

The Researcher
as a
Detective

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Agenda

- Acquiring Knowledge
- Scientific Method
- The Experiment
- Research Process & Idea
- Literature Search
- Critiquing the Research
- The Hypothesis



Acquiring Knowledge (C. Peirce)

- Tenacity: Repetition of information
- Authority: Experts
- Experience: Direct personal experience
- Reason and Logic

The Scientific Method

- Scientific Approach (W. Wundt):
 - Objective measurement of phenomenon under construction
 - Ability to verify or confirm measurements made by others “ability to replicate”
 - Self-correction of errors and faulty reasoning
 - Exercising control to rule out the influence of unwanted factors

The Experiment

- **Experiment** – An attempt to determine the cause-and-effect relations that exist in nature.
 - Involves the manipulation of an independent variable (IV), recording of changes in a dependent variable (DV), and control of extraneous variables.

The Experiment (cont.)

- The three factors in more detail:
 - **Independent variable (IV):** Factor that is directly manipulated. “causal” part
 - Two or more values (levels)
 - **Dependent variable (DV):** Recorded information or results. Changes in DV are dependent on manipulation of IV.
 - **Extraneous variables:** Factors other than IV that could influence the DV.

The Research Process

- Finding a problem or question
 - Gap in knowledge, or wonder about a relationship
- Literature review
 - Current knowledge and/or information
- Theoretical considerations
 - Current beliefs relating to problem or question

The Research Process (cont.)

- Hypothesis
 - Hypotheses that contribute to problem or question
 - Experimental hypothesis – Predicted outcome of experiment
- Research design
 - Detailed plan for conducting research
- Conducting experiment
 - Data collection

The Research Process (cont.)

- Data analysis & statistical decisions
 - Validate assumptions, conduct appropriate analysis
- Decisions in terms of past research and theory
 - Interpretation of results based on theories and findings
- Preparation of research report
 - Prepare content for dissemination

The Research Process (cont.)

- Sharing your results: presentation and publication
 - Poster sessions, professional society meetings, publication
- Finding a new problem
 - Results uncover (hopefully) another problem or question

The Research Idea

- Identification of a gap in the knowledge base or an unanswered question in an area of interest.



The Research Idea (cont.)

- Similar to decisions in investing in stocks, or where to buy a home, or even at the poker table, early decisions matter most!
 - Be sure not to rush the process of developing your research idea.
 - Rushing into a research idea is among the biggest mistakes in research.

The Research Idea (cont.)

- Characteristics of a good research idea (testable):
- How *reasonably* testable are the following activities
 - Measuring neural activity while playing basketball
 - Measuring time it takes to run 100 yards
 - Measuring how someone feels after watching a video
 - Measuring neural activity while watching a video
 - Measuring ability at decision making

The Research Idea (cont.)

- Characteristics of a good research idea:
 - Likelihood of Success
 - Measuring stress related to gambling
 - Associating IQ with decision making ability
 - Associating physician fatigue and cognitive performance

The Research Idea (cont.)

- Sources of Research Ideas
 - Nonsystematic – Ideas present themselves in an unpredictable manner.
 - Inspiration – Ideas pop into your mind
 - Serendipity – Situations where we look for one phenomenon but find something else. E.g., Pavlov's dog and classical conditioning
 - Everyday Occurrences
 - Daily encounters – Observations of patient behaviors based on length of time in the waiting room.

The Research Idea (cont.)

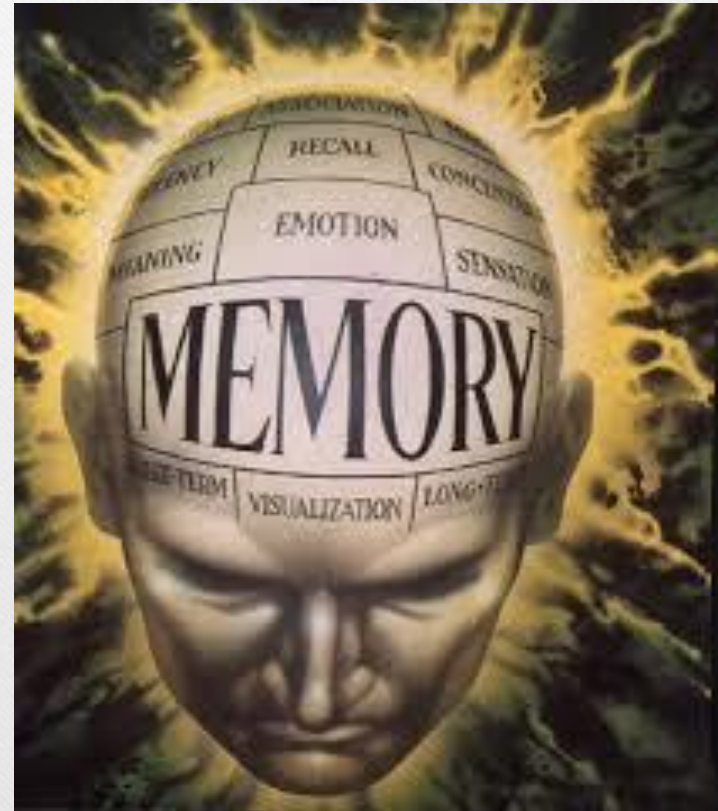
- Sources of Research Ideas (cont.)
 - Systematic – Purposeful examination of a topic
 - Past Research – Review of literature
 - Based on current hypotheses
 - Somatic marker hypothesis
 - Professional lectures
 - Hearing about research or content that sparks interest

Steps in Conducting a Search of the Literature

- **Selection of Index Terms**: List all relevant terms related to your topic of interest
 - E.g., Social groups: related terms include, Cadres, Cliques, Groups, Ingroup, outgroup, Reference groups, Social networks.

Steps in Conducting a Search of the Literature (cont.)

- What are some relevant terms for the following:
 - Memory
 - Emotion
 - Health
 - Pain



Steps in Conducting a Search of the Literature (cont.)

- Computerize Search of the Literature:
 - Google scholar
 - PsycINFO
 - *Always evaluate the Internet source!*

Steps in Conducting a Search of the Literature (cont.)

- Obtaining Relevant Publications: Obtain relevant documents
 - Reading
 - Note taking
 - Photocopying
 - Interlibrary loan

* *See Reviewing the Literature document for details on documenting relevant information.*

Steps in Conducting a Search of the Literature (cont.)

- Integrating Results of Literature. Search:
 - Summarize articles in a consistent manner
 - Copy reference list (needed for your own reference list)
 - Introduction – Why did the researchers conduct this study?
 - Methods – Participants, Apparatus, Procedure
 - Results – What did they find
 - Discussion – What conclusions did the authors reach? What do you think about the conclusions (agree, disagree)

Critiquing Research

- Guidelines:
 - Are the literature reviews within the article consistent with the research question?
 - Are the research questions clearly stated? Should have a clear understanding after reading introduction.
 - Are hypotheses clearly stated and appropriate?
 - Are key terms defined? IV, DV, extraneous variables, details of any apparatus

Critiquing Research (cont.)

- Are the IV's and their levels appropriate?
 - Asking how much coffee a participant drank that morning is not as accurate as directly providing the coffee to the participant.
 - Levels should relate to research question.
 - Gender & intelligence should not have three levels
- Does the DV appear to be appropriate?
 - Would GPA be a good measure of intelligence?

Critiquing Research (cont.)

- Can you think of any uncontrolled variables that could influence the results?
 - The influence of diet on BMI.
 - Blood pressure and exercise
 - Test anxiety and gastrointestinal symptoms

Critiquing Research (cont.)

- Did author use an appropriate design to test the specific hypothesis?
 - Compare research question with design.
- Does the Method section provide enough detail for you to replicate the research?
 - Assuming you had access to all materials

Critiquing Research (cont.)

- Did researchers use appropriate sampling procedures to select participants and assign them to groups?
 - Select participants from 1 location or specific time?
 - Survey individuals at a mall on a weekday in the afternoon
 - Was the assignment to groups random?

Critiquing Research (cont.)

- Sufficient number of participants?
 - Comparing intelligence of two groups would require a larger sample (typically due to effect size – see effect size presentation).
 - Studying the neural activity of individuals watching emotional videos might require fewer participants.
 - Formula's are used such as G power to generate an estimate of participants needed

Critiquing Research (cont.)

- Did authors report appropriate statistical results?
 - Mean – Average of group
 - Standard Deviation (SD) – Deviation from mean
 - Confidence intervals
 - p value
 - **Effect Size** – Amount of variance explained by the IV
 - Very Important! See Effect size presentation

Critiquing Research (cont.)

- Did author appropriately interpret the results?
- Are conclusions justified by data results?
 - Did they consider other possible conclusions?
- Do all references cited in text appear in reference section?
- Were ethical procedures followed?

Critiquing Research (cont.)

- Last but not least!
 - *Was the article easy to read or did it seem like you were reading another language?*

The Research Hypothesis

*The experimenter's
predicted outcome of
a research project.
What you believe will
occur.*



Characteristics of the Research Hypothesis (cont.)

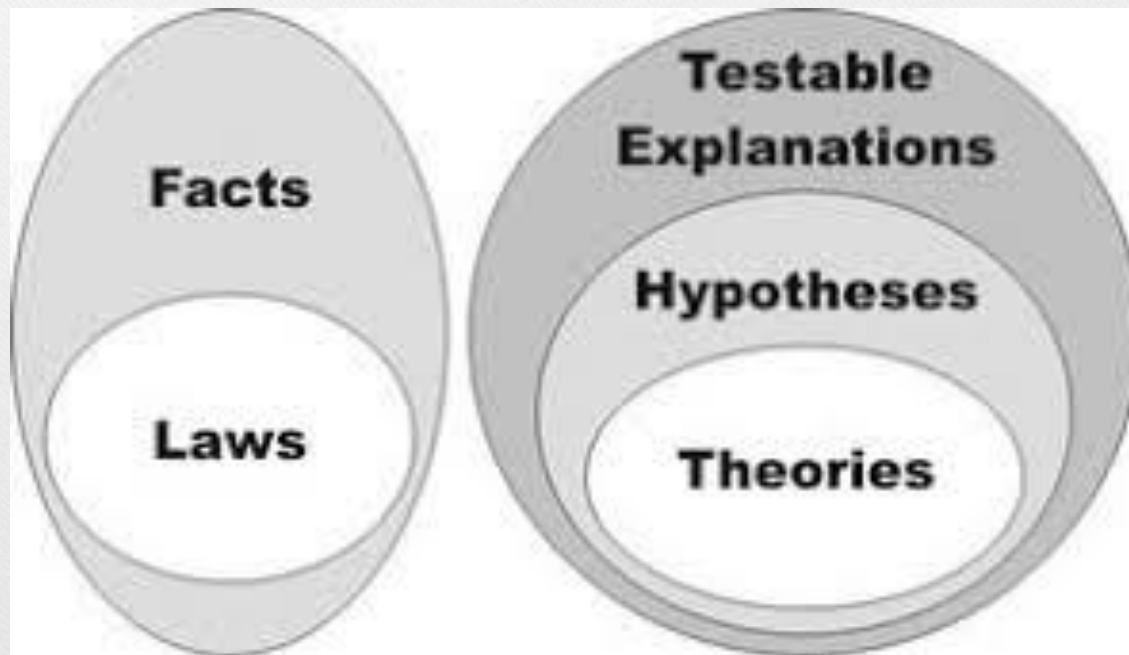
- General format of the hypothesis, If/then
 - If portion relates to IV manipulation, then portion relates to the DV changes we expect

If students receive candy each time they spell a word correctly, then their spelling performance will be better than that of a group who does not receive candy for each correctly spelled word.

- What's the IV and DV in this statement?

Characteristics of the Research Hypothesis (cont.)

- Principle of falsifiability – Hypothesis can be considered as a scientific theory only if it can be disproved



Characteristics of the Research Hypothesis (cont.)

- Types of Reasoning – Must be aware of type of reasoning when stating a hypothesis
 - **Inductive logic** - Reasoning that proceeds from specific cases to general conclusions.
 - **Deductive logic** – Reasoning that proceeds from general theories to specific cases.

Characteristics of the Research Hypothesis (cont.)

- Directional vs. Non-directional
 - Directional – Prediction to the direction of the outcome
 - Group A will score significantly higher than group B
 - Non-directional – No direction is predicted.
 - Group As scores will differ significantly from group Bs

The End
