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SKKU ISS3147
Myths and Mysteries of Human Learning and Memory

Brief Primer on Research Methods

29 Jun 2016

Sources of Knowledge

Authority

- Take someone else's word
  - Young children believe what their parents tell them
  - Religious beliefs
  - You may believe your professors because they are authorities in certain topics
- Since we lack the resources to investigate everything we learn, much knowledge (and many beliefs) are acquired by this method
- Provided nothing occurs to raise doubts about the competence of the authority, this method offers the advantage of minimum effort and substantial security
- Tenacity: Clinging to an idea/theory/belief despite evidence to the contrary
  - Allows one to maintain a constant outlook on things → can be comforting

Sources of Knowledge

Science

- Beliefs acquired through experience
- Assumes that events have causes, and that we can discover the causes through controlled observation
- Emphasis on *empirical* observation
  - Experience (or data) rather than faith is the source of knowledge
- Mechanism for establishing the superiority of one belief over another
  - Old beliefs/theories are discarded or revised if they do not fit the empirical data
- (Aims to be) objective and replicable
- Self-correcting (slow process, but eventually incorrect ideas are weeded out)

Scientific Procedures in Psychology

Goals of scientific psychology

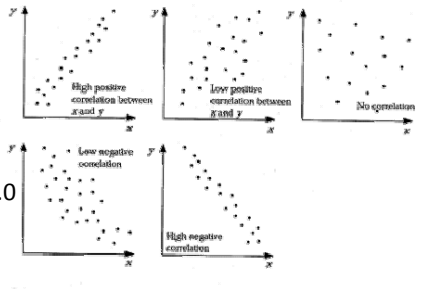
1. Describe
2. Predict
3. Explain

Major classes of research techniques

1. Observation
   - Naturalistic observation
   - Surveys
   - Case studies
   - Ethnography
2. Correlation
   - E.g., college admissions
3. Experimentation
   - To determine the cause(s)
   - Involves manipulating some aspect of the situation and observing the effect

Correlational Research

- Examining the degree and direction of the relationship between variables
  - E.g., Studies in the 1950s and 1960s consistently found a moderately high positive correlation between cigarette smoking and lung cancer (the more cigarettes a person smoked, the more likely the person was to get lung cancer)
    - US Surgeon General's report in 1964 concluding that smoking was a *cause* of lung and laryngeal cancer was based almost entirely on correlational evidence
  - Positive correlation = as one variable increases, so does the other
  - Negative correlation = as one variable increases, the other decreases
  - Correlation coefficient ranges from –1.0 to +1.0



Correlational Research

- Interpreting correlations
  - The existence of a sizeable correlation implies nothing about the existence of a causal relationship between the 2 variables (i.e., correlation does not mean causation)
  - In correlational studies, we cannot conclude that one factor produces or causes another because there are likely to be other factors that vary simultaneously with the one of interest (in experiments, we try to get around this problem by directly manipulating one factor while holding others constant)
  - Confounding: when 2 (or more) factors are varied at the same time, so we cannot know whether one factor, the other factor, or both operating together that produce the effect
  - E.g., Let's say there is a positive correlation between prevalence of gun ownership in a geographical area and the # of murders in that area
    - Proponents of gun control might use this as evidence that increased # of guns leads to (causes, produces) more murders
    - But alternative explanations are possible:
      - People in high-crime neighbourhoods might have a tendency to buy guns to protect themselves
      - Other factors may be at play: SES

Experiments

- Dependent Variable (DV)
  - The response measure that is dependent on the subject (AKA participant)
- Independent Variable (IV)
  - Manipulation of the environment controlled by the experimenter
  - Must have at least 2 levels (e.g., High vs. Low, Happy vs. Neutral vs. Sad)
    - So that we can compare the levels/conditions to determine if the IV produced a change in the DV
- In an (ideal) experiment, no factors (variables) except the one being studied are allowed to influence the outcome (DV)
  - Extraneous variables are controlled for
  - Any difference in outcome *must* be due to the manipulation of the IV (since that is the only thing that changed)
  - Changes in the IV *cause* observed changes in the DV
- Main advantage of experiments: They permit conclusions about causation

Experiments

- Potential Pitfalls
  - Demand characteristics
    - Subjects may spontaneously form hypotheses about the purpose of the experiment, and then alter their patterns of behaviour
    - E.g., Hawthorne effect
  - Experimenter effects
    - Experimenter (unintentionally) provides subjects with cues as to the experimenter's expectations (e.g., nodding with approval when the subject's response is correct)
    - Gender, race, ethnicity of the experimenter may have an influence on studies that focus on those factors
  - Measures to reduce the likelihood of above-listed problems:
    - Double-blind experiments – neither the experimenter nor the subject knows which condition s/he is in
    - Automation of experiments (using computers)

Journal of Personality and Social Psychology
1976, Vol. 33, No. 5, 541–546

Personal Space Invasions in the Lavatory:
Suggestive Evidence for Arousal

R. Dennis Middlemist
Oklahoma State University

Eric S. Knowles
Ohio State University

Charles F. Matter
University of Wisconsin—Green Bay

1. Observational / Correlational study:
   - Researcher pretended to groom himself at mirror of a public toilet, while actually recording which urinals men stood at, and the onset delay of urination
2. Followed up with an experiment:
   - Confederate would stand at adjacent urinal or one urinal away. Used a concealed periscope to measure the stream/flow.

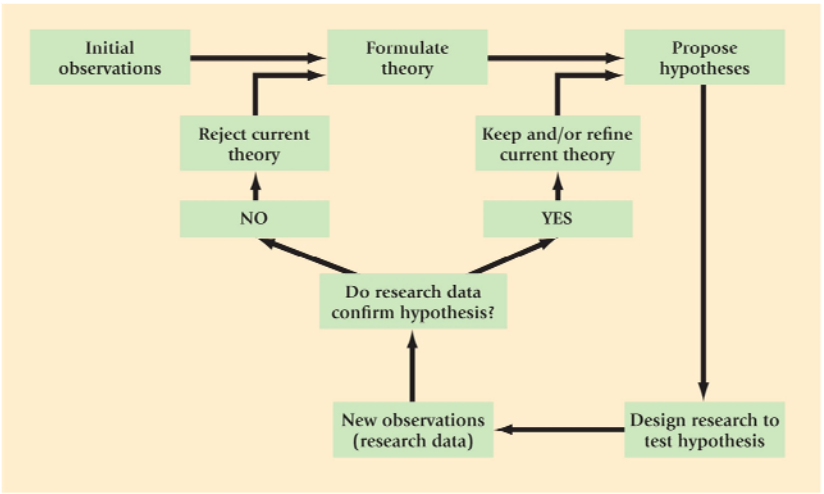
What is a theory?

- A set of statements that explains a variety of occurrences
  - The more the occurrences and the fewer the statements, the better the theory
- Performs 2 functions:
  1. Provides framework for organising the data
  2. Allows scientists to generate *predictions* for new situations
- Theories will never be complete (because *all* the data will never become available)
- What do correct predictions reveal?
  - If a theory is verified by the results of experiments, a deductive scientist might have increased confidence in the veracity of the theory
  - But since empirical observations are not final, something other than verification is essential for acceptance/rejection of a theory
- Karl Popper has proposed that good theories must be ***falsifiable***.
  - i.e., the predictions of a theory must be capable of tests that could show them to be false
  - A theory can never by *proven*; it can only be disproven.

Evaluating Theories

- A theory does not have to be either true or false
  - Can be incorrect in some portion and yet continue to be used (e.g., think of light, in modern physics)
- Although scientists generally do not state that a theory is true, they often assess several theories and decide which is best (accounts for the most data)
  - Parsimony (if 2 theories can explain the same number of results, the one with fewer explanatory concepts is preferred)
  - Precision (theories that involve math equations are generally more precise than those that use loose verbal statements)
  - Testability (a theory that cannot be tested can never be disproved)
- Belief in a theory increases as it survives tests that could reject it

Role of theory in scientific investigations



Scientific Journal Articles

Aim of scientific journals: to disseminate research findings

- Peer-reviewed
- Audience: other researchers (in the discipline/field)
- Writing style can be terse; use of jargon

Research reports are typically written in a conventional format, with predictable sections.

(Some of the readings are *literature reviews* – i.e., a summary of research findings on a given topic – so they do not conform to this format.)

Parts of an Article

- Title (gives you can idea of the contents)
- Author
- Abstract
  - A short paragraph (~150 words) that summarises the key points of the article.
  - The best way to discover quickly what an article is about.
- Introduction
  - Specifies the problem/question to be studied, and why it is important
  - Reviews the relevant research literature on the topic
  - Lists the specific hypotheses to be tested and the rationale behind the predictions

Parts of an Article

- Method
  - Subjects / Participants
  - Apparatus
  - Materials
  - Design
  - Procedure
- Results
  - Statistics (descriptive & inferential)
  - Figures & Tables

Pay some attention to what the researchers did

Don't get bogged down in the stats; try to get a sense of the main patterns / findings

Parts of an Article

- Discussion
  - Often a recap of the main findings is provided at the start of the discussion
  - Authors interpret their findings and draw conclusions
  - Discuss limitations of the study, implications of the findings
  - Suggest follow-up research
- References
  - Other studies/articles cited in the text are included in this section
  - Can be a valuable guide for related information

Questions to ask yourself when reading…

- Introduction
  - What is the author's goal?
  - What hypotheses will be tested in the present study?
  - If I had to design a study to test this hypothesis, what would I do?
- Method
  - Does the author's method actually test the hypothesis?
  - Would I do anything differently if I were conducting the study?
- Results
  - Did the author get unexpected results?

Questions to ask yourself when reading…

- Discussion
  - Do I agree with the author's interpretation of the results?
  - Are there any plausible alternative interpretations?
  - Does the author offer a good discussion of the implications / applications of the results?