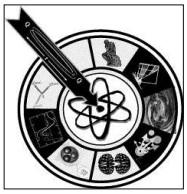
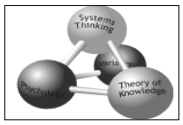
Theories & Hypothesis



- Scientific Hypotheses & Predictions.
- Constructs & Operational Definitions.
- Converging Operations.
- Scientific Theories & Scientific Laws.
- Induction & Deduction in Science.
- Generating Hypotheses.
- Two Lab Activities & Assignment #2.



Scientific Hypothesis

- ***A statement of the relation between two variables.***
- ***The main idea or thesis behind a research project.***
- ***To be useful, a hypothesis must be...***
  - ***Concrete: Based on operationally defined variables.***
  - ***Testable: Procedures must be available to test it.***
  - ***Falsifiable: Able to be proven incorrect.***
  - ***Parsimonious: As simple as possible.***

Prediction

- ***A specific statement about what will occur in a particular research investigation (e.g., an experiment).***

Hypotheses & Predictions: Examples

- **Effects of feedback on learning…**
  - *"We hypothesized that immediate feedback would increase long-term retention of course material."*
  - *"We predicted that students given immediate feedback on course exams would show higher final-exam performance compared to students given feedback two days later."*
- **Effects of alcohol on memory…**
  - *"We hypothesized that, owing to its effects on the frontal-lobe and hippocampus, alcohol consumption would impair long-term memory."*
  - *"We predicted that subjects who drank 6 or more ounces of alcohol would recall significantly fewer names than students given a placebo beverage."*

Constructs & Operational Definitions

- **Construct**: *A hypothetical factor (e.g., hunger) that cannot be observed directly but is inferred from certain behaviors (e.g., eating) and which is assumed to follow from certain circumstances (e.g., 24 hours without food).*

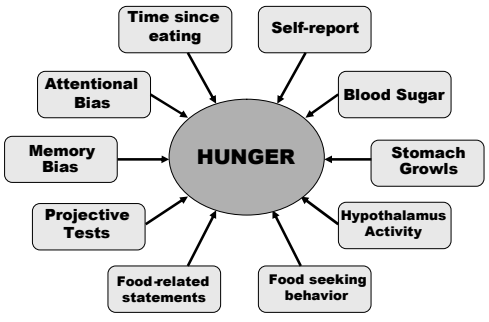
• ***Intelligence***	• ***Attention***	• ***Anxiety***
• ***Boredom***	• ***Charisma***	• ***Dementia***
• ***Memory***	• ***Stress***	• ***Love***
• ***Aggression***	• ***Affection***	• ***Violence***

Constructs & Operational Definitions

- **Operational Definition**: *Defining a variable in terms of the operations used to (a) measure or (b) implement it.*
  - *Is not the same as dictionary/conceptual definition (although its good to start with this kind of definition).*
  - *Usually involves a combination of Behavioral, Physiological, or Self-Report measures or procedures.*
  - *Must be specific enough for another researcher to repeat it.*
  - *Should be valid--truly getting at (measuring or implementing) the underlying construct.*

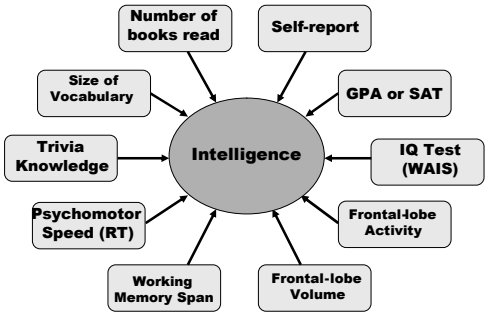
Converging Operations

The use of multiple operational definitions (multiple measures) to "pin down" the full meaning of a construct.



Converging Operations

The use of multiple operational definitions (multiple measures) to "pin down" the full meaning of a construct.



Scientific Theories

A theory is an interrelated set of assumptions, constructs, and principles that specify the causes of phenomena thereby allowing for explanation and control.

- ***Darwin's Theory of Evolution by Natural Selection.***
- ***Einstein's Theory of Relativity.***
- ***The James-Lange Theory of Emotion.***
- ***The Executive-Process Theory of Frontal-Lobe Function.***

➢ **The Dual-Process Theory of Recognition Memory:**

- **Recognition reflect two distinct memory processes.**

1. **Recollection: Conscious memory for the details of events.**
   - ***Slow, Voluntary, Search-based, Hippocampus.***
2. **Familiarity: A feeling of oldness without event details.**
   - ***Fast, Involuntary, Fluency-based, Non-Hippocampus.***

Scientific Theories

There are Four Main Characteristics of a Good Theory

1. **Organizes & Explains Existing Data**.
   And Thus Provides a Framework for Interpreting New Data
2. **Is Parsimonious** [aka. Occam's Razor; Lloyd Morgan's Cannon].
   "Everything should be made as simple as possible, but no simpler."
   - Albert Einstein.
3. **Productive** [aka. Fruitful].
   Generates New Ideas & Research Studies.
4. **Falsifiable** [cf. Karl Popper].
   Capable of being proven incorrect.
   (not as easy as with hypotheses and predictions!).

Theory → **Hypothesis** → **Prediction**

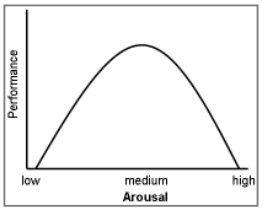
Increasing specificity
Increasing ability to be proven incorrect

Scientific Laws

A scientific law is a relation between variables that has been confirmed so many times, in so many situations, that it is unlikely to be overturned by future experimentation.

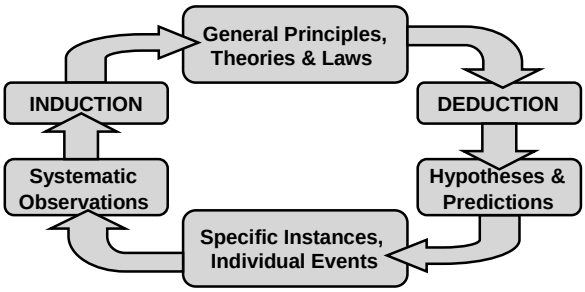
- ***Newton's Laws of Gravity.***
- ***Kepler's Laws of Planetary Motion.***

- **Thorndike's Law of Effect: Behaviors that are reinforced are more likely to be repeated.**
- **Yerkes-Dodson Law: The relationship between arousal and performance is an inverted U-shaped function.**



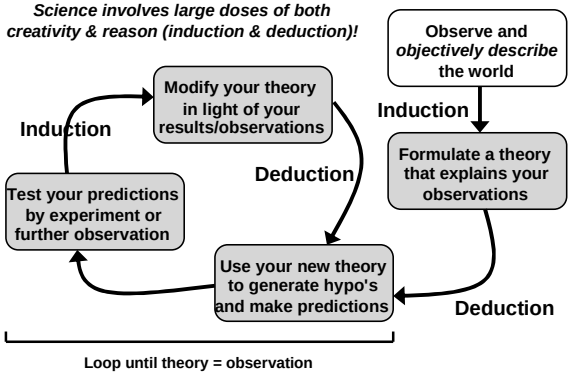
Induction & Deduction in Science

- **Induction: A form of reasoning that uses specific observations to form more general principles, hypotheses, & theories.**
- **Deduction: A form of reasoning that uses general principles (theoretical claims) to formulate specific predictions.**



Induction & Deduction in Science

Science involves large doses of both creativity & reason (induction & deduction)!



Generating Hypotheses

There are numerous ways that scientists come up with research questions to investigate.

- **Induction: Observing thought & behavior and looking for generalities.**
- **Deduction: Testing the implications of a theory.**
- **Serendipity: "Stumbling" onto good ideas (usually after immersing yourself in a subject area).**
- **Intuition: Testing hunches about why people think, behave, and feel the way they do.**
- **Searching & Reviewing the Research Literature.**
  - **Can be a great way to find cool ideas, but is ALWAYS the first step in research, regardless of how your hypothesis was initial generated.**

Lab Activity 1: Hypotheses

- **Get into groups of 4. Each group will then be given a pair of psychological constructs. For each pair, the group should create two or more hypotheses that meet the criterion of being *concrete*, *testable*, and *falsifiable*. A sample of these hypotheses will then be discussed amongst the entire class.**

Lab Activity 2: Operational Definitions

- **Everybody picks a term, gets into a group of 4, and generates three operational definitions for their term (one physio, one behavioral, one self-report). Have your group critique your definitions. We then will regroup as a class to compare definitions.**

Assignment #2: Due Next Tuesday

- **Pick your 2 best questions from Assignment 1.**
- **For each (a) refine your question into a hypothesis that is concrete, testable, & falsifiable; (b) give operational definitions for your main variables.**

- **Download "Assignment 2" from course webpage.**
- **Use the format described!**
- **Mail your completed assignment to MethodsTA@yahoo.com & bring a hard copy to class.**