

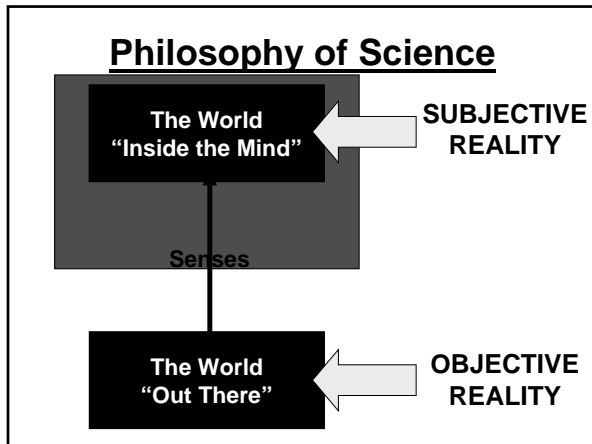


BL 204
Human
Biology

What are some stereotypes of science?

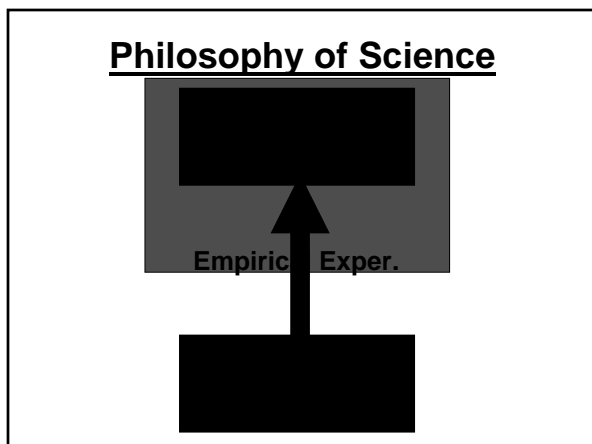
Philosophy of Science

- Science is based on empiricism.
- **Empiricism** = the theory that knowledge originates from sensory experience.
Evidence = Sensory Experience
Evidence ≠ “Mystical” Experience
- Sensory experience ***IS*** relative.
E.g., Some people lack some senses.



Assumptions of Science

- **Empirical evidence consistently reflects reality** (though *not* with 100% accuracy).
(i.e., Subjective sensory experience has some consistent similarity to objective reality.)
- **There is order in the universe.**
(i.e., Different events/things can have the same cause. **Can predict.**)



Science

- **Science** = A way of knowing the world based on the belief that phenomena have natural, predictable causes that can be revealed by empirical evidence.
- must be *testable* via reproducible observation
- *must be able to be rejected* based on observation

Philosophy of Science

- If sensory experience consistently reflects an ordered objective reality,...
then repeated observation by different individuals should better approximate a subjective concept of the real world.
- **Repeatability** of observations very important.

REPLICATION

- **Replication** = repeating observations as many times as reasonably possible.
Remember scientific doubt...
More replication = **MORE LIKELY**
= more opportunities to reject the hypothesis
- In Science **MORE REPLICATION = A BETTER** (MORE RIGOROUS) **STUDY**

Science

- Subjective knowledge is **ALWAYS** relative and approximate.
- Maintain doubt
Can never have 100% certainty.
CANNOT KNOW objective reality exactly through empirical means.
- Scientists can say...
PROBABLY or **NO**
- Nothing ever truly **PROVED**.

Scientific Method

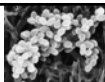
- Test hypotheses (ideas) for consistency with empirical data
- **Hypothesis** = tentative answer to some question
- Hypotheses may be **SUPPORTED** (consistent with data) or **REJECTED** (inconsistent).
- Hypothesis abandoned or modified and retested if inconsistent.

Theories & Laws

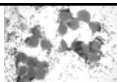
- **Theory** = well supported hypothesis
 - Cell Theory
 - Homeostatic Theory
 - Gene Theory
 - Evolutionary Theory
 - Ecological Theory
- **Law** = A very well supported hypothesis about the general qualities of matter or energy (in Chemistry & Physics).
Scientific laws **have** been rejected by empirical evidence. (After which they were replaced.)

Experimental Science

- **Experimental Group** = given treatment (mentioned in the hypothesis).
- **Negative Control (Group)** = treated the same as the Experimental Group, EXCEPT it does not receive the treatment --- ***A basis for comparison.***
- **Positive Control (Group)** = the treatment is applied to a situation with a known outcome ---
Identifies errors in the procedure.



Example



- **Hypothesis** = Treatment of a skin infection with green-tea extract will speed healing.
- **Experimental Group** = skin infections to which green-tea extract in gelatin is applied
- **Negative Control Group** = skin infections to which gelatin alone is applied
- **Positive Control Group** = skin infections to which known antibiotics in gelatin are applied (checks if it is a typical skin infection and if gelatin delivery works)

In-Class Exercise

- **Design a controlled experiment to test the hypothesis that:** The new drug Cold-B-Gone reduces the time people suffer from the common cold.
- What will be your treatment and negative control groups?
- What will you measure?
- How many times will you repeat it?

Summarizing Data to Address Hypotheses (Descriptive Statistics)

- **Descriptive Statistics** = Summarize a set of data. (Mean, Mode, Range)
- **Mean** = Average; Add all data, divide by total number.
- **Hypothesis**: People in the U.S. have fewer children than people in Sweden.
- **Data**: Mean # of children per family –
U.S.=2.20 Sweden=1.64

Do green M&M's increase libido?

- **Hypothesis** = Green M&M's increase desire.
- **Experimental Group** = 10 blindfolded people fed a bag of green M&M's.
- **Control Group** = 10 blindfolded people fed a bag of M&M's with no green M&M's.
- Survey both groups about desire
- Compare experimental group to control group.



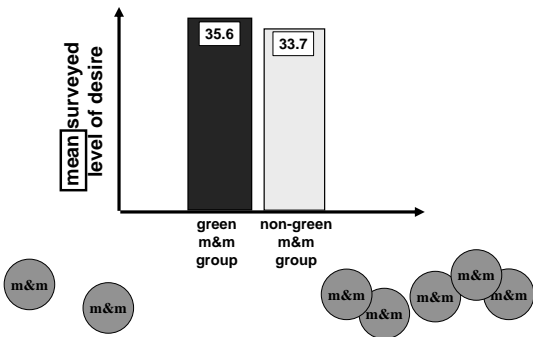
Do green M&M's increase libido?

- **Experimental Group Desire Scores**
50 35 24 36 44 30 22 40 45 30
- **Control Group Desire Scores**
30 40 41 24 52 20 28 41 33 28
- Which is greater? How can we see this more clearly?
- **Experimental Mean** = 35.6
- **Control Mean** = 33.7

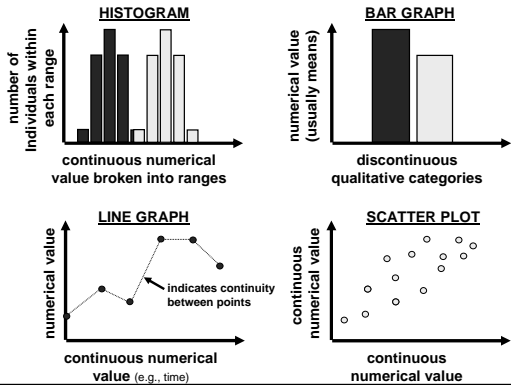


Do green M&M's increase libido?

BAR GRAPH



Summarizing Data - Graphs



Some Facts About Science

- All science does not require complex equipment (& lab coats).
- The popular opinion of professionals is not itself evidence of veracity. (4 of 5 doctors surveyed)
- Correlation does **not** equal Causation.
- Absence of evidence is **not** Evidence of absence.
