

Situating the course

- Goals of research
- Strategies of research
- Characteristics of research

Goals of research

- Describing behavior
 - Documenting how a particular child acquires language
 - Documenting hearing ability of elderly listeners
- Understanding or explaining behavior
 - How does language develop?
 - How does stress effect health?
- Predicting behavior
 - Predict risk of language disorders for children with different profiles
 - Predict success of a cochlear implant for different children
- Solving applied problems
 - Evaluating different programs of treatment

Research strategies

- Descriptive research
 - Researchers observe behavior
 - Observe how changes in one variable influence another.
- Experimental research
 - Researcher manipulates one of more factors, and examines how this manipulation influences the results.

Characteristics of research

- Scientific method
 - a particular method of arriving at knowledge

Scientific method

- Systematic empiricism (data-driven)
 - Research involves the collection and analysis of data
 - Involves direct observation, rather than intuition
- Public verifiability (objectivity)
 - Findings must be observable & replicable by others
 - Procedures used must be systematically reported (described in enough detail to be repeated by others)
- Testability (empirical questions)
 - Empirical questions
 - can be tested in a systematically empirical and publicly verifiable manner, given current knowledge and techniques
 - Non empirical questions – Is there life after death?

Why do research, anyway?

- What we experience can be biased – by our own beliefs, by outside factors.
 - Belief perseverance – ignoring/discounting contrary evidence
 - Availability heuristic - tendency to look at information easily available
 - How many words fit _ _ _ _ n _ ?
 - Confirmation bias - tendency for people to search for information that confirms their initial hypothesis, and fail to examine alternative hypotheses that are also consistent with available data.

Fallacies in judgment

- People's beliefs tend to be biased in a lot of ways; these beliefs can effect judgments if research is not done properly.
- More examples of belief fallacies: **Gambler's fallacy**
 - The belief that the possibility of a completely random event can be influenced by other events.

Text partially from Jim Norton, <http://www.info-pollution.com/evidence.htm>

Gambler's fallacy

- If a tossed coin has turned up heads 3x, believing that it is less likely to be heads the next time.
 - But the chance of it being heads is still 50%.
 - This fallacy leads people to believe they are on a hot streak, and cannot lose, or on a cold streak and just cannot win. Or that their luck is about to change.
 - They may also believe that a slot machine that has not paid off for a while is about to pay out big, or that certain numbers are more likely to be picked in the state lottery.

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Two bomb fallacy (a variation)

- According to this thinking, since the chance of there being one bomb on an airplane is very small, the chances of there being two bombs is virtually zero.
- Therefore, if people bring a fake bomb aboard they have greatly reduced the chance of real bomb being on board.
 - In reality bringing one bomb on board has no effect.

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Cancer clusters

- When a number of people in one area all develop cancer (or a particular type of cancer); the fallacy is in assuming this means there is something wrong in the air/water/environment...
- In reality, if the incidences of an event are randomly distributed, then they will tend to form clusters.

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Why care about research methods?

- Many people just skip to the conclusions section.
- But in a research paper, the conclusions section is a section that goes *beyond* the data.
- So if you skip to conclusions, you're missing what was really found.
- You need to be able to judge whether these conclusions are warranted by the findings...

Can't you just trust a published article?

- **Sloppy stats shame science.**
 - *The Economist*, 3 June, 2004
- **Incongruence between test statistics and P values medical papers.** *BMC Medical Research Methodology*, 2004, 4:13
 - Emil Garcia-Berthou and Carles Alcaraz
- "In their article, Garcia-Berthou and Carles Alcaraz investigated 32 papers from editions of *Nature* published in 2001, and 12 papers from the *British Medical Journal* in the same year. The authors checked the calculations of the p values. They also looked at the distribution of the digits of numbers used in the tests. They found that 38% of those sampled from *Nature*, and 25% of those sampled in the *British Medical Journal* contained one or more statistical errors. The authors concluded that 4% of the errors may have caused non-significant findings to be misrepresented as being significant."

Taken from CHANCE News 13.04, April - June, 2004. Copyright 2004 Laurie Snell

Some newspaper math, for fun

- Obesity levels in the UK have tripled in the past two decades. Almost 24 million adults are now overweight or obese - a fifth are men and a quarter are women.
 - The Big Issue. 28 July-3 Aug 2003
- After the menopause, women's risk of heart disease is similar to men's. One woman in six dies of it every year. Medical editor,
 - The Daily Telegraph. 15 July 2003
- *Headline:* Thousands Worldwide Protest War in Iraq
Sub-head: Hundreds of Thousands Worldwide Open Day of Rallies Against Possible Military Action in Iraq
Lead: Millions of protesters many of them marching in the capitals of America's traditional allies demonstrated Saturday against possible U.S. plans to attack Iraq.
 - Associated Press by Robert Barr posted on ABC news and other places on Feb. 15, 2003