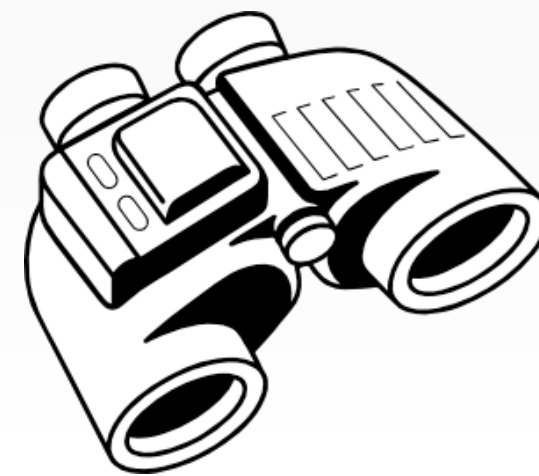


# Three Approaches to HCI Research



Test

Empirical science



Look

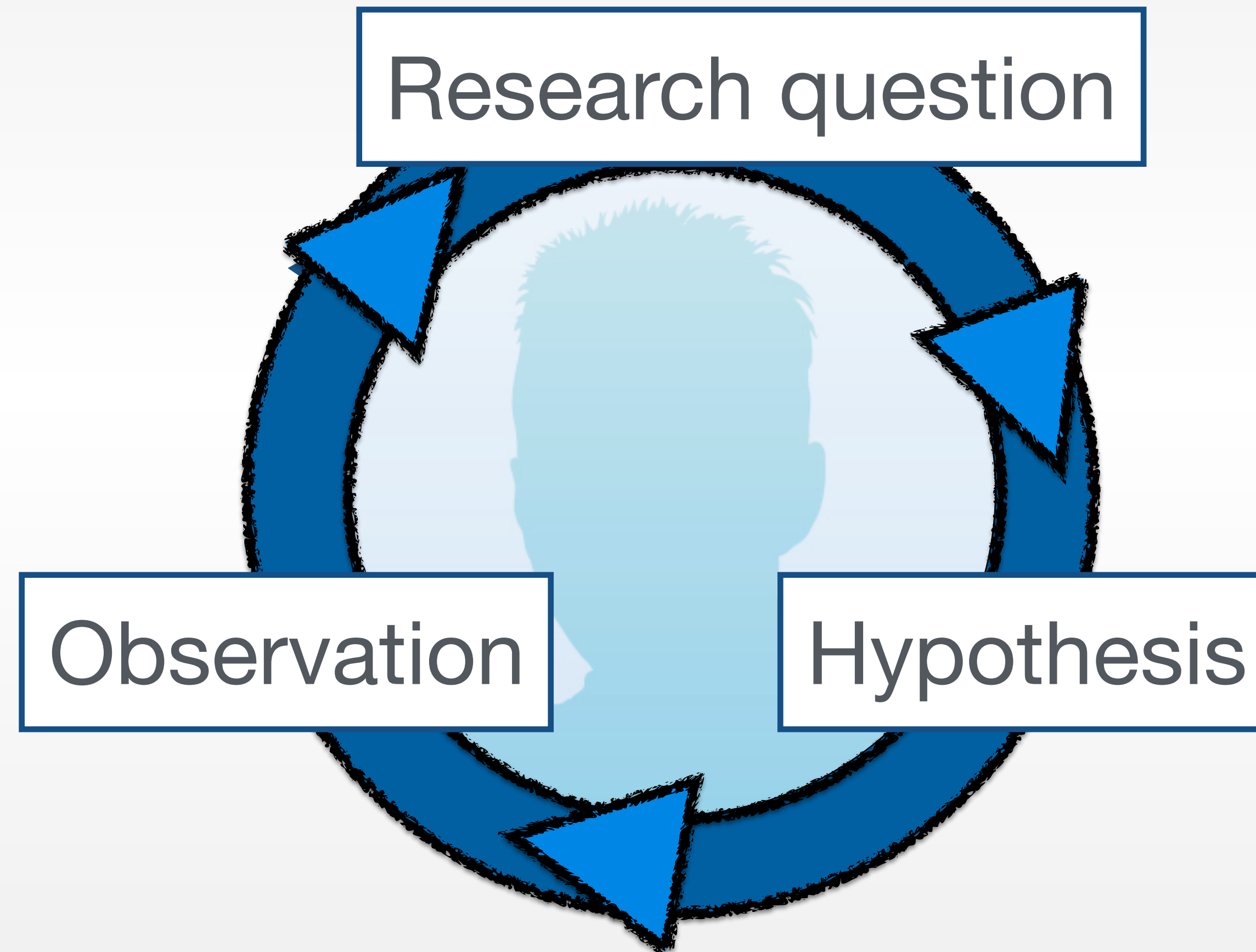
Ethnography



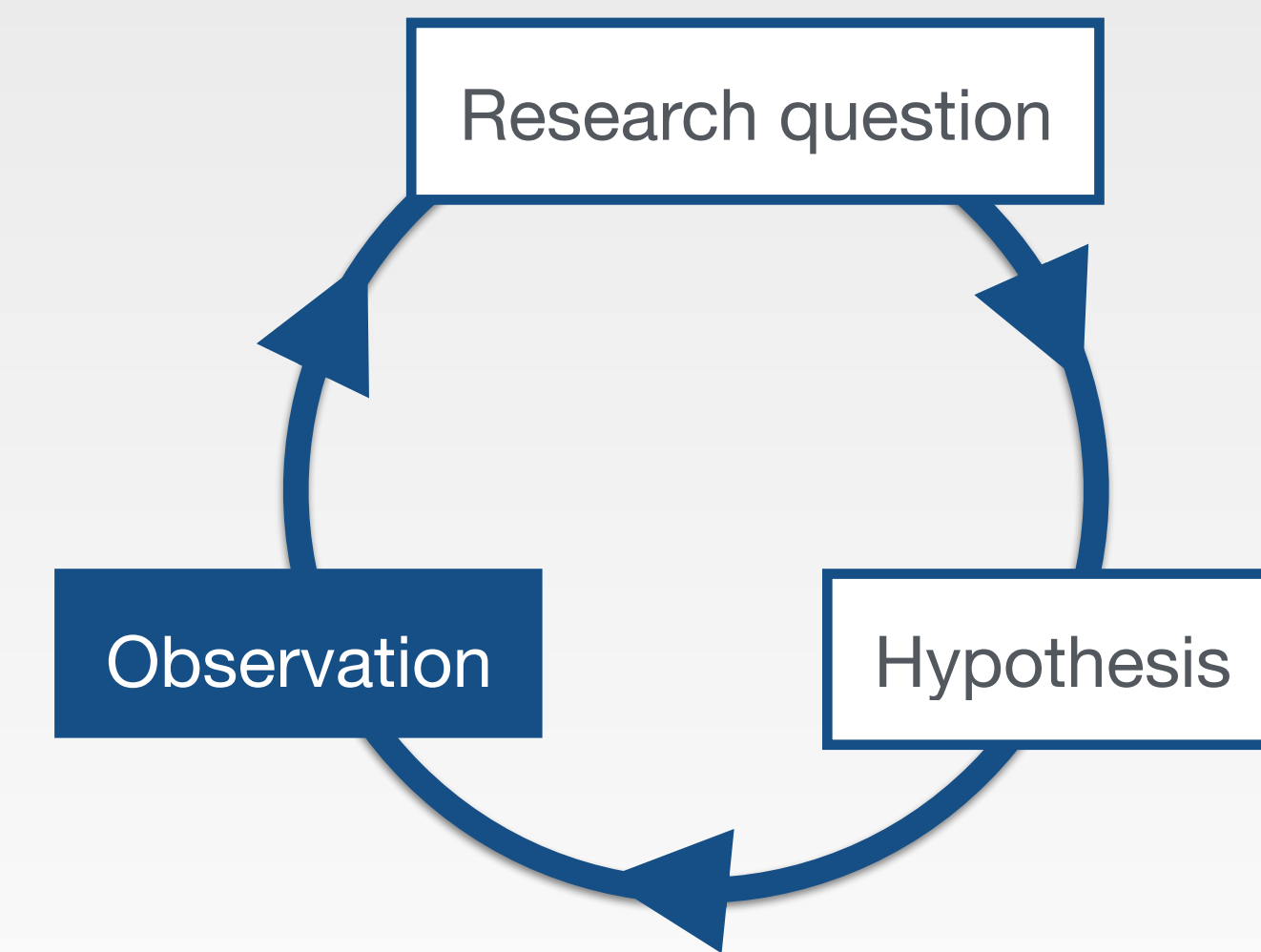
Make

Engineering  
and design

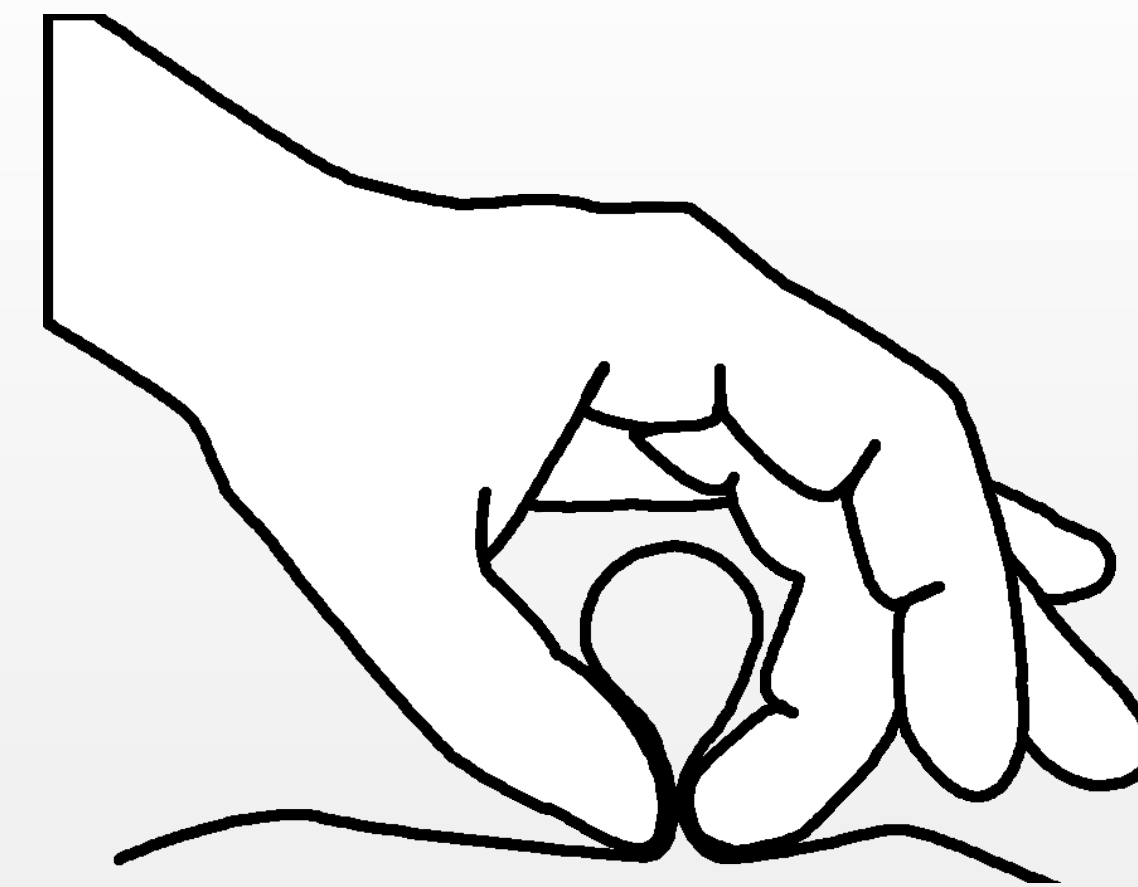
# Empirical Approach



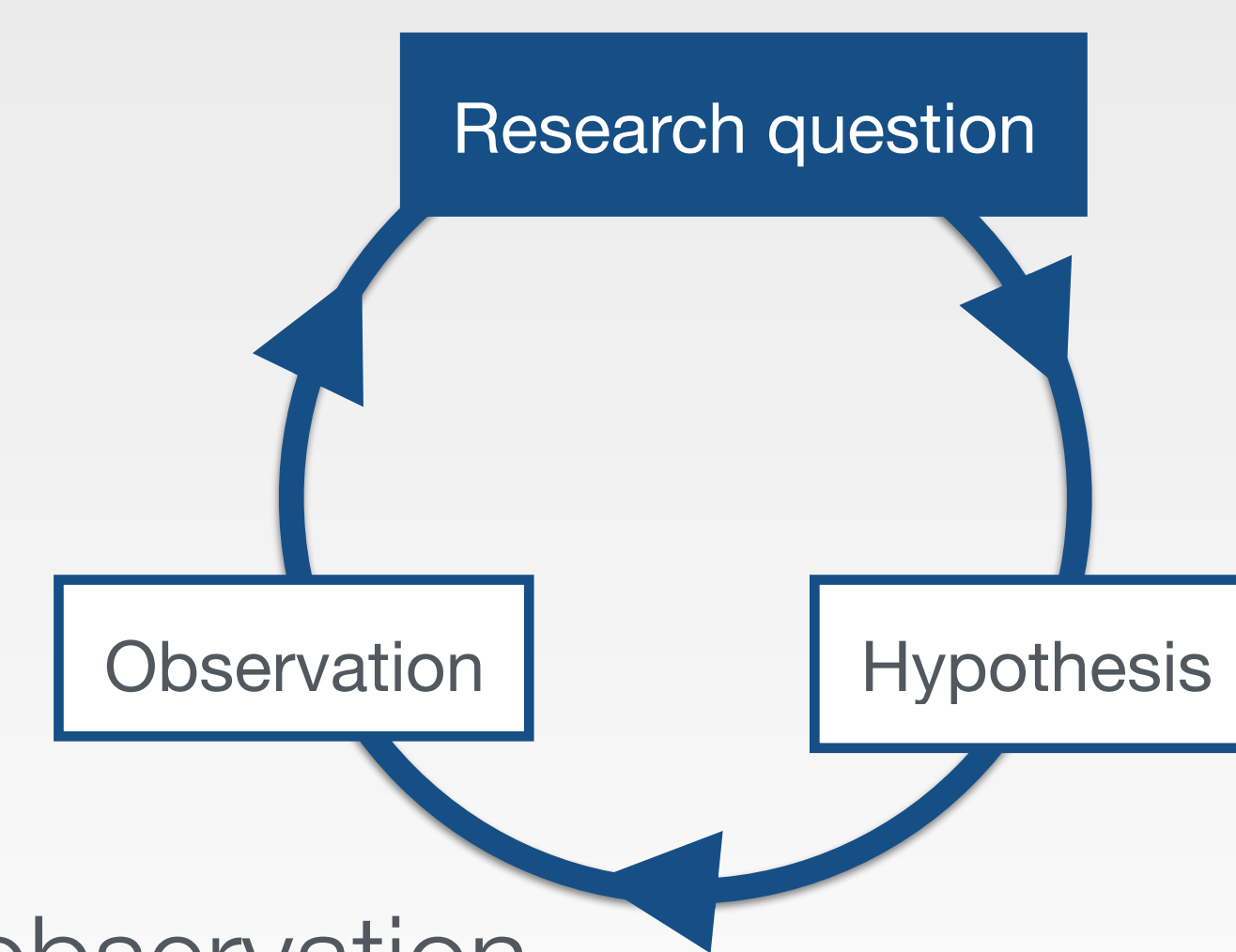
# Initial Observation



- 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?”

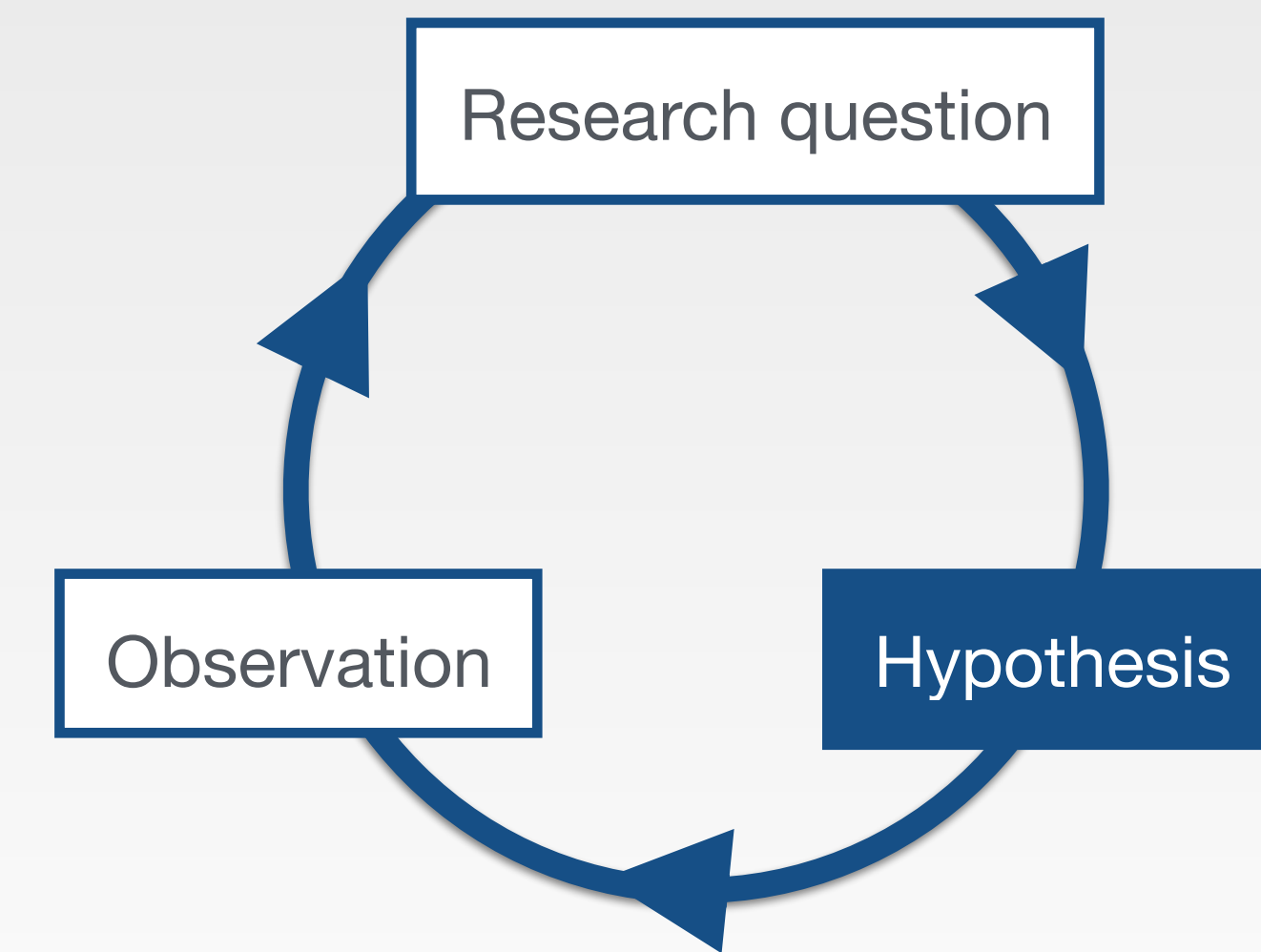


# Research Question



- Identify variables and 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**”

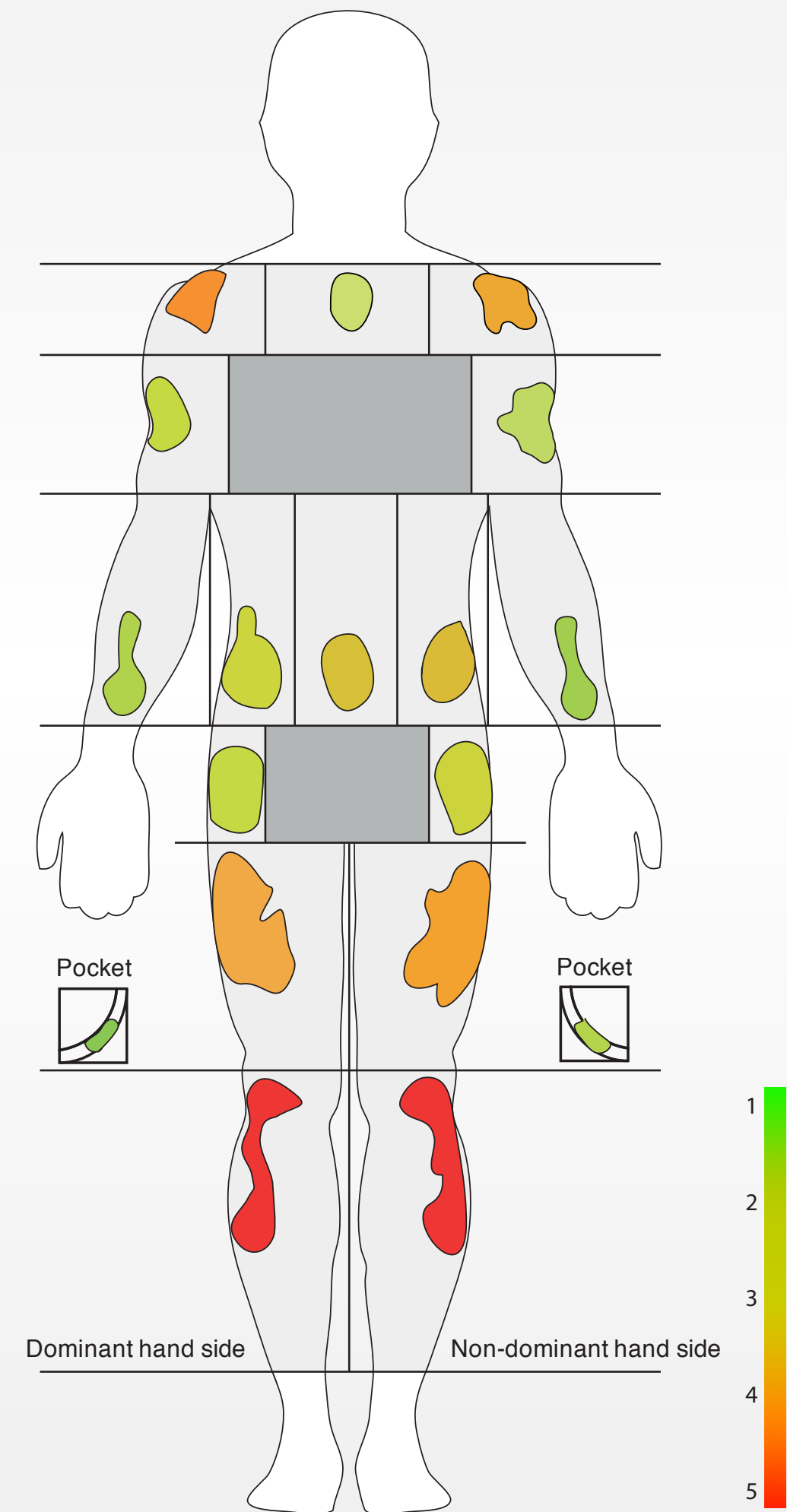
# Hypothesis



- 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 for pinching cloth among different areas on the body.”

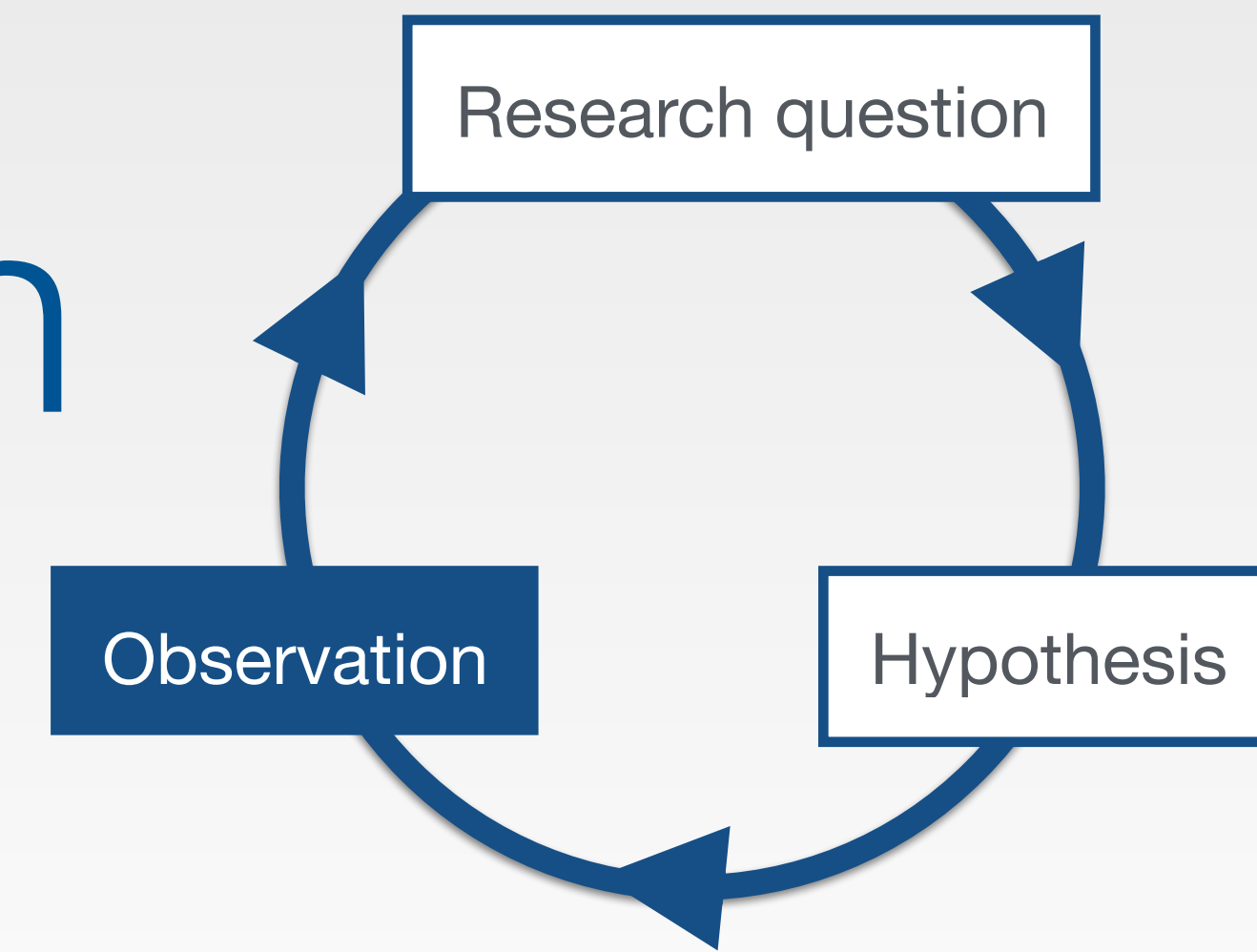
# Research Example: Pinstripe

- 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



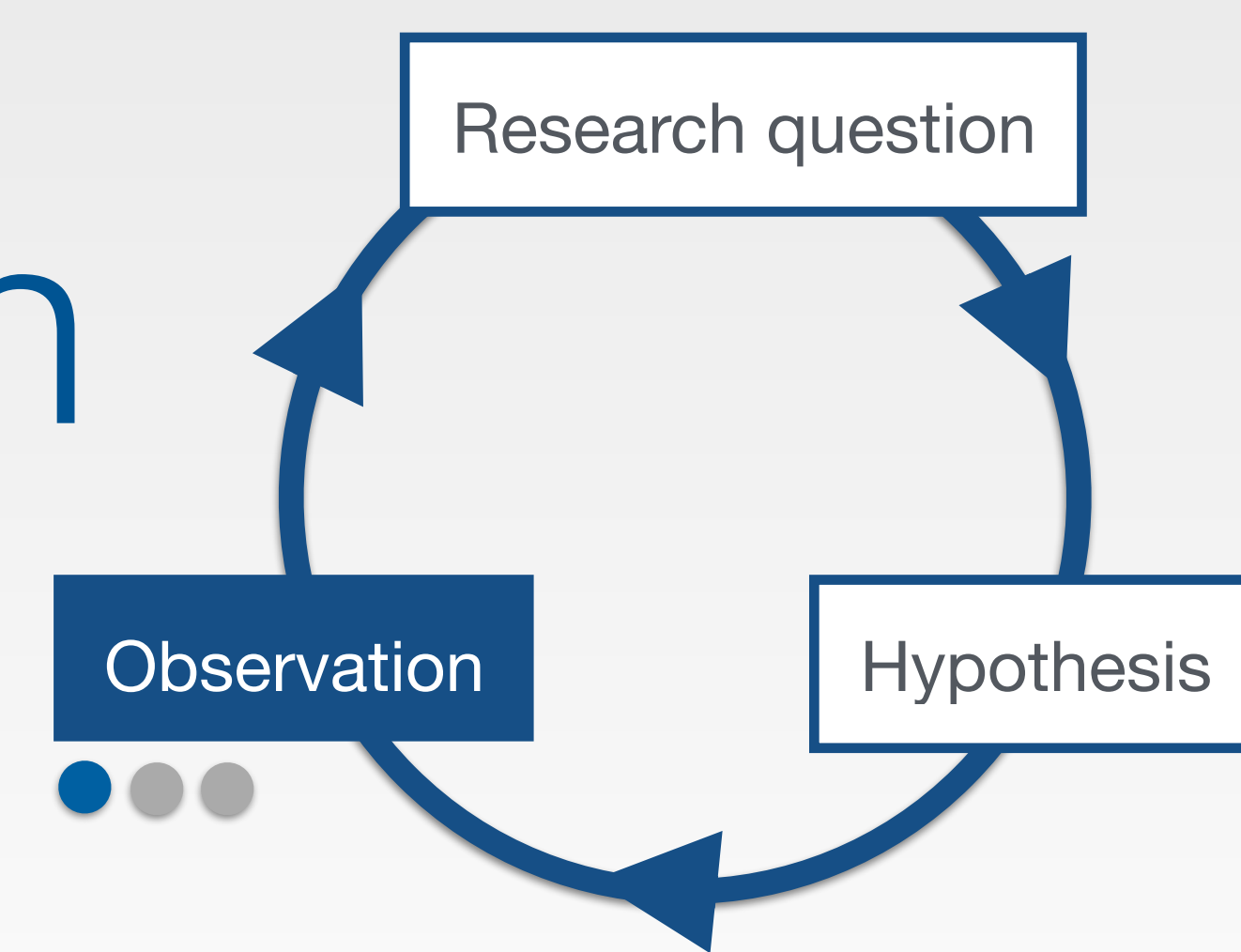


# Planned Observation



- 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


# 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



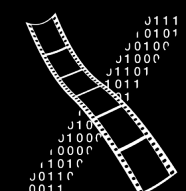
# Research Example: Natural Troubles of Driving with GPS

- 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  $\Rightarrow$  75 clips  $\Rightarrow$  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](#)

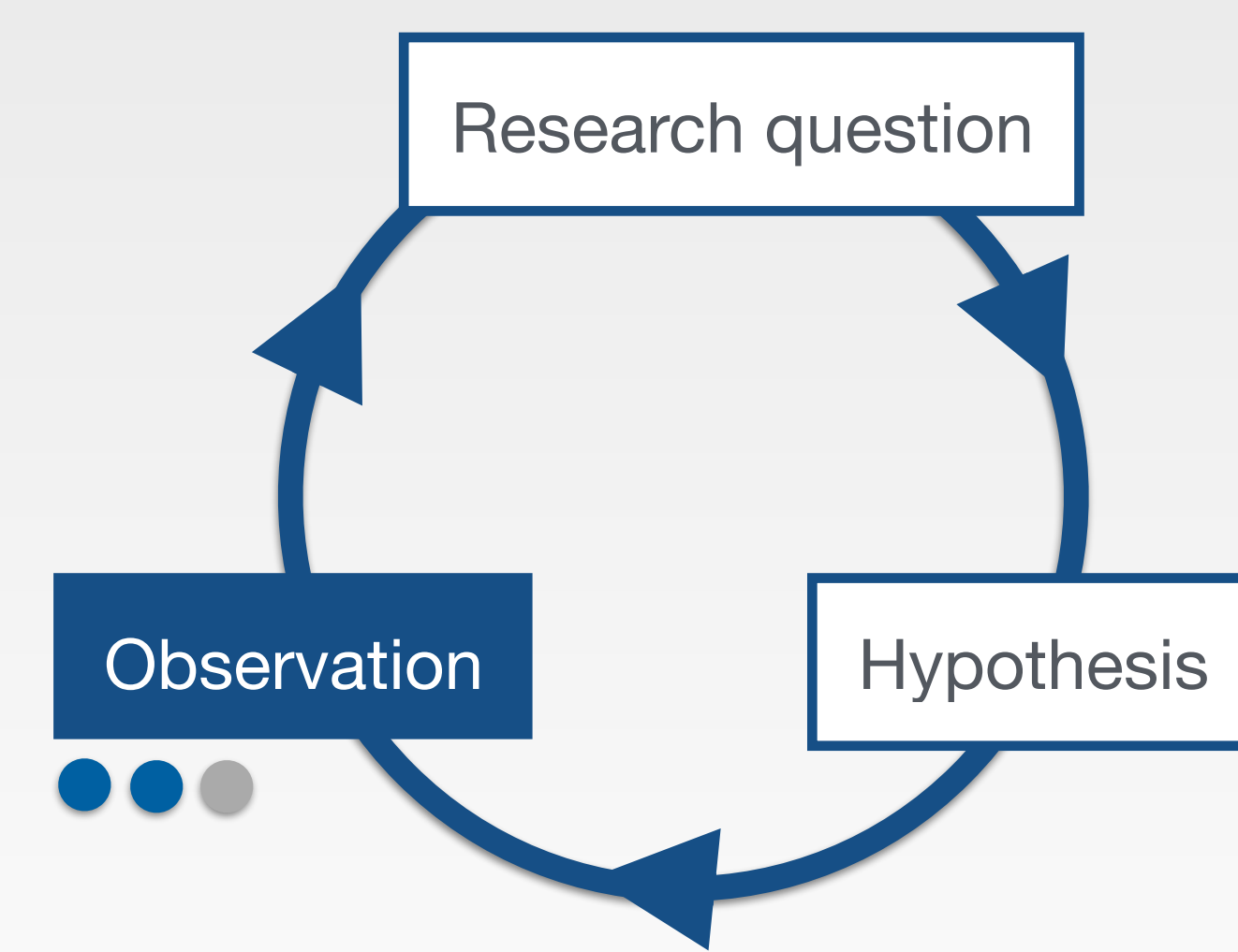




# Natural Troubles of Driving with GPS

- 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.”

# Relational Research

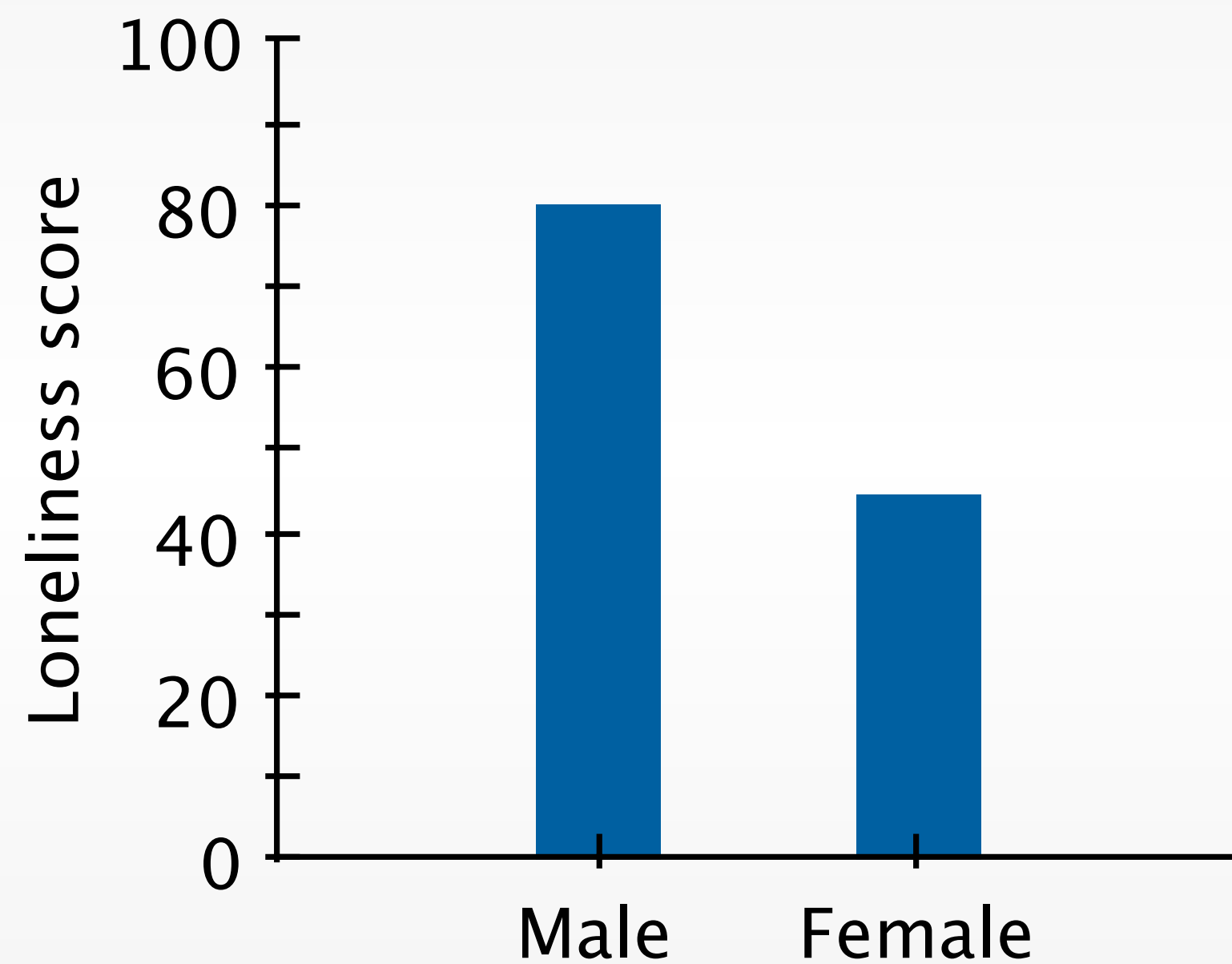


- Measure a set of variables for each participant
- Examine to identify **patterns** of relationship
  - Changes in one variable are consistently and predictably accompanied by changes in another variable
- Measure the **strength** of the relationship

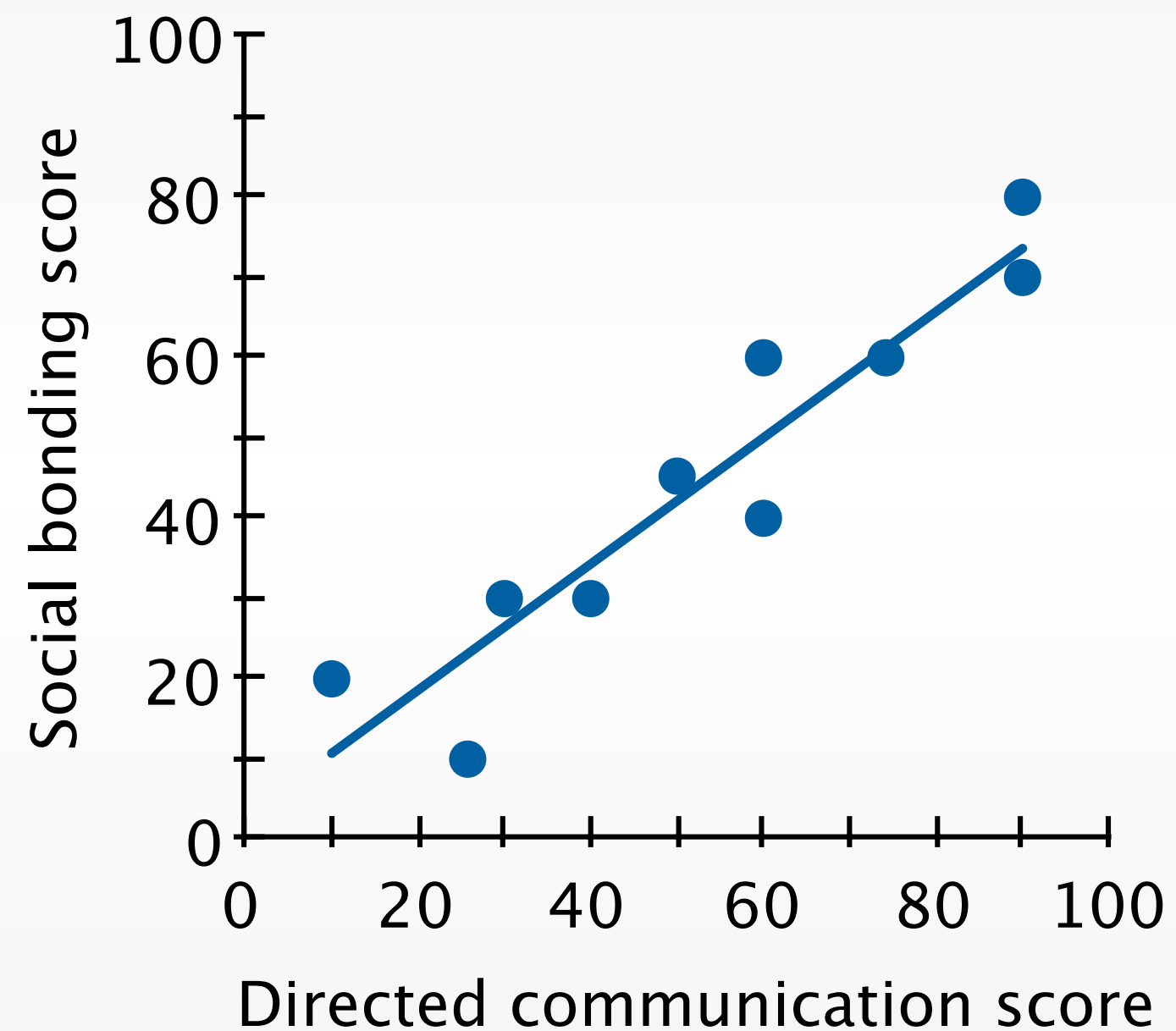
# Research Example: Social Network Activity and Social Well-Being

- 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)
- 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

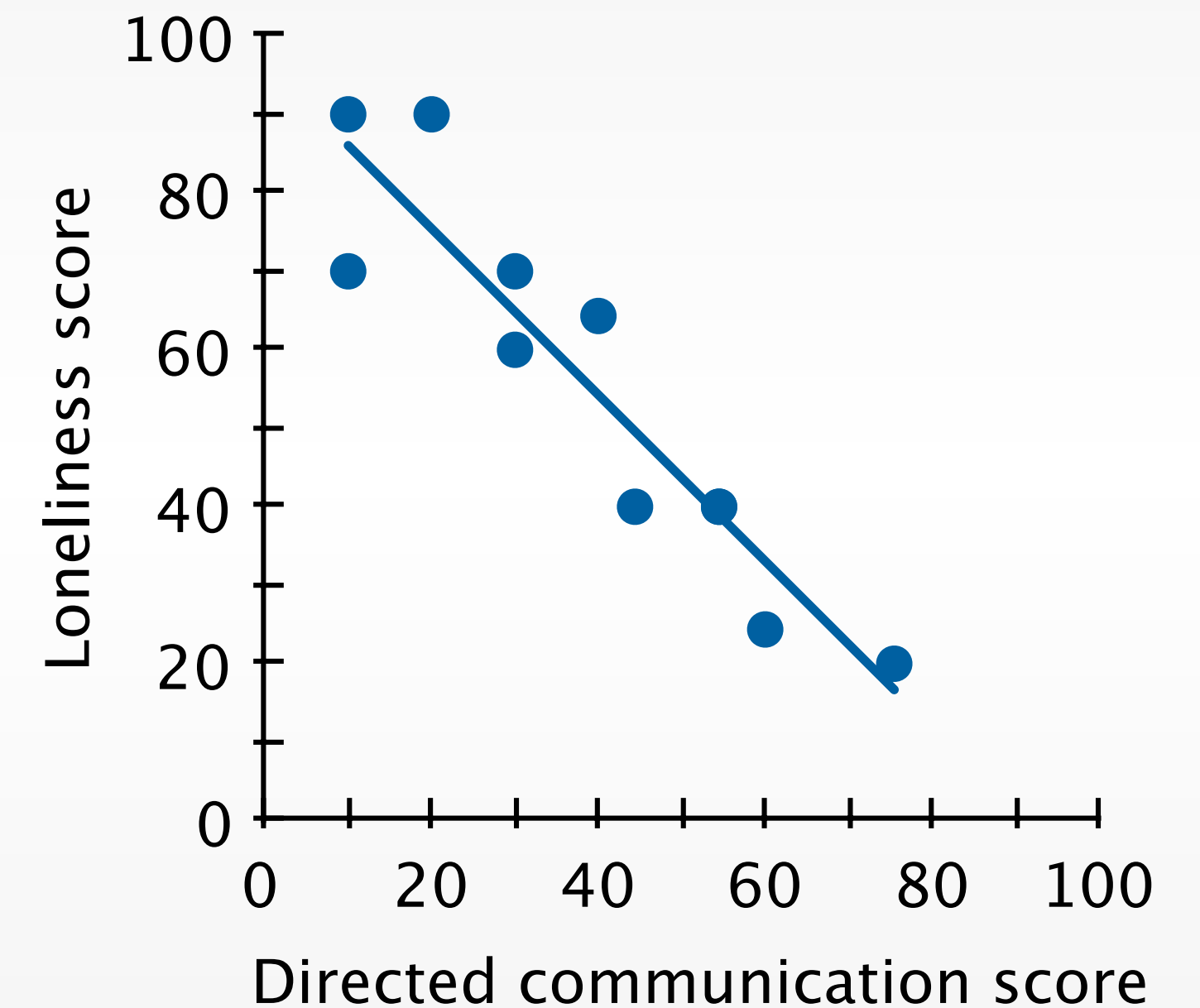
# Patterns in the Relationship between Variables



General relationship



Positive relationship

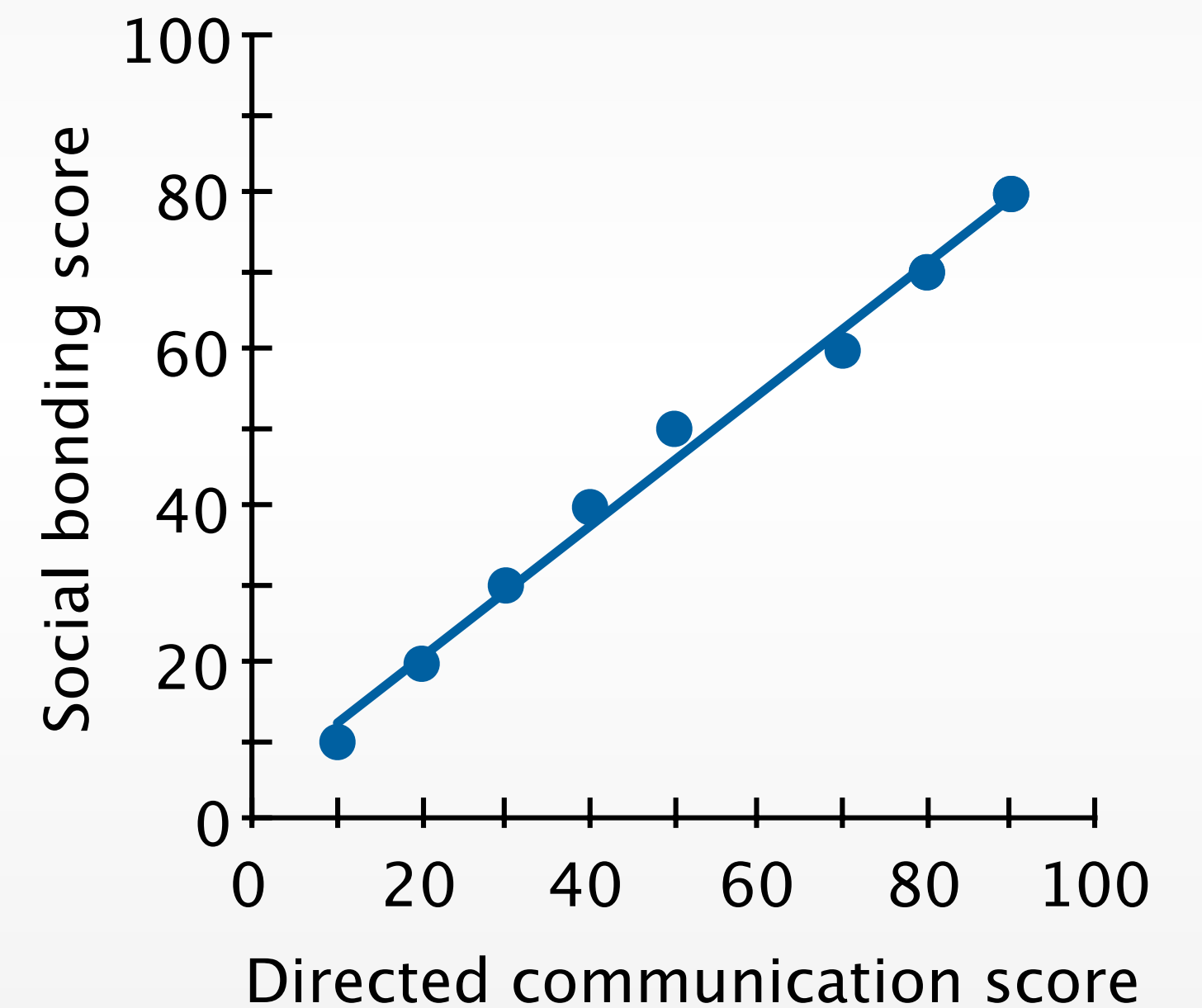
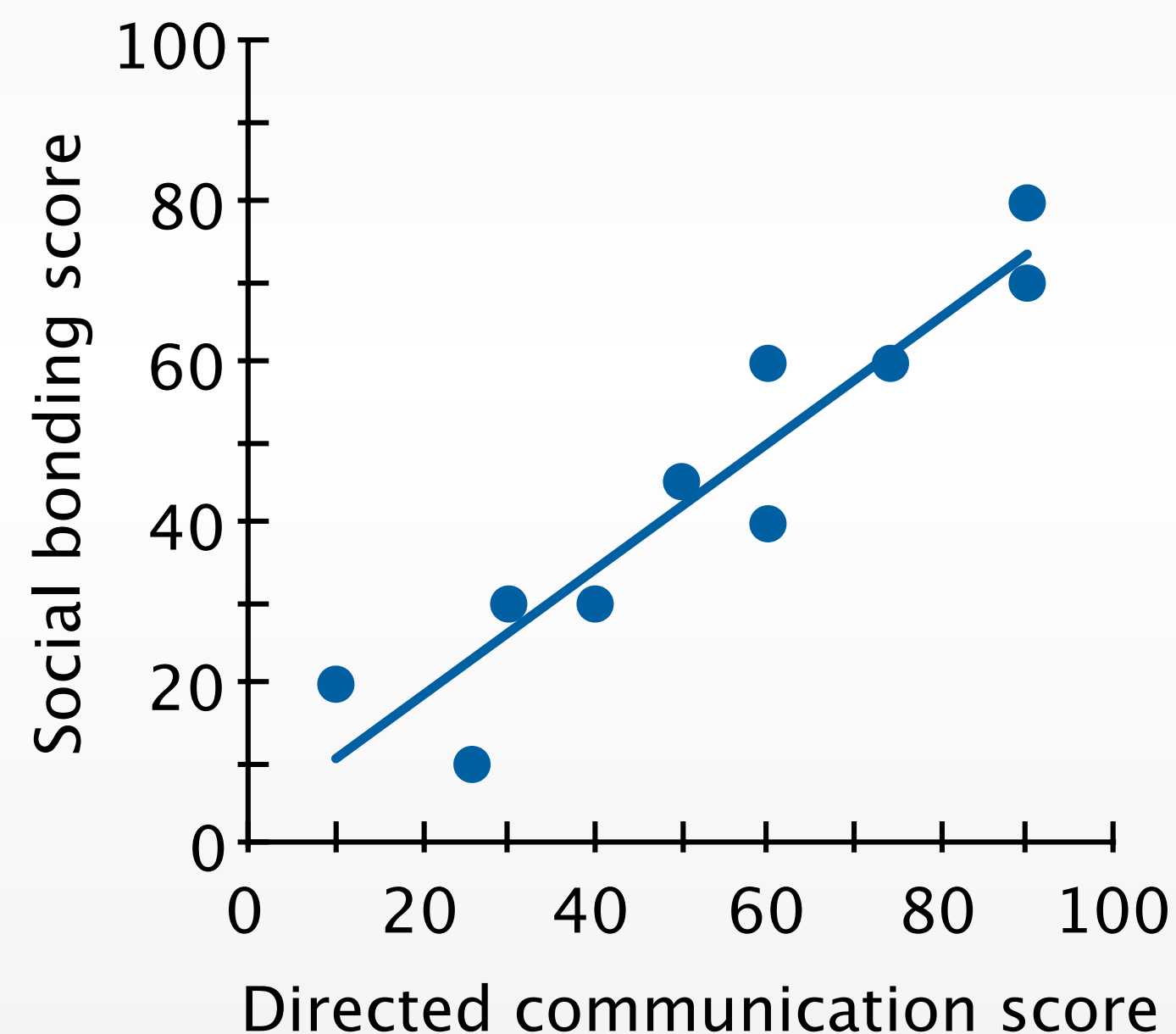
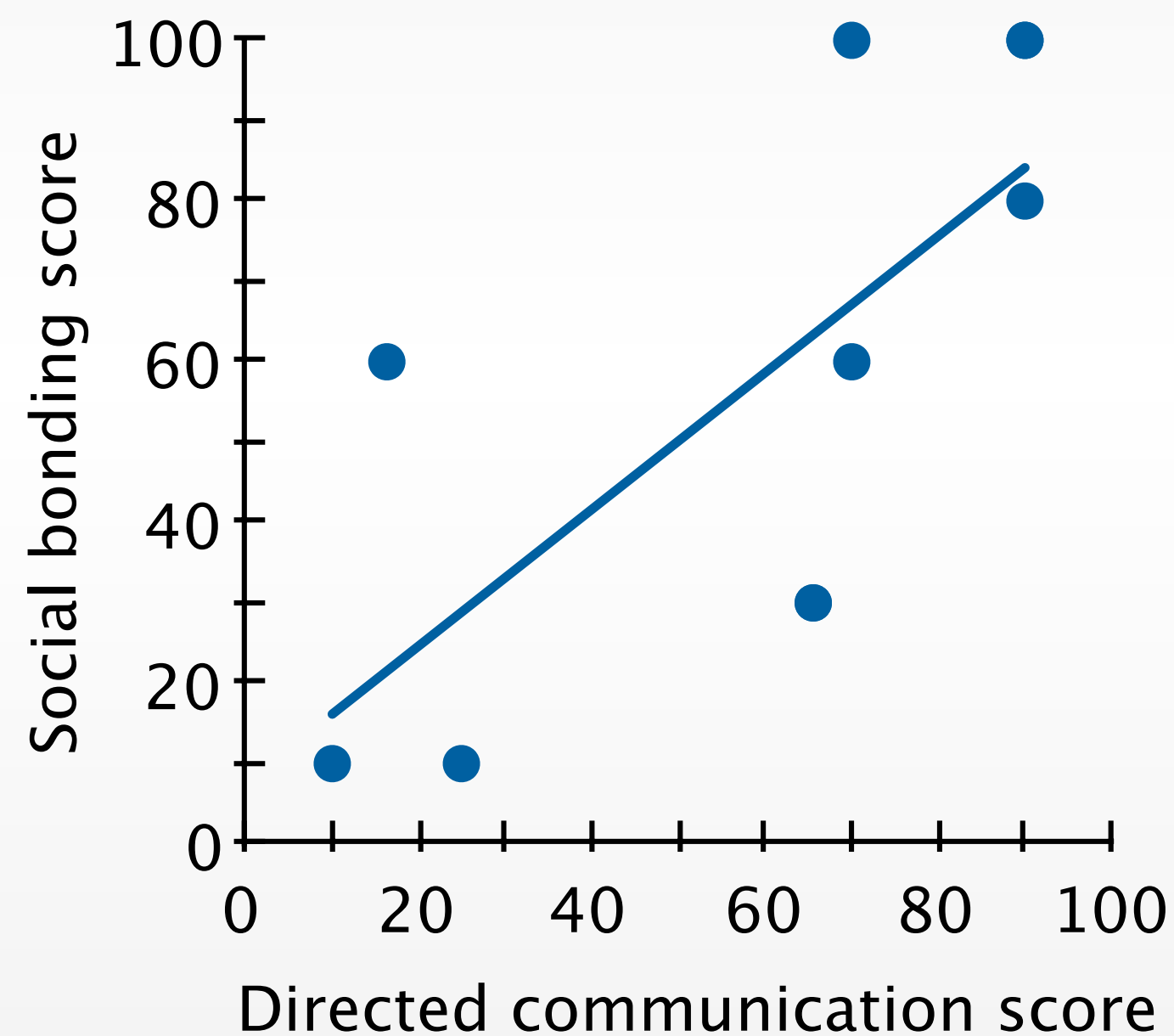


Negative relationship

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



# Strength of the Relationship between Variables



Weak

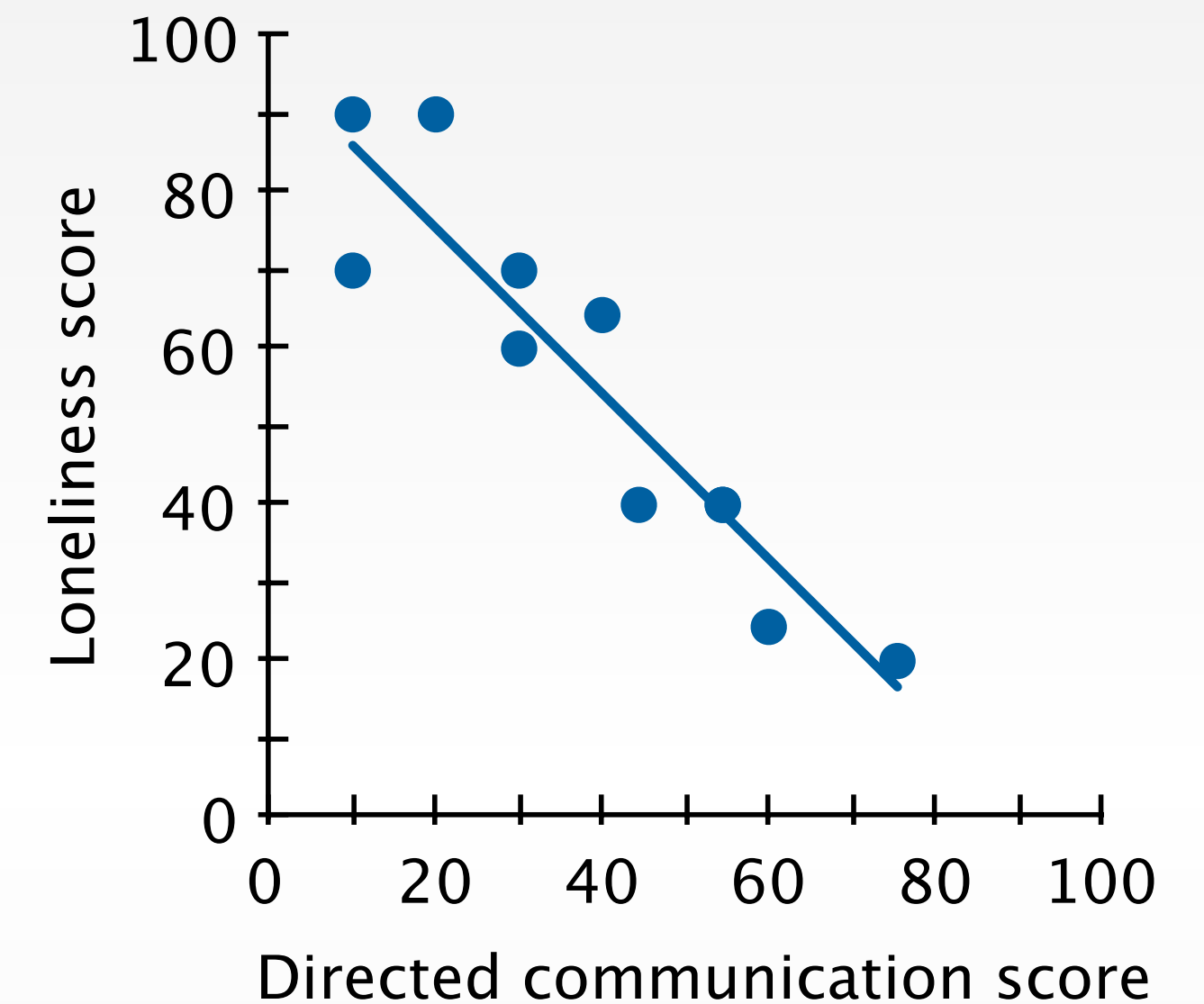


Strong

Simulated data for instructional purpose

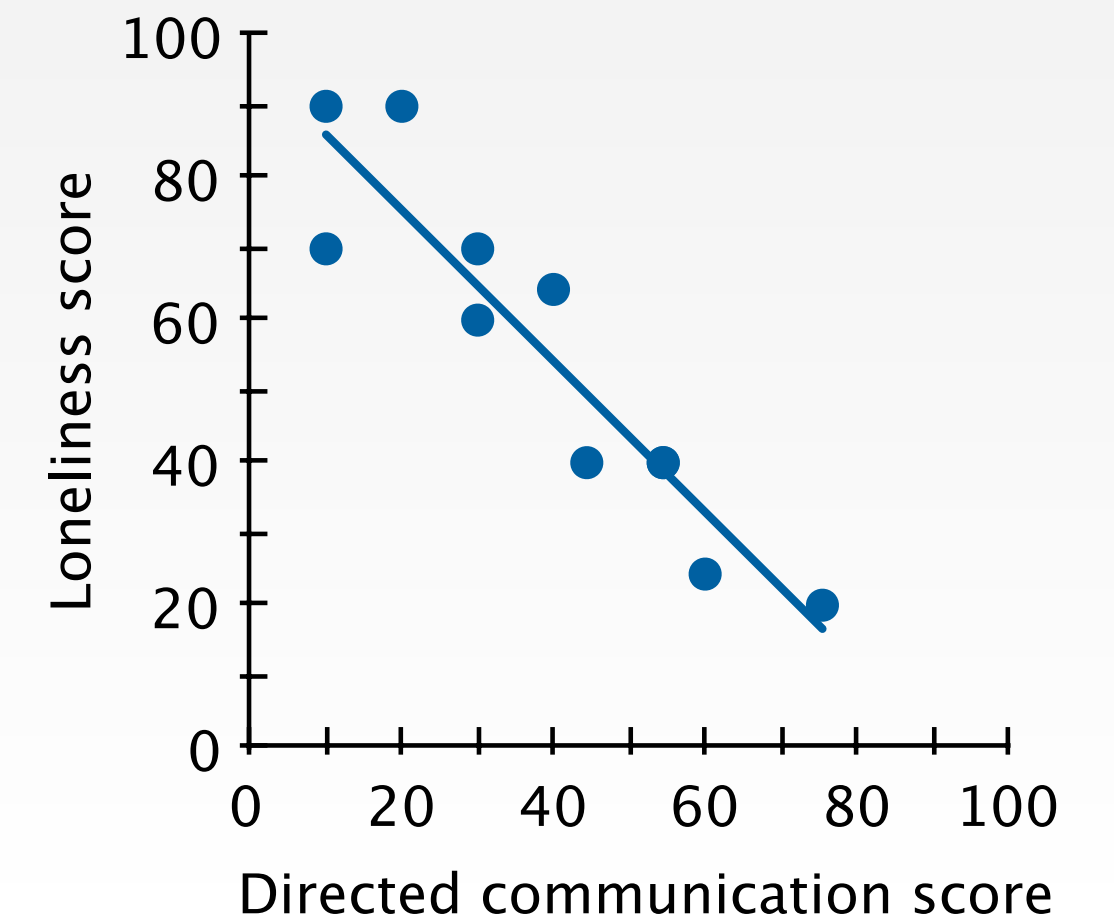
# Limitations of Relational Research

- Correlation does not imply causation
  - E.g., loneliness  $\Rightarrow$  less direct communication?  
or less direct communication  $\Rightarrow$  loneliness?  
or third variable  $\Rightarrow$  direct communication and loneliness?
- **Third variable problem:** unidentified variable controls the correlated variables

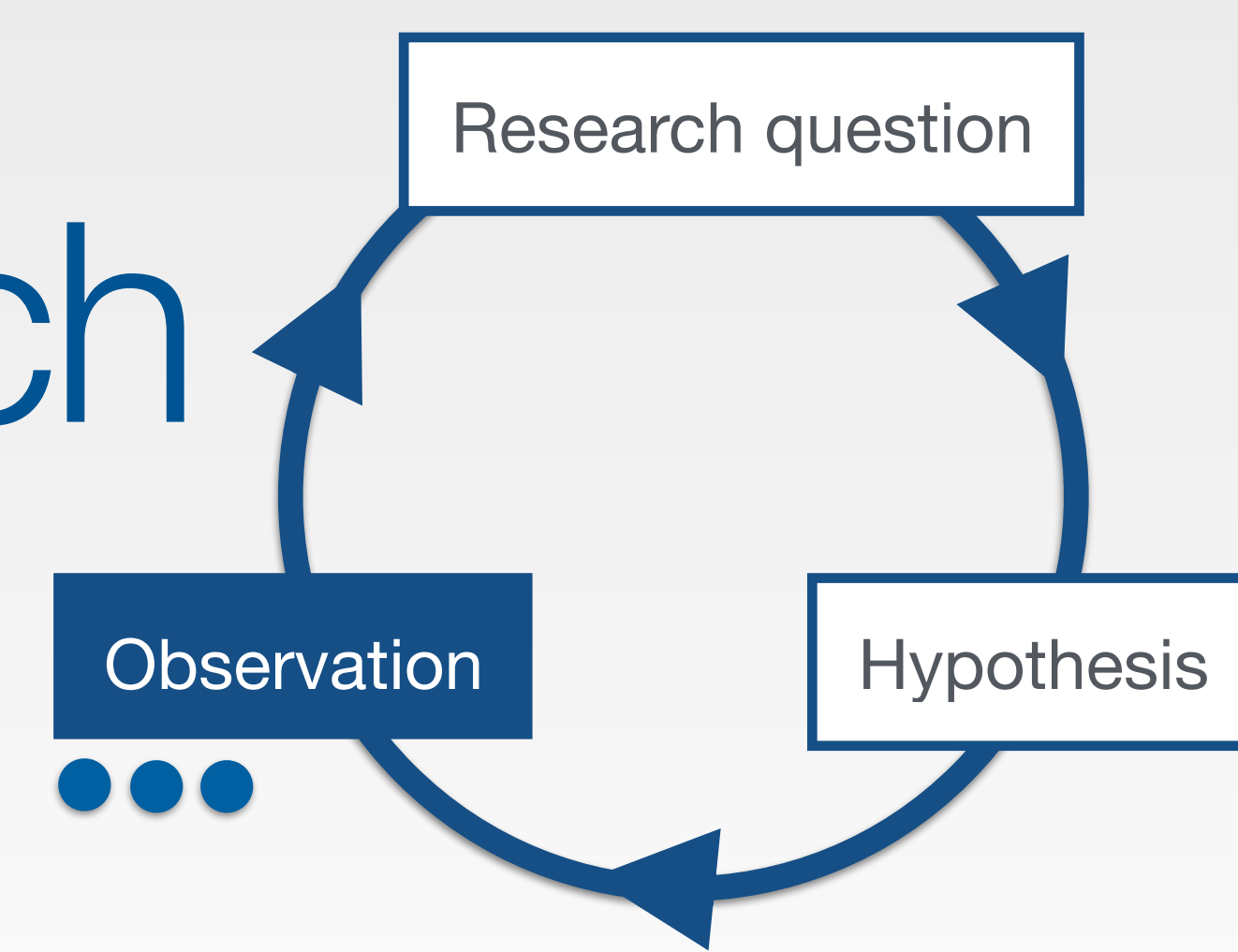


# Limitations of Relational Research

- **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




# Experimental Research

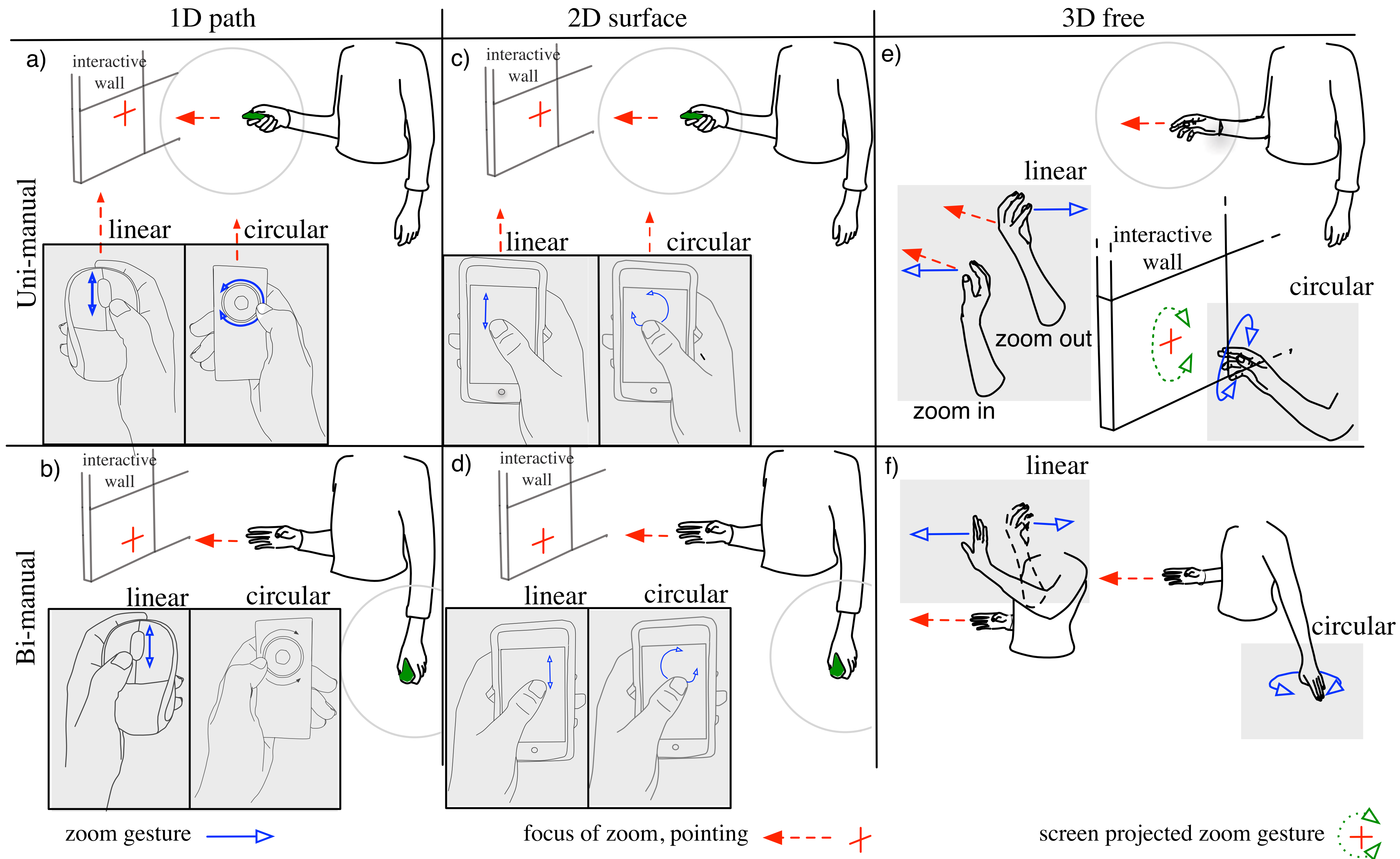


- Purpose: To infer cause-and-effect relationship
- Controlling *independent variable*
- Observe the change in the *dependent variables*
- In-class exercise: recall the following experimental designs
  - Between-group vs. within-group
  - Benefits and drawbacks
- More details in next lecture

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

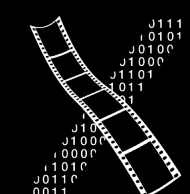
- Nancel et al. (Paris), Best paper CHI '11 
- Contributions & Benefits:
  - “Design and evaluation of multiscale navigation techniques for very large displays based on **three key factors**: number of hands involved, type of movement, type of feedback.”







Source

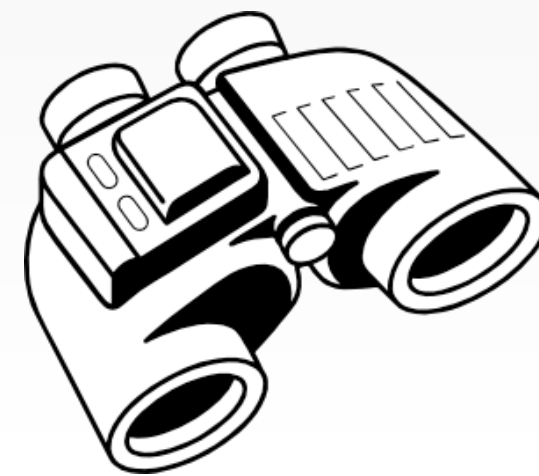


# Three Approaches to HCI Research



Test

Empirical science



Look

Ethnography



Make

Engineering  
and design