### **Critical Reasoning:** A Romp Through the Foothills of Logic Lecture Five: Inductive Strength

Marianne Talbot Department for Continuing Education University of Oxford Michaelmas Term 2012 Last week we learned:

 how to evaluate deductive arguments as valid or invalid by constructing counterexamples

- that valid arguments can have false premises and false conclusions
- that invalid arguments can have true premises and true conclusions
- how to evaluate deductive arguments from the perspective of everyday life
- about the paradoxes of entailment and the importance of context and relevance
- about what it is for an argument to be sound
- why circular arguments should not persuade us of anything despite their being valid and relevant (and often sound)

So now we know how to:

- recognise arguments;
- analyse arguments;
- set out arguments logic book style;

- distinguish deductive arguments from inductive arguments;
- evaluate deductive arguments

#### This week we shall:

learn more about the nature of induction

- reflect on the value of induction
- describe the different types of induction;
- learn how to evaluate the different types of inductive argument

### Inductive arguments are *ampliative*; such that they add something that cannot be logically deduced.

Inductive arguments are not monotonic: they can always be made weaker or stronger by additional information

Inductive arguments can only ever be evaluated by bringing to bear background information about their subject matter



All these qualities stem from the fact that inductive arguments rely on what the **Scottish philosopher David Hume called** 'the Principle of the Uniformity of Nature'

#### The Principle of the Uniformity of Nature tells us that the future will always be like the past...

...the belief that this is the case underpins every single inductive argument

#### But how do we know that, with respect to the sun, we are not like Russell's chicken?





### Any attempt to justify the Principle of the Uniformity of Nature is circular



... been like the past in the past...

...therefore the future will be like the past...

... in the future...

... our claim goes in a circle

### Nevertheless we firmly believe the future *will* be like the past

# Hume argued that we can't *not* believe the future will be like the past

That it is part of the very structure of human thinking

But, said Hume, such thinking is not rational (nor is it irrational)

### Some philosophers have believed this shows that we should reject induction as a means of acquiring knowledge.



# Karl Popper, the famous philosopher of science believed that the only *good* arguments are deductive arguments

#### Scientists, said Popper, should never try to *confirm* hypotheses and should never claim to know that a theory is *true*

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Instead scientists should try to *falsify* hypotheses and the most they should say, of a theory, is that it 'hasn't yet been falsified'.

#### But in saying this Popper illustrates Hume's claim that we can't manage without induction...

...why should we believe that a hypothesis that has been falsified at t will be falsified again at t+1...

... unless we were relying on the PUN?



Popper was wrong to think we could give up induction...

...and anyone who thinks induction is inferior to deduction because it doesn't give us certainty...

...manifests their failure to understand that without induction we couldn't learn anything new about our world...

... induction isn't *inferior* it is just *different* 

#### The three qualities of induction mentioned above (ampliativity, non-monotonicity and a posterioricity)...

... have so far made it impossible for us to systematise the evaluation of inductive arguments...

... in the way we have systematised the evaluation of deductive arguments

# Whereas deductive validity is very well understood...

#### ... inductive strength is not well understood at all...

...not withstanding the mathematical theory of statistical probability

#### Nevertheless it is clear that there are *strong* inductive arguments and *weak* inductive arguments...

... and we know quite a lot about how to evaluate the different types of inductive argument.

### Before we look at the different types of inductive argument we should remind ourselves that we *always* want the premises of our arguments to be true

#### Just as with respect to deductive arguments we always ask: (a) are the premises true? (b) is the argument valid?

With inductive arguments we always ask (a) are the premises true? (b) is the argument *strong*?

#### I classify inductive arguments thus:

inductive generalisations

- causal generalisations
- analogies
- arguments from authority
- abductive arguments

# We'll look at each type of argument making sure we know how to recognise it...

# ...then we'll go back and ask how to evaluate each one

### Inductive generalisations make claims about whole populations from observations of samples of those populations, e.g:

every swan I have ever seen has been white therefore all swans are white

## Beware: deductive arguments can have premises that must be based on induction:

All swans are white

The bird in the next room is a swan

Therefore the bird in the next room is white

An inductive premise doesn't make a deductive argument inductive

### Causal generalisations make claims about causation on the basis of claims about correlations, e.g:

many of the people at Jane's party on Saturday were ill on Sunday. Their illness must have been caused by something they ate at Jane's place

### Analogies make claims about things on the basis of claims about their similarity to other things, e.g:

the universe is like a watch, watches have makers, therefore the universe has a maker Arguments from Authority make claims about the correctness of things someone says on the basis of their being an authority e.g:

Einstein says that nothing goes faster than the speed of light in a vacuum, therefore nothing goes faster than the speed of light in a vacuum. Abductive Arguments make claims about which explanations are likely to be correct on the basis of observations about the sort of explanations that have been correct in the past, e.g:

Crop circles will eventually be explained by science because in the past many things thought to be susceptible only to supernatural explanations have been explained by science Exercise: Can you classify these inductive arguments by type:

- 1. Many undergraduates like to get drunk at the weekend, so I should imagine that as it is Saturday, James may be in the pub.
- 2. Jesame is the Chief Executive Officer so if she said expenses won't be paid today then expenses won't be paid today.
- 3. Often, after I have been in an aeroplane I have developed a cold, I am travelling to Johannesburg on Saturday so I am expecting to have a cold by Tuesday.
- 4. Bankers are like vampire bats, they suck our blood and should be destroyed.
- 5. The last three times I have asked Susan what was on at the cinema she misled me, so I shan't ask her again.
- 6. Many children have developed autism shortly after having been given the MMR jab, therefore the MMR jab causes autism.

# Next we'll learn how to evaluate the arguments we now know how to recognise

We'll learn this by listing questions to which we'd like answers and seeing why we would like answers to them

After each one I'll include an exercise that you should do at home

#### We will *always* be asking 'assuming the premises of the argument are true, how strong a reason are they to believe that the conclusion of the argument is true?'

**Evaluating inductive generalisations:** 

Every swan we have ever seen has been white therefore every swan is white

#### What is the 'sample'?

(Here it is swans we have seen)

#### What is the 'population'

(Here it is all swans)

#### How large is the sample?

(How many swans have 'we' actually seen? Who is this 'we'? Have we any idea how the number of swans we have seen compares with the number in the population taken as a whole?)

#### Is the sample representative of the population?

(Do we have reason to think that there is something odd or special about the swans we have seen?)

#### Are there any counterexamples?

(Has anyone ever seen swans that were not white?)

The claim 'all swans are white', was seen to be false when, in 1790, naturalist John Latham, sailed up the river later known as the Swan River in Western Australia, and discovered black swans.

Does Latham's discovery mean that the argument for the claim 'all swans are white' was a bad argument? Exercise to do at home: Evaluate these inductive generalisations:

- 1. Those on the third generation pill have a huge risk of a blood clot: taking the third generation pill *doubles* the risk.
- 2. About 1,755,637 square kilometers (677,855 square miles) of Greenland are covered in ice throughout the year, therefore Tasilaq (which is a city of 6,000 people in Greenland) is ice bound.
- 3. Met Office figures show that between 1997 to 2012 there was no discernible rise in global temperature. This means that human-induced climate change is a myth.
- 4. Nearly every time I have rung my bank I have been put on hold and forced to listen to irritating music for ages. I bet no-one ever gets through to their bank without this problem.
- 5. About 1/3 of Britons have used controlled drugs at some point in their lives, nearly 1/10 during the past year, this shows that legalising drugs is the only way to go.



**Evaluating causal generalisations (1):** 

Many of the people at Jane's party on Saturday night were ill on Sunday. The illness must have been caused by something they ate at Jane's party.

How many correlations have been observed? (What does `many' mean here?)

Under what circumstances have correlations been observed? (Is it Jane's enemy Freya, who wasn't invited to the party the one doing the counting?)

#### Are there any exceptions to the correlation?

(Are there are any who are ill who weren't at Jane's party – we know there were some at Jane's party who weren't ill)

continued....
**Evaluating causal generalisations (2):** 

Many of the people at Jane's party on Saturday night were ill on Sunday. The illness must have been caused by something they ate at Jane's party.

#### **Could the correlations be accidental?**

(Could the illnesses have had variable causes, so it was just an accident all the ill people were at Jane's party?)

#### **Could the correlations be explained by a common cause?**

(Did Jane throw her party because of an earlier event at which those who are ill might have caught something or eaten something bad? )

#### Could the causal relationship run the other way?

(Could it be that it was because they were going to get ill that certain people went to Jane's party?)

#### Does a causal relation make sense?

(Pineapples and striking matches!)

#### Most people know someone who has smoked for decades and yet, in his eighties, has no sign of lung cancer.

Does this mean that smoking doesn't cause lung cancer?

## Explain what is wrong with the following causal generalisations:

- 1. Sleeping with your shoes on gives you headaches.
- 2. Zebra crossings cause accidents.

- 3. Every time I have met you I have aged a year. My ageing is your fault.
- 4. I must wear my lucky red jumper to the exam, it has always worked in the past.
- 5. Since the 1950s, the atmospheric CO2 level and the crime level have increased sharply, maybe there is a causal relationship?

#### **Evaluating Analogies**

You greatly enjoyed *Barchester Towers* so I am sure you would enjoy *Can You Forgive Her,* they are similar in all sorts of ways.

#### Is the claimed similarity relevant to the conclusion drawn?

(Are the ways in which the latter book is similar to the former book relevant (the fact they are both published by Penguin probably isn't)? )

#### In how many respects are they similar?

(The more (relevant) similarities the better)

#### Are there any respects in which the two things are dissimilar?

(The subject matter of Barchester Towers differs from that of Can you Forgive Her, does this matter?)

In 1992 the marketing people at Hoover reasoned that because the take up of air tickets to Europe on a recent promotion had been low, a promotion offering air tickets to the US in exchange for buying £100 worth of Hoover products would also be low.

Was this a good analogy?

#### **Evaluate these analogies:**

- 1. Leaders should run the economy as if they were running a household budget. After all the former, like the latter, directly affects the lives of individuals
- 2. There is no more to genetic modification (removing and inserting genes to ensure certain phenotypical effects) than selective breeding (breeding to ensure certain phenotypical effects)
- 3. The soul has three parts, reason, spirit and appetite, each has its part to play but in the just man reason is the ruler. The state has three types of citizen corresponding to these parts (the rulers, soldiers and the people) and the state is just when it is ruled by the rulers. (Plato's Republic)
- 4. There is no more to being visible than being seen. Similarly there is no more to being desirable than being desired. (Mill's Utilitarianism)

**Evaluating Arguments from Authority** 

Several times in these lectures Marianne has told us we should 'just believe her' about something to do with logic. Should we believe her?

#### Is the authority qualified?

(Does Marianne really 'know what she is talking about'?)

#### Is the authority qualified in the appropriate area?

(Is Marianne an authority on logic and critical reasoning?)

#### Do other authorities agree?

(Are there other philosophers who disagree with Marianne?)

**Could the authority be biased?** (Is Marianne being paid to say what she said?)

#### Can references be provided by whoever appeals to the authority?

(Can Marianne provide references/can whoever appeals to M's authority provide references??)

Dame Judi Dench, Sting and Julie Christie have urged Prime Minister David Cameron to decriminalise possession of all drugs. In an open letter to him they call for "a swift and transparent review of the effectiveness of drug policies".

Is this an appeal to authority?

**Does it work?** 

# Answer these questions about these Arguments from Authority:

- 1. In his book The Grand Design Stephen Hawking claims that philosophy is dead. Hawking is a great physicist....has he given us reason to turn our backs on philosophy?
- 2. In 1932 Einstein said 'there is not the slightest indication that nuclear energy will ever be obtainable. It would mean the atom would have to be shattered at will". Einstein said it and Einstein is a great physicist, surely, therefore, it must be true?

#### **Abductive Arguments**

Walking along the beach Fred, Hilary and Sam came across an excellent likeness of Winston Churchill drawn in the sand. Hilary expressed amazement that crawling ants could have made such a picture. Sam said there was no way it could be ants it must have been the wind. Fred insisted it must have been drawn by a person. Obviously we should assume Fred's explanation is the true explanation, it is the best of the three.

#### Do we have other hypotheses?

(We have been offered three hypotheses here, might there be others?)

#### Might there be an even better hypothesis?

(Otherwise we might choose the best of a bad lot)

#### Are there hypotheses we are unable to formulate?

(The monkey half way up a tree on the way to the moon)

At the beginning of the nineteenth century, it was discovered that the orbit of Uranus, one of the seven planets known at the time, departed from the orbit as predicted on the basis of Isaac Newton's theory of universal gravitation and the auxiliary assumption that there were no further planets in the solar system. One possible explanation was, of course, that Newton's theory is false. Given its great empirical successes for (then) more than two centuries, that did not appear to be a very good explanation. Two astronomers, John Couch Adams and Urbain Leverrier, instead suggested (independently of each other but almost simultaneously) that there was an eighth, as yet undiscovered planet in the solar system; that, they thought, provided the best explanation of Uranus' deviating orbit. Not much later, this planet, which is now known as "Neptune," was discovered.

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Stanford Encyclopaedia of Philosophy

http://plato.stanford.edu/entries/abduction/

### **Evaluate this abduction:**

My bank rang to say that my card has been 'cloned'. They asked for my security details. I asked if I could ring them back to check they were my bank and they said yes. I rang the number he gave me and the same chap answered immediately (it hardly even rang!). So it had to be the bank and I gave them my details.

Should there be other hypotheses in play?

## If there's anything you'd like to follow up on induction here are some references:

http://plato.stanford.edu/entries/induction-problem/ (Stanford Encyclopaedia's entry on the problem of induction. It will give you references for David Hume)

http://plato.stanford.edu/entries/popper/ Stanford's entry on Popper and his misgivings about induction.

http://plato.stanford.edu/entries/abduction/ The Stanford entry on abduction

To go with this lecture series, which I gave at the Department For Continuing Education, The University of Oxford (OUDCE) in Michaelmas Term 2012, there is an e-book and a short (ten week) online course run by OUDCE.

Both are entitled: <u>Critical Reasoning: A Romp Through the Foothills of</u> <u>Logic</u>

 The book, by Marianne Talbot will soon be available from all good e-book providers (follow me on Twitter @oxphil\_marianne to find out when it will be released)

 Further details of the course can be accessed here: <u>http://www.conted.ox.ac.uk/courses/online/short/</u> <u>subject.php?course\_subject=Philosophy</u>

Marianne Talbot October 2013

### That's it for today folks....next week is the last week and we'll be doing fallacies