COGS 14A
Intro to Research Methods

Welcome!
• Nuts and bolts of how to do science
• Who this is important to:
  – Student researchers and professors
  – _______ researchers
  – People working in ___
  – _______ consumers
  – Congress (?!)

This week
• Review syllabus
• Chapters 1-2

Later on
• We’ll slow down more as we talk about research design and analysis

How I teach
• Lots of concrete examples to anchor general principles.
• Why?
  – It’s interesting.
  – People remember interesting things more than non-interesting things.
  – Not memorable: Sometimes people fabricate data. They might get found out and fired.
  – Memorable: Researcher X fooled their students into analyzing fake data for over 30 papers. Then they got turned in by their own students, and kicked out of their university.

Scientific reasoning
vs. other kinds of reasoning

Not science
• Superstition
  – Subjective
  – _______
• Intuition
  – _______
  – Not necessarily _______
• Authority
  – _______ sources*
  – _______ is subjective
• Rational-Inductive argument
  – Use _______ to argue for a conclusion
  – One’s use of _______ can be subjective/biased

Science
• Objective
• Systematic
  – _______
• Repeatable
• Manipulate
  something to show  
  _______
Elements of experiments

- **Hypothesis** (pl. hypotheses)
  - ________ about an outcome
- **Variables**
  - ________ variable manipulated by scientist
  - ________ (_______) variable observed by scientist

More on variables

- Independent has 2+ ________ establish causality
  - Pulling lever, ________
  - Remember 2 digits, 4 digits, 7 digits
  - Experimental drug, placebo
    - ________ group
    - ________ group
  - Confounds – things correlated with ________ variable
    - ________ (_______) variables
    - CANNOT
    - Gender
    - Presence of
      - ________ color
      - ________ language

Goals of science

- **Describe/classify**
  - Types of ________, species, classroom styles
  - Helps develop ________
- **and predict**
  - Figuring out why it happens
  - Make new predictions to test
- **Control** (in applied research)
  - If you know why it happens, you can ________ it.
  - If you can predict when it's going to happen, you can ________ (tornadoes, getting hungry)

Theories

Attempt to explain ____________

Composed of

- Laws (Clear ________ formation; little doubt as to accuracy)
  - Few in cognitive science (______'s Law)
  - Principles (less certain than laws)
    - ________ (shouldn't be in there, but they are)

A good theory is

- ________ – As few elements as possible
- ________ – Predictions as detailed as possible
- ________ (_______) – If every possible outcome is consistent with your theory, it's a pretty useless theory!

Scientific ethics

- Treatment of participants/subjects
- Treatment of data

Equitable treatment of participants/subjects

- **Informed**
  - If it can be given (young children: ________ with parental ________; infants can't even ________)
    - Avoid coercion (false incentives, pressure)
  - Safety (physical and ________)
    - Confidentiality, privacy
    - ________ (no more risk than present in ________)
- **Deception** (concealed purpose; confederates)
  - Only if necessary
  - Don't deceive about ________ (but Milgram experiments)
    - ________
    - Even if no deception, clarify misconceptions
    - What if ________ is unethical?
- **Protection of ________ groups**
  - Infants, children
  - Developmentally delayed
### Sources of guidance on ethical treatment of subjects

- **American Psychological Association (APA)**
  - Code of Conduct
- ________ report (1979) – more general guidance from US Dept. of Health and Human Services

### Belmont report

- Autonomy
- Protection of vulnerable populations
- Prevent harm
  - Both minimize risks and maximize benefits
- ________
  - Don’t test on one group and then use research to benefit another (economic status, ethnicity)

*Example:* Ebola vaccine testing

### Animal research

- **APA Guidelines for Ethical Conduct in the Care and Use of Animals**
  - Treat animals humanely
  - Only use pain/stress/________ if absolutely necessary
  - If surgery necessary, avoid ________, minimize pain
  - Personnel ________ in animal care
- **Guide for the Care and Use of Laboratory Animals** (National Research Council, 2010)
  - Guidelines for comfort of ____________

### Research review boards

- **Institutional Review Boards (IRBs)**
- **Institutional Animal Care and Use Committee (IACUC)**

### Research review boards

- A board of researchers and community members at a research organization (scientists, ________; non-university community members; ________ diverse)
- Review ________ for human subjects research

- Established by __________ (1990)
  - ________ (s); researcher(s); nonscientist; someone unaffiliated with the university
  - Review ________ for animal research
  - ________ animal facilities every 6 months
  - Evaluate ________ qualifications
Ethics in research reporting

• Be as honest as possible!
• Why people aren’t honest:
  – ________________
  – ________________
• “Doctoring” data
  – Letting ________ guide interpretation of data
• Outright ________ data
• There are also ______ mistakes.

Consequences of scientific misconduct

• PI (________________) gets fired.
• Wasted ________ (NIH, NSF, DOD, private sources)
  – PI may have to pay it all back!
• Others’ careers negatively affected
  – Research collaborators
  – Current ________
  – Former ________
• Ineffective treatments for ________
• We don’t know what’s really true.