Formal Fallacies

Supplemental module

First, what is a fallacy?

a mistake or failure in an argument that affects its cogency
(sometimes its validity, sometimes its truth)

V · T · E

Fallacies (list) [hide]

Formal	**In propositional logic**		Affirming a disjunct · Affirming the consequent · Denying the antecedent · Argument from fallacy
	In quantificational logic		Existential · Illicit conversion · Proof by example · Quantifier shift
	Syllogistic fallacy		Affirmative conclusion from a negative premise · Exclusive premises · Existential · Necessity · Four terms · Illicit major · Illicit minor · Negative conclusion from affirmative premises · Undistributed middle
	Masked man · Mathematical fallacy		
Informal	**Equivocation**		Equivocation · False equivalence · False attribution · Quoting out of context · Loki's Wager · No true Scotsman · Reification
	Question-begging fallacies		Circular reasoning / Begging the question · Loaded language (Leading question) · Compound question / Loaded question / Complex question · No true Scotsman
	Correlative-based fallacies		False dilemma (Perfect solution) · Denying the correlative · Suppressed correlative
	Illicit transference		Composition · Division · Ecological
	Secundum quid		Accident · Converse accident
	Faulty generalization		Anecdotal evidence · Sampling bias (Cherry picking · McNamara) · Base rate / Conjunction · Double counting · False analogy · Slothful induction · Overwhelming exception
	Vagueness / ambiguity		Accent · False precision · Moving the goalposts · Quoting out of context · Slippery slope · Sorites paradox · Syntactic ambiguity
	Questionable cause		Animistic (Furtive) · Correlation implies causation (*Cum hoc* · *Post hoc*) · Gambler's (Inverse) · Regression · Single cause · Slippery slope · Texas sharpshooter
	Fallacies of relevance	**Appeals to emotion**	Fear · Flattery · Novelty · Pity · Ridicule · Think of the children · In-group favoritism · Invented here / Not invented here · Island mentality · Loyalty · Parade of horribles · Spite · Stirring symbols · Wisdom of repugnance
		Genetic fallacies	***Ad hominem*** — Appeal to motive · Association (*Reductio ad Hitlerum* (Godwin's law) · *Reductio ad Stalinum*) · Bulverism · Poisoning the well · Tone · *Tu quoque* · Whataboutism
			Authority (Accomplishment · *Ipse dixit* · Poverty / Wealth) · Etymology · Nature · Tradition / Novelty (Chronological snobbery)
		Appeals to consequences	*Argumentum ad baculum* · Wishful thinking
		Ad nauseam (Sealioning) · Argument to moderation · *Argumentum ad populum* · Appeal to the stone / Proof by assertion · *Ignoratio elenchi* · Argument from anecdote · Argument from silence · Invincible ignorance · Moralistic / Naturalistic · Motte-and-bailey fallacy · Rationalization · Red herring (Two wrongs make a right) · Special pleading · Straw man · Cliché · I'm entitled to my opinion	

Category

What counts as a fallacy?

What counts as a fallacy?

the types of fallacies include:

- informal (here, I'm including all fallacies of relevance and semantic fallacies; e.g., ad hominem, red herring, appeal to authority, equivocation)
- inductive (e.g., base rate fallacy, hasty generalization, faulty analogy, gambler's fallacy)
- formal (us!)

E.g., Red herring…wait, literally?

Brexit trade deal: What does it mean for fishing?

By Chris Morris & Oliver Barn
BBC Reality Check

Rotting fish, lost business and piles of red tape. The reality of Brexit hits Britain

Analysis by Luke McGee, CNN Business
Published 12:00 AM EST, Sat January 23, 2021

Brexit: UK salmon exports to EU crash 98%

Lucy Harley-McKeown
22 March 2021 · 3-min read

GBPEUR=X -0.0983% GBP=X +0.54% EUR=X +0.40%

Fishy business: Why access to UK waters is red herring in Brexit talks

The EU is making a

The issue of fish is a red herring in the Brexit negotiations

It is the level playing field rules that are the real guts of Brexit, on which we must not compromise sovereignty

Henry Carden @henrycarden · Jun 28, 2020

Brexiteers obsession with fish is an absolute #redherring It's worth remembering that the UK fishing industry is worth £1.4 billion to the economy each year, compared to the UK music industry (which certainly won't be "better off" by Brexit) being worth around £5.2 billion.

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E.g., gambler's fallacy

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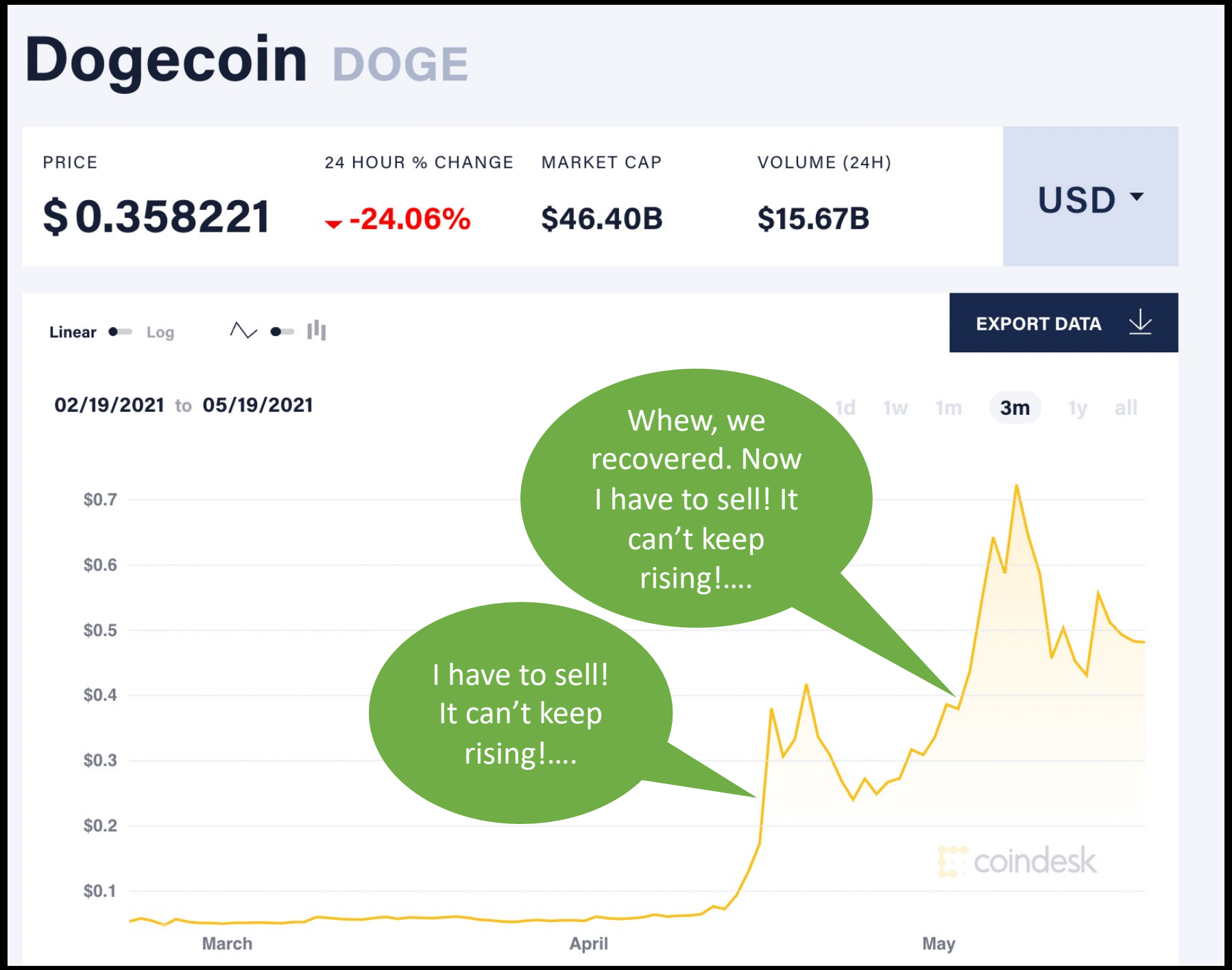
Gambler's fallacy is a belief that the probability of something happening becomes higher or lower as the process is repeated.

It is the belief that random events are somehow interconnected and that each event influences the likelihood of another.

In trading, this bias can cause traders to close profitable trades too early because they believe that the stock is unlikely to continue its trajectory and the chances of more profit become lower as time proceeds.

E.g., gambler's fallacy*

*please invest wisely ☺



NOT gambler's fallacy*

*please invest wisely ☺

What counts as a fallacy?

- formal (us!)
  - fallacies involving conditionals: affirming the consequent, denying the antecedent
  - others: affirming a disjunct, denying a conjunct
  - fallacies involve QL: fallacy of undistributed middle

Affirming the consequent

Basic idea: You want to argue: $a \rightarrow$ b, b $\therefore$ a

How do we know this is bad?

a	b	$a \rightarrow$ b,	b		a
T	T	T	T	✓	T
T	F	F	F	✓	T
F	T	T	T	✗	F
F	F	T	F	✓	F

Affirming the consequent

Basic idea: You want to argue: $a \rightarrow$ b, b $\therefore$ a

If you are fully vaccinated, then you do not need to wear a mask.
You are not wearing a mask.
$\therefore$ You must be fully vaccinated.

Ryan Utter @rye_b · Dec 4, 2020

To use a real-world example:

If COVID-19 was spread by droplets (A) then transmission would happen at close proximity (B)

Transmission happens at close proximity (B)

Therefore COVID-19 is spread by droplets (A)

when arguing something is affirming the consequent, it's often **useful** to show an alternative way of getting the consequent (besides the antecedent):

> If COVID-19 was spread by droplets (A) then transmission would happen at close proximity (B)
>
> If COVID-19 was spread by aerosols (C) then transmission would happen at close proximity (B)

Denying the antecedent

Basic idea: You want to argue: $a \rightarrow$ b, ¬a $\therefore$ ¬b

How do we know this is bad?

a	b	$a \rightarrow$ b,	¬a		¬b
T	T	T	F	✓	F
T	F	F	F	✓	T
F	T	T	T	✗	F
F	F	T	T	✓	T

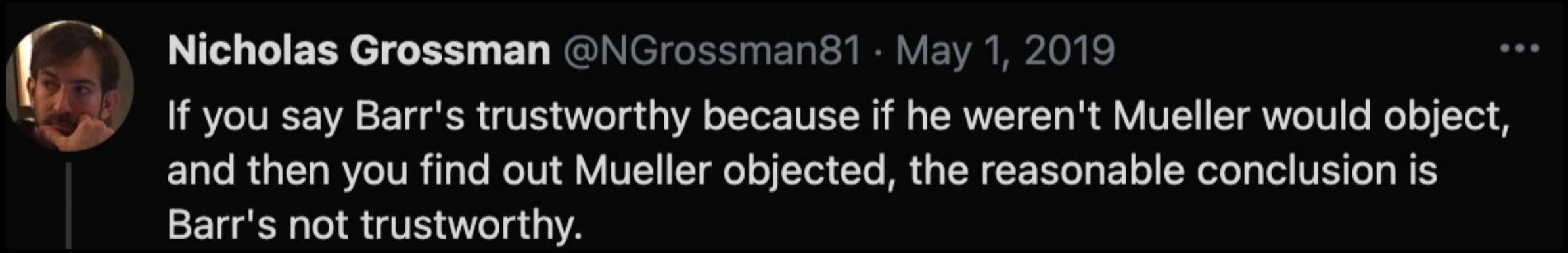
Denying the antecedent

Basic idea: You want to argue: $a \rightarrow$ b, ¬a $\therefore$ ¬b

1) **Everything that begins to exist has a cause.**
2) **The universe did not begin to exist.**
3) **Therefore, the universe did not have a cause.**

Denying the antecedent

Basic idea: You want to argue: $a \rightarrow$ b, ¬a $\therefore$ ¬b



translation manual:
m = “Mueller does not object”
b = “Barr is trustworthy”

m→b
¬m
$\therefore$ ¬b

What about…

Basic idea: You want to argue: $a \rightarrow$ b, ¬b $\therefore$ ¬a

not bad! this is the contraposition of the original conditional and is a valid argument.

a	b	$a \rightarrow$ b,	¬b		¬a
T	T	T	F	✓	F
T	F	F	T	✓	F
F	T	T	F	✓	T
F	F	T	T	✓	T

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Affirming a disjunct

Basic idea: You want to argue: $a \vee b$, a $\therefore \neg$b

equivalently: You want to argue: $a \vee b$, b $\therefore \neg$a

Affirming a disjunct

Translation manual:
s: "is an issue with soda”
c: "is an issue with calories”

$s \vee c, c \therefore \neg s$

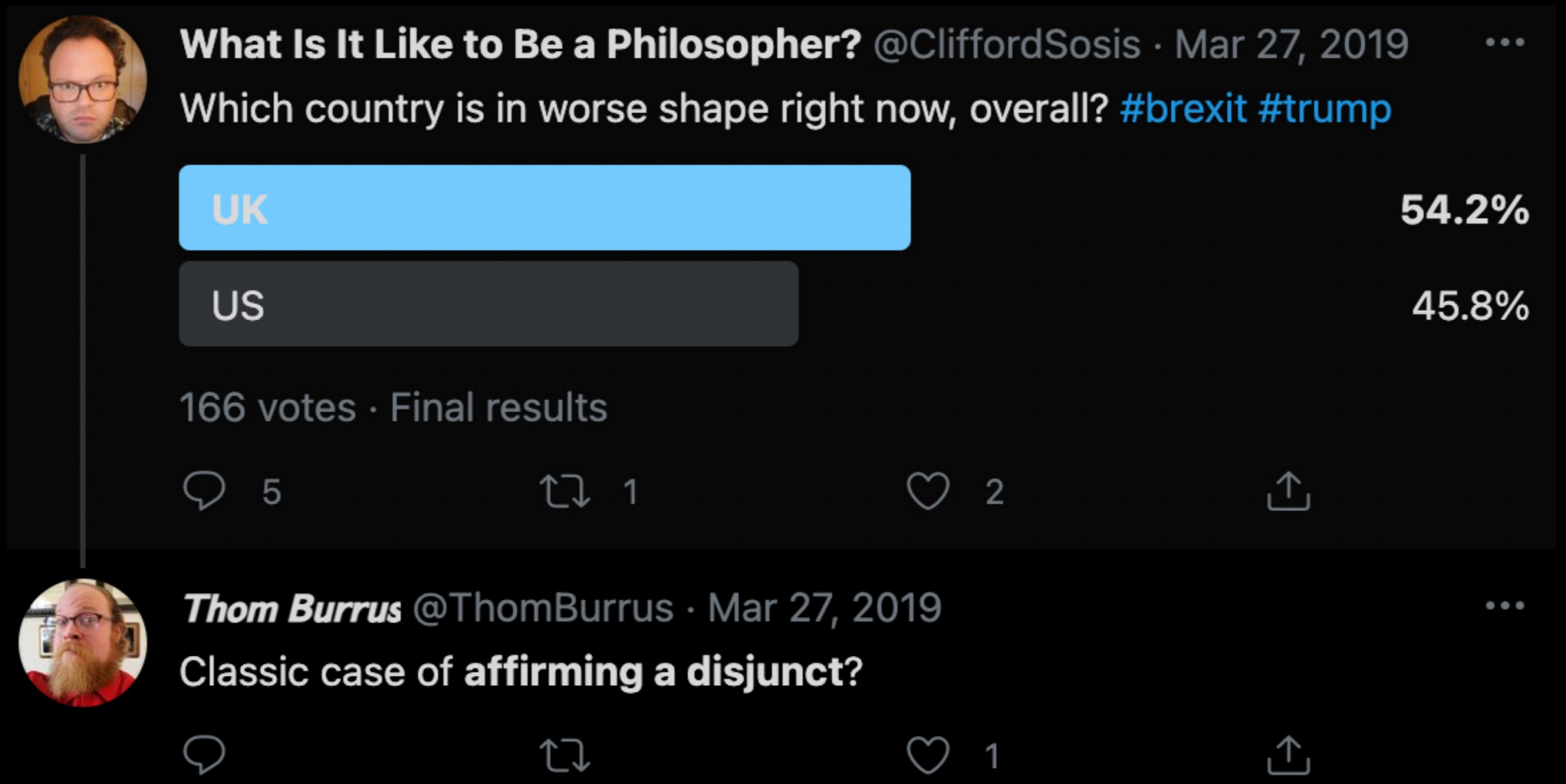
Is it affirming a disjunct really?

Translation manual:
s: "is an issue with soda”
c: "is an issue with calories”

$s \vee c, c \therefore \neg s$

But researching issues with calories is a red herring when soda is the issue!

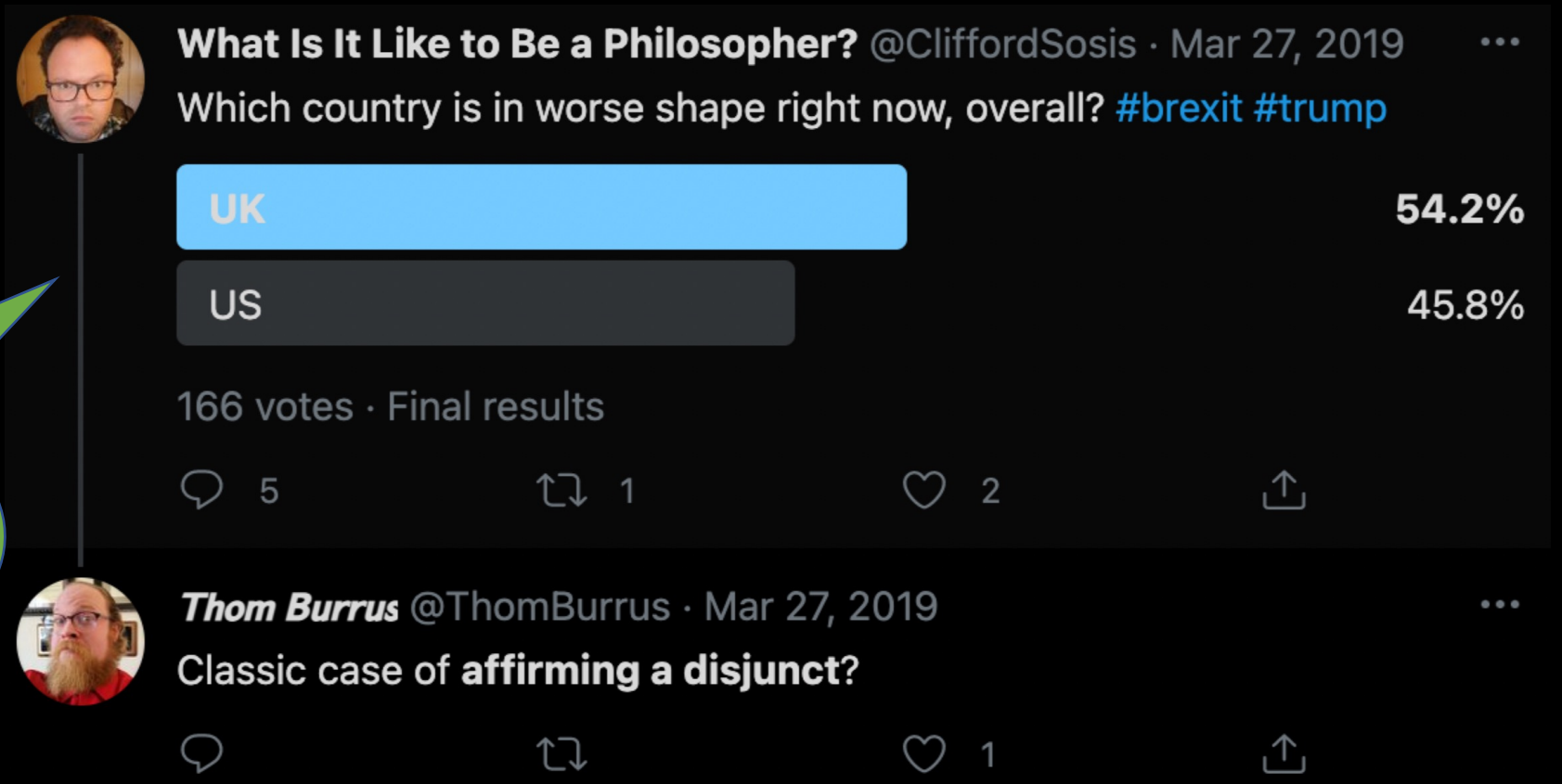
Affirming a disjunct



Translation manual:
s: ”the US is worse off”
k: "the UK is worse off”

$$s \vee k, k \therefore \neg s$$

Is it affirming a disjunct really?



"Worse off" translates to an exclusive or!

Translation manual:
s: "the US is worse off"
k: "the UK is worse off"

$s \vee k, k \therefore \neg s$

Translation manual:
s: "the US is worse off"
k: "the UK is worse off"

$s \vee k, \neg(s \wedge k), k \therefore \neg s$

Denying a conjunct

Basic idea: You want to argue: $\neg(a \wedge b)$, $\neg$b $\therefore a$

equivalently: You want to argue:$\neg(a \wedge b)$, $\neg$a $\therefore b$

Using DeMorgan's, we have: $(\neg a \vee \neg b)$, $\neg$b $\therefore a$

if you switch all a to $\neg a$, and all b to $\neg b$ and use double negation elimination, you recover affirming a disjunct:

Affirming a disjunct: $a \vee b$, b $\therefore \neg$a

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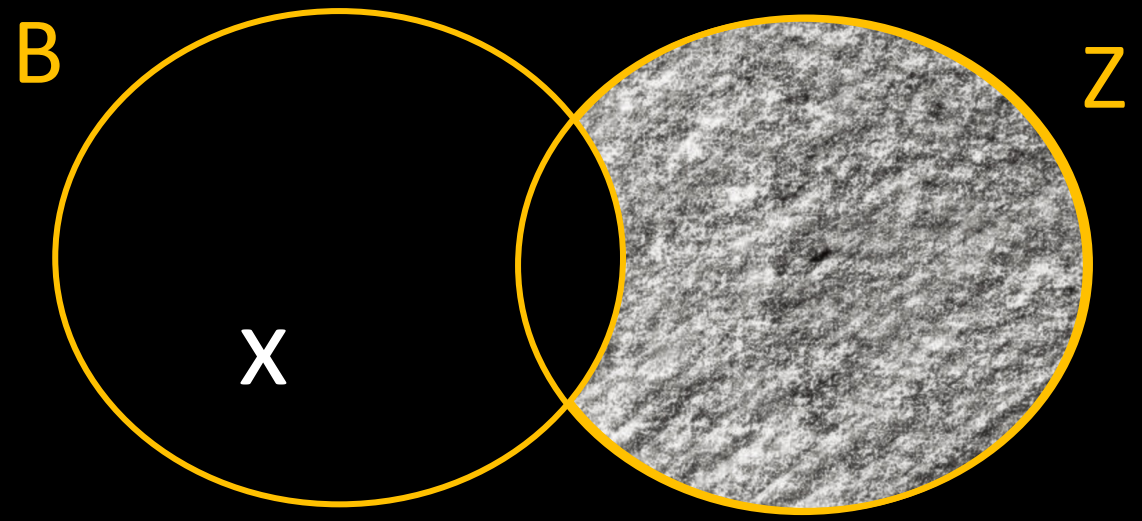
Fallacy of undistributed middle

Basic idea: You want to argue: $\forall x(Zx \rightarrow Bx), B\mathrm{a} \vdash Za$

How do we know this is bad?
Check via Venn Diagrams:



Fallacy of undistributed middle

Basic idea: You want to argue:
$\forall x(Zx \rightarrow Bx), B\mathrm{a} \vdash Z\alpha$

Fallacy of undistributed middle

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