



Introduction to Logic

JAKE CHANDLER

Arguments



WHY STUDY LOGIC?

Survey

A reasoning test

Four cards, each of which has a letter written on one side and a number written on the other side:

E T 4 7

Claim:

'If a card has a vowel on one side, then it has an even number on the other side.'

Question:

Which card or cards should you turn over in order to decide whether the claim is true or false?

Answer

- The answer: first and last cards.

E T 4 7

Check first card to verify that there isn't an odd number on the other side.

But also...check last card to verify that there isn't an vowel on the other side!

- If you messed up you are in good company: 75% average failure on this *very elementary* task. (Common answer: first card)

It quickly gets worse

- Even in *simple* cases, we're bad at assessing whether we have been given good reasons to believe a claim
- It doesn't take much for us to become completely useless:

Doors

"The sign on the red door says that the prize is behind the red door. The signs on both the blue door and the green door say that the prize isn't behind the blue door. At least one of the signs states a falsehood and at least one of the signs states a truth. Therefore the prize is behind the green door."

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Why study logic?

- Logic is the study of the general rules of good reasoning
- It provides a rigorous, upscalable set of tools to sharpen your reasoning skills.
- Logic can greatly improve your ability to read, assess and write **philosophy** (both 'analytic' and 'continental')
- Logic can enhance your performance in **other academic disciplines** (law, mathematics, computer science,...)

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Why study logic?

- Examples of use of logic in engineering and CS:
 - Hardware Model Checking (e.g. Intel's microchips or NVIDIA's GPUs)
 - Software Verification (e.g. NASA, Microsoft, Amazon...)
 - Expert Systems and Decision Support (e.g. IBM's Watson)
 - Database Management (e.g. query optimisation in Oracle's DBs)
 - Network Security (e.g. firewall rules for Cisco's ASA Firewall)
- Logic can equip you with important transferable skills for the **job market**
- Logic is interesting **in itself**, as a rich and fascinating philosophical subject of study



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A FIRST LOOK AT ARGUMENTS

- **Arguments** are particular kinds of sets of sentences

Some arguments

“I think it’s going to rain later because I heard the weather forecast on the radio ,which is usually reliable.”

“Climate scientists predict that the world is facing environmental catastrophe, and they are the experts on these issues.”

“ If the donkey carried dates, then the goat carried oil. If the donkey carried oil, then the camel carried dates. And if the goat carried dates, then the camel carried oil. Each animal carried either oil or dates, but not both. Therefore the goat carried oil.”

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Declarative sentences

- Arguments aren’t just made up of *any* old kind of sentences: they are made up of **declarative sentences**.
- Declarative sentences: sentences making a factual claim, and thus in principle evaluable as being true or false.

Declarative sentences

It was way past the Dormouse’s bedtime.

A Caucus race will take place today.

Non-declarative sentences

What time is it? (interrogative)

Drink up! (imperative)

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Sentences vs propositions

- Note: Restall talks of **propositions** rather than declarative sentences.
- Translation manual:
 - ‘proposition’ = ‘declarative sentence’ (henceforth ‘sentence’)
 - ‘propositional’ = ‘sentential’

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Premises and conclusions

- The sentences in an argument must also be divisible into two parts:
 - (i) the **premise(s)**,
 - (ii) the **conclusion(s)**.
- with (i) *purporting* to provide **reasons** for believing (ii)

Premises vs conclusion

“It’s important to become an effective critical thinker
[*conclusion*]: being able to recognise good arguments will prevent
you from doing or believing the wrong things [*premise*].”

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Joint vs independent reasons

- Reasons can do their job solo or merely collaboratively
- **Independent** reasons: reasons that are sufficient to support the conclusion by themselves

Snakes

“You shouldn’t go down to the woods tomorrow because it’s
going to rain and because it’s snake season.”

- **Joint** reasons: reasons that are only sufficient to support the conclusion in conjunction with further reasons

Square

“That’s a square: it has four equal sides and the inner angles are
ninety degrees”

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Chains of reasons

- Reasons can be backed up by other reasons, which can be backed by further reasons...
- These form **chains** of reasons

Broke

“I think Nina won’t be joining us on the trip: She’s broke. Simon
told me that she lost her job last month.”

- Arguments containing chains are sometimes known as **compound arguments**



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Arguments

REPRESENTING ARGUMENTS

- For ease of readability and future reference, philosophers like to present arguments in **standard form**
- How to present in standard form:
 - Identify the conclusion
 - Identify the premises
 - Number the premises $P_1, \dots, P_n$ and write them out in order
 - Draw in an “inference bar”
 - Write out the conclusion, placing “C” in front of it
- I prefer: simply number all statements, including the conclusion
- Alternative to inference bar: $\therefore$

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Standard form: Examples

Some arguments in standard form

- (1) Bart has two sisters
-
- (2) Bart is not an only child
-
- (1) Helping someone to commit suicide is murder
 - (2) Murder is wrong
-
- (3) Helping someone to commit suicide is wrong

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Standard form: Examples (ctd)

Another argument in standard form

- (1) The sign on the red door says that the prize is behind the red door.
 - (2) The signs on both the blue door and the green door say that the prize isn't behind the blue door.
 - (3) At least one of the signs states a falsehood and at least one of the signs states a truth.
-
- (4) The prize is behind the green door.

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Compound arguments

- We can also represent compound arguments in standard form:

A compound argument

- (1) Either Alice had green tea or she had a cappuccino.
 - (2) If Alice had a cappuccino then she didn't take sugar.
 - (3) Alice took sugar.
-
- (4) Alice had green tea. (From (1)–(3))
 - (5) If Alice had green tea, then the Dormouse didn't.
 - (6) If the Dormouse didn't have green tea, then he had nothing at all.
-
- (7) The Dormouse had nothing at all. (From (4)–(6))

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Arguments



RECONSTRUCTING ARGUMENTS

Argument reconstruction

- Real-life debates don't come in tidy standard form: art of **argument reconstruction**
- General strategy: Identify the conclusion, then work your way along the chain
- Crucial guiding principle: Present the views of others as **accurately** and **charitably** as possible
- Why so?
 - (i) it is **courteous**
 - (ii) it **maximises impact**, ensuring your discussion is as effective as it could be
- Note: You'll get a better sense of what charity requires when you have a better idea of what makes an argument a good one

Difficulties

- 2 common issues:
 - (1) Poor signposting
 - (2) Missing claims

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(1) Poor signposting (ctd)

- We might have **premise indicators**.

Cheshire cat

“The Cheshire cat could, after all, be beheaded, *since* it was only a head, and anything with a head can be beheaded.”

- Other premise indicators:
 - given that
 - as indicated by the fact that
 - for the reason that
 - because
 - seeing as...

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(1) Poor signposting

- It's not always clear what's given as a reason for what
- Often, the premise / conclusion division is flagged out by **argument indicators**
- We might have a **conclusion indicator**.

Rectangle

“It has four sides and four right angles. *Therefore* it is a rectangle.”

- Other conclusion indicators:
 - hence
 - thus
 - for that reason...

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(1) Poor signposting (ctd)

- However: in some cases, there are no explicit indicators *at all*.

Arguments without indicators

“He stole something from the shop: the attendant tells me he saw him acting shifty.”

“It has four sides and its inner angles are 90 degrees. It's a rectangle.”

- In these cases: try **inserting markers to test**

Inserting markers

“He stole something from the shop *since* the attendant tells me he saw him acting shifty.”

“It has four sides and its inner angles are 90 degrees. *Therefore* it's a rectangle.”

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(1) Poor signposting (ctd)

- Note: indicator words are **not part of the claims** that make up the argument! Don't include them in your representation

Rectangle

(1) It has four sides, and four right angles.

(2) *Therefore it is a rectangle.*

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(2) Missing claims: More examples

Englishmen

"All Englishmen are idiots. You shouldn't marry an Englishman."

"All Englishmen are idiots. **You shouldn't marry an idiot.** You shouldn't marry an Englishman."

Lottery

"Positive thinking can't help you win the lottery. If it could, then lots of people would win."

"Positive thinking can't help you win the lottery. If it could, then lots of people would win. **But not many people do win.**"

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(2) Missing claims

- Premises, intermediate steps and conclusions can be **implicit**

Bible

"The Bible says that God forbids tattoos. So you shouldn't get a tattoo."

"The Bible says that God forbids tattoos. **Whatever the Bible says is true. Therefore, God forbids getting a tattoo. Furthermore, one should not do what God forbids.** So, you shouldn't get a tattoo."

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(2) Missing claims: More examples

Out and About

"She's not home. If she'd driven home, her car would be in the drive. And it was raining, so she didn't walk home."

"She's not home. **If she is home, then either she walked home or she drove.** If she'd driven home, her car would be in the drive. **Her car is not in the drive. So she didn't drive home. If it was raining, then she didn't walk home.** And it was raining, so she didn't walk home."

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(2) Missing claims: Argument reconstruction

- Implicit premises are OK, so long as they are:
 - easily **recoverable** from context
 - entirely **uncontroversial**
- When reconstructing an argument, try to make things explicit:
 - The missing premises/steps might not be that uncontroversial (see previous examples)
 - It's is charitable to the person offering the arguments
 - It lets you construct the strongest counterargument possible
- Try to find the weakest and most plausible assumptions that make the argument float