Chapter 3

What is Pseudoscience?

Common Factors

- Most pseudosciences share two things
  - It's easy to find evidence for them
  - Many claims can't be easily falsified
- Often taken seriously and thought to correspond to reality
  - Mostly due to gullibility and willingness to believe

"I can't believe that," said Alice.

"Can't you?" the Queen said in a pitying tone. "Try again: draw a long breath and shut your eyes."

Astrology as Example

- Based on the idea that astronomical bodies (and their movements) influence our behavior
- Developed independently in Mesopotamian and Chinese cultures over 4,000 years ago
- Generally used to identify their personality or predict a person's future

Typical Description of a Scorpio

- Positives:
  - Loyal, passionate, resourceful, observant, and dynamic
- Negatives:
  - Jealous, obsessive, suspicious, manipulative, and unyielding

Typical Scorpio Horoscope

- Innovative thinking can be intimidating sometimes, but try not to let it freak you out. Be open to new ideas right now -- you have the insight and wisdom to recognize a good thing when it comes along, so trust yourself. Keep your eyes peeled: If you see a crowd of people running and screaming, then go see what they were running from and screaming about. You'll learn something they'll never know. Be proud of going against the crowd. You're your own person!

Wanting to Believe

- How many of these traits does everyone display at times?
- How general is the horoscope? Would it apply to more than just 1/12 of the population?
- How strong is the will to believe?

Bertram Forer (1914-2000)

- An American clinical psychologist interested in why people seemed to buy into horoscopes
- Performed a landmark study in late 1940s

Forer's Experiment

- He gave a personality test to his undergrads with a promise to give them personalized feedback the next day
- Everyone actually got the same feedback, a few sentences culled from a newstand astrology book

You have a great need for other people to like and admire you. You have a tendency to be critical of yourself. You have a great deal of unused capacity which you have not turned to your advantage. While you have some personality weaknesses, you are generally able to compensate for them.

Your sexual adjustment has presented problems for you. Disciplined and self-controlled outside, you tend to be worrisome and insecure inside. At times you have serious doubts as to whether you have made the right decision or done the right thing. You prefer a certain amount of change and variety and become dissatisfied when hemmed in by restrictions and limitations.

You pride yourself as an independent thinker and do not accept others' statements without satisfactory proof. You have found it unwise to be too frank in revealing yourself to others. At times you are extroverted, affable, sociable, while at other times you are introverted, wary, reserved. Some of your aspirations tend to be pretty unrealistic. Security is one of your major goals in life.

Forer's Experiment

- He then asked the students to evaluate the accuracy of the feedback on a scale of 0 (least accurate) to 5 (most accurate)
- The average result was a rating of 4.26!
- This effect has been replicated across time and cultures

Forer's Lesson

- We tend to accept highly generalized descriptions (as in astrology) as accurate
- We notice and overvalue things that confirm our beliefs about ourselves (and others), while ignoring those that do not
- This can lead to numerous problems

Problems with Pseudoscience

- Indirect harms
  - Opportunity costs when quackery takes the places of effective interventions
  - Monetary costs of paying for quackery
  - "Climate of unreason" from not thinking critically
- Direct harms
  - Human deaths
  - Animal deaths

Power Balance as Example

- Uses "holographic technology" to "resonate with and respond to the natural energy field of the body"
- Marketed as helping with athletic skills such as balance, coordination, and strength

Power Balance as Example

- Usually cost about $30 per bracelet
- "Proof" relies purely on applied kinesiology – a magician's trick
- In 2010, PB was ordered to pay out $57 million due to deceiving public

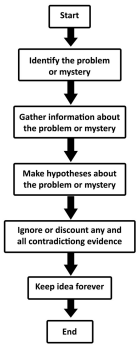
Pseudoscience

- Any claim, hypothesis or theory that is **presented in the language** and manner typical of scientific claims, but that **fails to conform** to accepted standards in science
  - Openness to peer-review
  - Peplicability
  - Transparent methodology
  - Potential for falsifiability

Pseudoscience

- It tries to look like science, but does not have the self-corrections of science
- Tends to rely on personal experience and appeals to authority
- Does not test itself to fail, so shows little or no progress from inception
- Often relies on the supernatural for explanations and tolerates inconsistencies

The flowchart of pseudoscience



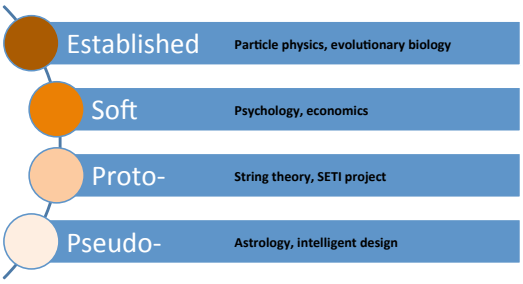
Confounds

- Those practicing or selling pseudoscience are not always *intending* to be deceptive
  - The effects of it are bad, but that doesn't mean the people using it are
- Poorly done or communicated science is not necessarily pseudoscientific

Demarcation Problem

- Despite a sound definition, there is often not a clear boundary between science and pseudoscience in the real world
- May be more useful to think less in terms of clear cut boundaries and more in terms of shades of "scientificness"

Types of Science



Tips for Identifying Pseudoscience

- Sensationalism and oversimplification
- Press releases, jargon, and "churnalism"
- Conflicts of interest
- Anecdotal evidence
- Small and unrepresentative sample sizes
- Cherry-picking
- No control group, no blind testing

Sensationalism & Oversimplification

- Simplistic, click-bait titles for stories
  - "Shocking findings reveal that your shampoo is giving you cancer!"
- Presenting something as *known* rather than more or less supported by the evidence
  - Certainty over probability

Press Releases, Jargon, & Churnalism

- "Sciency" language often obscures facts
  - Neurobabble and technical jargon
- Reporting on studies via press release, rather than actually reading them
  - 40% of press releases contain exaggerations to begin with
- Churnalism undermines the integrity and threatens the jobs of good journalists

Conflicts of Interest

- Information coming from someone with incentives for it to be seen as true is suspect
- Doesn't necessarily invalidate it, but you should be more careful than when the same information comes from neutral parties
- Look for reported *and* unreported COIs

Anecdotal Evidence

- Uncontrolled observations are inherently full of potential bias and error
- The herbal remedy you are taking might be causing your increased alertness…or you may have made other changes…or be responding to a placebo effect

Sample Size Issues

- The smaller the size of a sample, the more prone to error it is
- Large samples decrease random error, allowing for a higher level of confidence in findings

Cherry Picking

- Only looking at arguments on a particular side of an issue and ignoring others
- The *totality* of the evidence must be accounted for

No Controls or Blinds

- Control groups (which receive a placebo) are needed to determine if any treatment has an actual effect
- People in the trial *and* the people evaluating the trials should be *double-blinded*

Limits of Science

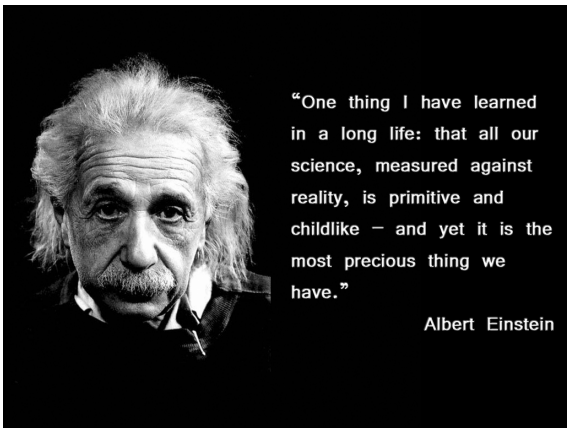
- Difficult, complex stories with no chance of complete certainty are the stock and trade of science
- Tends to be less about final, ultimate answers and more about evaluating claims
- Cannot draw conclusions about things that fall outside the empirical realm

Limits of Science

- Science (and scientists) is not infallible
- It is, though, the best means we have for understanding the universe

Who can be a Scientist?

- Anyone, it just takes a certain mindset!
  - Understand the scientific method
  - Know warning signs of pseudoscience
  - Test your ideas to control your biases



Media Critique #1