Current Topics in Media Computing and HCI

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Media Computing Group
RWTH Aachen University
Summer Semester 2013
http://hci.rwth-aachen.de/cthci

Current Topics in Media Computing and HCI

- Audience
  - M.Sc. Computer Science
  - M.Sc. Media Informatics
  - M.Sc. Software Systems Engineering
  - B.Sc. Computer Science (extra credit / carry-over)
  - B.Sc. / M.A. Technical Communication (with focus on CS/HCI research)

- Prerequisite: DIS I
  - In class, assignments, and exams we assume that you know DIS I

Goals

- Understand ways to do research in HCI

- Practice how to retrieve and evaluate information from the literature
  ⇒ Preparation for thesis and future research work

- Learn about up-to-date developments in Human–Computer Interaction and interactive multimedia from new books and recent conference/journal articles
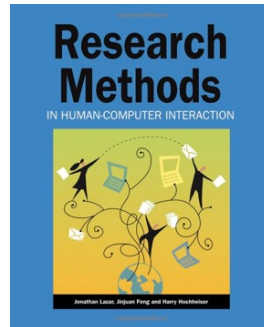

Literature Sources

- Recent (usually last 2 years) conference papers
  - CHI, UIST, TEI, ITS, DIS, NIME, MM, Ubicomp,…

- Recent journal articles
  - TOCHI, Interactions,…

Literature Sources

- Recent books
  - Research Methods in HCI
    Lazar et al. (2010)
  - Recommended reading for more details about evaluation methods — especially if you are going to do your thesis at our chair!

Topics for 2013

- Part I: Research literacy (2 weeks)
  - Understanding HCI research and publication process
  - Sample topic: text entry

- Part II: Recent topics (8 weeks)
  - Midair input
  - Crowdsourcing and human computation
  - Personal fabrication and personal design
  - Claytronics
  - Coding and integrated development environment
  - Interactive surfaces and tangible UIs
  - HCI design patterns

Administrative

- Format: V2/Ü3 (6 ECTS)

- Lecture: Tuesday, 10:00–11:30
  - Presentation & discussion of research topics
  - Small group in-class exercises

- Lab: Wednesday, 13:00–14:30   Attendance is compulsory!
  - Weekly reading assignments (individual)
  - Moderate and summarize in mock PC meetings (in groups)
  - Four paper review assignments (in groups)

- Final Grade
  - 30% midterm & 40% final
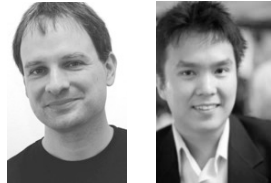 - PC meetings: 5% moderation, 5% summarizing
  - 5% × 4 paper reviews

Learning Resource

- Public website:
  http://hci.rwth-aachen.de/cthci
  - L^2P course room: slides, literature, assignments
  - Lecture recordings on iTunes U
    RSS links available on L2P
  - Research papers: ACM Digital Library
    Free access from inside RWTH network

CTHCI Team

- Prof. Dr. Jan Borchers

- Chat Wacharamanotham, M.Sc.
  - chat@cs.rwth-aachen.de

- Topic presenters

Plagiarism

www.interaction-design.org/encyclopedia/gestalt_principles_of_for...

The law of similarity captures the idea that elements will be grouped perceptually if they are similar to each other. In the "preferences window" of

" Law of Similarity
The law of similarity captures the idea that elements will be grouped perceptually if they are similar to each other. For instance in the following dialog we tend to devide the given files into two groups: [1]

Law of Similarity –

The law of similarity states that objects will be grouped perceptually if they are similar to each other. In other words the repetition in the forms persuades the human mind to group it [1]

[1] http://www.interaction-design.org/encyclopedia/gestalt_principles_of_form_perception.html
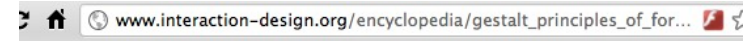
> **Cite and quote instead of plagiarizing!**

Consequences of Plagiarism in this Class

- Plagiarism will result in an immediate 5.0 for this class.

- Repeated plagiarism will also lead to banning from all other i10 classes.

- Sign the declaration of compliance and hand it in after the lab.

HCI Research Literacy I
Different approaches to HCI research

Three Approaches to HCI Research
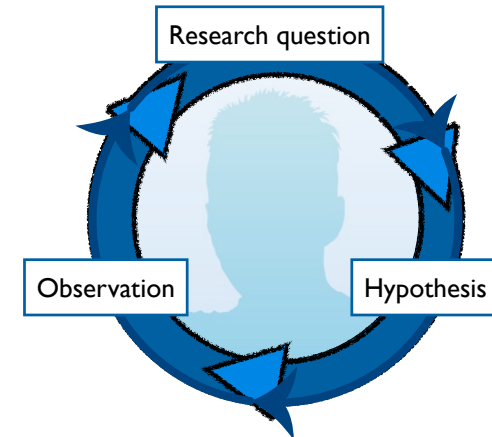

Test

Empirical science

Look

Ethnography
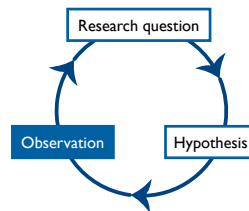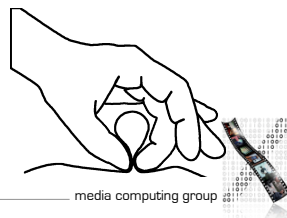
Make

Engineering and design

Empirical Approach

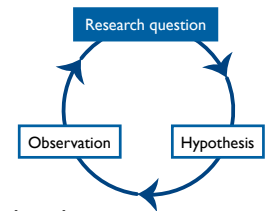Research question

Observation

Hypothesis

Initial Observation

- Begin with casual or informal observation

- Usually comes from personal experience that catches your attention or raises questions in your mind

- Example: "Cloth has an affordance of pinching. Could this be useful for interaction design?"
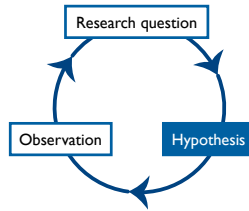
Research Question

- Identify variables and hypothesis that are associated with your observation

- Variables: characteristics or conditions that change or have different values for different individuals

- Research question: a statement that describes or explains a relationship between or among variables
  - A proposal to be tested

- Example: "For pinching cloth, different areas of the body would differ in preference and the way people pinch"

Hypothesis
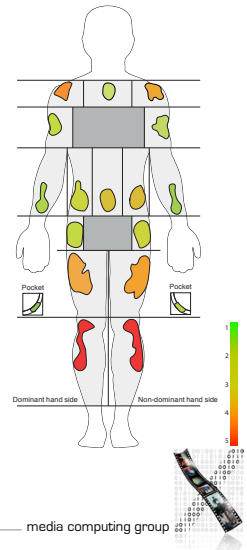

- Concrete and testable statements derived from the research question

- Operational definition: a specific set of operations for measuring external, observable behavior

- In-class exercise: try giving an operational definition for the variables highlighted below
  - "There would be a difference in user's preference among different areas on the body for pinching cloth."
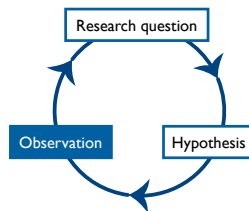

Research Example: Pinstripe

- Karrer et al., CHI '11

- Recall the prediction:
  - "There would be a difference in user's preference among different areas on the body for cloth pinching."

- Method:
  - Identify 16 different body area
  - Ask the participants to perform the pinching gesture in these areas
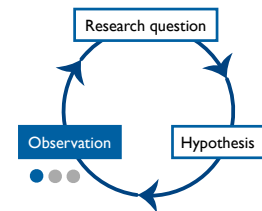 - Collect convenience rating in 5-point Likert scale

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Planned Observation

- Collect data to support, refute, or refine the original hypothesis

- Three strategies
  - Descriptive research: X happens
    Focus on the current state of each individual variable
  - Relational research: X and Y happen together
    Measure two or more variables that exist naturally from each participant
  - Experimental research: X causes Y
    Manipulate one or more variables and observe their effects to other variables
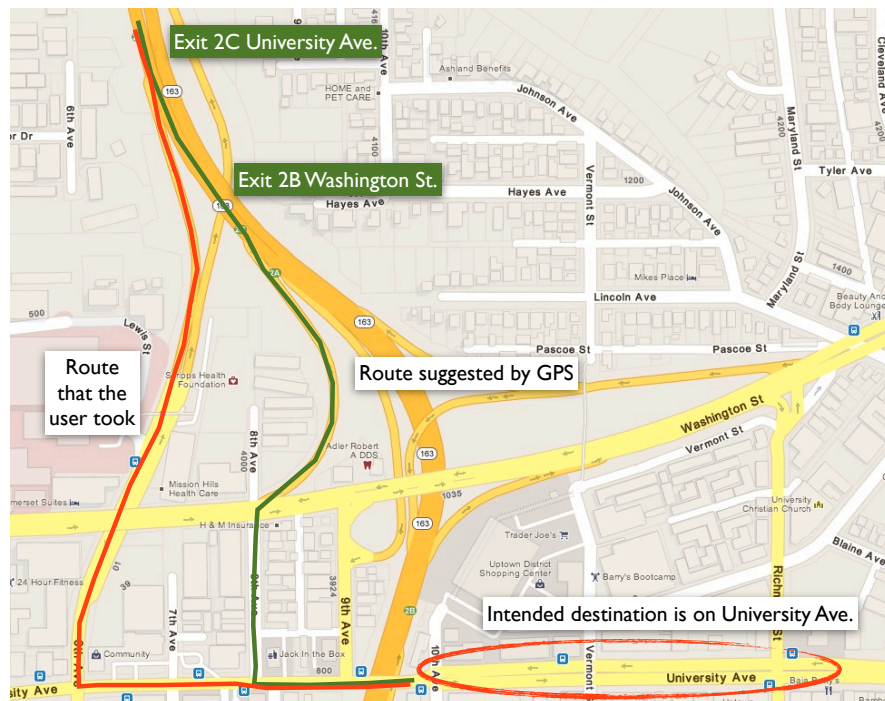

Descriptive Research

- Describe a naturally-occurring phenomenon

- Measure and report individual variables without claiming relationships

- Natural phenomena can occur when using a new technology as well

- Methods: observation, survey, case study

Research Example:
Natural Troubles of Driving with GPS

- Brown (Sweden) and Laurier (Edinburgh), Best paper CHI '12 🏆

- Goal: To understand users' interaction with GPS navigation system in non-controlled setting

- 14 drivers, 2 video cameras, field notes

  - 9 hours of video ⇒ 75 clips ⇒ 37 detailed transcriptions

  - Analyzed the data to find common patterns/themes and construct theories that explain them

The normal natural troubles of driving with GPS
Available at: http://dl.acm.org/citation.cfm?id=2208285

Exit 2C University Ave.
Exit 2B Washington St.
Route that the user took
Route suggested by GPS
Intended destination is on University Ave.

163 SOUTH Downtown
Washington Street 1/2 MILE
6th Ave University Ave EXIT 2C

Exit 2C University Ave.
Exit 2B

GPS still recommends to take 2B, even when the car is in "Exit only" lane

Exit 2C University Ave.

Natural Troubles of Driving with GPS

- Contribution & benefits:
  - "Presents a video analysis study of driving using GPS navigation systems in natural settings. The paper argues for [understanding] driving with [a] GPS as an active process and not as 'docile driving'."

- Conclusion
  - Designer should take into account the "intelligent driver"
    - E.g., less persistent instructions when the user decided to deviate from them
  - Normal natural trouble: "GPS is used in the way that was not foreseen. The driver must take instructions and the map and fit them with the situation."

The normal natural troubles of driving with GPS
Available at: http://dl.acm.org/citation.cfm?id=2208285

Relational Research

Research question

Observation   Hypothesis

- Measure a set of variables for each participant

- Examine to identify patterns of relationship
  - Changes in one variable are consistently and predictably accompanied by changes in another variable

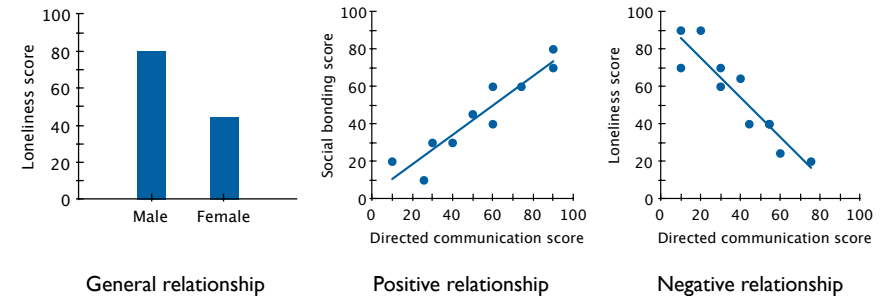- Measure the strength of the relationship

Research Example: Social Network Activity and Social Well-Being

- Burke (CMU), Marlow, and Lento (Facebook). Best paper CHI '10 🏆
  - "An empirical analysis of the relationship between direct and passive communication on Facebook and social well-being, including loneliness, bridging, and bonding social capital."

- Survey in Likert scale (N=1193)
  - Bonding, e.g., "There are several people I trust to help solve my problems"
  - Bridging, e.g., "I come in contact with new people all the time"
  - Loneliness, e.g., "I often feel close to people"

- Analyze the past two months Facebook activity data, e.g.,
  - Friend count (actual)
  - Directed communication: comments, likes
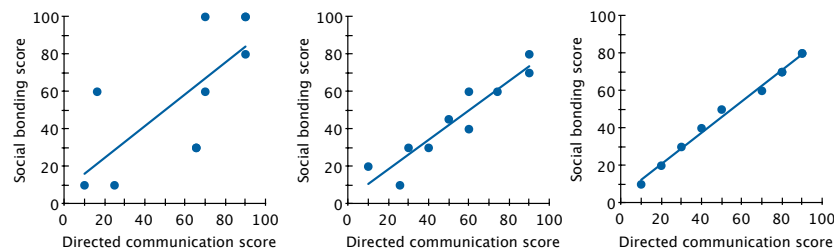 - Passive consumption of broadcasted items, e.g., status update

Patterns in the Relationship between Variables

General relationship   Positive relationship   Negative relationship

Simulated data for instructional purpose, based on the result from [Burke et al., CHI '10]

Strength of the Relationship between Variables

Weak ⟷ Strong

Simulated data for instructional purpose

Limitations of Relational Research

- Correlation does not imply causation
  - E.g.,   loneliness   ⇒ consumption
    or   consumption   ⇒ loneliness?
    or   third variable   ⇒ consumption and loneliness?

- Third variable problem: unidentified variable controls the correlated variables

- Shallow data from large number of people instead of deep data
  - Can be improved by follow-up interviews, follow-up surveys

- Participant sampling method limits the conclusion
  - Method: advertisement on Facebook
  - Participants: only English-speaking users, but compensated by many countries of origin

Experimental Research

- Purpose: To infer cause-and-effect relationship

- Controlling independent variable

- Observe the change in the dependent variables

- In-class exercise: recall the following experimental designs
  - Between-group vs. within-group
  - Benefits and drawbacks

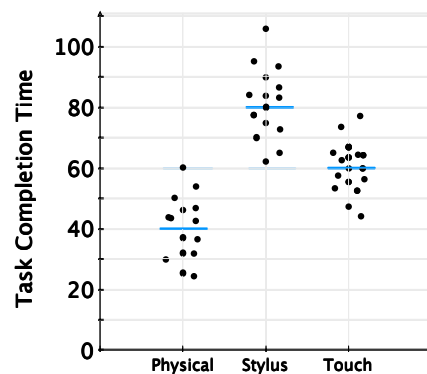- More details in lecture 2 and 3

In-class Exercise:
Mobile Phone Text Input Example

- Research question: On a mobile phone, is typing faster using *physical keys* compared to using a touchscreen and your *fingers* or a *stylus*?

- IV: keyboard types: {physical, stylus, touch}

- DV: time in seconds for typing a specified sentence.
  - Begin: when the user presses the first key
  - End: when the user presses Enter

- Design: between-groups
  - Each keyboard is tested by 20 participants
  - Each participant types the sentence only one time (one trial)

Variance of Real Data

- Data from experiments is noisy

- Effect: Variance caused by the different levels of our IV

- Confound: Variance caused by uncontrolled factors ("confounding variables")

Research Example: Mid-air
Pan-and-Zoom on Wall-sized Displays

- Nancel et al. (Paris), Best paper CHI '11 🏆

- Contributions & Benefits:
  - "Design and evaluation of multiscale navigation techniques for very large displays based on three key factors: number of hands involved, type of movement, type of feedback."

Mid-air pan-and-zoom on wall-sized displays
Available at: http://dl.acm.org/citation.cfm?id=1978969

Last Tuesday in Current Topics…

Empirical science   Ethnography   Engineering and design

- Three approaches to HCI research

- Three steps in the empirical science approach

- Three strategies in the planned observation

Research question

Observation   Hypothesis

Descriptive
Relational
Experimental
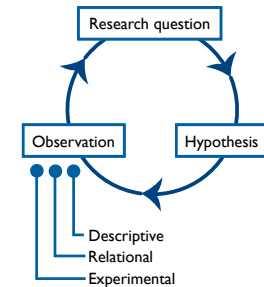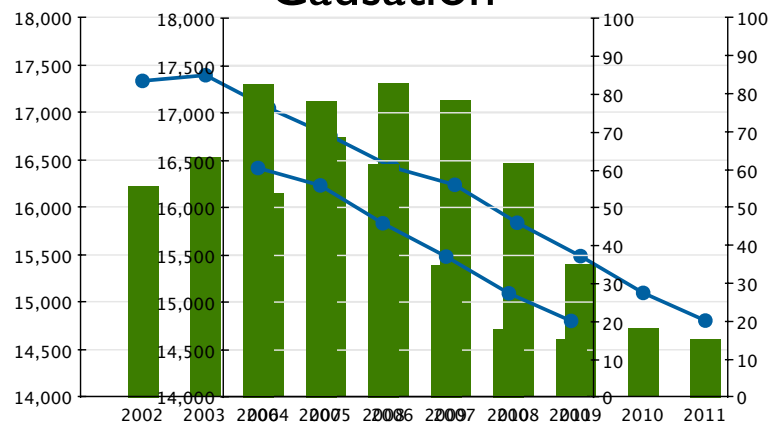
Correlation Does Not Imply Causation

■ Internet Explorer Market Share   ●— Murders in the US

Adapted from a tweet of @altonncf with data from FBI and W3Schools

Careerbuilding - Programm   **Femtec.Network**

Femtec.Network ist ein gemeinsames **Karriereprogramm von 10 großen Konzernen** mit dem Ziel, **Frauen aus den Ingenieur- und Naturwissenschaften** der teilnehmenden Hochschulen auf Führungspositionen vorzubereiten.

Bewerben können sich Studentinnen der Ingenieur- und Naturwissenschaften, die idealerweise am Ende ihres Bachelor- oder am Beginn ihres Masterstudiums stehen, **bis zum 12.05.2013 unter** www.femtec.org.

Informationen gibt es unter www.femtec.rwth-aachen.de oder zur **Infoveranstaltung am 23.04.2013 um 16.00 Uhr im SuperC.**

Kooperierende Unternehmen   Kooperierende Universitäten und Hochschulen

ABB   PORSCHE   ThyssenKrupp   TU   RWTH AACHEN UNIVERSITY   TECHNISCHE UNIVERSITÄT DRESDEN   TECHNISCHE UNIVERSITÄT DARMSTADT

EADS   BOSCH   ·····T···   bp   Universität Stuttgart

DAIMLER   EnBW   e·on   KIT   ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich   nth niedersächsische technische hochschule
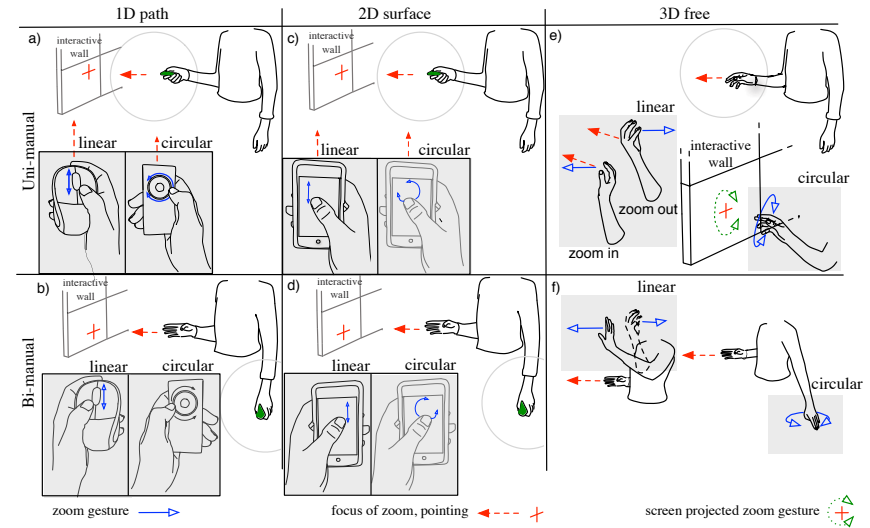
Literature in this Class

- Do I need to know what problems that GPS creates while driving?
  - No.

- Required reading: Examinable, must be read by everyone
  - The list will be published on our website and on L2P this week

REQUIRED

- Recommended reading: Not examinable
  - Different papers for each groups for reviews or discussion

Group 1–5
Group 6–10

- Other papers are example
  - Examples to illustrate the concepts explained in the class.

	1D path	2D surface	3D free
Uni-manual	a) interactive wall — linear / circular	c) interactive wall — linear / circular	e) linear / interactive wall / circular — zoom out, zoom in
Bi-manual	b) interactive wall — linear / circular	d) interactive wall — linear / circular	f) linear / circular

zoom gesture →   focus of zoom, pointing ◄--- +   screen projected zoom gesture

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Three Approaches to HCI Research

Test	Look	Make
Empirical science	Ethnography	Engineering and design

Ethnography

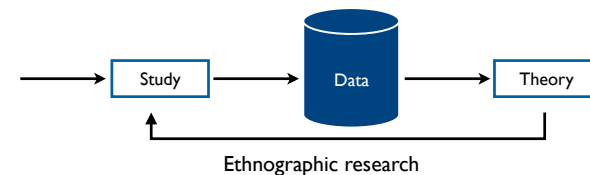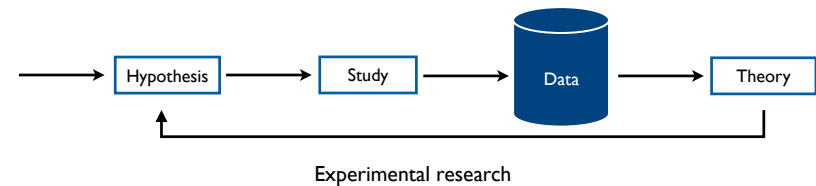Hypothesis → Study → Data → Theory

Experimental research

Study → Data → Theory

Ethnographic research
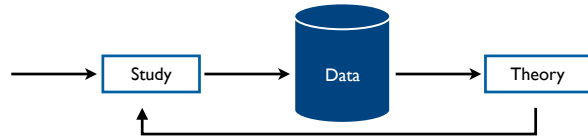
Ethnography

- Collect the data

- Code the data and find patterns that occur in the data

- Create theories that explain the data

- Try to attack the theories by gathering more data
  - Leads to stronger theories

Data Collection

- Methods: Observation, interview, participation, logging
  - Format: Field notes, video, audio, log files

- Triangulation: use multiple data sources to support an interpretation to increase the confidence of the conclusion
  - From different participants
  - From different types of data, e.g., observation, interview, logs

ChronoViz [Fouse et al., CHI '11]

Research Example: Vlogging in Dentist Training

- Becvar and Hollan (UCSD), GROUP '07

- Field site: dental hygiene training program in San Diego, CA, USA

- Goals
  - To gain understand the teaching and learning practices, media and representations
  - To implement and evaluate a design prototype based on the finding of the first goal

- Method
  - Ethnographic study of the current practice
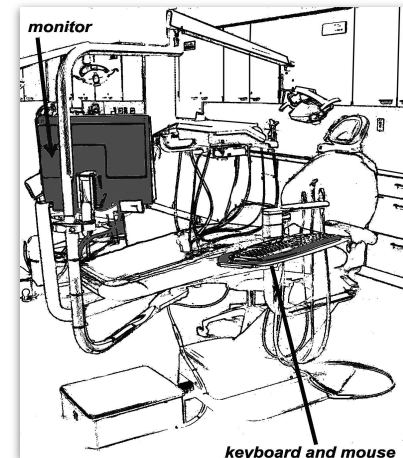 - Implement and deploy the prototype, then do another ethnographic study

Vlogging in Dentist Training: Understanding Current Practice

- Method (2004, one year in the field)
  - Observation
  - Video recording
  - Contextual interview

- 18 students, 4 instructors participated

- Sample finding: strategies used by clinical instructors
  - Molding: laying their hands over students' hands as they work with instruments
  - Directing: verbally talking a student through a new procedure: "Do this"
  - Demonstration: using hand gestures to show correct/incorrect ways to handle instruments

Vlogging in Dentist Training: Evaluation of the Prototype

monitor

keyboard and mouse

- Methods
  - Observation, video recording, web-based survey, server log data, interviews

- 63 students, 5 instructors over 2 semesters (Fall 2005–06)

Vlogging in Dentist Training: Evaluation of the Prototype

- Sample finding: how instructors and students used vlogs
  - Following: students compared their hand with the first-person view videos
  - Context-supporting: students opened vlog to support their discussion
  - Highlighting: instructors indicated relevant gestures or speech in vlog

SEE HOW SHE REALLY...

OVER ANGULATES?

THAT'S WHAT YOU NEED TO DO TO ADAPT THIS ONE RIGHT.

All watch screen.   **Instructor lifts her instrument.**

Three Approaches to HCI Research

Test	Look	Make
Empirical science	Ethnography	Engineering and design

Engineering & Design

- Objective: solve a problem with a solution that works

- Key attributes*:
  - Compelling target
    - Solve a concrete, compelling problem with demonstrated need
    - Solve a set of problems using a unifying set of principles
    - Explore how people will interact with computers in the future
  - Technical challenge
    - Requires novel, non-trivial algorithms, or configuration of components
  - Deployed when possible
    - System is deployed and intended benefits and unexpected outcomes documented

* from James Landay Slides: James & Friends' Systems How To

Research Example: Skinput

- Harrison et al., Best paper CHI '10

- Contributions & Benefits
  - "Skinput is a technology that appropriates the human body for acoustic transmission, allowing the skin to be used as a finger input surface."

Skinput: appropriating the body as an input surface
Available at: http://dl.acm.org/citation.cfm?id=1753394

Three Approaches to HCI Research

Test	Look	Make
Empirical science	Ethnography	Engineering and design

The Messy Truth

Observation

Real-world study

Long-term effect study

Prototype 1   Prototype 2   …   Prototype n   Commercial product

Related scientific theory

Descriptive model

Predictive model

Research Example: CommandMaps

- Scarr et al., Best paper CHI '12

- Improve toolbar (specifically Microsoft's Ribbon interface)

- In-class exercise:
  - Contributions?
  - Benefits?
  - Which part uses empirical science, ethnography, and engineering/design approach?

CommandMaps, CHI '13

Available at: http://dl.acm.org/citation.cfm?id=2207713

CommandMaps

- Contributions & Benefits:
  - "Introduces CommandMap interfaces for mouse-based command invocation. Theoretically and empirically demonstrates that their defining properties — spatially stable command locations and a flat command hierarchy — improve user performance."

    [Scarr et al., CHI '12]

Closing Remarks:
Design Meets Science

"This was my ideal model of how the supporting science could work. It required good designers to actually do design, but what we could do was help structure the design space so that the movement through that design space was much more rapid. The science didn't design the mouse, but it provided the constraints to do it."

— Stu Card, **Designing Interactions** (2007)