

## Bias, Humans Perception, and the Internet

### What are your favorite conspiracy theories?

- Moon landing hoax
- Vaccines cause autism
- Climate change is a hoax
- Chemtrails are a thing
- Politicians are all Reptilian impostors
- 9/11 was an inside job
- Etc., etc., etc. ...

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## These are Opinions:

- “Star Trek” is better than “Star Wars”
- “Star Wars” is better than “Star Trek”
- Tom Baker was the best “Dr. Who”
- David Tennant was the best “Dr. Who”
- Nobody should put sugar in cornbread
- Sugar in cornbread is terrific
- President Obama was a great president
- President Obama was an awful president

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## These are Facts:

- The Earth goes around the Sun
- We landed on the moon
- Vaccines work
- Evolution is the backbone of biology
- Science *works*, dammit...

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## Example: Moon Landing (CON)

- No stars in pictures
  - *They are there, but too dim to show up*
- Shadows not black
  - *Lunar surface is very reflective*
- No blast crater after landing
  - *Low exhaust rate in vacuum, very thin*
- Flag waves in vacuum
  - *Motion imparted by astronauts during set-up, no damping effect from air*

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## Example: Moon Landing (PRO)

- Still living lunar astronauts (testimony)
- No objection from Soviets (competition)
- If there was a conspiracy, then either:
  - Everyone was involved in the conspiracy:
    - 300,000 participants worldwide and no deathbed confessions? Really?
  - Nobody (except management) was involved:
    - 300,000 bright, highly dedicated engineers who don't know they are supposed to fail, so... ..they don't.
- **Artifacts observable** on the surface (evidence)

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## Hypotheses, Theories, Facts

- A hypothesis is an explanation that fits limited observable facts.
- A theory is a conceptual framework, able to explain observations, with predictive value. (Popular usage: half-assed guess.)
- Facts are theories with overwhelming supporting evidence.

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## What Makes a Fact?

- Evidence!
- Corroboration
- Evidence!
- Independent analysis
- Evidence!

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## Skepticism vs. Denialism

### Skepticism

is healthy doubt when faced  
with lack of credible  
evidence.

### Denial

is willful doubt in the face of  
overwhelming credible  
evidence.

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## Skepticism vs. Denialism



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## How Answers can be Wrong

- What is  $2 + 2$  ?
  - 12 (wrong, but in the correct domain)
  - Somewhere between 2 and 6 (not terrible)
  - 3.9...4.1 (actually pretty useful)
  - 3.99...4.01 (even more useful)
  - 3.999999...4.000001 (very, very useful)
  - 4 (correct)
  - Elephant (not even wrong)

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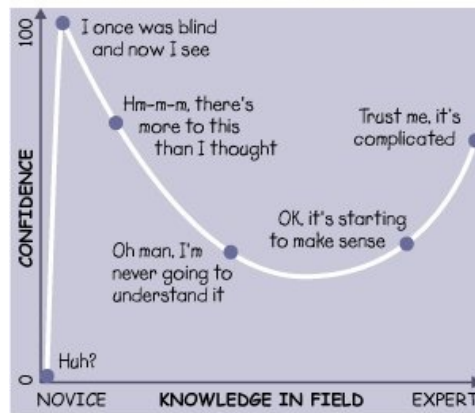
## If you “believe” something...

- ...how do you convince others of its truth?
- ...what is the result of being wrong?
- ...what would change your mind?
- ...if presented with contrary evidence, would you:
  - Change your view?
  - Double-down?

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## The Dunning-Kruger Effect

### Dunning-Kruger Effect



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## What if *you're* wrong?

- What would change your mind:
  - Nothing! (You are likely a conspiracy theorist)
  - Evidence! (That's thinking scientifically!)

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## What if *they're* wrong?

- How do you convince someone else:
  - Persuasion, threats, bribes, cajoling...
    - May be effective, but not satisfying
  - Evidence!
    - May be satisfying, but frequently not effective
  - Um, often you can't...

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## How do you separate Fact from Opinion on the Internet?

- Option #1: Try to find the **least biased site** for the topic under discussion.
  - How do you know?
  - Very hard to do
- Option #2: Try to find the **most biased site** for the topic under discussion.
  - They've dug up the dirt on the opposition!
  - The bias is known and can be subtracted out

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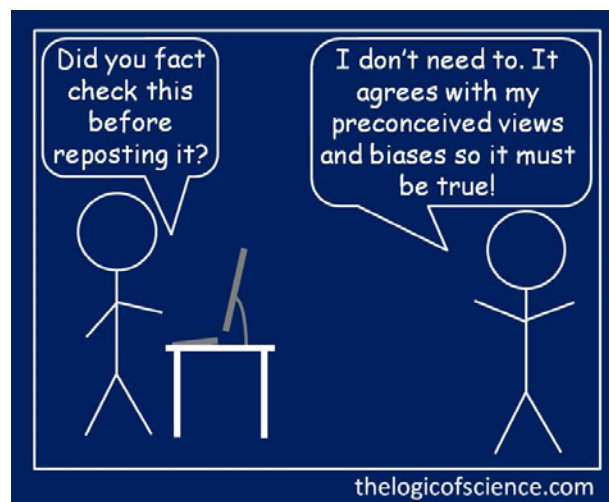


## Types of Bias (Incomplete)

- Confirmation Bias
- Hindsight Bias
- The Bandwagon Fallacy
- False Dichotomy
- “No True Scotsman” Fallacy
- Non-Sequitur
- Ad-Hominem Attacks
- Correlation is not Causality

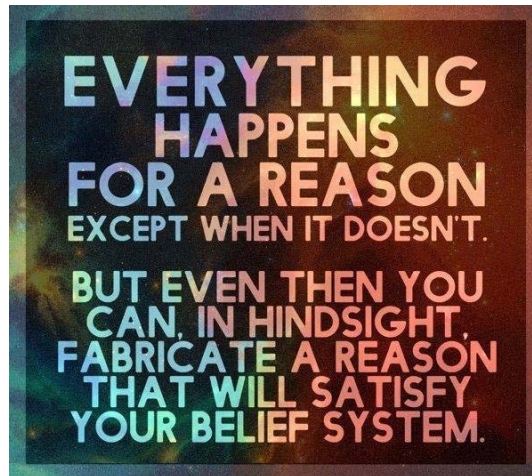
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## Confirmation Bias



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## Hindsight Bias



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## Bandwagon Fallacy

- Appeal to the masses
- Appeal to belief
- Appeal to the majority
- Appeal to the people
- Argument by consensus
- Authority of the many

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## False Dichotomy

- Reduction of a problem to only two choices.
- If A is not true then B must be true.

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## Argument from Incredulity

- An assertion that because one personally finds a premise unlikely or unbelievable, the premise can be assumed not to be true, or alternately that another preferred but unproven premise is true instead.
- I can't believe this is possible, so it can't be true.
- That's not what people say about this; people instead agree with what I am saying.

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## Argument from Ignorance

- A logical fallacy in which it is claimed that a premise is true only because it has not been proven false.
- Something is currently unexplained or insufficiently understood or explained, so it is not (or must not be) true.
- Because there appears to be a lack of evidence for one hypothesis, another chosen hypothesis is therefore considered proven.

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## “No True Scotsman”

- An ad hoc shift in argument
- Argument: "No Scotsman puts sugar on his porridge."
- Reply: "But my uncle Angus, who is a Scotsman, likes sugar with his porridge."
- Rebuttal: "Aye, but no true Scotsman puts sugar on his porridge."
- Also known as “Moving the Goalposts”

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## Irrelevant Conclusion

- Diverts attention away from a fact in dispute rather than address it directly. This is sometimes referred to as a "red herring". Subsets include:
- purely personal considerations (argumentum ad hominem),
- popular sentiment (argumentum ad populum -- appeal to the majority)
- fear (argumentum ad baculum),
- conventional propriety (argumentum ad verecundiam – appeal to authority)

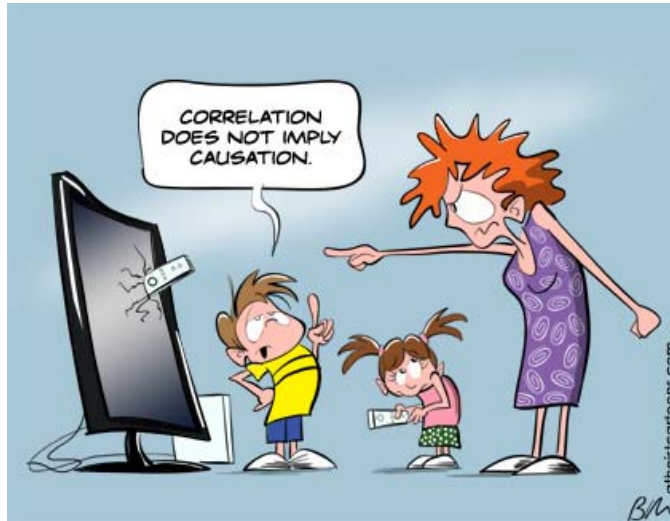
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## Ad-Hominem Attacks



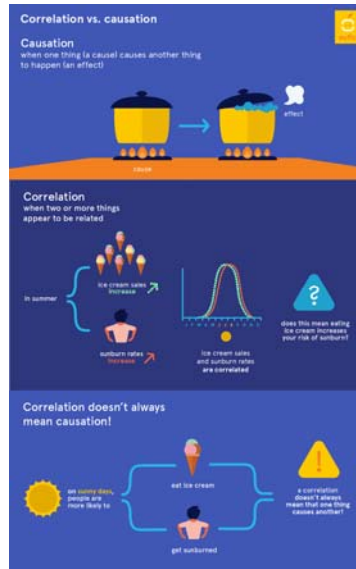
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# Correlation vs. Causality



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# Correlation vs. Causality

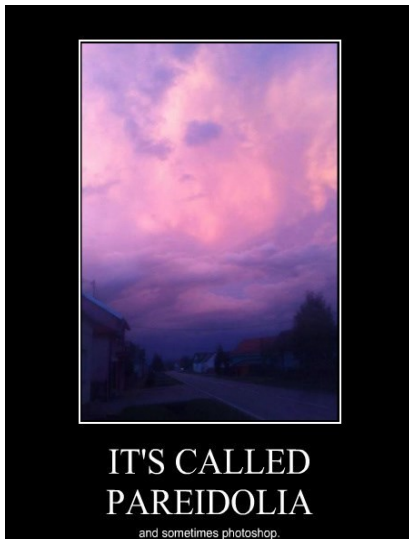


## Perceptual Bias: **Pareidolia**

- Definition: Perceiving pattern in random data
- Possible evolutionary advantage
- We're *very good* at this:
  - Visual (Elvis in your cornflakes)
  - Auditory (music played backwards)

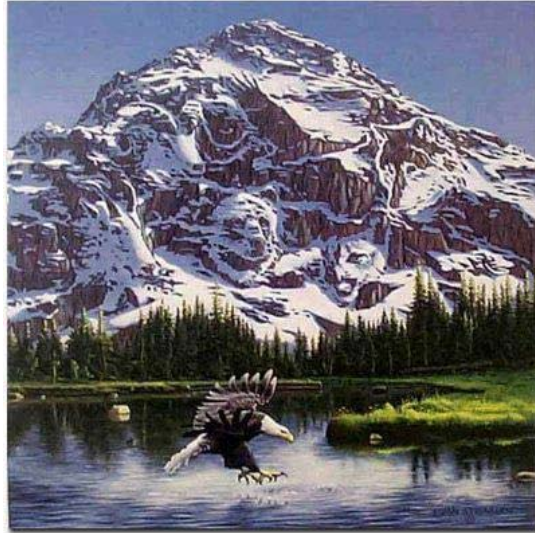
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## Pareidolia



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## Pareidolia



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## Pareidolia



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We Know Memes



## Pareidolia

- Can it be audio but not played backwards?