Week 1 lecture notes - PSYC 5301

Jan 21, 2017

Philosophical underpinnings

The goal of research is to find the **one truth**... however, the **paths are many**. Let's see how an ancient Hindu text can actually serve as a metaphor for how we do science.

Three paths to enlightenment (Bhagavad Gita, 500 BCE):

1. Karma yoga - the path of *action*
2. Jnana yoga - path of *knowledge*
3. Bhakti yoga - path of *devotion*

These map nicely onto Royall's (1997) three questions one should ask regarding data:

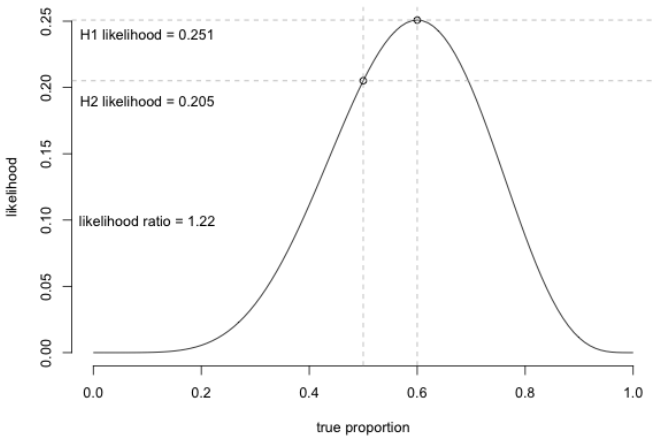
1. What should I do?
2. What's the relative evidence?
3. What should I believe?

Paths for research:

1. **Path of action**: search for rules to govern our *behavior* such that, in the long run, we will not be wrong too often
    - $p < \alpha$: reject H_0
    - $p > \alpha$: remain in doubt
    - A rule to govern our *behavior* in the *long run*. It tells us *nothing* about the *current test*.

2. **Path of knowledge**: compare the likelihood of different hypotheses, given the data.

    - suppose you flip a coin 10 times: you get 6 heads and 4 tails. Is the coin biased (unfair)?
    - Two hypotheses:
        - H_1: the coin is biased (the true proportion of heads/tails is 0.6
        - H_2: the coin is fair (true proportion of heads/tails is 0.5
        - Question: given the data, how much more likely is H_1 than H_2



3. **Path of belief**: do I really *believe* this coin will come up heads 60% of the time?

    - No. . . I have *prior* beliefs.
    - One "experiment" with 6 heads does not *change* my prior beliefs

These paths form the basis of three dominant statistical paradigms in the psychological literature:

1. Neyman-Pearson (the most common)
2. Likelihood
3. Bayesian

Neyman-Pearson method

Historically, our method of hypothesis testing (using p-values) is an amalgamation of two (quite different) ideas from a couple of early 20th century statisticians:

- Jerzy Neyman: p-value tells you what *action* to perform. If $p < \alpha$, then we reject null hypothesis
- Ronald Fisher: p-value measures evidence...the smaller the p-value, the greater the evidence (this is actually incorrect)
- Note: when I teach undergraduate statistics, I teach *only* the Neyman method. - define H_0
  - set α (usually 0.05) and find the critical test statistic
  - if test statistic exceeds critical, we we reject H_0 (action)
- However, most psychological literature (and many courses) implicitly tack on the incorrect Fisher ideas.
  - Example: I got $p = 0.03$ for "Effect 1" and $p = 0.003$ for "Effect 2"..which has "more evidence"?
  - Answer: neither, but Fisher thought Effect 2 would have more evidence
  - this understanding is implicit everywhere in psychology, but it is wrong!

This is why we hyphenate the two and refer to the entire paradigm as "Neyman-Fisher"