Current Topics in Media Computing and HCI

Research Approaches in HCI

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https://hci.rwth-aachen.de/cthci

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Three Approaches to HCI Research

Test

Empirical science

Look

Ethnography

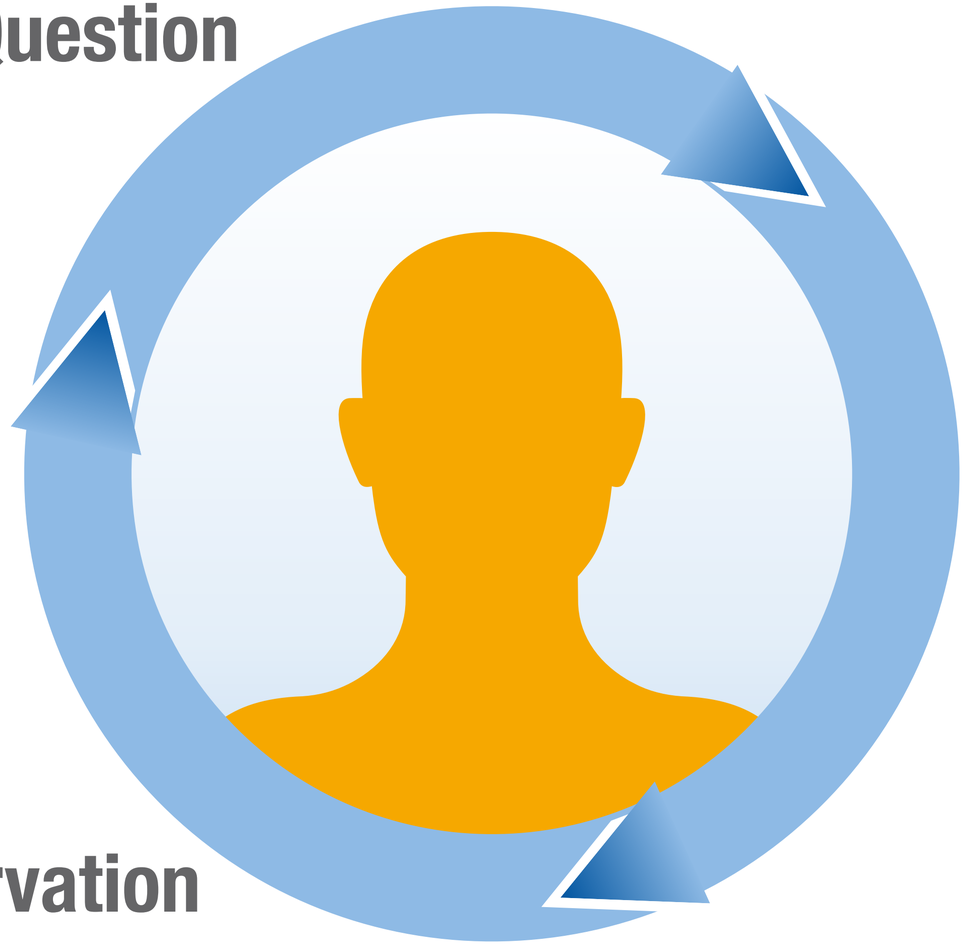
Make

Engineering & Design

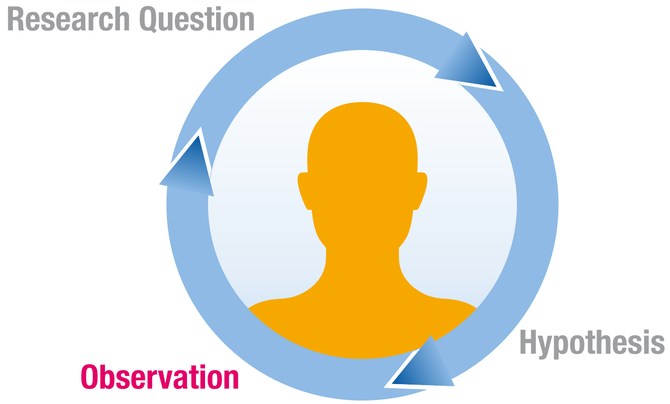
CHAPTER 9

Empirical Approach

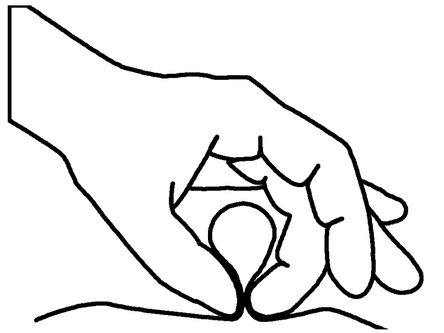
Empirical Approach



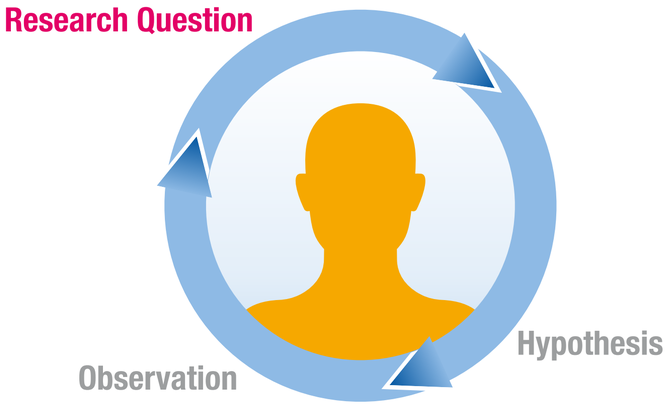
Initial Observation



- 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



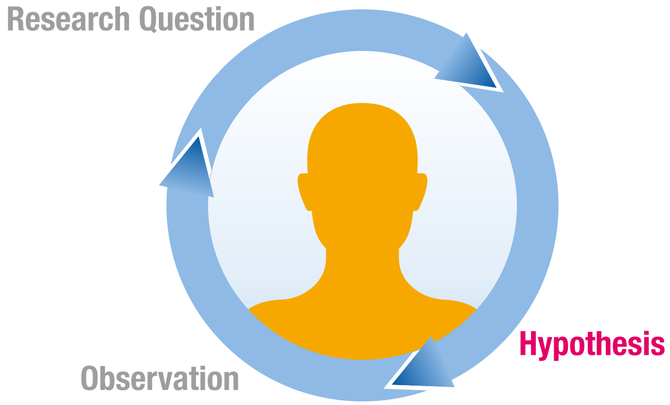
- Identify variables and research question for your observation

- **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



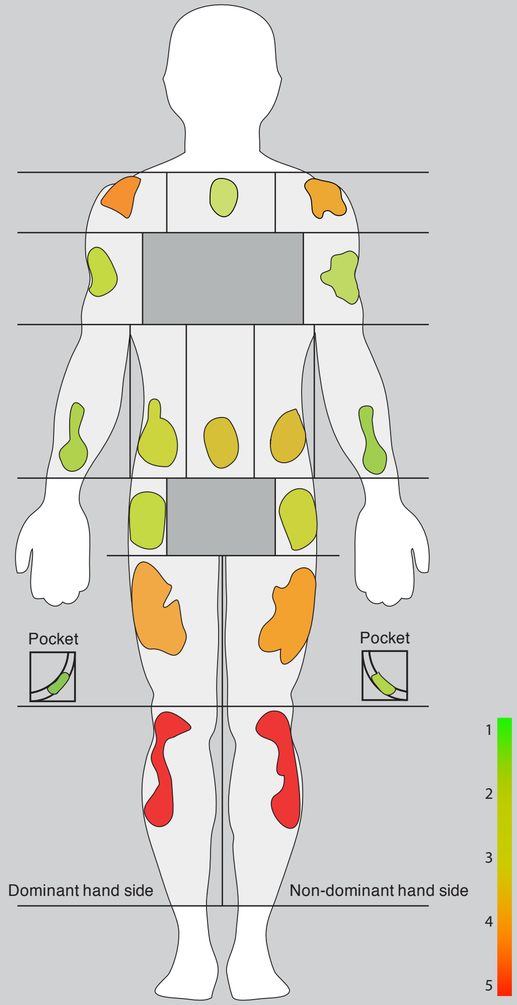
- **Concrete and testable** statements derived from the research question

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

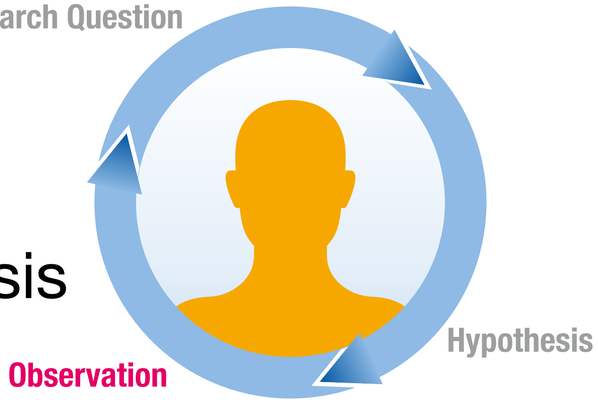
- In-class exercise: try giving an operational definition for the variables highlighted below
  - “There would be a difference in **user’s preference** for pinching cloth among different **areas** on the body.”

Example: Pinstripe

- Karrer et al., CHI ’11
- Recall the prediction:
  - “There would be a difference in **user’s preference** for pinching cloth among different **areas** on the body.”
- Method:
  - Identify 16 different body areas
  - Ask the participants to perform the pinching gesture in these areas
  - Collect convenience rating in 5-point Likert scale



Planned Observation

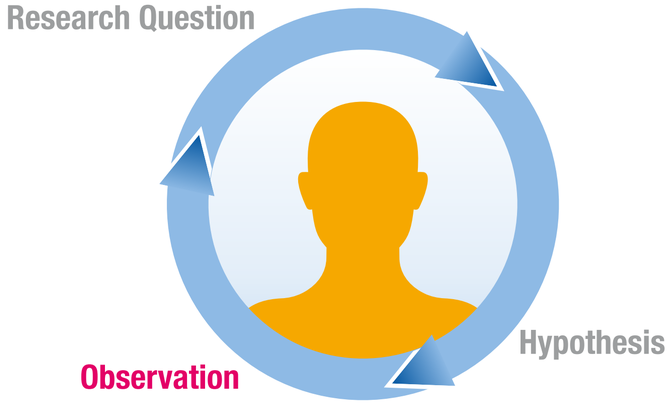


- Collect data to support, refute, or refine the original hypothesis
- Three strategies
  - **Descriptive research:** X happens
    - Focus on the current state of each **individual** variable
  - **Relational research**: X and Y happen together
    - Measure **two or more variables** that **exist naturally**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

EMPIRICAL

Descriptive Research

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

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

Figure 1:
Following GPS instructions

While the driver 'follows' what the GPS recommends the driver still needs skill to read what the GPS says and even to ignore GPS instructions.

Source

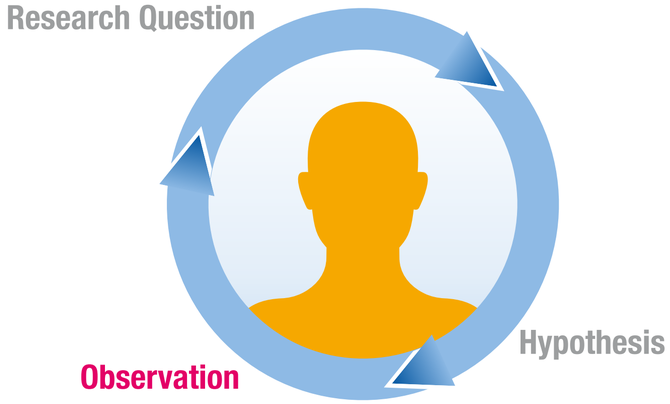
Natural Troubles of Driving with GPS

- 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 “driver intelligence” into account
    - 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.”

EMPIRICAL

Relational Research

Relational Research

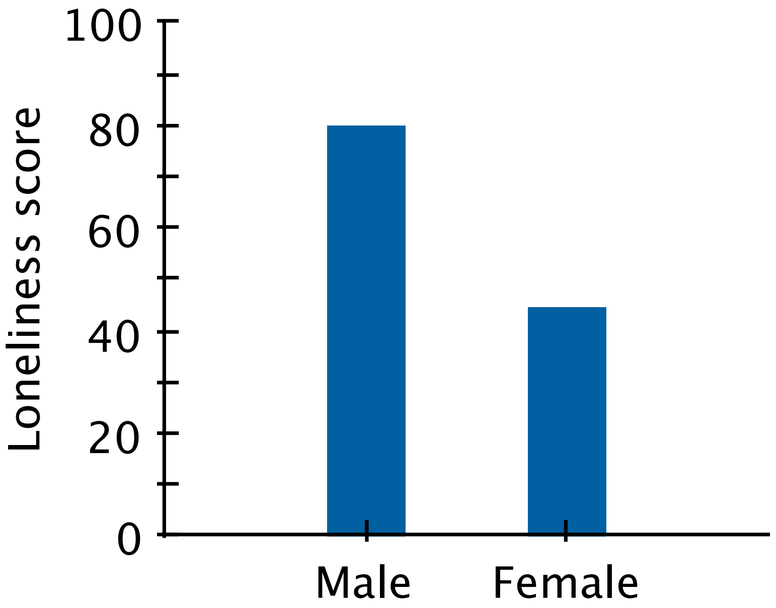


- Measure a set of variables for each participant
- Examine to identify **patterns** of relationship
  - Changes in one variable are consistently and predictably accompanied by changes in another variable
- Measure the **strength** of the relationship

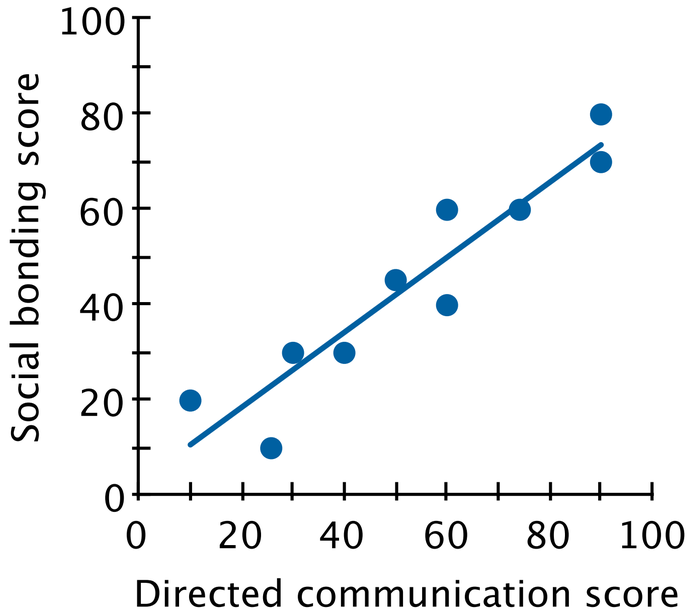
Example: Social Network Activity and Social Well-Being

- 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**)
- Analyze the past two months of users’ Facebook activity data, e.g.,
  - Friend count (actual)
  - Directed communication: comments, likes
  - Passive consumption of broadcast items such as status updates

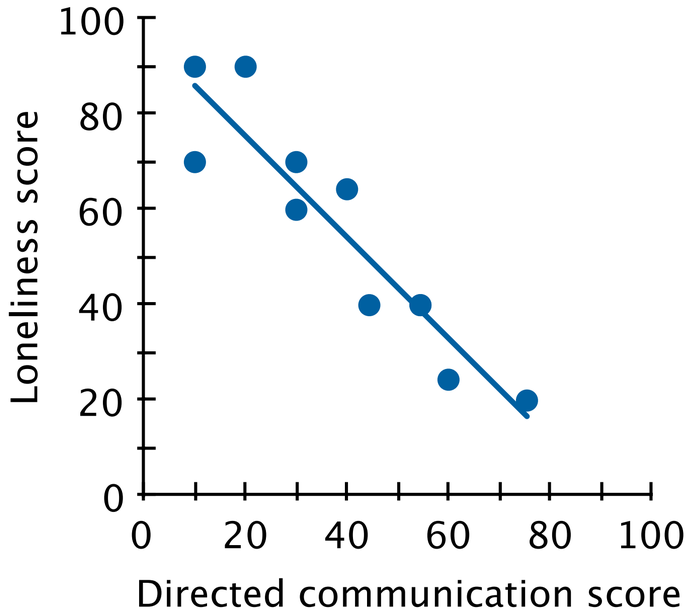
Patterns in the Relationship between Variables



General relationship



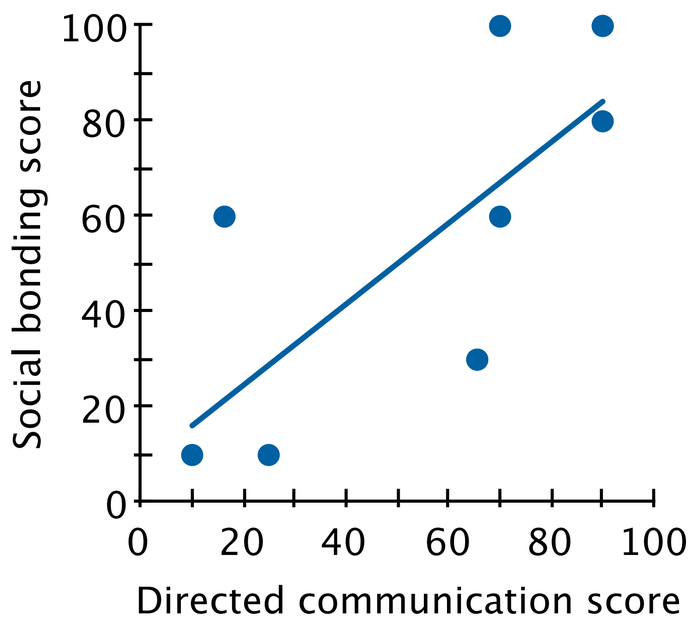
Positive relationship

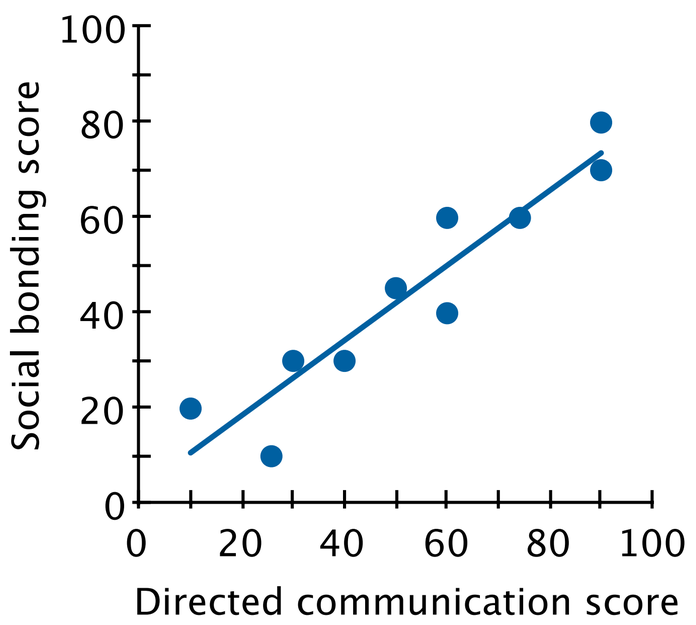


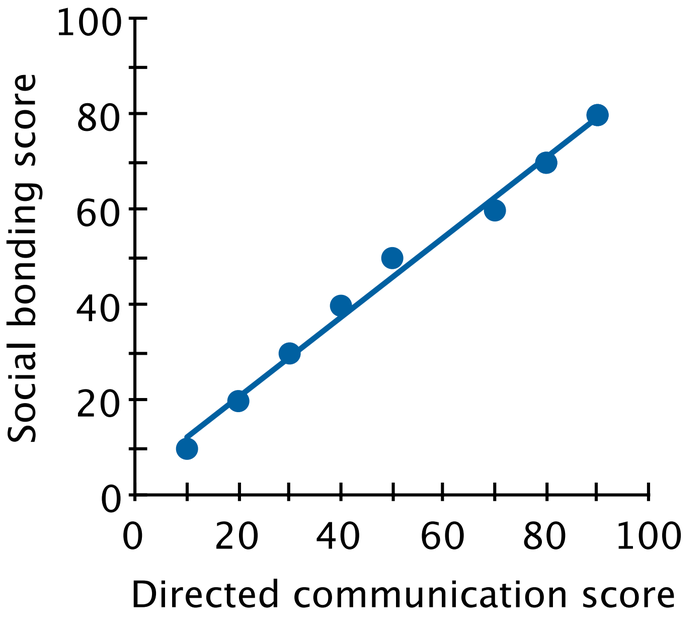
Negative relationship

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

Strength of the Relationship between Variables







Weak ⟷ **Strong**

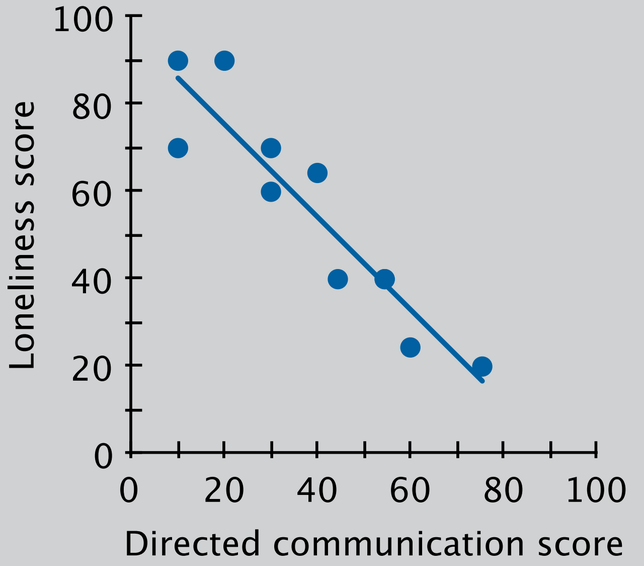
Simulated data for instructional purpose

Limitations of Relational Research

- Correlation does not imply causation
  - E.g., loneliness ⇒ less direct communication?

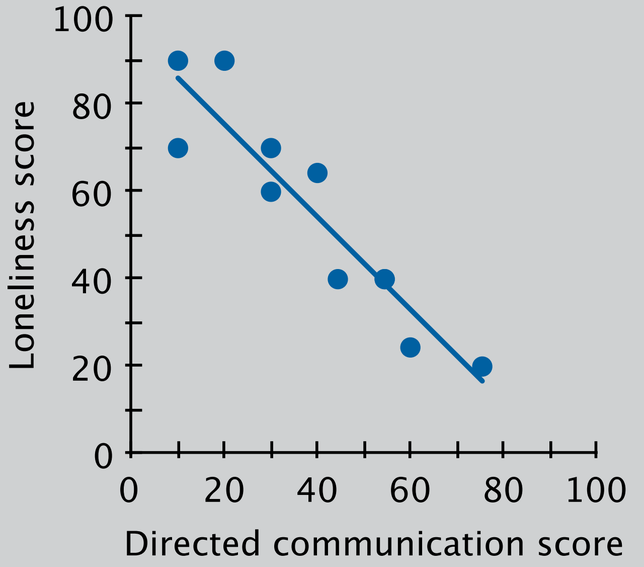
    or less direct communication ⇒ loneliness?

    or third variable ⇒ direct communication and loneliness?
- **Third variable problem:** unidentified variable controls the correlated variables



Limitations of Relational Research

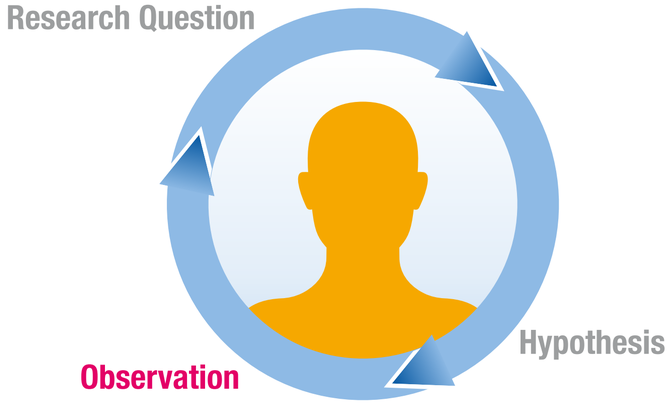
- **Shallow** data from large number of people instead of **deep** data
  - Can be improved by follow-up interviews, follow-up surveys
- Participant sampling method limits the conclusion
  - Method: advertisement on Facebook
  - Participants: only English-speaking users, but compensated by many countries of origin



EMPIRICAL

Experimental Research

Experimental Research



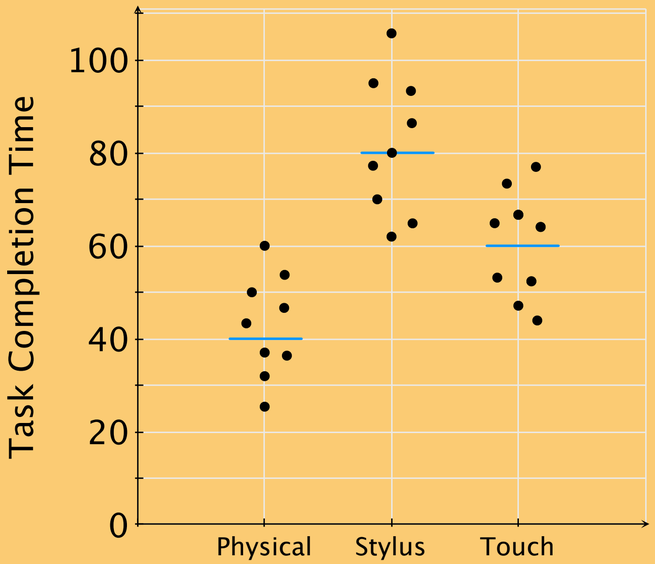
- Purpose: To infer cause-and-effect relationship
- Controlling **independent variable**
- Observe the change in the **dependent variables**
- In-class exercise: recall the following experimental designs
  - Between-group vs. within-group
  - Benefits and drawbacks
- More details in next lecture

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)

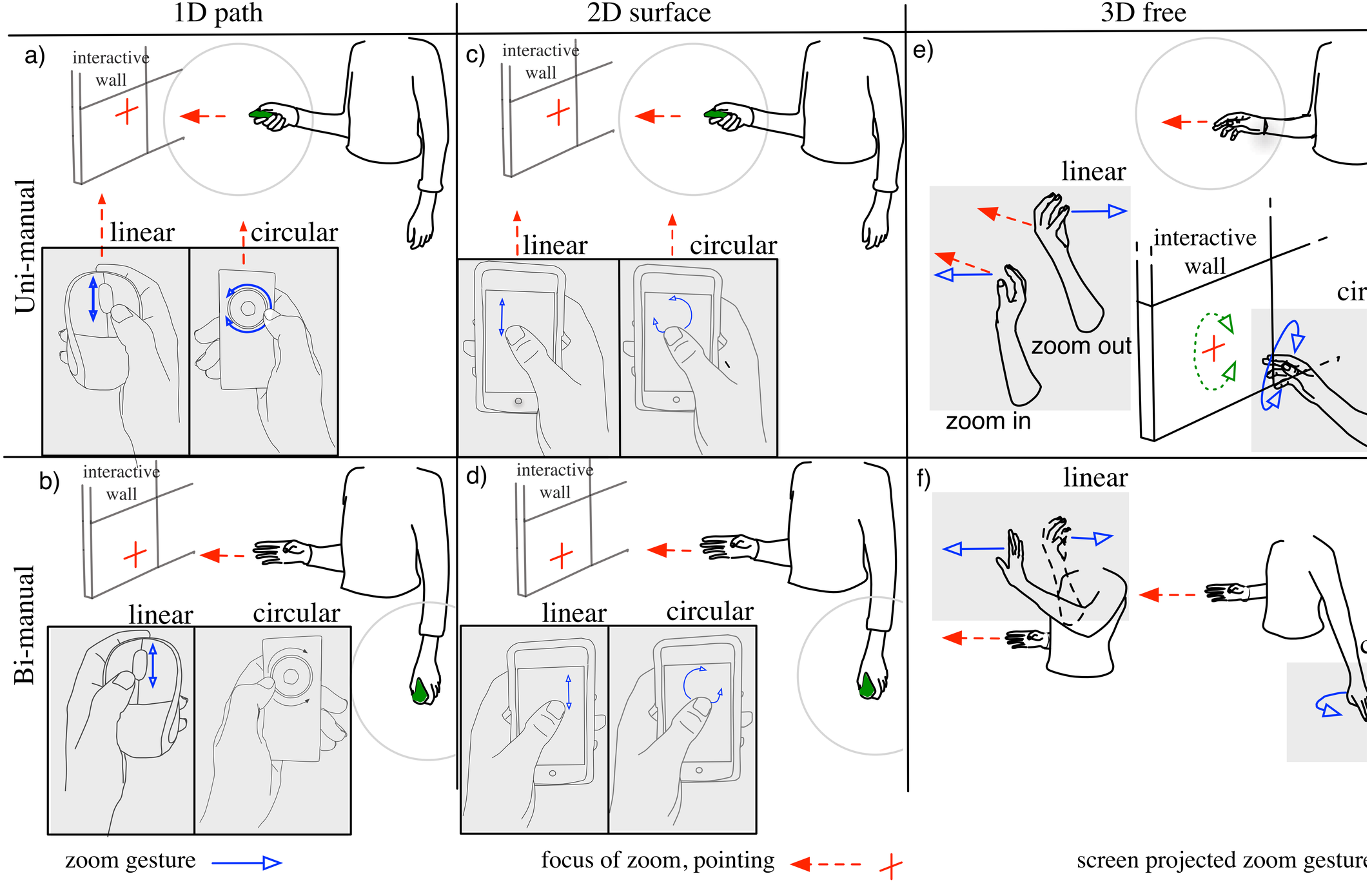
Limitations of Relational Research

- Data from experiments is noisy
- **Effect:** Variance caused by the different levels of our IV
- **Confound:** Variance caused by uncontrolled factors (“confounding variables”)



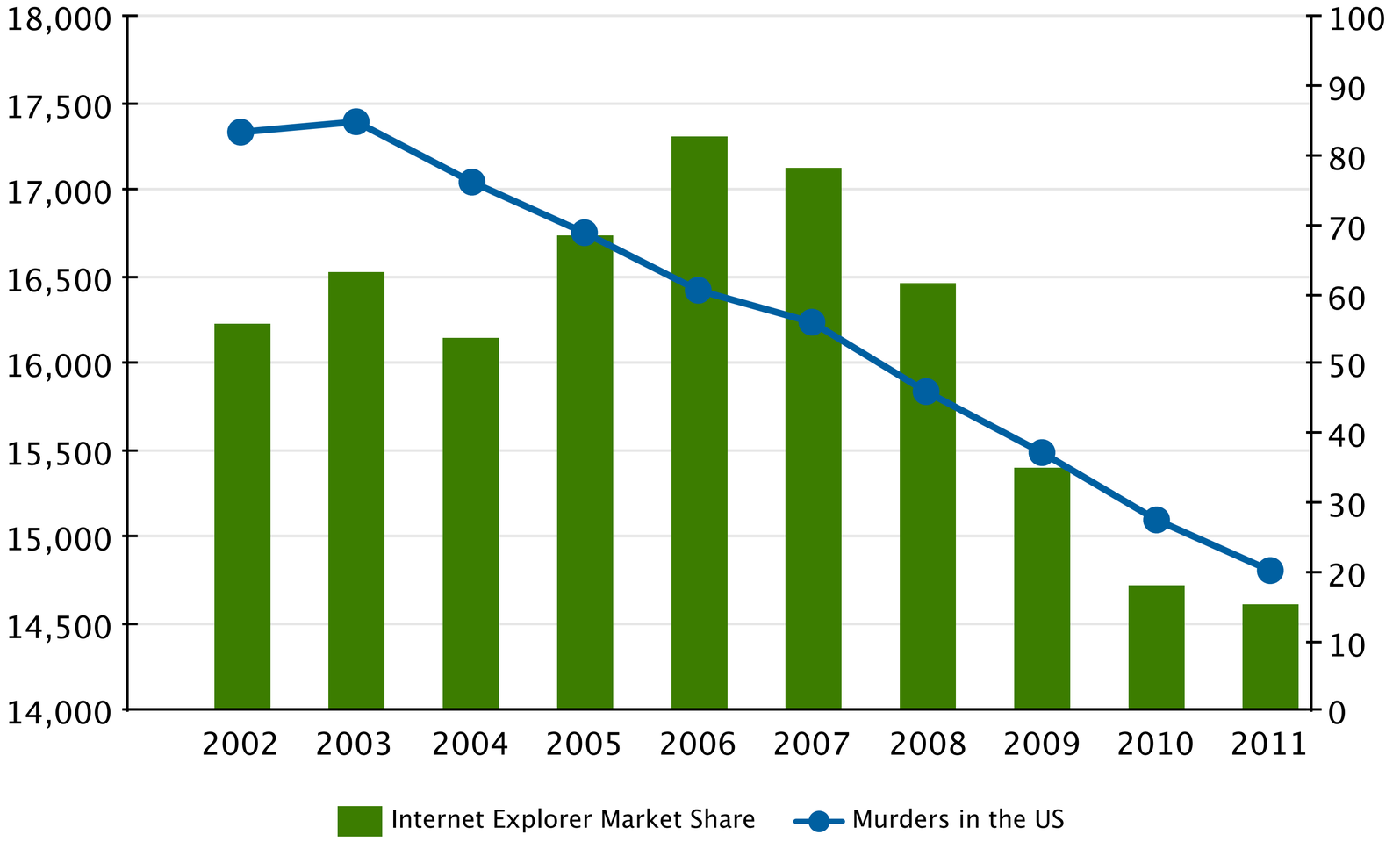
Example: Mid-air Pan-and-Zoom on Wall-sized Displays

- 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.”

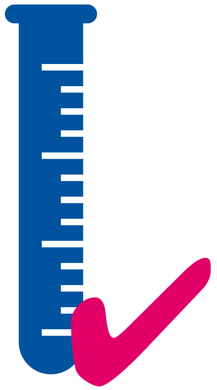

1D path
2D surface
3D free
Uni-manual
Bi-manual
a)
b)
c)
d)
e)
f)
interactive wall
linear
circular
zoom out
zoom in
zoom gesture
focus of zoom, pointing
screen projected zoom gesture

Correlation Does Not Imply Causation

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



Three Approaches to HCI Research



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