The Politics, Perception, and Philosophy of Physics (F34PPP)
Lecture 1: Induction, Deduction, Reduction

- What we’ll cover in F34PPP (and some disclaimers)
- Timetable and assessment
- Observations and facts (or “facts”?)
- Deduction, induction, and Bacon
- Is science irrational?
- Are we unbiased?
## F34PPP in brief

All sessions in A113, 9 am, Mondays (autumn semester)

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<td>Wrong, or not even wrong?</td>
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<td>Are most scientific papers wrong?</td>
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F34PPP in brief: Recommended reading

- *What is this thing called science?*, 3rd edition, AF Chalmers (Open University Press, 1999)

- *Understanding philosophy of science*, J. Ladyman (Routledge, 2002)

F34PPP in brief -- assessment

- A short blog post (300 - 500 words) [Deadline: Oct. 21] 10%
- An opinion piece (along the lines of a one-page Physics World article, 1000-1500 words) [Deadline: Nov. 21] 30%
- A "feature article" (2000-2500 words, in the style of a broadsheet article) [Deadline: Jan 16] 60%
Suggested blog post topics

- Should scientists have to justify their research in terms of its socioeconomic impact?
- Do social media have a role to play in the scientific process?
- When should scientists “go public” with their results?
- Is “many worlds”/multiverse theory science?
- Can science be crowd-funded?
- Is peer review working?
- Should universities cut back on funding of PhD positions?
- Is Richard Dawkins closed-minded?
Please send me your suggestions for blog post themes:
philip.moriarty@nottingham.ac.uk
SCIENCE AND SCIENCE FICTION

William Evans

Ever since humans first looked at the stars we have dreamt of what lied in the depths of space. Ever since we discovered electricity we have imagined the limits of its uses. Ever since theorising relativity we have fantasized about hidden universes and time travel. In the age of space stations, smart phones and synthetic biology we are now closer than ever to the realms of science fiction. But the relationship between the scientific community and the sci-fi genre is perhaps more complex than it may seem.

Primarily we should consider the responsibility that sci-fi has within its role between the worlds of science and popular culture. Bridging this gap is no easy task but we should be able to expect sci-fi writers to have a level of integrity when presenting scientific theory. Most recently Interstellar has bravely taken on the subjects of relativity and
Science – more than just a technology driver

- How is scientific knowledge different from other forms of knowledge? [Epistemology]
- Can we define the scientific method?
Science: Rational, logical, objective

Rightly or wrongly, science is often thought to be the ultimate form of objective and rational inquiry, and scientists are widely regarded as being able to gather and interpret evidence and use it to arrive at conclusions that are ‘scientifically proven’ and so not just the product of ideology or prejudice. Courts do not convict or acquit someone of a
Science proves nothing

By Philip Moriarty

If you’re not a regular viewer of the BBC’s Sunday Morning Live — perhaps, like me, you’ve facepalmed your way through an episode before and sworn off it for life — you may have missed the following astounding revelation on this week’s programme:

“Quantum physics has proved there’s an after..."
Professor, that man claims the Earth is 6,000 years old!

So? Just use your head and don't concern yourself overmuch with what other people think.

But he says the fossils in the mountains were put there in a flood!

Well, evidence suggests that they were not.

But he--

A million people can call the mountains a fiction, yet it need not trouble you as you stand atop them.

Science is the belief in the ignorance of experts.
(Richard Feynman)
"Science is derived from the facts" (Chalmers, p. 1)
...but are our eyes good enough?
What colour is this dress?

A. Black and blue
B. White and gold

79% Black and blue
21% White and gold
And can we trust our ears?
“Your brain is always making use of prior information to make sense of new information coming in.”

Belief, bias and Bayes

Evidence can modify our beliefs, but the impact it has depends upon those beliefs. An 18th century priest has something to say about that, in what could be seen as a mathematical formulation of the scientific method.

\[
P(A|B) = \frac{P(B|A)P(A)}{P(B)}
\]
Seeing is believing?: Striped nanoparticles

http://physicsfocus.org/philip-moriarty-peer-review-cyber-bullies/
Seeing is believing?: Striped nanoparticles
Seeing is believing?: Striped nanoparticles
Do we really see intermolecular bonds?

Zhang et al., Science 342 611 (2013)
Do we *really* see intermolecular bonds?
Logic and reason

“Logic is the study of reasoning abstracted from what that reasoning is about.” [Ladyman]

All dachshunds are good physicists.
Daisy is a dachshund.
Therefore Daisy is a good physicist.

All human beings are mortal (PREMISE)
Socrates is a human being (PREMISE)
Therefore Socrates is mortal (CONCLUSION)

Both are valid arguments!
Logic and reason: Deduction

All dachshunds are good physicists
Edward is a good physicist
Therefore Edward is a dachshund.

All human beings are animals
Daisy is an animal
Therefore Daisy is a human being

Invalid arguments!
Another valid but bad argument

The Bible says that God exists. The Bible is the word of God and therefore true. Therefore God exists.

God
@TheTweetOfGod

I deeply regret some of you.
2013/08/17 7:00
Invalid but not necessarily bad argument...

Moriarty claims to be a physicist
I have no reason to believe he is lying
Therefore Moriarty is a physicist

Both premises could be true but conclusion could be false – invalid argument.
Induction and Bacon

- Induction: deductively invalid but persuasive argument.
- Observation without bias or prejudice (!)
- Instruments should eliminate the role of the “unreliable senses”
- Induction (in sense Bacon used term) is generalisation from $N$ cases to all cases...
From Bacon to Nano...