Philosophy 104

Chapter 6 Notes (Part 1)

What is Logical?

Most, when they think of logic, think of something devoid of emotion. When Spock held forth on what was and was not *logical*, he usually meant to say what was and was not *rational*.

Logic:

- Logic, in the sense in which we will be interested, is deductive logic.
- Deductive logic is a formal (means it has set rules) system for determining and ensuring that our reasoning is truth-preserving.
- Put another way, we want to make sure that we don't start with things that are true and end up deriving things that are false from them. When we know that some things are true, we want to make sure that we only derive other true things from those.

Deduction, my dear Watson!

Deduction is made famous by the character Sherlock Holmes, though he very rarely engaged in it. Most of his reasoning was really INDUCTIVE or ABDUCTIVE.

The real celebrities of logic

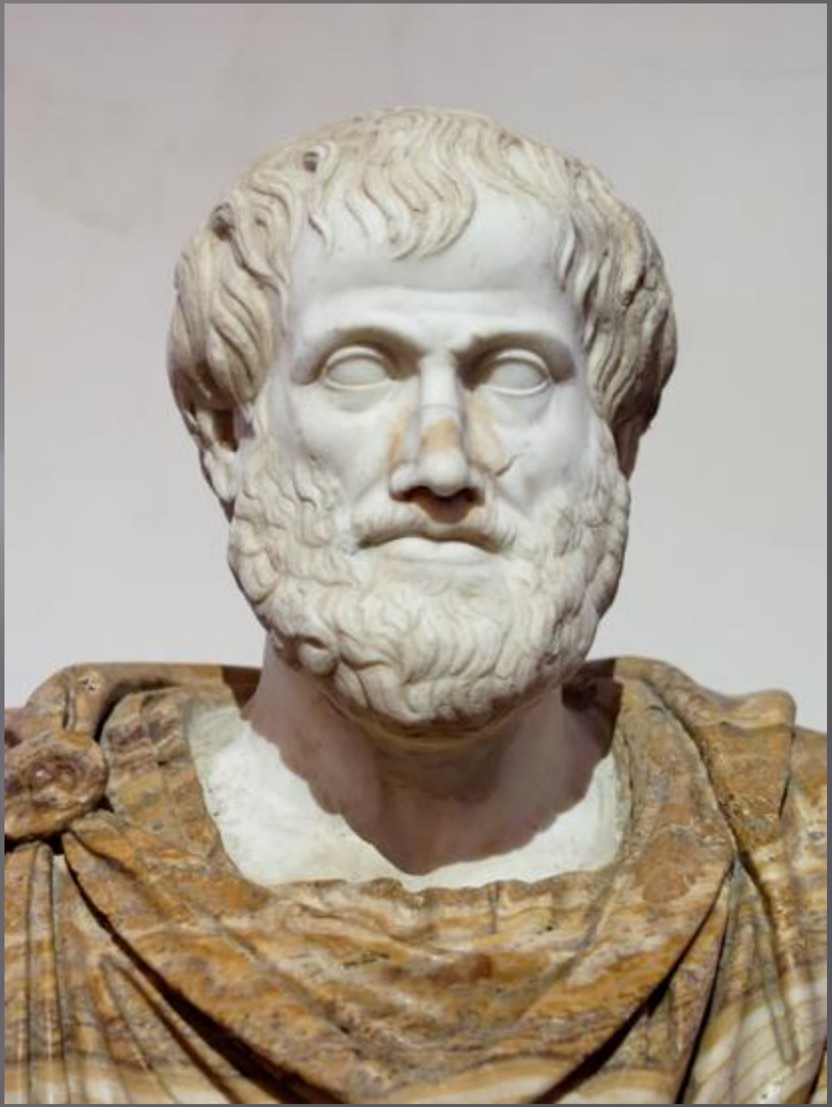
Aristotle, Russell, Wittgenstein

Aristotle

This is a bust of what Aristotle probably looked very little like.

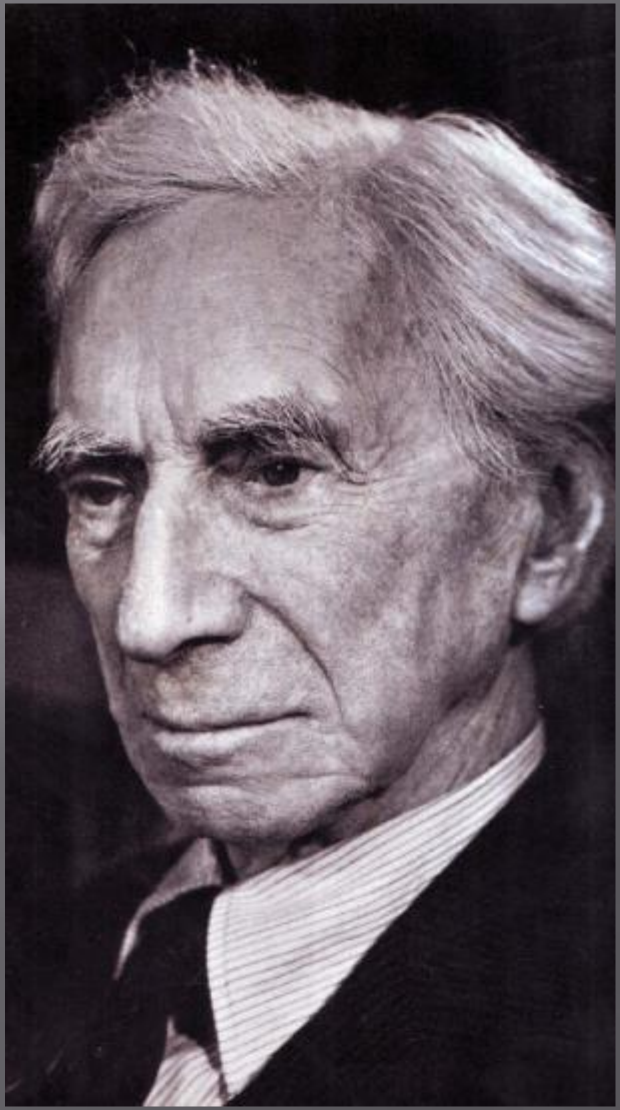
Aristotle developed a system of logic that was unrivaled for over 2000 years.

Chapter 7 is concerned with Aristotelian (or Categorical) Logic.



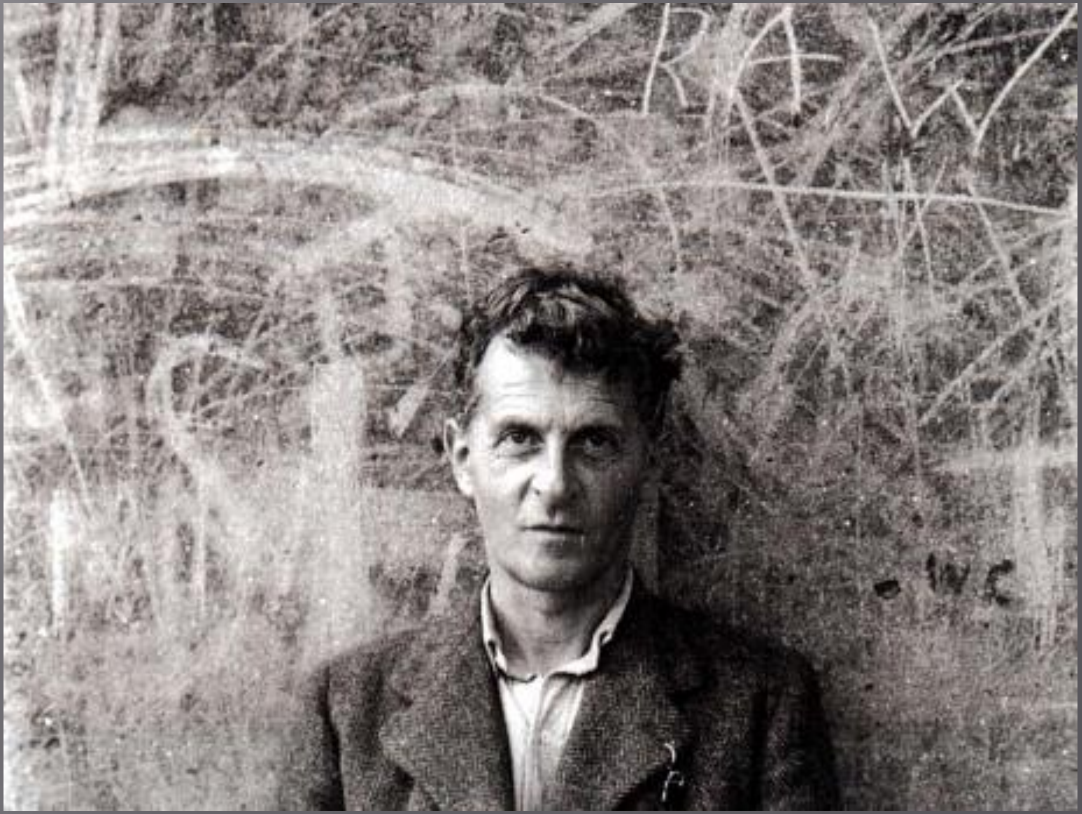
Bertrand Russell

He and Alfred North Whitehead wrote *Principia Mathematica*. This book substantially contains the system of logic that we will learn and use in Chapter 6.



Ludwig Wittgenstein

Often credited with inventing truth tables, with which you shall become quite familiar in chapter 6.



Formal Logic:

- All human language has a structure that hides behind it (probably because human beings have a thought structure in common).
- Symbolic logic is an abstract language that has been developed to reveal that structure and help us to understand and analyze it.
- As we progress through the unit we'll build up a set of tools to determine whether our reasoning is truth-preserving (i.e. whether arguments are valid).

A note about the rules of logic:

- The rules of logic are not made up or stipulated, or even proved in any way external to logic itself (though they can be derived from one another like the axioms of Euclidian geometry)
- The rules of logic are discovered, and are lent force by the very fact that they're obvious, otherwise we wouldn't be able to call them rules of logic.

But first, Propositions:

- A proposition is a single thing that could or could not be the case.
- Propositions are expressed by sentences.
- You already believe this, here are a few examples that illustrate the point:

Propositions and translation:

- For example, the sentence "The girl carries water" expresses the proposition that *the girl carries water,* which is true when the girl carries water and false otherwise.
- Note that the sentence "Puella aquam portat" *means* the same thing as above because it *expresses the same proposition*.

Propositions and Phrasing

- The sentences "Bob hit Biff" and "Biff was hit by Bob" are *not the same sentence,* because they use different words in a different order, but they *mean* the same thing because they *express the same proposition.*

Propositions

- Not all sentences express propositions; some kinds of sentences do not.
  - To express a proposition, a sentence must be an example of a linguistic act.
  - The sentence must also assert something that could be true or could be false; a sentence that does not express a proposition is not truth-evaluable.
  - A sentence that does express a proposition is called <u>truth-evaluable</u> because it can be evaluated as to its truth or falsity at any given time.

Sentences that do not express propositions (non truth-evaluable)

- Nonsense statements (not linguistic acts):
  - Colorless green ideas sleep furiously.
- Exclamations:
  - Ouch!
- Questions:
  - What's for lunch?
- Commands:
  - Close the door.
- Emotive statements:
  - Hooray for our side.

Two Fundamental Rules of Logic

- *No* proposition is *both* true and false at the same time (Law of Non-Contradiction)
- *All* propositions are *either* true or false. (Law of Excluded Middle) There is no such thing in this context as "partially true", "neither true nor false", "mostly true".

Symbolic Logic

- For our purposes, we will make use of some symbols and shorthand to make the logical structure of sentences more obvious.

Propositional variables

- When we work with sentences that express a single proposition, we can just replace them with what we will call a **propositional variable.**
- Propositional variables are lower case letters (p, q, r, etc.) that can stand for any given single proposition.

Sentences that express more than one proposition

- Consider the sentence:
  - I am wearing shoes and a hat.
- The above sentence expresses not one, but two propositions:
  - I am wearing shoes
  - I am wearing a hat
- The sentence also connects those two propositions together with an ‘and’.
- Is the sentence true or false?

Truth-functionality

- The truth of a compound sentence (one that expresses multiple propositions and connects them together in some way) is a function of the truth of its parts and the way in which they are connected.
- ‘I am wearing a hat and I am wearing shoes’
  - Is false because I am not wearing a hat
  - When propositions are connected by ‘and’ they are false whenever one or both propositions are false.

Conjunction

- Just as we will be replacing individual propositions with propositional variables, we will be replacing some English connecting words with **truth-functional connectives.**
- The connective that replaces 'and' is the ampersand, or the conjunction symbol, '&'

Conjunction
Symbol

Conjunct Conjunct

$$\underbrace{\overbrace{P}^{\text{Conjunct}} \;\&\; \overbrace{Q}^{\text{Conjunct}}}_{\text{Conjunction}}$$

Conjunction

The truth table for ‘&’

p	q	p & q
T	T	T
T	F	F
F	T	F
F	F	F

Another connective:

- Consider the sentence:
  - I am wearing black shoes or blue socks today.
- This connects the following two propositions with an 'or'
  - I am wearing black shoes today
  - I am wearing blue socks today
- Under what conditions is the above true?

$$\underbrace{\overbrace{P}^{\text{Disjunct}} \; \overbrace{\vee}^{\text{Disjunction Symbol}} \; \overbrace{Q}^{\text{Disjunct}}}_{\textbf{Disjunction}}$$

Exclusive vs. Inclusive ‘or’

- Sometimes when a person says something of the form “p or q” they mean “p or q or both” and sometimes they mean “p or q and not both”. The former is an inclusive ‘or’ and the latter is exclusive.
- Most logicians default to the inclusive ‘or’. Some even claim that all uses of ‘or’ are inclusive, and it is conversational implication that makes some of them exclusive.
- In any case, it is important to examine cases where ‘or’ is used to determine which is which, because it will affect the validity of any argument that ‘or’ is used in.

Disjunction

p	q	p v q
T	T	T
T	F	T
F	T	T
F	F	F

Negation

- It is tempting to say that “Smurfs are blue” and “Smurfs are not blue” are sentences that express two propositions.
- That is not the case. What is going on is that the same proposition is involved, and in one case the proposition is negated.
- If ‘s’ stands for “Smurfs are blue” and ‘~’ is our symbol for negation, then “Smurfs are not blue” is formalized as “~s”.

Negation Symbol

$$\sim P$$

Negation

Be careful with Negation

- Sometimes ‘not’ is syntactically ambiguous. Translating ‘~’ as “it is not the case that…” can help to disentangle ambiguity.
- Be careful with opposites.
  - “nobody owns Mars” is the negation of “somebody owns Mars” because “it is not the case that somebody owns Mars” means the same thing as “nobody owns Mars”
  - However, some opposites are not binary. Consider “Cheering for the Yankees is moral”. The negation of this should just be “It is not the case that cheering for the Yankees is moral”. Resist the temptation to translate the negation as “Cheering for the Yankees is immoral”. This is because actions that are not moral could be either amoral or immoral (but not both).
  - The point is, just be strict in translating ‘~’ as “it is not the case that…”

Further ambiguity in negation:

- Consider ~(Everyone loves running)
  - Not everyone loves running
  - Everyone does not love running
  - Everyone loves not running
  - No one loves running
  - Everyone hates running
  - Everyone loves walking
  - For the sake of Pete, just say "It is not the case that everyone loves running"