Class Requirements

- 3 Exams
  - 25% each
  - Total 75% of grade
  - Not cumulative
- Research Paper (25%)
  - Design original experiment and write up your rationale and methodology APA style
- 10 credits Sona research participation

Conducting Research

“The wise man doesn’t give the right answers, he poses the right questions.”

Claude Levi-Strauss

- The allure of answering “mysteries”, resolving debates, contributing to knowledge
- To construct a properly designed, well controlled experiment is, for the psychologist, like constructing a beautiful building is for the architect

Why is the Research Methods Course Important?

- It is the methodology used by behavioral scientists such as psychologists
- It assists you in other classes
  - The more completely you understand research methodology, the better you will be able to master the material in your other classes.
- Becoming a Knowledgeable Consumer of Research
- Understanding brief descriptions of studies
- Getting into Graduate School
- Conducting a research project after graduation
Non-Scientific Ways to Acquire Knowledge

- **Tenacity**
  - Continued presentation of a particular bit of information
  - When we hear a statement repeated a sufficient number of times, we have a tendency to accept it as being true.
- **Superstition**
  - e.g. breaking a mirror = 7 years bad luck
  - “You can’t teach an old dog new tricks”

Non-Scientific Ways to Acquire Knowledge cont.

- **Authority**
  - Accepting knowledge from authority figures
  - Acceptance of knowledge from an authority; taking someone’s word for it; also depends on the credibility of the person presenting the information.
  - Parents, teachers/professors, mechanics, spiritual leaders etc.
  - Football player selling soup etc.

Non-Scientific Ways to Acquire Knowledge cont.

- **Method of Faith**
  - Extension of method of authority
  - Have complete faith in authority figure
  - E.g. young children have absolute faith in answers given by parents
  - Involves accepting another’s view of the truth without verification

Non-Scientific Ways to Acquire Knowledge cont.

- **Intuition**
  - Information accepted as true because “it feels right”
  - Hunch and instinct
  - Roulette player “feels like” number 23 is going to come up
Problems

- What problems can you identify with acquiring knowledge through tenacity, intuition, and authority?
  - You have no way of knowing if the knowledge you have gained is true.
  - The inability or unwillingness of tenacity and authority to change in the face of contradictory evidence.
  - Authorities can be biased
    - E.g. conflicting testimony by expert witnesses
    - Differing opinions of doctors
  - Experts aren’t always really experts

Non-scientific ways of knowing cont.

- Reason and Logic
  - Based on the premise that we can apply reason and logic to a situation in order to gain knowledge and understanding
  - This process is frequently called a logical syllogism.
  - An example of a logical syllogism is the assumption that “beautiful people are good.”

- Rational Method
  - Seek answers by logical reasoning

  \[
  \begin{align*}
  &\text{Socrates is a man} \\
  &\text{All men are mortal} \\
  &\text{Therefore, Socrates is mortal}
  \\
  &\text{Dinosaurs are animals} \\
  &\text{All animals are in zoos} \\
  &\text{Therefore, dinosaurs are in zoos}
  \end{align*}
  \]

  Premise statements
  Logical conclusion

- Logic may be sound but conclusion may not be true if premise statements are incomplete or inaccurate

Non-scientific ways of knowing cont.

- Experience/Empiricism
  - Process of learning through direct observation and experience
  - All knowledge acquired through the senses
  - It is common for people to misperceive or misinterpret world

BUT
Optical Illusions

- [https://www.youtube.com/watch?v=y2EB4PGUs8](https://www.youtube.com/watch?v=y2EB4PGUs8)
- [https://www.youtube.com/watch?v=PxGB2Zz4R04](https://www.youtube.com/watch?v=PxGB2Zz4R04)
- [https://www.youtube.com/watch?v=ffrBY2Xs1LU](https://www.youtube.com/watch?v=ffrBY2Xs1LU)
- [https://www.youtube.com/watch?v=b3LiaKrM0E](https://www.youtube.com/watch?v=b3LiaKrM0E)

Ponzo Illusion

Muller-Lyer Illusion

Poggendorf Illusion
Hering-Helmholtz Illusion

Ebbinghaus Illusion

Non-scientific ways of knowing cont.

- Experience/Empiricism cont.
  
  **Problems:**
  
  - Objective experience in conflict with subjective belief
    
    - E.g. vegetarian eats delicious dish without knowing it had meat in it
  
  - Make accurate observations but misinterpret what you see
    
    - E.g. sun rising in east and setting in west – misconception that sun travelled around the earth
  
  - Time-consuming, sometimes dangerous
    
    - E.g. eating poisonous mushrooms

Scientific Ways to Acquire Knowledge

- Science
  
  - The key elements of the scientific approach are:
    
    - Formulating specific questions
    
    - **Objective, systematic** measurements of the phenomenon under consideration
    
    - The ability to **verify or confirm** the measurements made by other individuals
    
    - Self-correction of errors and faulty reasoning
    
    - Exercising control to rule out the influence of unwanted factors
Commonsense Psychology

- Our culture is full of psychological conclusions that are more based on commonsense than science
- "Smart kids sit in front of the class"
- How are these conclusions made?
- What are the problems?
- How can we test scientifically?

The Scientific Method

1. Observe Behavior or Phenomena
   - Casual observation of own or other’s behavior or events (empiricism)
   - Inductive reasoning
     - Generalize beyond actual observations
     - Use small set of observations to form general statement about larger set of possible observations
     - E.g. students not paying attention in back of class – maybe good students DO sit at the front!

2. Form Hypothesis
   - A statement that describes or explains a relationship between or among variables
   - Identify other factors/variables associated with your observation
   - Background research (authority)
   - Choose most plausible or interesting explanation

3. Use Hypothesis to Generate Testable Prediction
   - Use logic to make prediction
   - Deductive Reasoning – begin with universal statement and make specific deductions
   - Must be possible to demonstrate that prediction is either correct or incorrect – for prediction to be testable, both outcomes must be possible
The Scientific Method

4. Evaluate Prediction by making Systematic, Planned Observations
   - Empirical method
   - Research or data collection phase
   - Provide fair, unbiased test of hypothesis by observing whether predictions are accurate

5. Use Observations to Support, Refute, or Refine Original Hypothesis
   - Compare actual observations with predictions
   - Circle back to step 2 (hypothesis formation)
   - Circular vs. linear process

Question

How does the scientific method avoid the problems associated with tenacity, authority, intuition, experience, and reason & logic?

Components of the Scientific Method

- Objectivity
  - select research participants to avoid biasing factors (such as age or sex).
  - Researchers make their measurements with instruments in order to be as objective as possible.
  - *empirical* because they are based on objectively quantifiable observations.
  - Observations are systematic and structured in such a way as to rule out competing explanations
Components of the Scientific Method

- Confirmation of Findings
  - Observations must be made public in order to be evaluated by others
  - Because the procedures and measurements are objective, we should be able to repeat them and confirm the original results. Confirmation of findings is important for validity

- Replication
  - A research study conducted in exactly the same manner as a previous study.
  - A replication with extension generates new information at the same time it confirms previous findings.

Components of the Scientific Method (recap)

- Objectivity
- Control
- Confirmation of findings
- Self-correction

Components of the Scientific Method

- Control
  - Direct manipulation of factors of major interest.
    - An experiment is an implementation of control by manipulating the factor(s) that is the central focus of research.
  - Control of unwanted factors
    - Potentially influential and undesirable factors (other than the factor of major interest) are not allowed to change.

Components of the Scientific Method

- Self-correction
  - Errors and faulty reasoning that become apparent should lead to a change in the conclusions we reach.
  - If experimental evidence fails to support the predicted relations between our independent and dependent variables, we change our view about how nature operates.
The Research Process

- Theoretical Considerations
  - A **theory** is a formal statement of the relationship(s) among the relevant variables in a particular research area. All good theories:
    - Attempt to organize a given body of scientific data.
    - Point the way to new research.

The Research Process: Step 2

- Hypothesis
  - States a testable prediction about the relations between the independent and dependent variables in your experiment
  - Specific aspect of larger theory
  - The **research or experimental hypothesis** is the predicted outcome of a research project.

Elements of A Good Hypothesis

1. Logical
   - Should be logical conclusion of logical argument
   - Know basic facts, theories, predictions and methods that make up knowledge base for your topic area
   - Logical argument
     - provides rationale or justification for your hypothesis
     - establishes connection between your research and previous research results

Elements of A Good Hypothesis

2. Testable
   - Must be possible to observe and measure all of the variables involved
   - Must involve real events and individuals, can not involve hypotheticals
Elements of A Good Hypothesis

3. Refutable/Falsifiable
- Must be possible to obtain results that contradict your hypothesis
- NOT hypotheses involving moral or religious issues, value judgments, hypothetical situations etc.
- E.g. There is an animal somewhere that has a theory of mind

4. Positive
- Must make positive statement about existence of something – usually existence of a relationship, difference, or treatment effect
- Fail to find convincing evidence vs. stating that relationship does not exist
- Showing absence of effect is not same as showing effect does not exist – failure to prove guilt does not = evidence of innocence, but can prove guilt

The Research Process

- The more deeply you immerse yourself in a research area, the more questions and problems you will find to research
- There are no final answers!