Where Intuition Goes Wrong

Quote of the day:

“It ain’t what you don’t know that gets you into trouble. It’s what you know that just ain’t so.”

-- Mark Twain

Readings for next time

Midterm exam on Thursday, October 28

Moving next to intuition, and how mistakes in our intuition give rise to particular fallacies and biases

intuition: the ability to understand something immediately, without the need for conscious reasoning

Intuition is sometimes highly accurate. One such area covers matters closely linked to survival, where our distant ancestors had to make split-second decisions.

Some examples:

- **Reading facial emotions. People can do this quickly, and there is broad (though far from perfect) agreement across individuals and societies on what a person's face indicates.**

- **Sizing up dangers like spoiled food or wild animals.**

However, our intuition often fails in other areas, such as understanding scientific concepts (Andrew Shtulman, Scienceblind).

We can have intuitions that are culturally shaped and hence unquestioned, but which might not always be accurate (Sheena Iyengar and choice).

Our intuition is also faulty when it comes to understanding probability and statistics, and cause and effect relationships.

Let's examine your strings of 200 coin flips.

How did I know (within a range of uncertainty) who actually flipped a coin 200 times and who made up the results? Let's look at two kinds of statistics.

Descriptive statistics. Constructed to describe a set of data. Examples include the mean, median, mode, range, and standard deviation. For the 200 flips, another useful descriptive statistic is the count of the longest string of either heads or tails.

Inferential statistics. Constructed to infer from a set of data to a larger population, process, or phenomenon. Science relies far more on inferential than descriptive statistics.

Using inferential statistics, I examined your results and inferred whether or not you made up the data. For 200 coin flips, here is the cumulative distribution function for the longest string of either heads or tails:

3 or fewer	1 in a million
4 or fewer	1 in a thousand
5 or fewer	4%
6 or fewer	21%
7 or fewer	46%
8 or fewer	68%
9 or fewer	83%
10 or fewer	91%
11 or fewer	95%
12 or fewer	97%

A longest string of 5 is suspicious, 4 is extremely suspicious, and with a longest string of 3, I'm virtually certain that you made up the data.

The same reasoning applies on the high side (strings of 12 or greater), but someone making up the data will normally miss on the low rather than the high side. Why?

Because they commit the gambler's fallacy: the belief that one or more results of a random process affect the subsequent results. Typically, people expect balancing and underestimate the probability of long strings.

On August 18, 1913 at the Monte Carlo Casino in Monaco, black came up on the roulette table 26 times in a row. Continually thinking that red was "due," desperate betters lost millions of francs.

hot hand fallacy: the belief that a person who has experienced success on a repeated event has a greater chance of success on additional attempts. The hot hand fallacy is the opposite of the gambler's fallacy.

The earliest research on professional basketball, examining both shots and free throws, found no evidence of a hot hand. Later research managed to detect a hot hand, though the effect size was tiny—far smaller than most fans would expect.

causal fallacy: assuming that correlation means causation. Our intuition often leads us to attribute causation indiscriminately.

several different possibilities could lead to a correlation between X and Y (the arrows indicate causation)

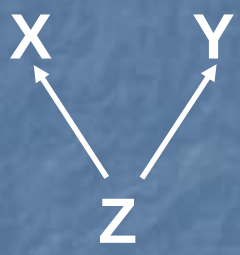
1. X → Y

2. X ← Y

3. X ⇄ Y

4. chance

5. spurious correlation



By designing research projects appropriately, we can gain evidence on whether a correlation does or does not indicate causation.

post hoc ergo propter hoc (“after this, therefore because of this”): assuming a second event following a first event was caused by that first event. A variant of the causal fallacy.

People often make an error that's the flip side of the gambler's fallacy, called the clustering illusion. It is the tendency to find in random data a pattern or cluster, which people interpret as meaningful. They mistakenly assume that a random process will not give rise to a pattern.

Example: when Apple first released its iPod with its randomizing (shuffle) function, some users fell for the clustering illusion and complained. Paradoxically, to make people think the shuffle function is random, Apple had to make it non-random.

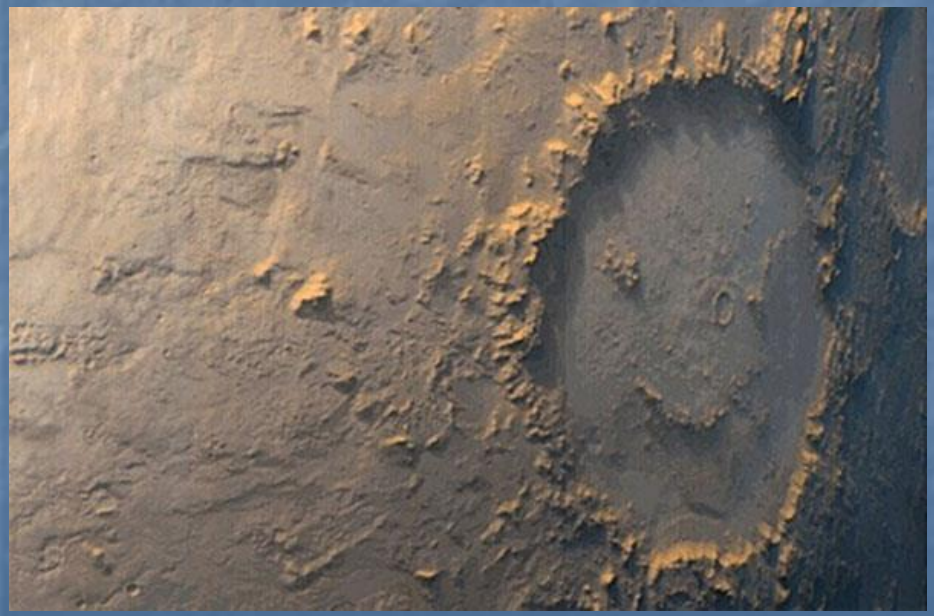
Our evolutionary history can explain why people so often fall for the causal fallacy, post hoc ergo proctor hoc, and the clustering illusion. Among our distant ancestors, it was more dangerous to fail to notice a real pattern or causal process than to falsely discover something that doesn't actually exist.

Texas sharpshooter fallacy, a variant of the clustering illusion:

a person finds a pattern or cluster within random data and then claims to have expected it all along. Normally this is a form of self-delusion rather than intentional deception.

When conducting scientific research, you should develop your hypothesis first and then test it on data. When you peek at the data first, you can easily commit the Texas sharpshooter fallacy (which is similar to the practice of "p-hacking").

Another variant of the clustering illusion is pareidolia, the tendency to interpret a random pattern within an image or sound as significant. A common example of pareidolia is finding faces in natural phenomena.



The Virgin Mary in a grilled cheese sandwich. Sold for $28,000 on eBay.

An example that pulls these fallacies together: the controversy over backmasking (putting messages in songs that could only be understood when playing the record backwards.)

Christian groups in the 1980s claimed that backmasking was rampant and reflected the hand of Satan. That claim morphed into a larger moral panic over (nonexistent) Satanic ritual abuse of children, the forerunner to today's QAnon assertions. In reality, if you listen to enough songs backward, a small percentage will appear to have words amongst the gibberish.

An example:

https://www.youtube.com/watch?v=rY0WxgSXdEE

https://www.youtube.com/watch?v=Gv6-ZAM5gds

The backmasking controversy showed a combination of the clustering illusion, pareidolia, the Texas sharpshooter fallacy, and expectancy effects (to be covered next time).

More fallacies and biases:

endowment effect: people often demand much more to give up an object than they would pay to acquire it

sunk cost fallacy: making a decision based on the costs that have already been incurred, as opposed to the current and future costs.

overconfidence bias: a form of self-delusion whereby people overestimate their own knowledge, attributes, competence, etc.

***The Onion* on males overestimating their fighting ability:**

https://www.youtube.com/watch?v=fe3na9umxDA

Most high school students rate themselves as above average in leadership skills (70%) and ability to get along with others (85%)

93% of drivers say their driving skills are above average

94% of college professors say they are above average teachers

Dunning-Kruger effect: a variant of overconfidence bias. The tendency for people with the lowest ability in a task to think they are more capable than they really are.

cherry picking: identifying and emphasizing evidence that supports your position while ignoring contrary evidence. Often done when someone engages in confirmation bias or motivated reasoning.

halo effect: a person or object that scores highly on one attribute (e.g., attractiveness) tends to get evaluated favorably overall and on unrelated attributes

false consensus effect: people overestimate the extent to which other people share their opinions, beliefs, and behaviors

One study found a correlation between people's (a) own positions and (b) their perceptions of other people's positions of .32 on the death penalty and .44 on gun control. (Positive correlations can range from 0 to 1)

hindsight bias: after you know an outcome, you claim that you expected it all along

2015 Super Bowl. 2nd and goal from the 1, with 26 seconds remaining, 1 timeout

https://www.youtube.com/watch?v=U7rPIg7ZNQ8