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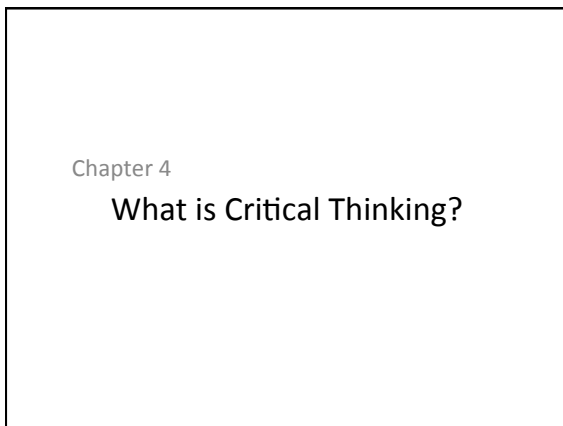
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Chapter 4

What is Critical Thinking?

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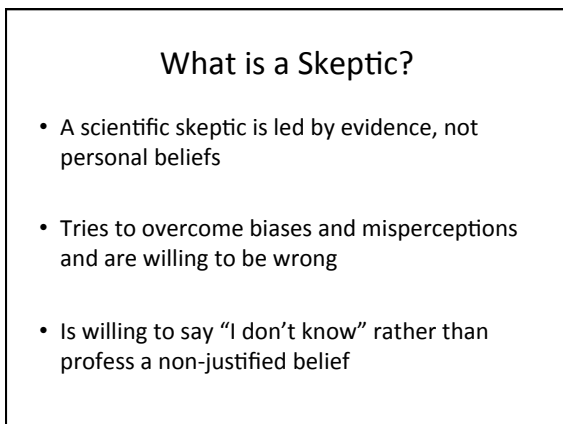
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What is a Skeptic?

- A scientific skeptic is led by evidence, not personal beliefs
- Tries to overcome biases and misperceptions and are willing to be wrong
- Is willing to say "I don't know" rather than profess a non-justified belief

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### What is a Skeptic?

- All beliefs should be contingent on the information we have access to
- Skeptics fight for *nuance* in belief by not feigning conviction when it is inappropriate
- Skeptics are willing to embrace uncertainty, and assert when a conclusion is strongly justified

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### Not Actual Skeptics

- People sometimes use “skeptic” when they should use the terms “cynic” or “denier”
- Both refer to “hyperskeptics” who doubt or deny the scientific consensus and engage in pseudoscientific thinking

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### Denialism Examples

- HIV doesn't cause AIDS
- Global warming is a hoax
- The Holocaust wasn't real




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## Types of Skepticism

**Scientific skepticism** – are open to new ideas, are willing to change if presented with evidence; do not accept the word of authority figures as evidence




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## Types of Skepticism

**Pathological skepticism** – marked by closed-mindedness and cynicism; guilty of the disconfirmation bias




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## Methods Matter Most

- Scientific skeptics value *how* we reach conclusions over *what* the conclusion is
- Being right (if we are) is the end result of a process of critical thinking
- Focusing on conclusions rather than methods can result in dogmatism and denial

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### Optimal Decisions

- For any one decision, we can be overwhelmed if trying to factor in all potential pieces of information to make the “perfect” choice
- Instead, we have to understand that we work within *bounded rationality*

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### Bounded Rationality

- All our decisions are constrained by numerous factors
  - Time available to think about a problem
  - Information we have access to
  - Resource shortages (money or time for research)
- We need to *satisfice*, or make the best decision we can within our limits

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### Got Problems? Need Research!

- Any problem that you are trying to solve or question you are trying to answer can be a research activity
- Research involves
  - Gathering information
  - Arranging that information into a useful package
  - Using that information to guide actions

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### Critical Thinking

- Understanding that we often make errors or show biases when evaluating information

AND

- Developing and implementing best practices for gathering and using information to make decisions about beliefs

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### The Space of Reasons

- If a serious issue is at stake, you should be able to give reasons why you believe one thing rather than something else
- Conversely, you should be enabled to ask other people for the same
- Critical thinking enables sound reasons

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### The Space of Reasons

- If an action or decision taken by someone else is likely to affect you, it is reasonable to
  - Require evidence that the decision or action has been thought through
  - For you to be reassured that the decision was
    - Taken carefully
    - Not made as a consequence of some bias or prejudice

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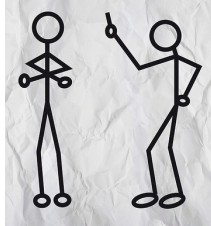
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## The Space of Reasons

- Conversation is a series of ongoing debates and research
- Each side presents their evidence and reasoning for why their belief is *justified*




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## Argument and Argumentation

- “Argument” doesn’t have mean an aggressive or emotional battle
- It can be a particular methodology that provides us with the best possible chance of arriving at a conclusion that
  - Best fits the evidence
  - Has the most advantageous consequences

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## Argument and Argumentation

- We often don’t even realize when we’ve made a decision using argumentation
- What’s for dinner?




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### Non-Arguments

- Not *all* communication is argument
  - Expressing feelings
  - Asking questions
  - Describing events
  - Explanations
- But, we need arguments as soon as a point of view, decision or action needs to be *justified*

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### Global Debates

- It is almost certain that you will interact with those who have different beliefs
- We need resources to determine what is worth believing without the safety net of our preconceived habits




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### Global Debates

- Everyone has a particular cultural background, which comes with it's own set of blinders
- So, you need to consider why *you* might be wrong, in order to feel justified that you are actually right
- Critical thinking provides a method for arriving at worthwhile beliefs

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## Critical Thinking

- Rules of thumb that let us become consistently better at reaching good conclusions
  - Extraordinary claims
  - Falsifiability
  - Occam's razor or parsimony
  - Ruling out rival hypotheses
  - Recognizing fallacies
  - Separating induction from deduction

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## Extraordinary Claims

- "A wise man...proportions his belief to the evidence."
- "No testimony is sufficient to establish a miracle, unless the testimony be of such a kind, that its falsehood would be more miraculous than the fact which it endeavors to establish."



David Hume, 18<sup>th</sup> century Scottish philosopher

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## Extraordinary Claims

- Hume's words inspired Carl Sagan to say...

"Extraordinary claims require extraordinary evidence."




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### Extraordinary Claims

- A good skeptic believes something only to the degree that it is supported by evidence
- The more spectacular a claim is, the more solid the evidence for such a claim must be in order to take it seriously

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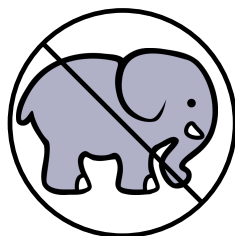
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### Falsifiability

- Determining truth via trying to prove our beliefs is inherently flawed




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### Falsifiability

- Instead, we need to determine truth via testing something to see if it is false
- If a claim is falsifiable *and* survives our attempts to falsify it, we can consider it strong
- So, take away the sticks from the man in Times Squares and see if the elephants show up

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### Falsification

- If there is no possibility of something be falsified, then there is no *rational* reason to believe it
- If can be believed for other reasons (emotional, spiritual) but not rational ones

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### Occam's Razor

- When considering various explanations for any phenomena, select the one with the fewest number of additional assumptions or complications
- Principle of *parsimony*



William of Ockham, 14<sup>th</sup> century English friar

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### Ruling Out Rival Hypotheses

- Parsimony does *not* guarantee you have selected the correct hypothesis
- But, you run a lower risk of error if you rely on assumptions that are not *themselves* in doubt or unprovable

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## Fallacies

- Broad term for a specific type of error or mistake in reasoning
- Conclusions that some has made fallaciously aren't always wrong, but they don't have a *justified* reason for someone to believe them

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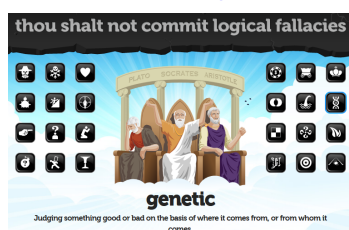
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## Specific Fallacies

- Almost too numerous to mention!
  - [Thou Shalt Not Commit Logical Fallacies](#)




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## Engaging with Fallacies

- Although entertaining, just pointing out what kind of fallacy someone is making does little to spread critical thinking
- Instead, being able to demonstrate *why* a person's (or your own!) reasoning is flawed is the key
  - The *fallacy fallacy*

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## Induction vs Deduction



Inference about a rule or pattern by reference to specific observations



Often broad in scope



Predictive ability depends on number and quality of one's observations



Moves from general rules to specific claims



Modest in scope, with conclusions generally narrower than premises



Conclusions are often quite reliable

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## Logic & Truth Preservation

- True evidence results in true conclusions, but only if your reasoning is error-free
- Logic alone, though, does not guarantee truth
- For example...

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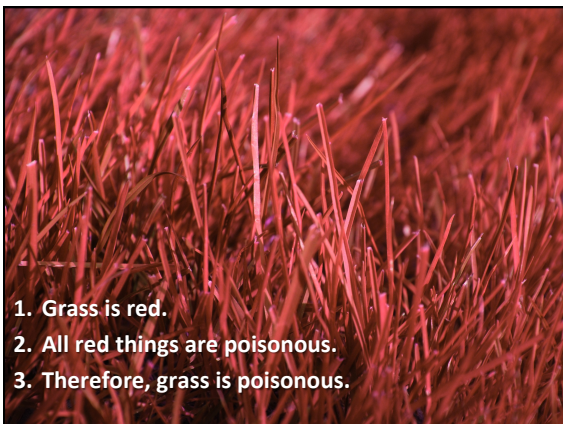
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1. Grass is red.
2. All red things are poisonous.
3. Therefore, grass is poisonous.

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### Logic & Truth Preservation

- Logic can be valid, and yet still removed from reality
- *Certainty* (via the structure of an argument) is different from *confidence* (via the evidence for an argument)

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### Conclusions

- Being a good critical thinker is hard work
- We should focus on whether or not a belief is *justified*, rather than being *certain* it is true
- Does the available evidence, when evaluated fairly, make a certain belief more likely to be true than any competing beliefs?

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