Introduction to Human-Computer Interaction

Designing Interactive Systems

Lecture 1

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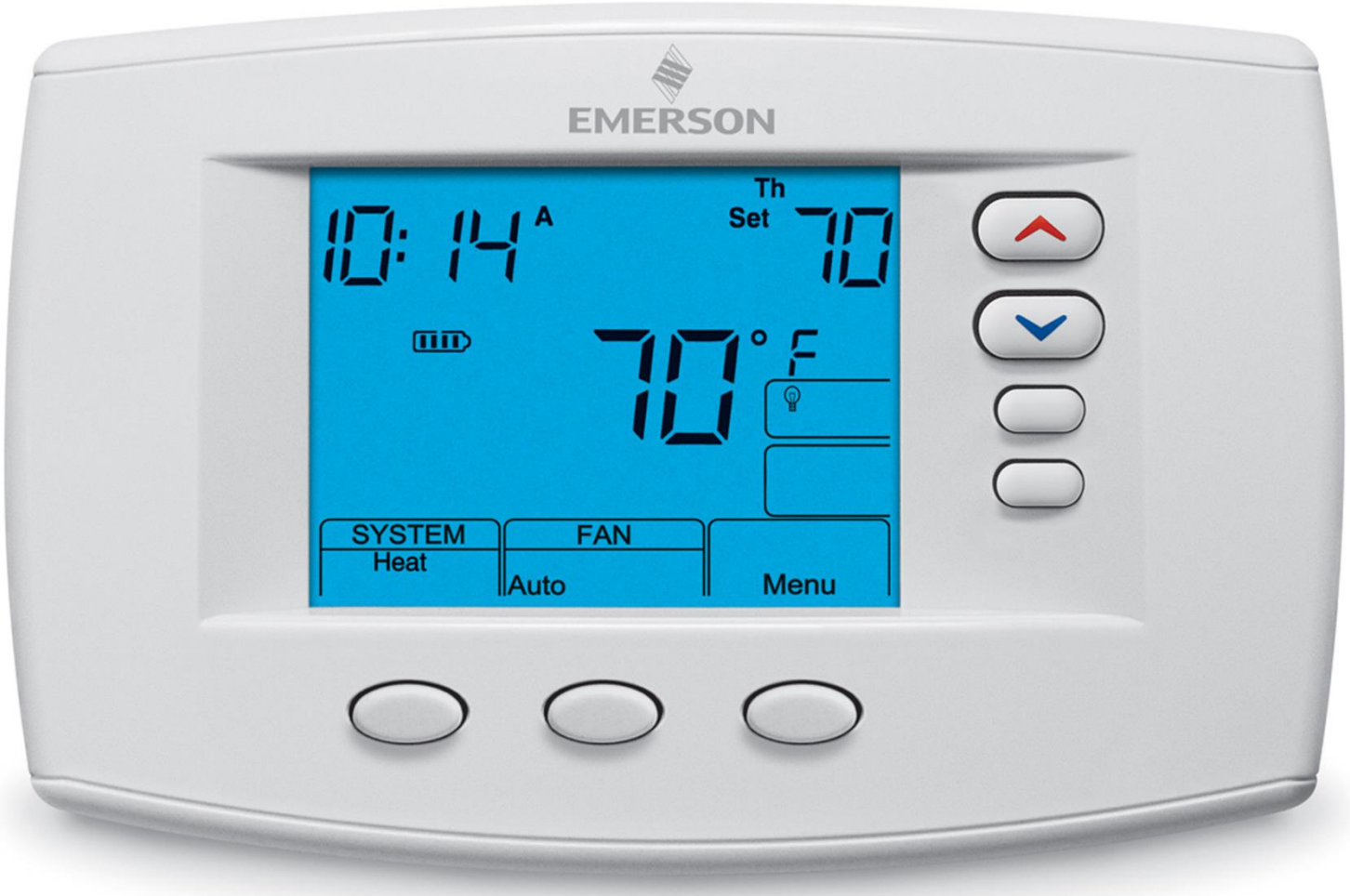
Photograph courtesy of Penelope Sanderson

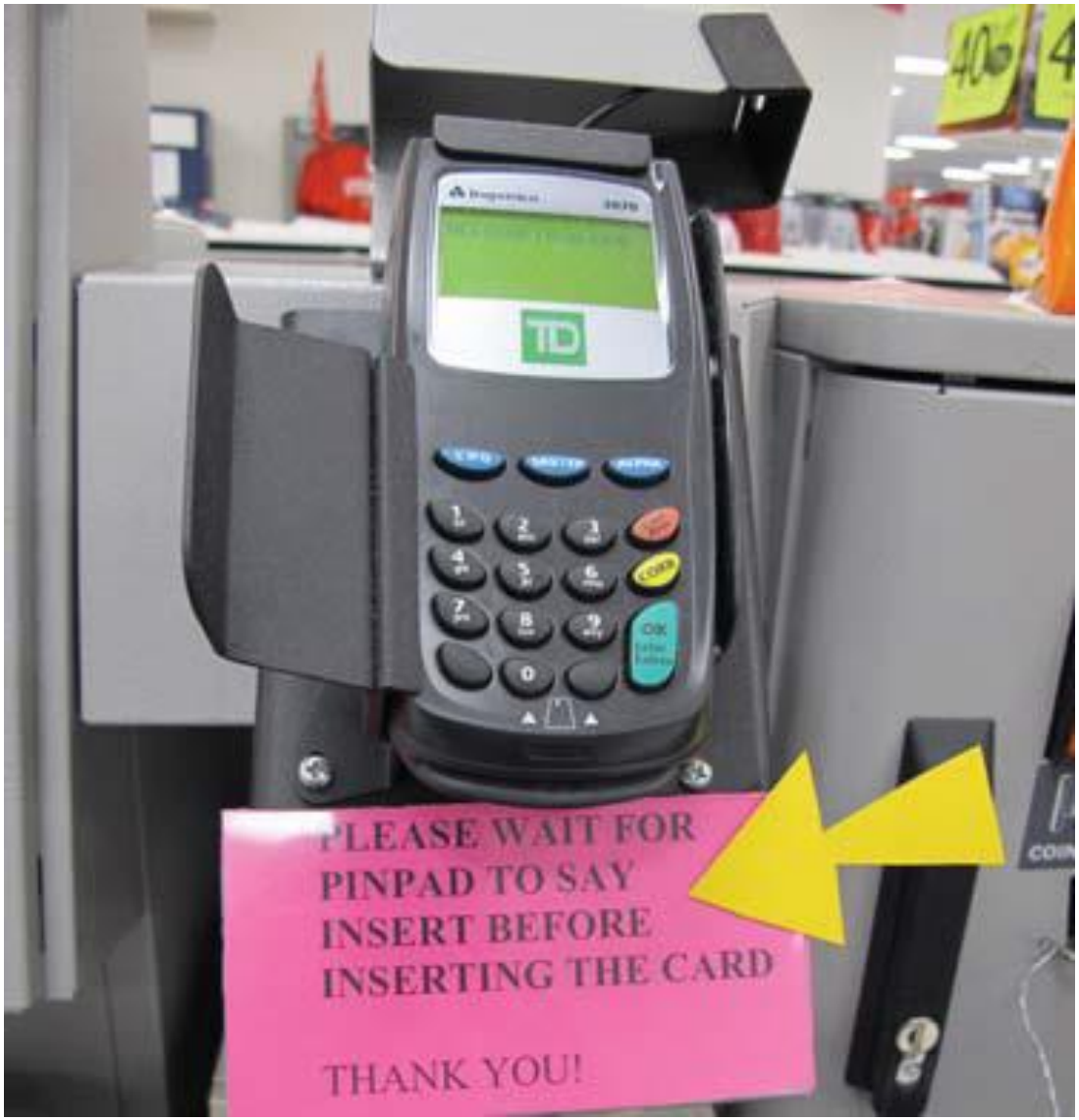
bad interaction design is everywhere

Photographs courtesy of Penelope Sanderson

bad interaction design is everywhere



bad interaction design is everywhere



even in the movies

“This Is What Happens When You Let Developers Create UI”

Jeff Atwood (Co-Founder StackOverflow)

bad interaction design can be harmful

in harmless cases just to your general sense of well-being

bad interaction design can be harmful

Money

- A $200 withdrawal turns into $20000
- Bad font choice ➔ "," looks like "."

bad interaction design can be harmful

Lives: Therac-25 Radiation Machine

- Massive doses of radiation led to several deaths
- The system noticed that something was wrong and halted the X-ray beam, but merely displayed the word "MALFUNCTION" followed by a number from 1 to 64. The user manual did not explain or even address the error codes, so the operator pressed the P key to override the warning and proceed anyway.

Therac 25 user interface [1]

```
PATIENT NAME   : JOHN DOE
TREATMENT MODE : FIX     BEAM TYPE: X     ENERGY (MeV): 25

                          ACTUAL     PRESCRIBED
    UNIT RATE/MINUTE          0          200
    MONITOR UNITS           50  50         200
    TIME (MIN)              0.27         1.00

GANTRY ROTATION (DEG)       0.0            0     VERIFIED
COLLIMATOR ROTATION (DEG) 359.2          359     VERIFIED
COLLIMATOR X (CM)          14.2         14.3     VERIFIED
COLLIMATOR Y (CM)          27.2         27.3     VERIFIED
WEDGE NUMBER                  1            1     VERIFIED
ACCESSORY NUMBER              0            0     VERIFIED

DATE   : 84-OCT-26   SYSTEM : BEAM READY   OP.MODE: TREAT AUTO
TIME   : 12:55. 8    TREAT  : TREAT PAUSE           X-RAY 173777
OPR ID : T25V02-RO3  REASON : OPERATOR     COMMAND:
```

"but, I wouldn't make those mistakes!"

maybe, but you're not the only one working on most projects. Your team might still make that mistake.

here's the problem:

- **you are typically not the user.**
- **you have your own biases.**

+

errare humanum est

summary

- interaction design is everywhere
- good interaction design is hard
- poorly designed things have big consequences
- good design practices can help
- you're going to be a good designer

course objectives

- learn ways to address interaction design problems
- learn how to understand users
- learn how to develop design representations
- work as part of an interaction design team

involves hands-on experience with multiple design methods: involving users, prototyping, (testing)

Course does NOT cover:

- Implementing specific interaction techniques
- Implementing using specific GUI toolkits
- …. and many other advanced HCI topics

introduction: me

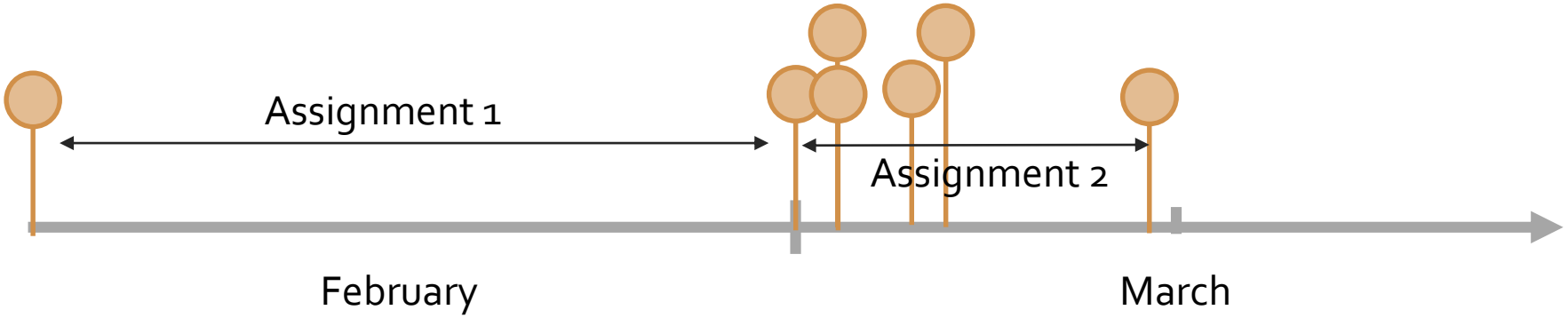
- instructor: Petra Isenberg
- research scientist (CR1) at INRIA
  - Ph.D. in Computer Science from University of Calgary
- research in Information Visualization / HCI
- office: at Université Paris Sud / Bâtiment 660 (plateau de Saclay)
  - email me for an appointment

basic course information

- website
  - http://tinyurl.com/ecphci
  - readings / slides
  - Posted online at the main website

Lecture	Break	Labs

lecture outline



assessment

- Assignments: 60%
- Exam: 50%

assessment – assignments 60%

- opportunity for you to engage in hands-on interaction design with a real project
- project teams of 3 (one group of 4)

Assignment 1 - Group Formation
Assignment 1 - User Requirements

Assignment 2 - Low-Fidelity Prototype

labs

- will explain the project components
- hands-on activities towards your project

Questions?

The Problem

WHY IS IT DIFFICULT TO DESIGN GOOD UIS?

the user experience

- all aspects of the user's interaction with the product: how it is perceived, learned, and used
- important questions:
  - what are the important qualities of the intended experience?
  - fast and efficient vs. slow and leisurely interactions

usability

- aim is to make things that meet users' needs
- there are many ways to meet needs
- usability is concerned with optimizing interactions

usability goals

- effective to use
- efficient to use
- safe to use
- have good utility
- easy to learn
- easy to remember how to use

Why is design hard?

- Everyone is different
  - Age, knowledge, skill, ability, background
- People *appropriate* technology unexpectedly…
  - Designer's fallacy: that a designer can design into a technology, its purposes and uses
- Contexts of use may differ than what we expect
  - Smartphone app use in the early days, and now

Appropriation

- In action...

http://appadvice.com/appnn/2012/01/ces-2012-ion-shreds-the-convention-world-with-guitar-apprentice

http://www.wired.com/gadgetlab/2010/04/sprocket-pocket-ipad-turn-signal-for-cyclists/

Why is design hard?

- We've never "seen" it before
- We aren't the people using it
- We can't anticipate how people will use it

Why is design hard?

- Judging/predicting which designs will be successful is difficult
  - Way more is possible than what is good
- Design involves making trade-offs
- Good designs are non-obvious

Why is design hard?

- People make errors
  - slips: unintended action [motor action]
  - mistakes: incorrect action [cognitive goal]

- Exercise: classify these
  - Mistyping an email address
  - Clicking on a heading that isn't clickable
  - Clicking "Save" instead of "Open"

Core design skills

- To synthesize a solution from all of the relevant constraints, understanding everything that will make a difference to the result
- To frame, or reframe, the problem and objective
- To create and envision alternatives.
- To select from those alternatives, knowing intuitively how to choose the best approach.
- To visualize and prototype the intended solution

"*The user is not like me"*

- Familiarity with the interface problems being solved
- Confidence
- Designer's setting vs. user's setting
- Designers have different skills (perceptual, cognitive, or domain)

Are there processes that can be followed?

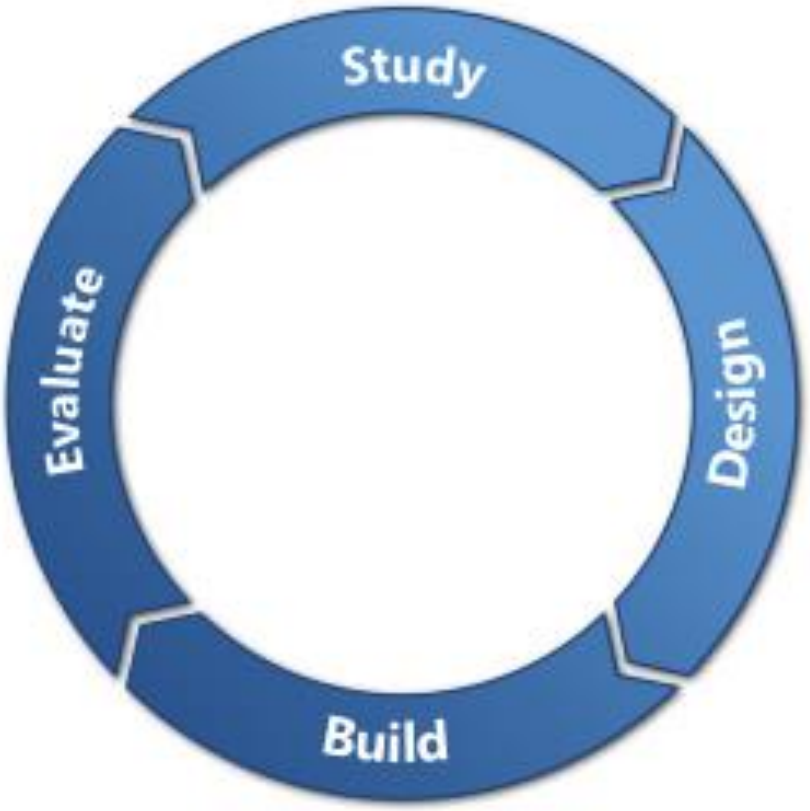
the user-centered approach

- early focus on users and tasks
- empirical measurement
- iterative design

four basic activities

1. establishing requirements
2. designing alternatives
3. prototyping
4. evaluating

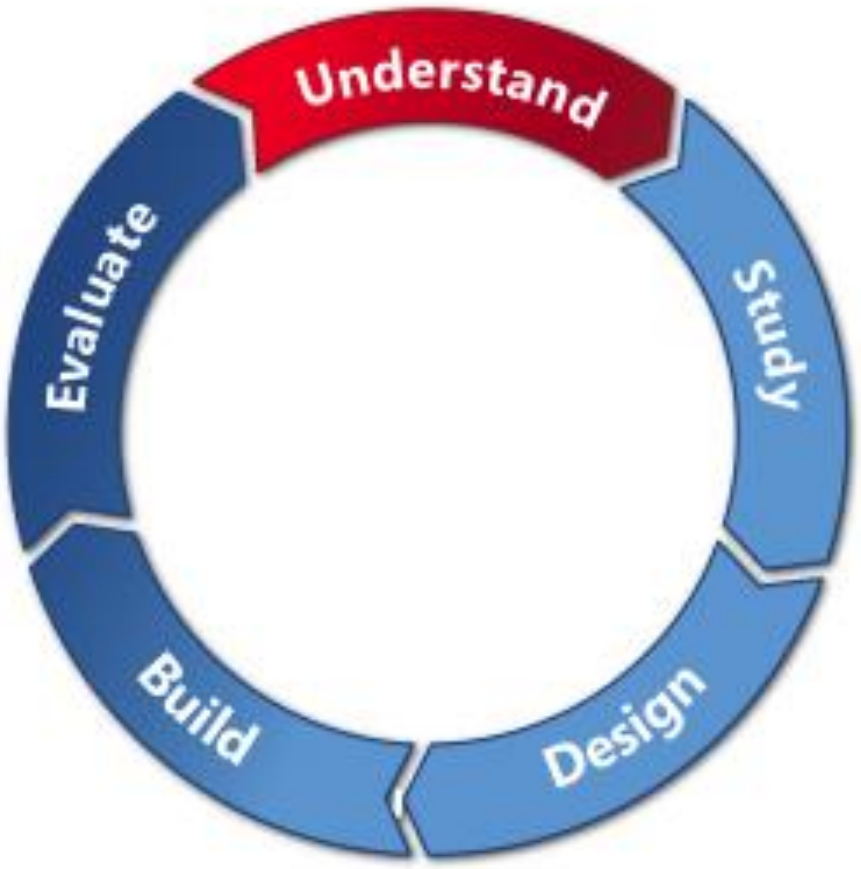
Iterative Process



The conventional user-centred, four-stage design/research model

Harper et al., 2008

Iterative Process



- what human values do we wish to design for?
- what are the various morale, personal, and social impacts of the proposed system?

Harper et al., 2008

practical issues

- who are the users?
- what are their needs?
- how do we generate alternatives?
- how to choose among alternatives?

requirements

understand as much as possibly about users, their tasks, and context of use in order to produce a stable set of requirements

users' needs

- **users rarely know what is possible**
- **look at existing tasks:**
  - their context
  - what information do they require?
  - who collaborates to achieve the task?
  - why is the task achieved the way it is?
- **envisioned tasks:**
  - can be rooted in existing behaviour
  - can be described as future scenarios

involving users

- **member of the design team**
  - participatory design approach
  - full- or part-time members, for short- or long-term periods of the project
- **occasional consultation**
  - interview users to identify needs
  - get feedback on prototypes through user testing

Goal

CREATE A DEEP UNDERSTANDING OF THE USER AND PROBLEM SPACE

task-centered system design

Steps:

- Articulate concrete descriptions of real-world people doing their real-world tasks
- Use these descriptions to determine which users and what tasks the system should support
- Prototype an interface to satisfy these requirements
- Evaluate the interface by performing a task-centered walk-through (or another method)

Reading: The Handbook of Task Analysis for Human-Computer Interaction (Chapter 2)

phase 1: discovering the tasks that users do

- strive for realism:
  - discover how real people do real tasks
  - but this is not always possible → other methods exist

research methods - ideal

- observing and/or interviewing the real end users
  - find out what current methods users use for doing their tasks
    (paper, competing systems, antiquated systems, …)
  - abstract users → real people with real needs

example:
if you are interested in customers who purchase items in a store, observe and talk to store customers as they move about the store

research methods – second best

- interviewing the end-user representative
  - if you absolutely cannot get hold of end-users
  - carefully select and interview end-user representatives
  - MUST be people with direct contact with end users and intimate knowledge and experience of their needs and what they do
  - people who work with end users are the best

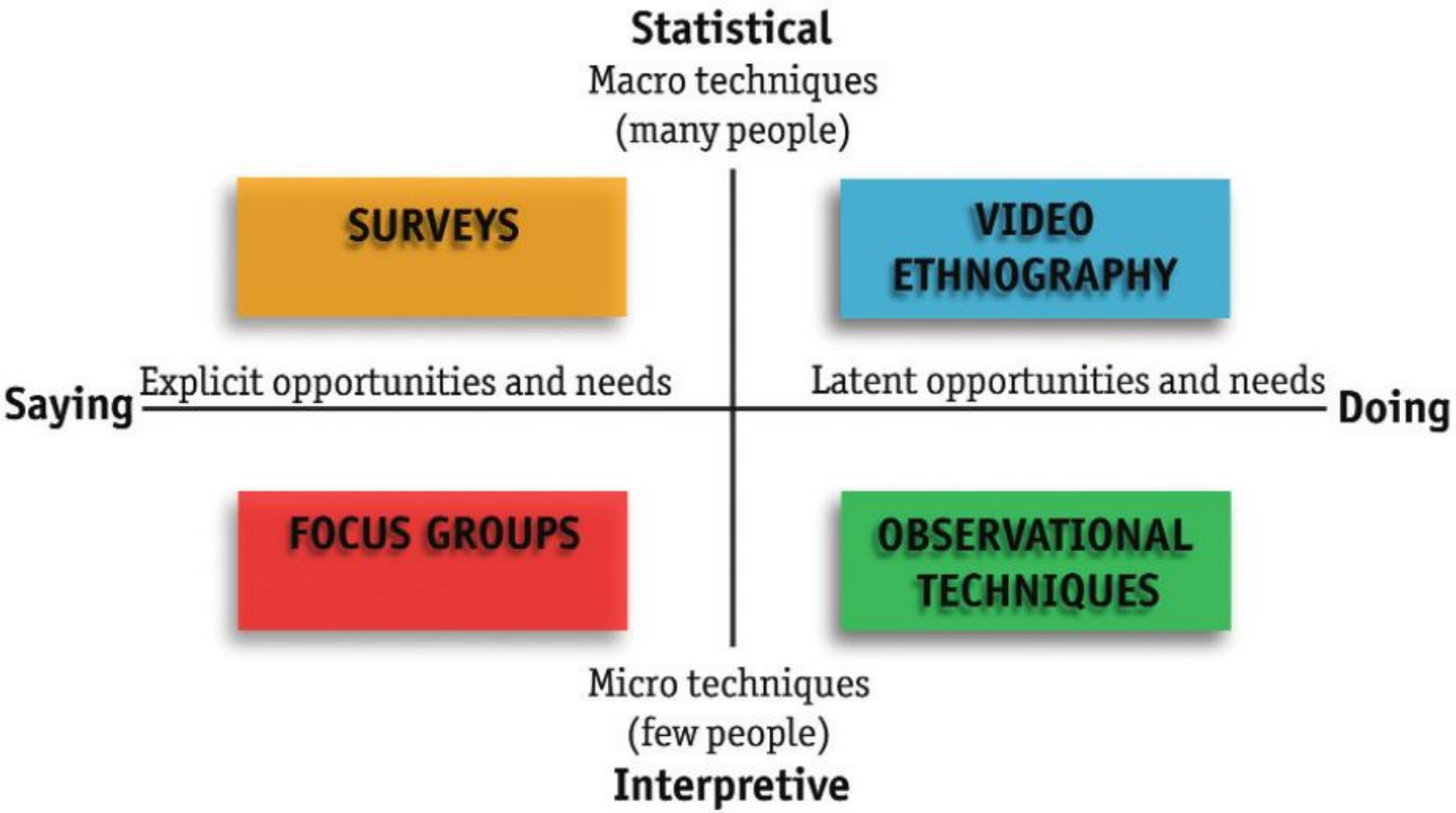
Example:
talk to front-line sales staff about their customers if you cannot observe or talk to customers directly. Better: interview/observe front-line staff as they deal with customers

research methods – if all else fails

- make your beliefs about the end users and the task space explicit
  - if you cannot get in touch with real end users or their representatives
  - use your team to articulate their assumptions about end users and their tasks
  - risk: resulting user and task descriptions do not resemble reality → only use as last resort

research methods

categories and examples (there are more methods than just these)



From: Moggridge – Designing Interactions

research methods

from the analyst's perspective:

- observe: users and their behavior in context
- engage: interact with and interview users
- immerse: experience what users experience

resource: 51 ways of learning about people

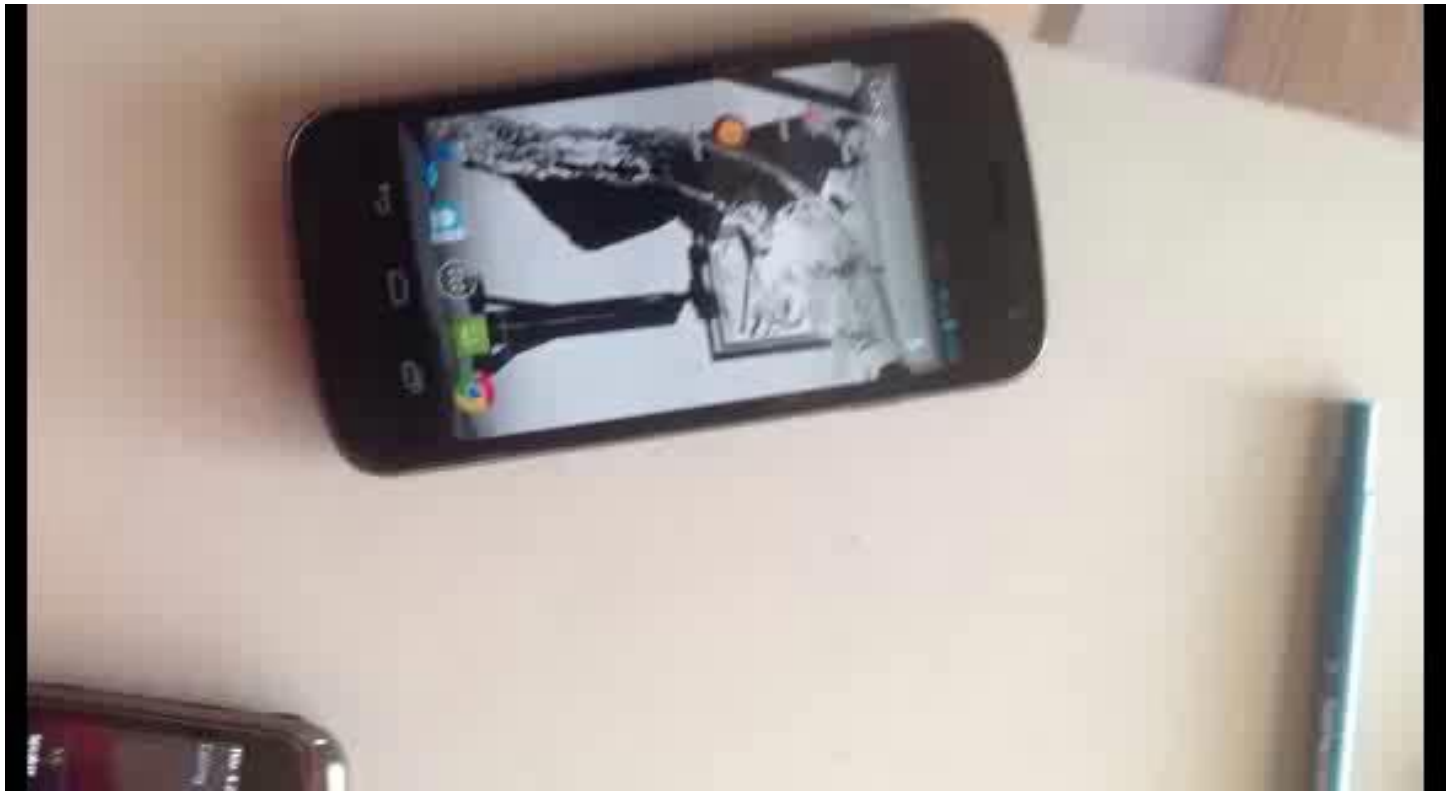
- IDEO method cards
  (remember the shopping cart people?)
- four categories:
  - Look: at what users do
  - Ask: them to help
  - Learn: from the facts you gather
  - Try: it for yourself

Look

OBSERVATION METHODS

first some caveats…

example 1: let's look at my friend Tony answering his phone



lets look at him answering his phone again

fat thumb example

- what happened here? What did you see?
  - a breakdown in a fundamental task
- what does this observation tell you?
  - opportunities for a new design
  - workaround possibilities
- would he have been embarrassed to tell you that his thumb sometimes hinders him from answering his phone?
  - very likely
  - (more on this problem later)

example 2: Swiffer

- people said they wanted a more powerful cleaner
- P&G outsourced design to a design firm
- firm discovered
  - mops are a pain, people don't like them
  - people cleaned their house before team showed up
  - they dropped coffee on the floor
  - people grabbed a paper towel and just mopped up
  - inspired the design of the Swiffer

lesson to learn

- what people say they want and what they want is not always the same
  - through observation you can uncover the latter
- what people say they do is not always what they actually do
  - through observation you can see what they do

(some) observation methods

- A Day in the Life
- **Behavioral Archaeology**
- Behavioral Mapping
- **Fly on the Wall**
- **Guided Tours**
- Personal Inventory
- Rapid Ethnography
- **Shadowing**
- Social Network Mapping
- Still-Photo Survey
- **Time-Lapse Video**

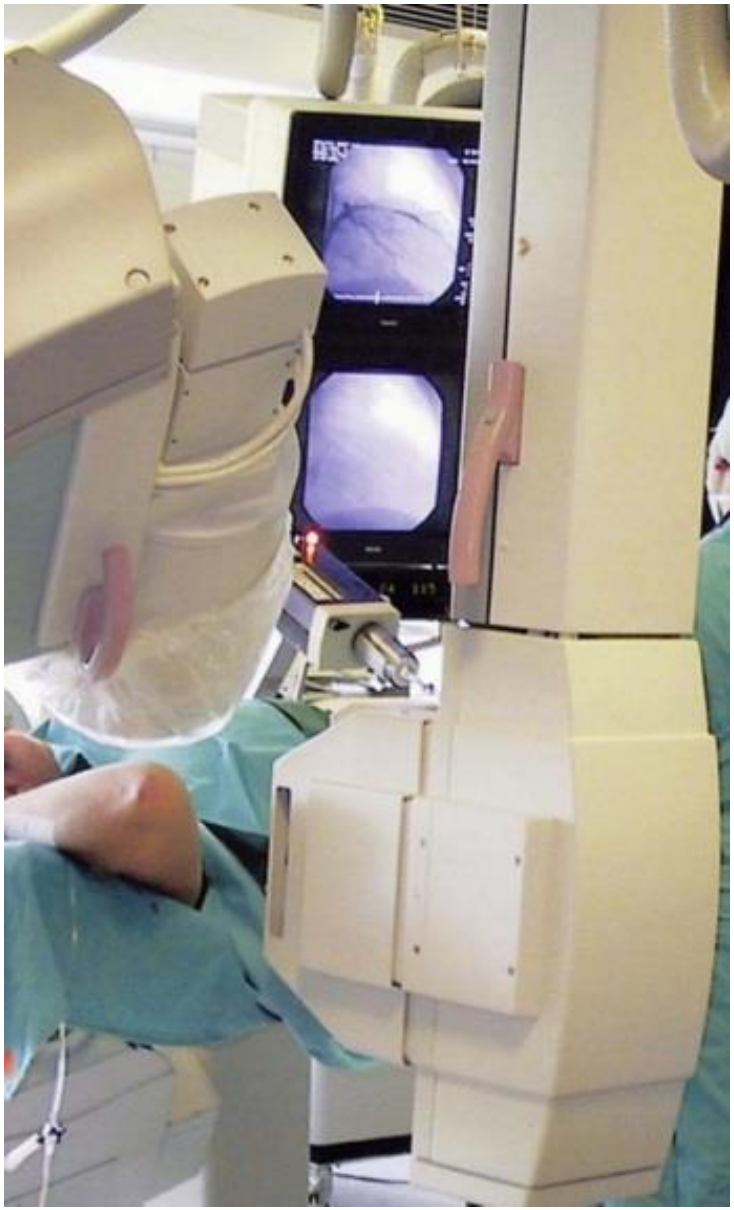
general observation methods

- natural
  - no interference from the investigator
- controlled
  - the investigator sets a task and observes it being carried out
- participatory
  - the investigator actively joins in the activity being observed to gain a firsthand activity

method: fly on the wall

- observe and record behavior within its context
- take notes, record audio and video if you can
- do not interfere with people's activities

example:
IDEO designers witnessed the regard with which the surgeons treated a transplant organ and incorporated these ideas into a transport box design



designing a mop/dustpan

it's important to know what people do so that you don't inadvertently bust something/take something away that they expected to do.

method: shadowing

- tag along with people to observe and understand their day-to-day routines, interactions, and contexts
- this is a valuable way to reveal design opportunities and show how a product might affect or complement users' behavior

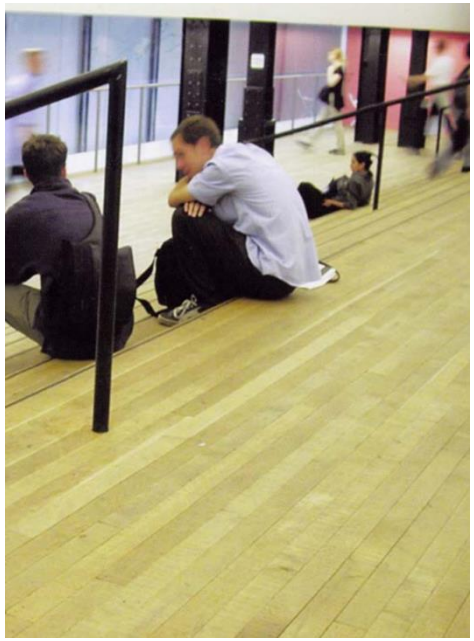
example:
the IDEO team accompanied truckers on their routes in order to understand how they might be affected by a device capable of detecting their drowsiness

method: shadowing

- distract the observed person as little as possible
- ask questions only in critical or unintelligible situations. You can deal with this by:
  - conducting interviews first to get to know the topic and/or situation before you start
  - collect all questions and do interviews later
  - bring a commentator who will explain behaviors, actions, and background as necessary

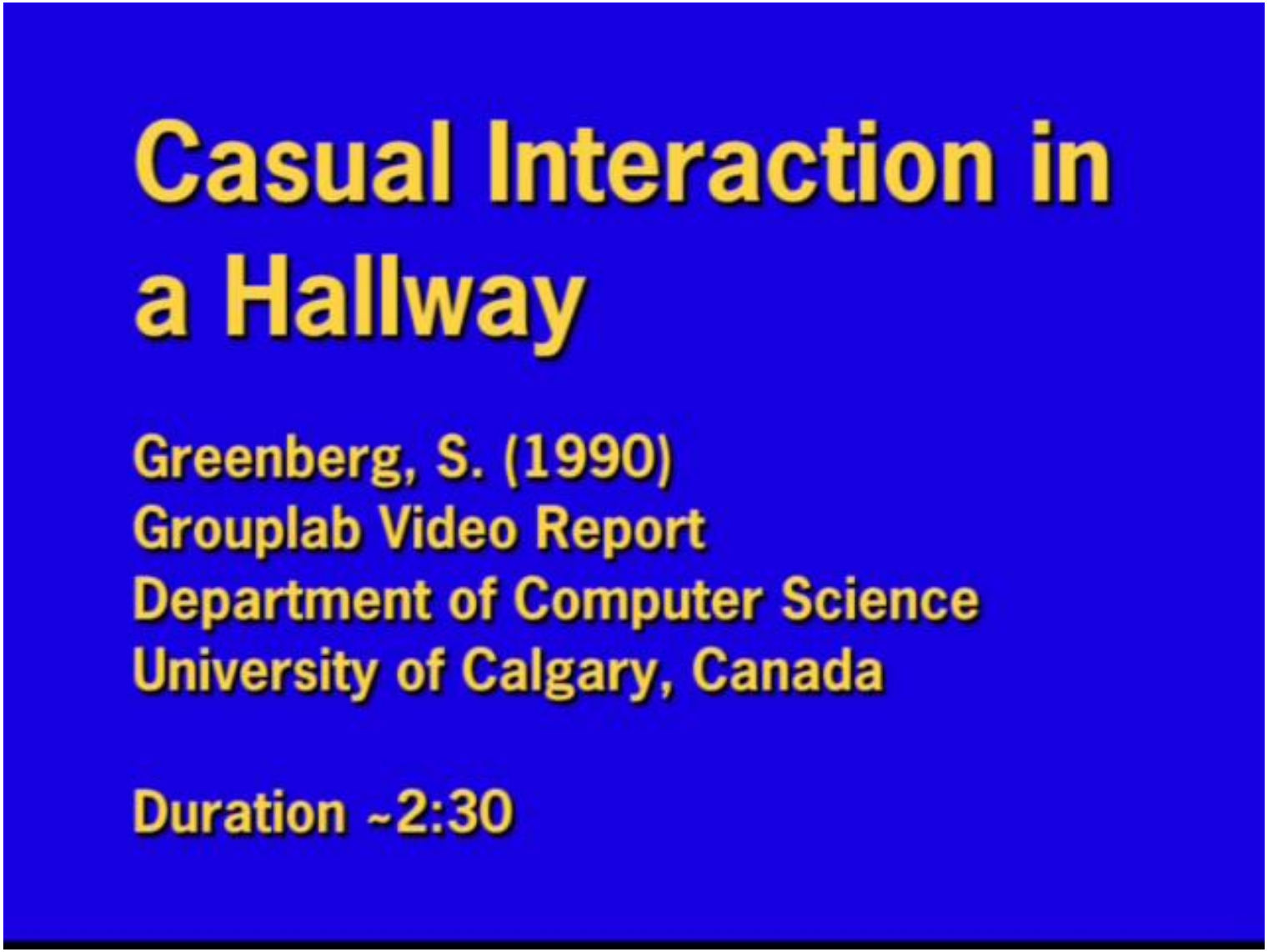
method: time-lapse video

- set up a time-lapse camera to record movements in a space over an extended period of time
- useful for providing an objective, longitudinal view of activity within a context



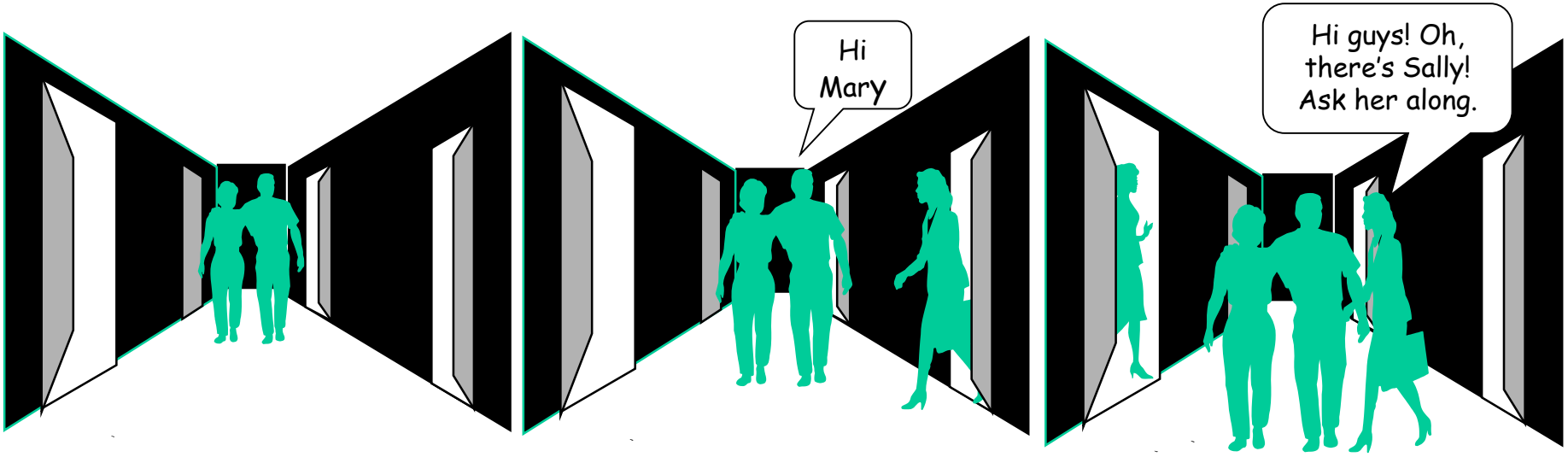
example:
IDEO team recorded the activity of museum visitors over several days to learn how to improve space layout

exercise: take notes on interesting behavior here



observations inspired design

- understanding casual interaction



Notification Collage

public display

personal display

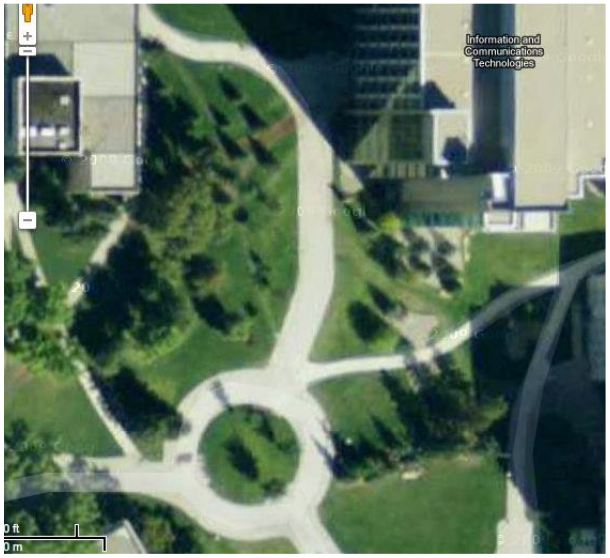
The Notification Collage: Posting Information to Public and Personal Displays. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'01. ACM Press, pages 515-521

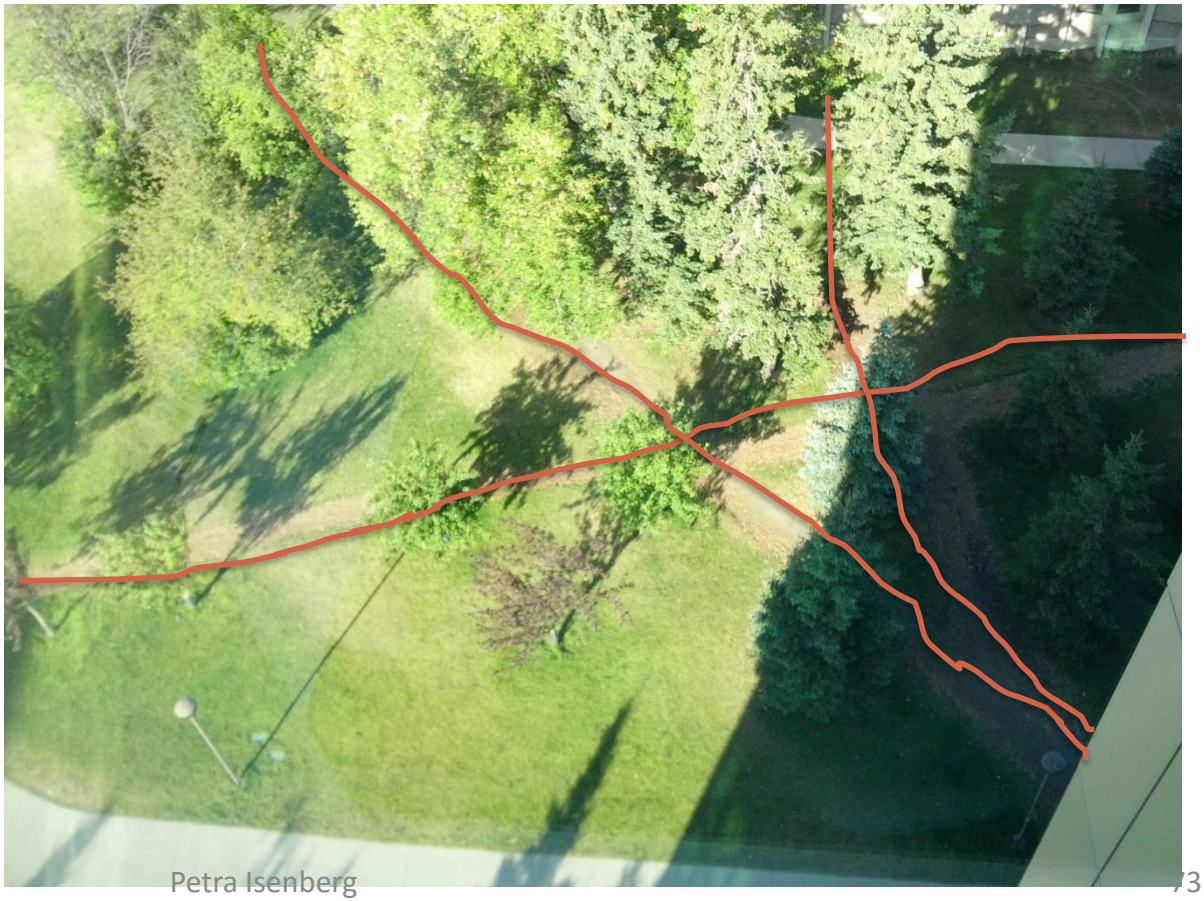
method: behavioral archaeology

- look for the evidence of people's activities inherent in the placement, wear patterns, and organization of places and things
- this reveals how artifacts and environments figure in people's lives, highlighting aspects of their lifestyle, habits, priorities and values

example:
noting that people efficiently organized multiple work tasks by stacking paper all over their desk surfaces, IDEO invented a brand-new system furniture element to support this

where should we put new walkways on campus?





what to pay attention to

- key features
  - Space
  - Actors
  - Activities
  - Objects
  - Workarounds
  - Acts
  - Events / triggers
  - Time
  - Goals
  - Feelings

questions

how is the physical space adapted to the task?

what are the key constraints on the task?

where are decisions made?

method: guided tours

- accompany participants on a guided tour of the project-relevant spaces and activities they experience
- making an exploration of objects and actions in situ helps people recall their intentions and values

example:
by following users through their homes, the IDEO team understood the various motivations behind ways photographs are used and stored

Break

Class will resume in 15 minute(s)

Deep Dive:

IDEO's redesign of the Shopping Cart

Idea Generation

LAB 1

Deep Dive Discussion – 15 mins

good design RARELY happens alone

- Others are needed to help generate ideas, give feedback, etc.
- Diversity of backgrounds, skills, and experiences are needed
- Today's lab is about understanding that group process and facilitating team formation

breakout Session

- Find teammates now
  - you can either self-assign
    (research does not recommend this)
  - we an do a small exercise to select groups
    (research recommends this)

group selection exercise – 5mins

You are designing a new interface for paying a parking ticket in a parking garage. Which of the following aspects would you choose to work on:

a) finding out how people currently pay
b) building an example mockup
c) designing the hardware
d) designing the software
e) something else

write your name and answer on a piece of paper and give it to the instructor

project we will work on during the course

- waiting in line is boring and wastes time
- your mission is to **improve the experience of waiting in line** (any line)…

breakout session – 15 mins

- Find with your group 10 examples of situations where people have to stand in line

- Write down:
  - who are the people
  - why do they stand in line

breakout session – 20 mins

- pick your favorite situation and create some sketches
  - what is the problem (or problems) that needs to be addressed?
  - where would an app to solve the problem be used?
  - what is the current situation?
- what are your assumptions about this problem?
  - assumptions are things you have not empirically backed up (e.g. security of children in a shopping cart is an issue – before you've read any studies about the topic)

- what would you need to find out?
- who would you ask?
- how would you ask?

breakout session – 5 min talks

- 5 minute talks – walk everyone through the charts you constructed

- 2 minute questions

group discussion – 10-15 mins

- Place the sketches of the different situations around the room
- Walk around, and discuss these with others
- Use sticky notes to add a variation to that idea
  - e.g. variations for who is waiting in line: (1) speed of the line; (2) context of waiting in line;
- If you would like to change groups, discuss with others

project Component I - deliverables

(details see website and grading sheet)

- Get, buy, reuse a binder and in it put
  - a piece of paper with the names & email addresses of all team members
  - a grading sheet (download from website)
  - a description of your 10 situations
  - list of 5 assumptions
  - 10 observations
  - 2 pictures from interviews

http://tinyurl.com/ecphci

Hand the binder in at the beginning of the next lab!

In the remaining time

- begin with your deliverable
- flash our your ideas for observations

Further readings

- Helen Sharp, Yvonne Rogers, Jenny Preece, Interaction Design: Beyond Human-Computer Interaction, Wiley, 2nd Edition, 2007, ISBN 0-47001866-6, http://www.id-book.com/
- Bill Buxton: Sketching User Experiences - Getting the Design Right and the Right Design. Morgan Kaufmann, 2007, ISBN 0-12-374037-1. Educating us in creativity and design
- [Shne05] Shneiderman, B., Plaisant, C.; Designing the User Interface; Pearson Addison-Wesley, 4th edition, 2005, ISBN 0-321-19786-0.

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