



# Introduction to Critical Thinking

Phil 145  
Section 001  
Prof: Chris Eliasmith

# Administrivia

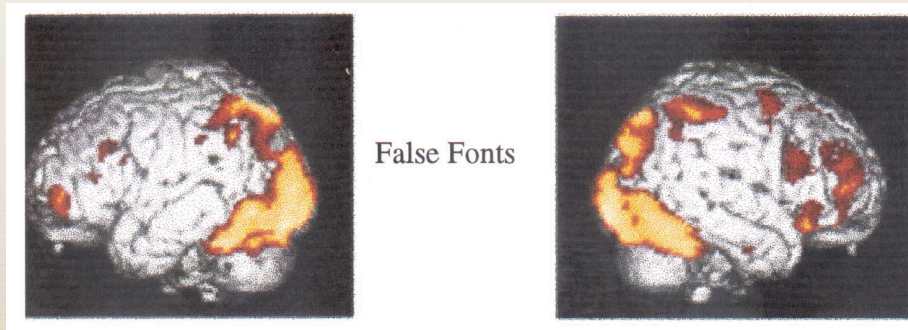
- Books: McKay and Gilovich
- Web: <http://watarts.uwaterloo.ca/~celiasmi/courses/Phil145/>
- Evaluation:
  - 10% in-class essays
  - 20% x 2 portfolios (Oct 25, Nov 20)
  - 25% x 2 tests (Oct 16, Nov 29)
- TAs: Contact any one of them, emails and office hours are posted on the web.

# FAQs

1. Webpage: <http://watarts.uwaterloo.ca/~celiasmi/Phil145>
2. Is it a bird course? No,(but it is 100 level).
3. Is the course non-stop thrills and action packed? ... um, yes?
4. Do we *have* to do *any* logic? Minimal.
5. Do we have to read stuff? Yes, please. *Before* class works.
6. Can we get the overheads? Yes, they're posted before class.
7. Others?

# Popular false beliefs

- Most everyone has some:
- Couples who adopt are more likely to conceive
- More babies are born when the moon is full (also [here](#) see [here](#))
- We only use 10% of our brain (see [here](#); and [here](#)).



# Popular unjustified beliefs

Most everyone has some:

- ESP is more likely to be true than evolution (USA, <http://www.csicop.org/list/listarchive/msg00227.html>; <http://www.cbsnews.com/stories/2004/11/22/opinion/polls/main657083.shtml>)
- Astrology can provide clues to the future (past prime ministers and presidents held this one)
- Homeopathic medicine is effective or well-founded (e.g., 40% of the French public have used homeopathy, 39% of French physicians have prescribed it)
- Beings from other planets have visited earth (USA, 48% believe UFOs have visited earth; <http://www.scifi.com/ufo/roper/05.html>).

# Who cares about false beliefs

- Consequences of unjustified/false belief can be personally severe
  - Moonie Cult
  - Order of the Solar Temple
- And socially severe:
  - Voting behaviour
  - Evaluating government policies
- And cumulative
  - Health care
  - Eating habits

# What is Critical Thinking?

Me	World	CT
Seek reasonable beliefs	Facts, truth-tellers, liars and stupid folk	Filter letting truths in and falsity out
Sometimes seek reasonable beliefs, but highly fallible	Other people mostly like me	Habit of seeking to minimize these fallibilities

# Highly effective CT

1. Must be a habit
2. Learning not to trust yourself
3. General use of basic skills
4. Basic numeracy
5. Qualitative understanding of statistics
6. Understanding (messy) science
7. Takes work



# Two perspectives



- I. Psychological perspective (Gilovich): studying typical human judgment and reasoning practices.

# Two perspectives

All chimps are mortal

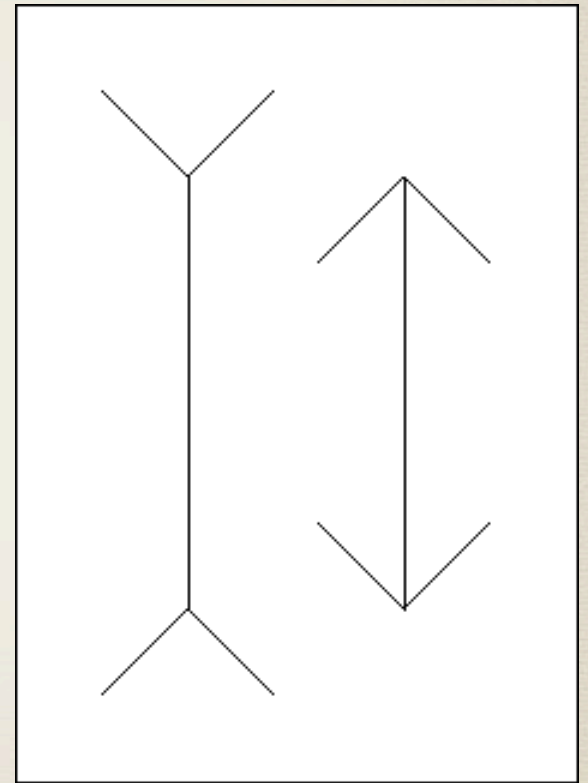
Socrates is a chimp

Therefore, Socrates is mortal

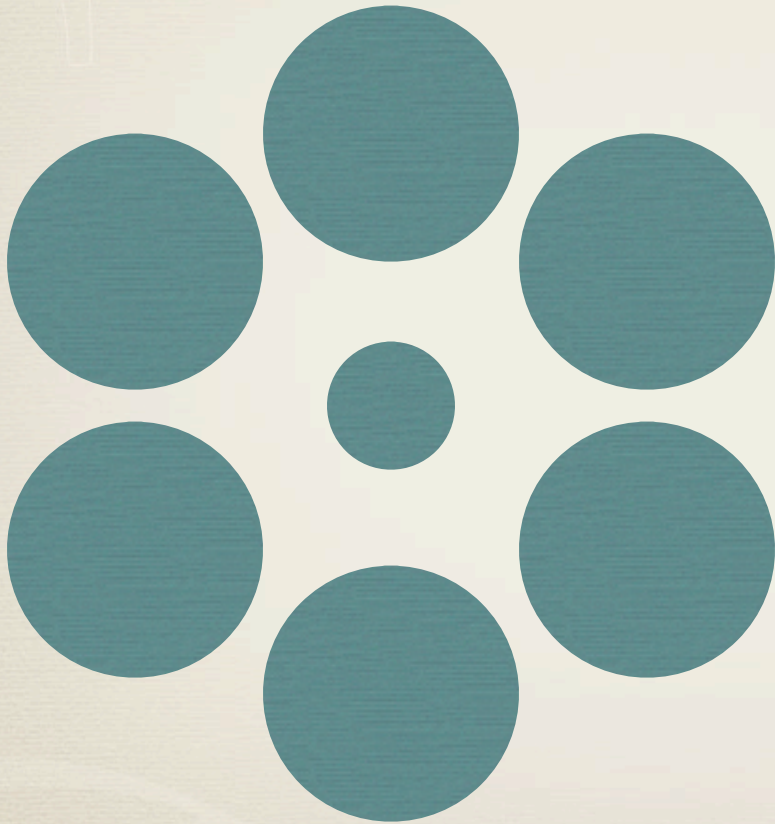
2. Formal perspective (McKay): looking at 'norms' of reasoning as found in logic, probability theory, and scientific practise.

# Psychological perspective

- Mis-thinking is like perceptual illusion
- Usually cognitive mechanisms are right, but not always.
- Evolutionary reasons for this.
- Despite these built-in limitations, we don't want to make errors



# Titchner Illusion



Explanation: [http://www.questacon.edu.au/html/titchener\\_illusion.html](http://www.questacon.edu.au/html/titchener_illusion.html)

# Psychological perspective

In sum, we'll learn:

*When not to trust  
yourself!*

# Formal perspective

- Not concerned with how people make mistakes or what they actually do, but what they *should* do (i.e., ‘norms’).
- These often provide the yardstick against which our performance can be compared.
- This is because they are ‘unbiased’ and/or optimal in various ways.
- Nevertheless, these tools are only applicable in certain circumstances (and tools change with circumstances).

# Formal perspective

In sum, we'll learn:

*How well you **could** do.*

# Mixing perspectives

- We will adopt both perspectives
- Mixing them gives a broad view of critical thinking and is more practical
- Psychological perspective will be more entertaining, but the formal perspective is equally important.
- NOTE: If you learn not to trust yourself, you will be better able to evaluate your own arguments.



# Argument

- Arguments consist of:
  - A set of reasons (premises)
  - A conclusion
- Monty Python reminds us that mere assertion isn't argument.
- Without this structure, formal analysis won't apply ...

# Last of the Mohicans

It was a feature peculiar to the colonial wars of North America, that the toils and dangers of the wilderness were to be encountered before the adverse hosts could meet. A wide and apparently an impervious boundary of forests severed the possessions of the hostile provinces of France and England. The hardy colonist, and the trained European who fought at his side, frequently expended months in struggling against the rapids of the streams, or in effecting the rugged passes of the mountains, in quest of an opportunity to exhibit their courage in a more martial conflict.

# Arguments

- We want tools that help distinguish good from bad arguments
- Good arguments should increase warrant/justification for beliefs
- Bad arguments should not change warrant/justification for beliefs (which start with no warrant)
- This also means that if we give bad arguments for our own beliefs, we're not justified in holding them.

# Arguments

- Don't need to be disagreements or disputes

Example:

1. 20 pieces of paper are  $\frac{1}{2}$  inch thick
2. There are 15 inches of paper in my bin

Therefore,

3. There are more than 20 pieces of paper in my bin.

# People are good at making them up

- Often people make up arguments that are incorrect (*confabulation*)
- Not only 'bad' memory (e.g. Loftus)
- Nisbett and Wilson (1978): Identical stockings were presented, most picked those on their right (because of handedness). When asked why they picked the stockings, reasons never had to do with placement, but rather with quality, texture, etc.

# Identifying arguments

- Rules of thumb:
  - Look for these words to identify premises:
    - for, since, because, due to the fact that, given, considering, etc.
  - Look for these words to identify conclusions:
    - so, hence, thus, therefore, it must be that, consequently, etc.
- Examples:
  - Since Socrates is a man, he is a mammal.
  - Socrates is a man therefore he is a mammal.

# Identifying arguments

- Can't rely on these indicator words alone.
- Example:
  - I think it's good for you to stay inside. I mean, if you go outside you'll freeze to death and you don't want to freeze to death.
- However, when you are writing arguments of your own, it is *always better* to use indicator words so your audience can clearly determine where the premises and conclusions are.

# Variations: implicit premises

- *Example:* Because it's raining outside, you'll get all wet when you go out there.

P1) It's raining out side

P2) If it's raining outside you'll get wet (Implicit).

C) You'll get wet (when you go).

- *Example:* Bob will get you the best deal on your car because he's a used car salesman.

P1) Bob is a used car salesman.

P2) All used car salesmen get the best deals. (Implicit)

C) Bob will get you the best deal on your car.



# Variations: embedding

- Can be embedded in a large number of sentences that are merely descriptive.
- Overheard at a friendly hockey game:

You're a loser. Your team sucks and so do you. We all know that if your team loses then you're a loser. Look at the scoreboard buddy... your team *lost*. 3D Loser!
- Extraneous: 3D Loser; Look at the scoreboard; Your team sucks...

# Variations: concatenation

- Multiple arguments can be strung together like this...
  - The beans for Belgian chocolate grows on trees. The beans from the Yucatan valley are the sweetest beans. Beans from the Yucatan are used to make Belgian chocolate. Therefore, Belgian chocolate is the best. At least, I sure like it.
  - Argument 1:  $P_1$ : If YV then SB;  $P_2$ : YV (in BC);  $C_1$  (implicit): SB (in BC).
  - Argument 2:  $P_3$  (implicit): SB (in BC);  $P_4$  (implicit): If SB then best;  $C_2$ : BC is best.

# Variations: concatenation

- Or like this...
- The beans for Belgian chocolate grows on trees. The sweetest beans are found only in the Yucatan valley. Only the sweetest beans are used to make Belgian chocolate. Therefore, Belgian chocolate is the best. At least, I sure like it.
- Argument 1:  $P_1$ : If SB then YV;  $P_2$ : SB (in BC);  $C_1$  (implicit): BC beans are from YV.
- Argument 2:  $P_2$ : SB (in BC);  $P_3$  (implicit): If SB then best;  $C_2$ : BC is best.

# Argument variations

- So remember...
- Arguments are sets of propositions (sentences).
- Arguments have premises (reasons) and a conclusion.
- Arguments can be 'hiding' in text (i.e. implicit parts, or extraneous parts)
- The same sentence can act as both a premise and a conclusion. (Technically, any set of sentences with two arguments can also be considered a single argument.)

# Formal logic

- A central tool for evaluating arguments
- Systematically describes the relation between premises and conclusions
- Often needs to be supplemented to be useful (as we'll discuss).
- Two central ideas in logic for classifying arguments:
  - Validity
  - Soundness

# Validity

An argument is *valid*:

- If, when all of the premises are true, the conclusion has to be true

Or, equivalently,

- If it's not possible for the conclusion to be false when the premises are true

# Soundness

An argument is *sound* if

- It is valid *and*
- All the premises are true
  
- Therefore, sound arguments are a subset of valid arguments

# Examples

1) The pen in my hand is either red or blue. It is not blue. Therefore it is red.

- (valid and (probably) sound)

2) The pen in my hand is either red or five hundred pounds. It is not red. Therefore it is five hundred pounds.

- (valid and (probably) not sound)

3) The pen in my hand is red or five hundred pounds. It is red. Therefore it is five hundred pounds.

- (invalid and so not sound)



# Validity and soundness

- Can be pulled apart when evaluating arguments.
- This is good because
  - we do not have to know the truth of various statements in argument in order to evaluate the argument to some degree
- Logic is mostly concerned with valid forms.
- However, in practice it is often more difficult to establish the truth or falsity of particular statements (since that can require much expert knowledge).

# More examples

1) If you like vegemite then you'll love German chocolate. You like vegemite. Therefore you'll love German chocolate.

- (valid, false premises)

2) If you like Belgian chocolate then you'll love German chocolate. You love German chocolate. So you like Belgian chocolate.

- (invalid, true premises)

3) If you don't like critical thinking then you don't like thinking. But you like critical thinking. Therefore you like thinking.

- (invalid, truth?)

# Thinking critically

Question:

An extended example

- Char Margolis “Cold reading” analyzed by The Amazing Randi (<http://www.randi.org/>).