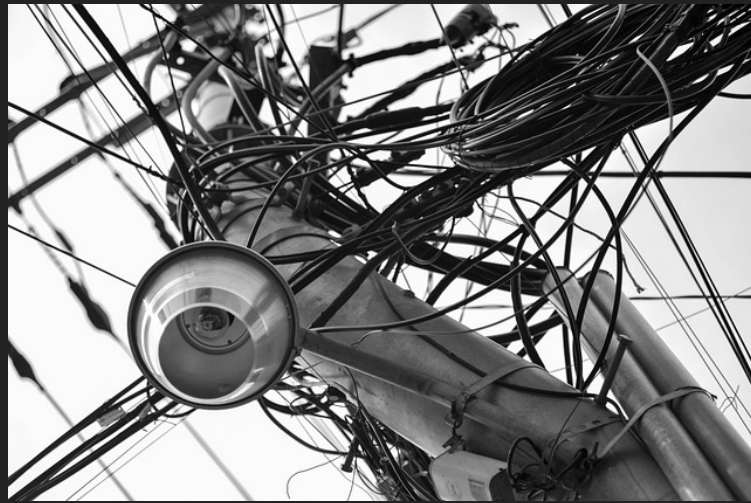


# *Fallacies and Biases*

*how NOT to think logically*



George Matthews, Pennsylvania College of Technology

*2020*

press "h" for help on keyboard controls

*How logical are we really?*



# *How logical are we really?*



We may all be *capable* of listening to reason  
but...



# *How logical are we really?*



We may all be *capable* of listening to reason but...

- We get fooled by fallacies.

# *How logical are we really?*



We may all be *capable* of listening to reason but...

- We get fooled by fallacies.
- Fallacies are bad arguments that can look good if we are not paying attention.

# *How logical are we really?*



We may all be *capable* of listening to reason but...

- We get fooled by fallacies.
  - Fallacies are bad arguments that can look good if we are not paying attention.
- Our thinking gets short-circuited by cognitive biases.



# *How logical are we really?*



We may all be *capable* of listening to reason but...

- We get fooled by fallacies.
  - Fallacies are bad arguments that can look good if we are not paying attention.
- Our thinking gets short-circuited by cognitive biases.
  - Cognitive biases are "bugs" in our mental operating systems that convince us that we know what just isn't so.

# *Types of fallacies*



# *Types of fallacies*

Fallacies of relevance

# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

## Fallacies of ambiguity

# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

## Fallacies of ambiguity

- Depend on multiple meanings of key terms to fool us.



# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

## Fallacies of ambiguity

- Depend on multiple meanings of key terms to fool us.

## Fallacies of presumption

# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

## Fallacies of ambiguity

- Depend on multiple meanings of key terms to fool us.

## Fallacies of presumption

- Rely on hidden assumptions to establish their conclusions.

# *Types of fallacies*

## Fallacies of relevance

- Rely on irrelevant information to push the argument along.

## Fallacies of ambiguity

- Depend on multiple meanings of key terms to fool us.

## Fallacies of presumption

- Rely on hidden assumptions to establish their conclusions.

NOTE: fallacies are typically invalid arguments that rely on tricks to close the gap between premises and conclusions.

# *Types of cognitive biases*



# *Types of cognitive biases*

Hot biases

# *Types of cognitive biases*

## Hot biases

- *Motivated irrationality*: ways in which our thinking goes off the rails when its results would conflict with what we want.

# *Types of cognitive biases*

## Hot biases

- *Motivated irrationality*: ways in which our thinking goes off the rails when its results would conflict with what we want.

## Cold biases

# *Types of cognitive biases*

## Hot biases

- *Motivated irrationality*: ways in which our thinking goes off the rails when its results would conflict with what we want.

## Cold biases

- *Unmotivated irrationality*: mistakes in reasoning that are by-products of the way our minds are built.



# *Types of cognitive biases*

## Hot biases

- *Motivated irrationality*: ways in which our thinking goes off the rails when its results would conflict with what we want.

## Cold biases

- *Unmotivated irrationality*: mistakes in reasoning that are by-products of the way our minds are built.

NOTE: cognitive biases are the result of the complexity of our mental "software" and the fact that our reasoning minds are not entirely separate from our emotional and perceptual minds.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to authority*

Stephanie is a scientist and she says that vaccines cause autism.

---

Thus vaccines are not as safe as the doctors are telling us.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to authority*

Stephanie is a scientist and she says that vaccines cause autism.

---

Thus vaccines are not as safe as the doctors are telling us.

While we often have no choice but to rely on experts, simply appealing to their expertise is never a good idea. Instead we should actually see what their claims are based on, otherwise we still have no real reason to believe what they tell us.

fallacies of  
relevance

## *Ad hominem*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

My trainer has me on a strict diet and says that my health will be better if I lose some weight.

---

But I saw him binge eating ice cream the other day, so I guess his advice is worthless.



fallacies of  
relevance

## *Ad hominem*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

My trainer has me on a strict diet and says that my health will be better if I lose some weight.

---

But I saw him binge eating ice cream the other day, so I guess his advice is worthless.

Even if we might attack someone for not "praticing what they preach," that is really irrelevant in that the same argument might have been uttered by someone else.

fallacies of  
relevance

## *Popular appeal*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Segregation laws were once popular in the American south, they were democratically enacted.

---

Therefore segregation was acceptable.

fallacies of  
relevance

## *Popular appeal*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Segregation laws were once popular in the American south, they were democratically enacted.

---

Therefore segregation was acceptable.

The majority of course might be wrong, no matter how numerous they are. This is why democratic societies are not only based on the principle that the majority gets to decide but instead we all have rights that protect us from the majority.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to force*

Matthews, either I pass this class or you might end up having an unfortunate "accident."

---

Ha! I knew you would realize my work was better than you first said it was.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to force*

Matthews, either I pass this class or you might end up having an unfortunate "accident."

---

Ha! I knew you would realize my work was better than you first said it was.

Threats might be effective as a way of getting people to do what you want, but they don't really provide us with any *reasons* for belief.



fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to consequences*

If evolution is correct then we are all related to all other organisms on the planet.

I refuse to admit that I am related to cockroaches in any way.

---

Therefore evolution must be wrong.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to consequences*

If evolution is correct then we are all related to all other organisms on the planet.

I refuse to admit that I am related to cockroaches in any way.

---

Therefore evolution must be wrong.

While we may not *like* the consequences of a theory, if the evidence really supports it, we'll just have to get used to them.

fallacies of  
relevance

## *Naturalistic fallacy*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Women should not be allowed into combat positions in the military, since, after all, women are not as aggressive as men are.

fallacies of  
relevance

## *Naturalistic fallacy*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Women should not be allowed into combat positions in the military, since, after all, women are not as aggressive as men are.

There are a couple of problems with this argument, first not all men and women fit the general pattern. Second it ignores the distinction between the way things are *by nature* and what *we decide* based on moral concepts like who deserves and owes what.

fallacies of  
relevance

## *Genetic fallacy*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

This study was funded by a large pharmaceutical company, so we can dismiss it as propaganda intended only to serve the interests of the corporation's stockholders.

fallacies of  
relevance

## *Genetic fallacy*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

This study was funded by a large pharmaceutical company, so we can dismiss it as propaganda intended only to serve the interests of the corporation's stockholders.

This fallacy is a generalization of the last one -- it appeals to the origins of something to determine the basic nature of that thing. Like other fallacies of relevance this argument mistakes the messenger for the message -- isn't *what* is said decisive, not *who says it*?

fallacies of  
relevance

## *Red herring*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Why do you keep saying that I am guilty of committing a crime, when there are important business decisions that need to be made in running this company?

fallacies of  
relevance

## *Red herring*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

Why do you keep saying that I am guilty of committing a crime, when there are important business decisions that need to be made in running this company?

This is less of a formal argument style and more of a debating tactic. Diverting attention from the topic at hand doesn't settle it one way or the other.



fallacies of  
relevance

## *Weak analogy*

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

I oppose taxation because it involves taking money from me unwillingly and that is the same thing as theft!

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Weak analogy*

I oppose taxation because it involves taking money from me unwillingly and that is the same thing as theft!

Analogies can help us illuminate obscure or abstract concepts, but they can also mislead us since they only go so far. We may wonder in this case about any relevant differences between taxation and theft.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Equivocation*

Religion depends on faith in God.

Science depends on faith in observation and data-analysis.

---

Therefore science is not really very different from religious belief.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Equivocation*

Religion depends on faith in God.

Science depends on faith in observation and data-analysis.

---

Therefore science is not really very different from religious belief.

This argument overlooks important differences between the meaning of "faith" in these two contexts. Science is based on public evidence, religion is not.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Straw person*

My opponent in this debate has stated that she doesn't believe in the Biblical creation story.

---

But that amounts to saying that there is no meaning at all in life, which is ridiculous.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Straw person*

My opponent in this debate has stated that she doesn't believe in the Biblical creation story.

---

But that amounts to saying that there is no meaning at all in life, which is ridiculous.

This is a debating trick that fails to address the topic at hand in the interest of scoring points with the audience. It may be tempting to paraphrase your opponent's viewpoint, but be careful not to misrepresent it!

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Cherry picking*

There are studies that show that vaccines are linked with autism.

---

So parents should have the right to opt out of childhood vaccination.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Cherry picking*

There are studies that show that vaccines are linked with autism.

---

So parents should have the right to opt out of childhood vaccination.

There is likely to be "evidence" for just about anything that we want if we look hard enough and ignore any evidence to the contrary. But the question is what the *evidence as a whole* shows. Even a broken clock is right twice a day.



fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Mere assertion*

There is no evidence linking asbestos to cancer.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Mere assertion*

There is no evidence linking asbestos to cancer.

This is not even really an argument, but a simple statement offered without evidence. It may seem like just stating something without argument would fail to convince anyone, and yet there is nothing like repeating a simple statement enough to get it stuck in people's heads.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Begging the question*

I know that ghosts exist because I have seen them  
with my own eyes.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Begging the question*

I know that ghosts exist because I have seen them  
with my own eyes.

While many people trust eyewitness testimony, the question here is how someone might *know* that what they saw was really a ghost. This would require accepting the assumption that ghosts do exist, but isn't that what the argument is claiming to prove?

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to ignorance*

There is no proof that the CIA did *not* assassinate Kennedy and then cover it up.

---

That's why I think that they did.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Appeal to ignorance*

There is no proof that the CIA did *not* assassinate Kennedy and then cover it up.

---

That's why I think that they did.

Conspiracy theories often rely on appeals to ignorance like this. They shift the "burden of proof" to someone opposing their viewpoint as opposed to providing sufficient evidence to prove their claims to be correct.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *False dilemma*

Either you are on the reservation or you are off the reservation.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *False dilemma*

Either you are on the reservation or you are off the reservation.

This is a quote from Richard Nixon, who in the last days of his presidency, believed that everyone who was not completely on his side was completely against him. There are, of course other options. Also known as the "black or white fallacy."



fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Hasty generalization*

Three Democrats I spoke with are opposed to abortion.

---

Thus all Democrats are opposed to abortion.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Hasty generalization*

Three Democrats I spoke with are opposed to abortion.

---

Thus all Democrats are opposed to abortion.

This is clearly too small a sample size to provide evidence for a claim about millions of people. Reliance on "anecdotal evidence" is another variety of this fallacy in that anecdotes report individual cases that may or may not show a general pattern.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Slippery slope*

If we allow human cloning, we'll end up with a dystopian future like in the movie "The Island" where clones are made just for "spare parts" and have no rights of their own.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Slippery slope*

If we allow human cloning, we'll end up with a dystopian future like in the movie "The Island" where clones are made just for "spare parts" and have no rights of their own.

Alarmist claims about what *will* happen as a result of doing something or other are hard to avoid since we do tend to think of worst case scenarios. In this case, since a clone is nothing but an artificially produced *twin*, raising a clone for its parts would be illegal and immoral?

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *False cause*

When the coach yells at us for losing badly, we play better the next game.

When he praises us after a great win, we don't do so well the next game.

---

SO negative reinforcement works, and positive reinforcement doesn't.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *False cause*

When the coach yells at us for losing badly, we play better the next game.

When he praises us after a great win, we don't do so well the next game.

---

SO negative reinforcement works, and positive reinforcement doesn't.

Isn't a better explanation here that after playing either better or worse than average, the team returns to their average?

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Circular reasoning*

You must be mentally ill if you commit a mass murder.

---

This is because only mentally ill people would do such a thing.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Circular reasoning*

You must be mentally ill if you commit a mass murder.

---

This is because only mentally ill people would do such a thing.

Circular reasoning is like the question of which came first the chicken or the egg? Which explains which according to this argument: does mental illness explain mass-murder or does mass murder prove mental illness? In either case no evidence is here presented.



fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Confirmation bias*

Wherever I look I see more evidence that the universe is governed by a malicious demon. Just consider the evidence of epidemics and hurricanes!

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Confirmation bias*

Wherever I look I see more evidence that the universe is governed by a malicious demon. Just consider the evidence of epidemics and hurricanes!

The problem here lies in not taking into account *all* of the available evidence. Good explanations of the data are not found by looking only at evidence that appears to confirm one's hypothesis.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Group think*

Why did we torture those prisoners? Well the leaders assured us that it was for a greater good and everyone else seemed to be going along with that too.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Group think*

Why did we torture those prisoners? Well the leaders assured us that it was for a greater good and everyone else seemed to be going along with that too.

We often forget that we are fundamentally social beings heavily invested in what (we think) others think of us. One rotten apple *can* spoil the whole barrel.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Wishful thinking*

We really can have endless economic growth and protect the environment at the same time!

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Wishful thinking*

We really can have endless economic growth and protect the environment at the same time!

The old saying that if it sounds too good to be true, it probably is applies here.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Anchoring effects*

This T-shirt is only 100 dollars! That is such a bargain compared to the one selling for 1000 dollars you showed me first!

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *Anchoring effects*

This T-shirt is only 100 dollars! That is such a bargain compared to the one selling for 1000 dollars you showed me first!

Even if nobody would pay such an outrageous price for a T-shirt just asking for such a price at the beginning of negotiations raises what we might later come to accept as a fair price. This reflects a bias towards information that comes first, regardless of its independent believability.



fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *The fundamental attribution error*

If I happen to be rude to someone at the store, it is because I am stressed out by work pressure, but if you are it is because you are a jerk.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *The fundamental attribution error*

If I happen to be rude to someone at the store, it is because I am stressed out by work pressure, but if you are it is because you are a jerk.

When we account for our own behavior we have a (realistic) sense of the large influence of external influences, but when we assess other people's behavior we tend to overemphasize their "internal" causes, how bad decisions reflect their true feelings and intentions.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *The availability heuristic*

I just heard the news about a terrorist hijacking a plane, so rather than fly to Florida I will drive.

fallacies of  
relevance

fallacies of  
ambiguity

fallacies of  
presumption

hot biases

cold biases

## *The availability heuristic*

I just heard the news about a terrorist hijacking a plane, so rather than fly to Florida I will drive.

A heuristic is a "rule of thumb" that might work in some contexts but fails in others. In this case even if a terroristic attack sticks out in one's mind, since it is dramatic, it is far *more* likely that you will get hurt or killed in a car wreck. What is available to the mind is not always the same as what is really more likely.

## *Find out more*

**Your Logical Fallacy Is:** A well designed website with good examples of a variety of fallacies.

**Your Bias Is:** By the creators of Your Logical Fallacy Is, this site is devoted to some important cognitive biases.

**Logically Fallacious:** a comprehensive list of hundreds of types of fallacies and biases.

**Fallacies:** The Internet Encyclopedia page on logical fallacies has another comprehensive list.



Credits

*Built with:*

[Rstudio](#)

[xarignan](#) html presentation framework

*Images by:* Image by [Gino Crescoli](#), [Jonas KIM](#), and [Andrew Martin](#) from [Pixabay](#)

**For more slideshows visit:**

[ethics slideshows home page](#)

[download this presentation](#) or [print it](#)

[editorial suggestions and comments](#): requires a (free) GitHub account.