!
- Keep asking why until you discover the root problem.

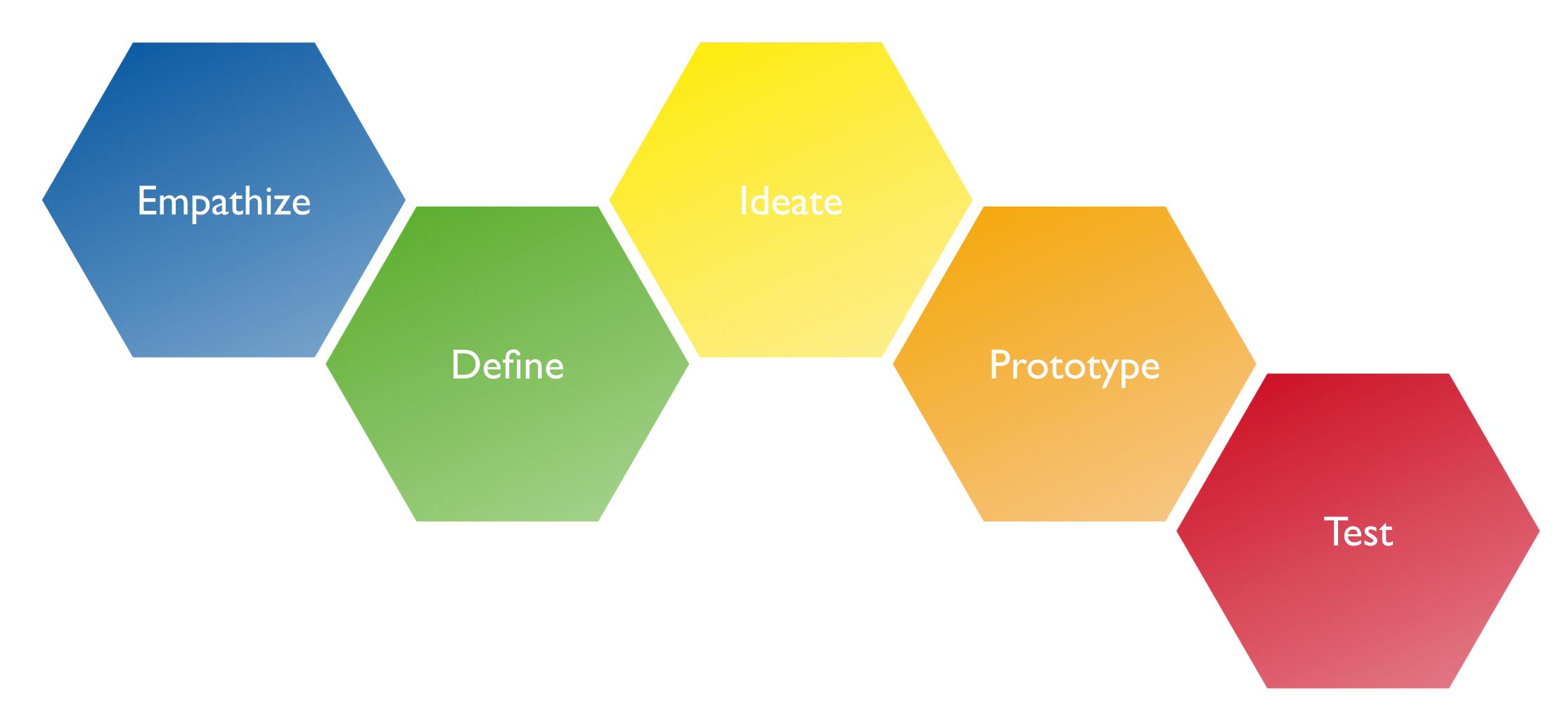


# Double-Diamond Model of Design





# Design Thinking





## The First Three Questions

- Whenever designing an interactive system, ask the following three questions first:
  - 1. Who are the users?
  - 2. What do they want to do with the system?
  - 3. What is the context?
- Many projects fail because these questions have not been answered!
- All three questions requires asking!



# Classifying Users

- Experience: Most central criterion
  - Newbies (no task knowledge) / first-time users (task knowledge): don't know UI, anxiety
    - → simple UI, few features, small consistent vocabulary, extensive feedback, help, and documentation
  - Average experienced users: know task well, UI so-so, forget functions
    - clear menu structures, consistency, see & choose instead of remember & type, continued error protection
  - Experts, regular users: know task & UI well
    - speed, efficiency, short nonintrusive feedback, shortcuts, macros, customizability, extendability



# More Dimensions to Classify Users

- Background
  - Name, age, nationality, education, income
- Computer experience
  - Particular apps, duration, depth (see before), special functions (printing, ...)
- Task experience
- Personality
  - Introvert/extrovert, systematic/spontaneous, risk threshold, early/late adopter



# Observing Users

- Setting goals
  - How will you analyze the data from the observation?
- Identifying users
  - Who will you observe?
- Triangulation
  - Use multiple sources and methods (interviews,...) to confirm your observations
- Pilot observation
  - Do a small-scale observation to debug the process



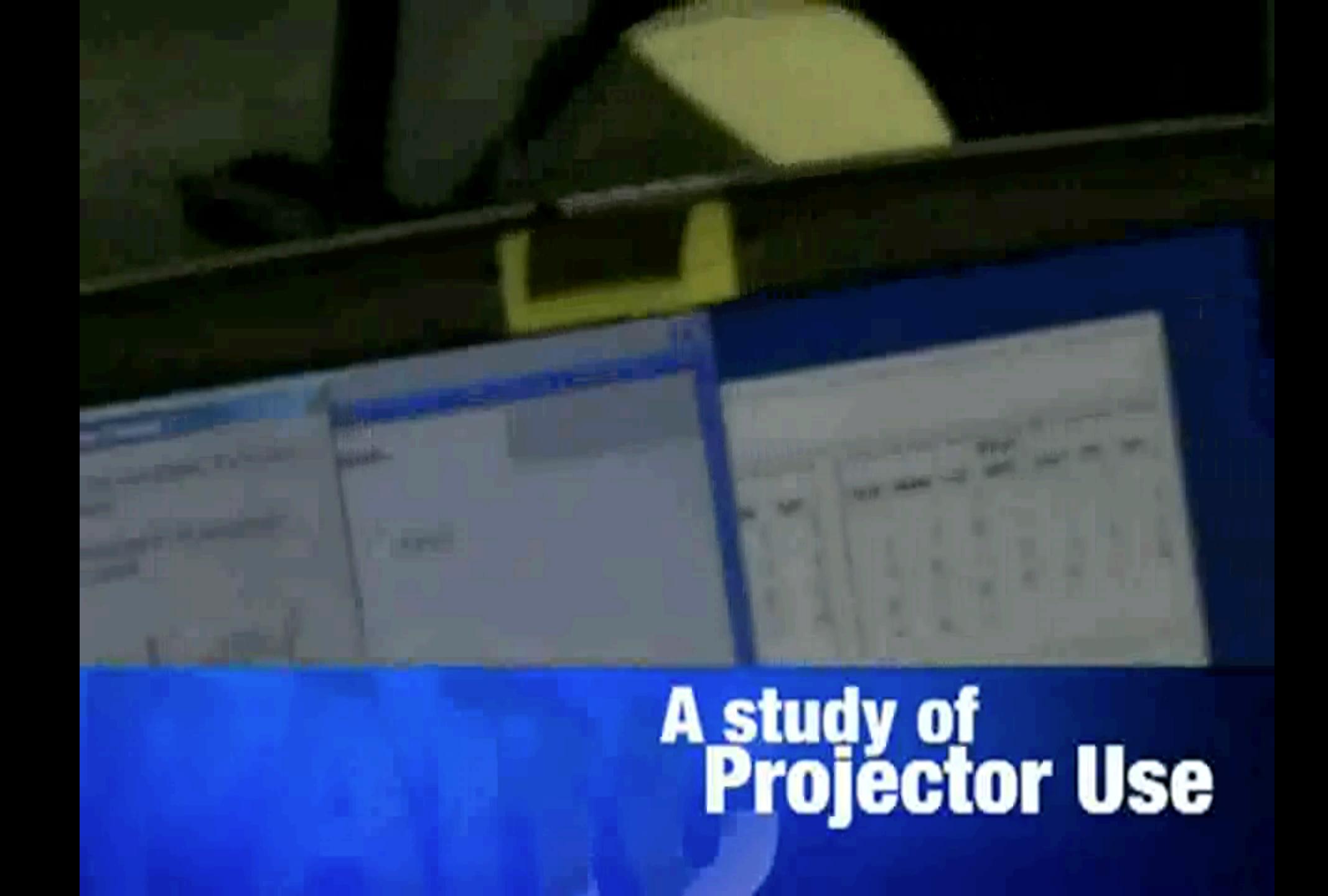
# Simple Observation Framework

- People: Who is using the technology at any particular time?
- Places: Where are they using it?
- Things: What are they doing with it?

## Detailed Observation Framework

- Space: What is the physical space like and how is it laid out?
- Actors: What are the names and relevant details of the people involved?
- Activities: What are the actors doing and why?
- Objects: What physical objects are present, such as furniture?
- Acts: What are specific individual actions?
- Events: Is what you observe part of a special event?
- Time: What is the sequence of the event?
- Goals: What are the actors trying to accomplish?
- Feelings: What is the mood of the group and of individuals?





# Interview: Preparation

- Create interview protocol: What will you ask?
- For initial input, do not focus on presenting your design ideas, but on learning about the task
- Pilot interview
  - Interview one student inside/outside your group
  - A separate observer to note the pitfalls



## How to Ask Questions

- Clear and simple, not too broad
  - "How do you like the UI?" is too general!
- Users don't always answer truthfully
  - Lack of knowledge, bad estimates, embarrassment
  - So formulate questions carefully, maybe indirectly
- No leading questions!
  - E.g., Want to ask: Do we need to add audio playback to an ebook reader?
    - "Do you want audio playback in an ebook reader?" ← Leading question (bad)
    - "Do you listen to audio while you are reading an ebook?" ← Better question



## Interview Results

- User profile
- Task profiles
- If system involved:
  - Problem areas with the system
  - Ideas for improvement
- In our case: an idea of the task our system should support



## Personas: Who Are the Users?

- Precise description of hypothetical users
- Act as stand-in for real users
  - Guide design decisions
- Fictitious, but based on knowledge of real users from observations
- Personas are not elastic
  - Avoids stretching users' assumed abilities, instead of creating a good design

#### BACKGROUND

- 15, Female
- Ongoing Private Education
- Ambitious
- Comfortable using technology to communicate

#### MOTIVATIONS

- Keeping in touch with her network
- Fashion/street cred
- Keeping up with peers.

#### FRUSTRATIONS

- Sad people trying to be 'friends' on Facebook
- Having to be in bed @ 11pm
- Being swamped in friends updates
- Missing important status updates

#### Ginnie

Receives private tutoring in Maths and English as these are not her strong subjects. Enjoys playing for the school's 2nd teams for netball and Lacrosse and is good at art.

She loves recording her favourite shows: ER and Sun Valley High on Sky+ and spends some of her time on her Laptop that Daddy bought her watching videos on YouTube, downloading music, keeping up to date with her friends on Facebook and chatting via MS IM to her cousin who is at University in Leeds.

She loves Ugg boots and Abercrombie & Fitch and uses the Internet to shop and find the cheapest prices.





"I want to easily hook up with my friends whilst watching TV"









Preece et al., Interaction Design, 3ed., 2011



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# Brainstorming: An Initial Design Technique

- Goal: Collect as many ideas on a given topic as possible
- Relax, have fun, invite good brainstormers
- Defer judgment, don't criticize or argue
  - Instead, leapfrog on each other's ideas
- Quantity, not quality; include crazy ideas
  - Go for a certain number of ideas, say, 100
- Scribe collects ideas visible for all
- Limit to 5–10 minutes



# To Help You Brainstorm

- Think of habits
  - Positive
  - Negative
- Think of physical gadgets and how the habits can be linked to the them
- Stick to a particular domain (e.g., diet, exercise, drinking, smoking, hygiene, etc.)
- Try to answer: "Who?" "What?" "Where?"



# In-Class Exercise: Brainstorming

- Problem: How to motivate people to clean their rooms?
- Create as many (crazy!) design ideas as possible
  - One person creates sticky notes
- Go for quantity not quality
- One idea per sticky note (write or sketch)
- Duration: 5 mins

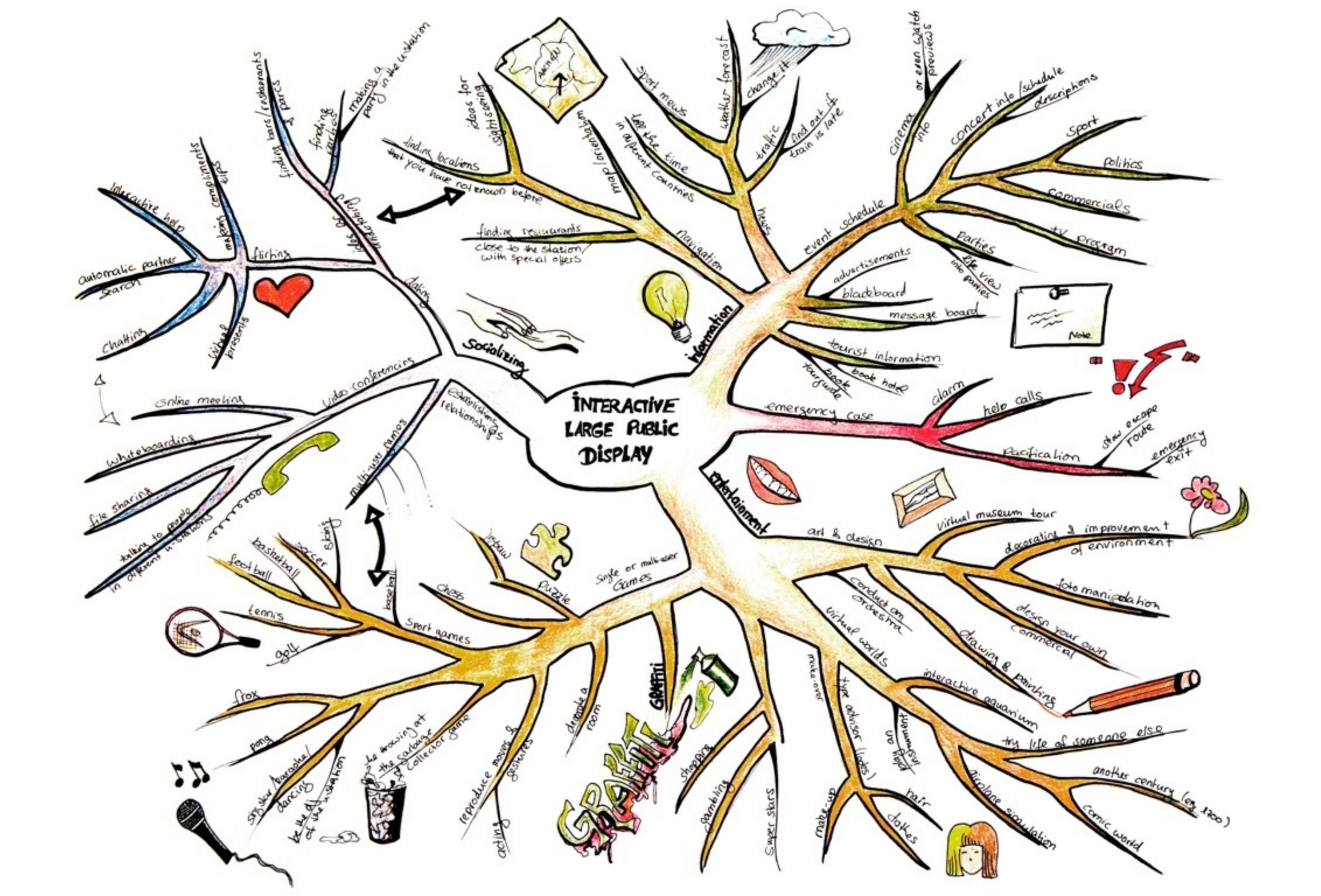




# Structuring Brainstorms: Concept Mapping

- Used since 1500s by Spanish monks
  - Mind Mapping trademarked by Tony Buzan in 70's
- Uses both brain sides, structures note-taking for overview, planning, learning... with a visual "gestalt"
  - Use A3 landscape, subject in middle, aspects on branches, subtopics on subbranches (software?)
  - Connect additional relationships with arrows
  - Use images/icons for keywords where they work
  - Use color for branches & connections (after pencil version becomes stable)
- Grows over time, combine individual maps





# In-Class Exercise: Concept Map



- Create a concept map for the problem:
   How to motivate people to clean their rooms?
- Use first-level branches for different aspects of your idea
- Note how the graphical layout helps you to organize your thoughts
- Use color + graphics to increase visual impact and uniqueness



## Storyboard: What do they want to do with the system?

#### What?

- Sequence of single images, like visual outline of a film
- Visual representation of a script, illustrates interaction

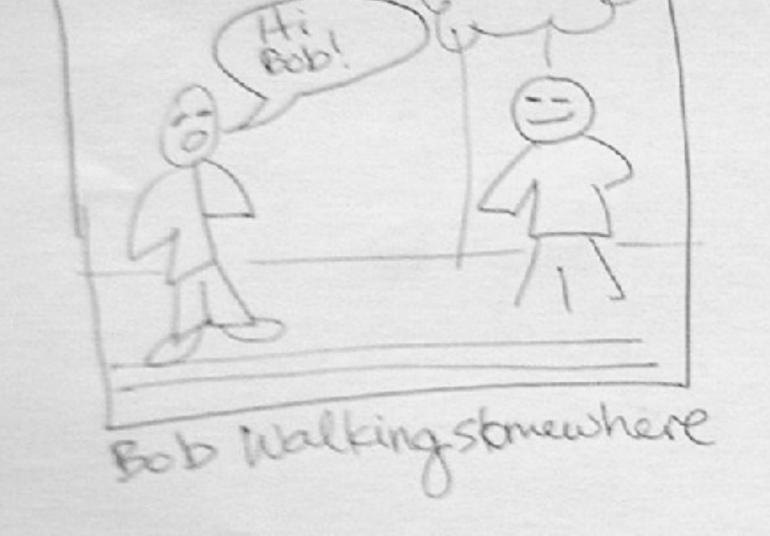
#### • Why?

- Describes task showing environment, user, and computer
- Or describes UI as series of screen images (but include user representation)
- Helps working out interaction details
- Great at-a-glance overview of interaction
- Helps developing usage scenarios, tasks, and tools

#### When?

After describing a task, storyboard it, take it back to the user. Did you get the story right?





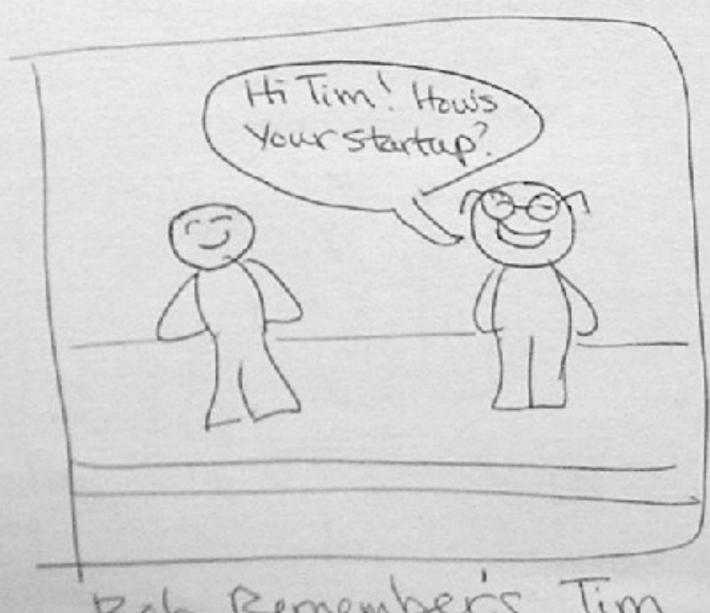




Faces ...

Tim is up If he had Recognition Glasses.





Bob Remember's Tim Brown's Start-up, Brown.com

Bob is

Mober

needs

with

## How To Draw Users

- Star Man and friends (interactive blackboard interlude)
  - Stick Man (bad)
  - Star Man
  - Sad, happy Star Man
  - Star Man pressing a button
  - Star Trek Man, Simple Star Trek Man
  - Family, users around an exhibit
  - Architect Man, Suits
  - A hand, a face



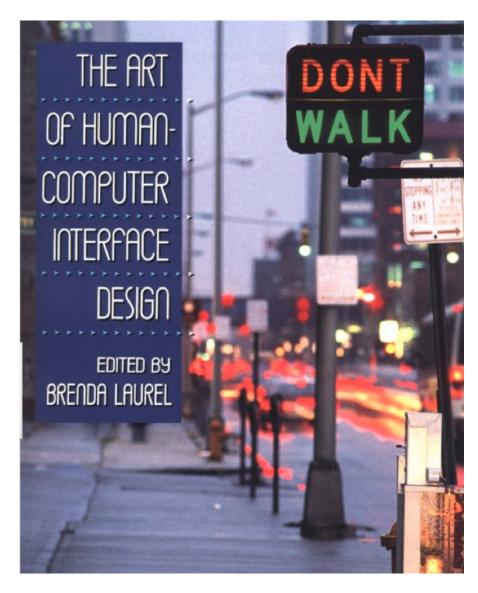
# Learning About Users

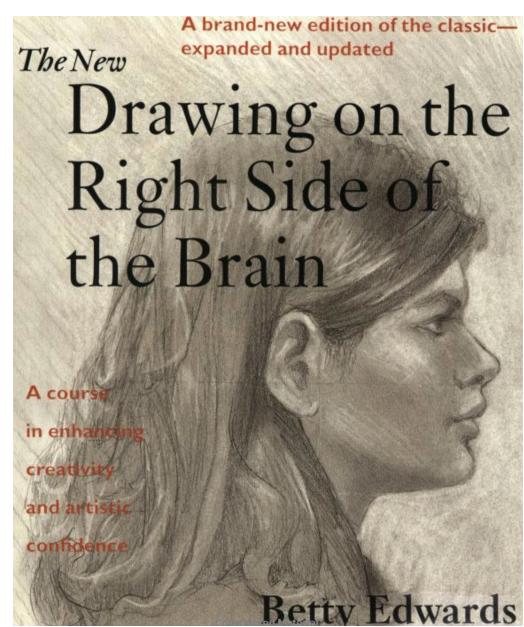
- Providing useful functions is not enough
- Functions also need to fit seamlessly into users' task environment, otherwise it won't be used (cost/benefit)
- So: Know The User!
- Find real people interested in your planned system (otherwise there's a problem)



# References on Storyboarding

- Full version of Bill Verplank's sketching guest talk: http://hci.rwth-aachen.de/verplank
- More examples: Brenda Laurel, "The Art of Human-Computer Interface Design"
- Learning to draw:
   Betty Edwards, "The New Drawing on the Right Side of the Brain"
- Digital storyboards: http://www.storyboardthat.com/
  - But: Manual sketching is essential in design meetings!





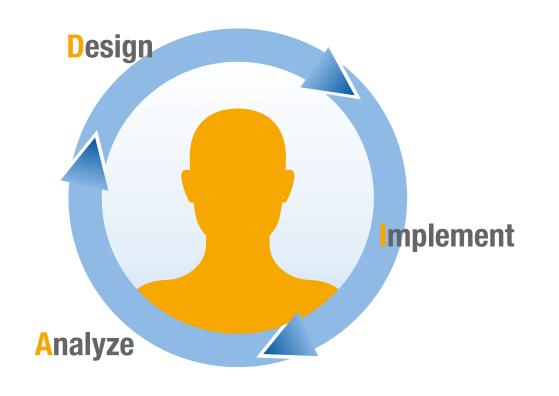


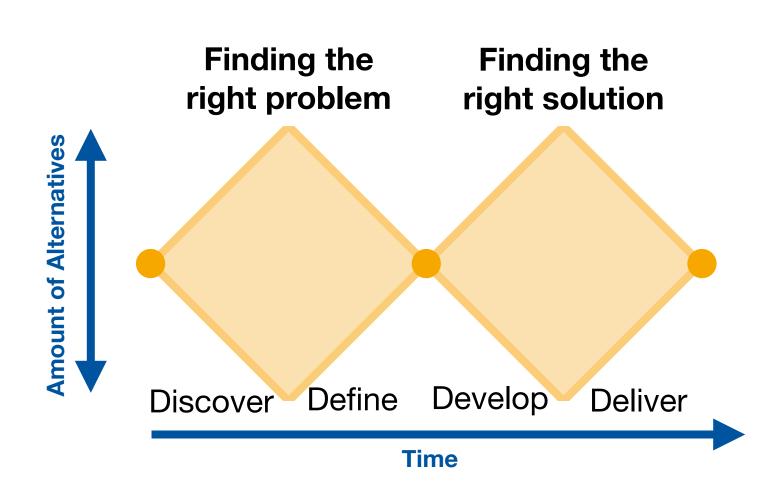
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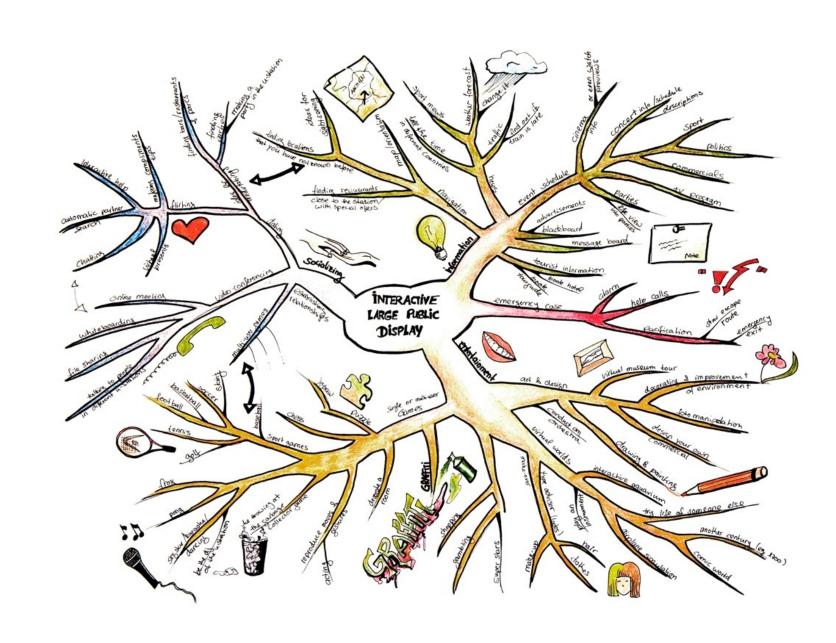
- Draw a simple storyboard for your preferred brainstormed idea
- Show how it helps users with a task in three pictures
- Make it readable from 2 m distance
- Walk-around idea fair



# Summary







- The three questions:
  - Who are the users?
  - What do they want to do with the system?
  - What is the context?
- Storyboards:
  - What? Why? When?

