LSE Philosophy, Logic & Scientific Method

Department of Philosophy, Logic and Scientific Method public lecture

Lakatos Award Lectures

Professor Gordon Belot
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Chair, LSE

Hashtag for Twitter users: #LSELakatos

LSE events

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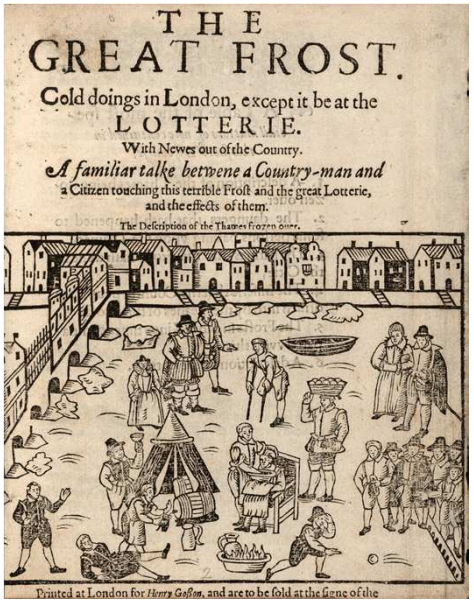
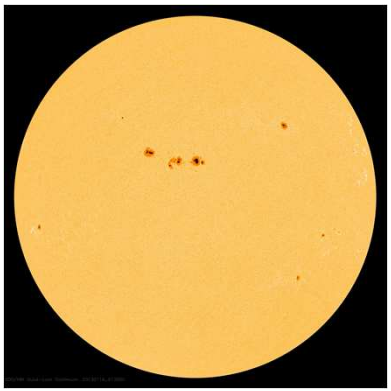


Objectivity, Limited

Gordon Belot
University of Michigan

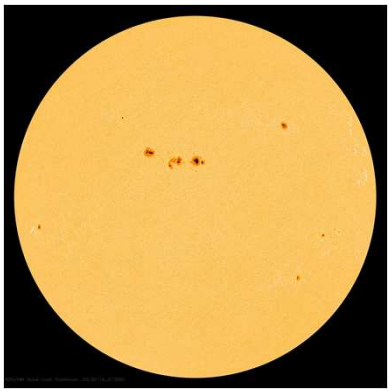
When were sunspots discovered?



Reeves & van Helden (eds.), *Galileo Galilei & Christoph Scheiner: On Sunspots*, Ch. 2

Reports from Chinese astronomers date back 2200 years.

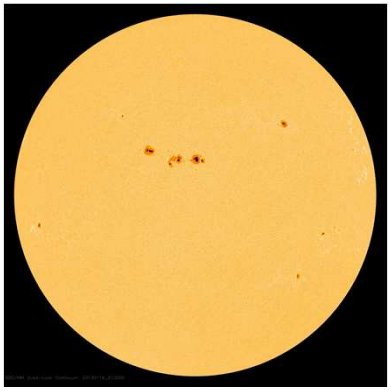
When were sunspots discovered?



Reeves & van Helden (eds.), *Galileo Galilei & Christoph Scheiner: On Sunspots*, Ch. 2

Reports from European historians date back 1200 years:

When were sunspots discovered?

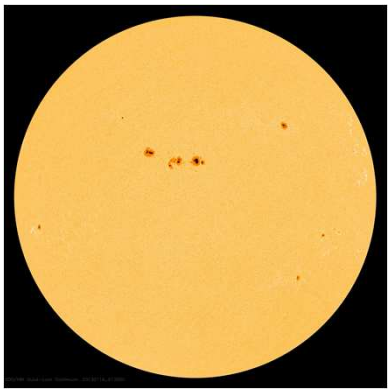


Reeves & van Helden (eds.), *Galileo Galilei & Christoph Scheiner: On Sunspots*, Ch. 2

There were dark spots on the sun, as if nails were driven into it, and the murkiness was so great that it was impossible to see anything for more than seven feet. . . . Woods and forests were burning and the dry marshes began to burn and the earth itself burned, and great fright and terror spread among men.

—Niconovsky Chronicle (1371)

When were sunspots discovered?

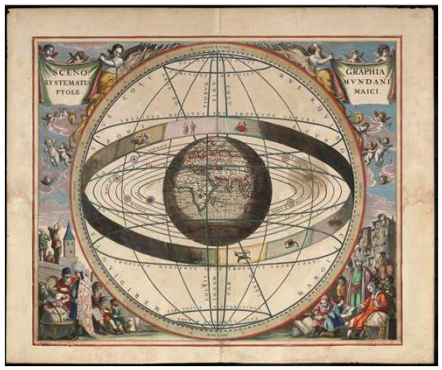


Reeves & van Helden (eds.), *Galileo Galilei & Christoph Scheiner: On Sunspots*, Ch. 2

Reports from astronomers in the Greco-Arabo-Latin tradition date back only 400 years.

* Al-Kindi, ibn Sina, and Kepler each reported having seen a spot on the sun—and each thought he must have seen Venus.

What was going on West of China?



In Greek astronomy and its descendants, the heav- ens were supposed to be changeless and the sun perfect. It appears that astronomers in these tra- ditions saw what they ex- pected to see.

Truth and Objectivity

* We all want to reach the truth.
* Some preconceptions (beliefs, methodologies) frustrate that desire.
* So we should seek to be objective—i.e., free of those preconceptions that obstruct our search for truth.

A First Idea

A natural thought is that we should avoid all preconceptions.

* Absolute Objectivity: We should begin inquiry without making any substantive assumptions about how the world works.

Absolute Objectivity is a Chimera

Goodman, *Fact, Fiction, and Forecast*

Imagine designing a robot that will investigate a distant world, learn about its environment, and make predictions.

Absolute Objectivity is a Chimera

Goodman, *Fact, Fiction, and Forecast*

You will give it a deduction module—it will need to be able to perform logical operations.

Absolute Objectivity is a Chimera

Goodman, *Fact, Fiction, and Forecast*

You will give it a simple induction module—if it has seen a million F's and they have all been G's, it will predict that the next F will be a G.

Absolute Objectivity is a Chimera

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If you do not build in expectations about what its world is like, the robot will make nonsensical predictions.

Absolute Objectivity is a Chimera

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Suppose it sees its one millionth emerald as its first year of operation comes to a close.

Absolute Objectivity is a Chimera

Goodman, *Fact, Fiction, and Forecast*

* Then it has seen one million emeralds, all green.
* And it has seen one million emeralds, all blue-or-seen-in-the-first-year.
* Should it expect the next emerald to be green or blue?

Absolute Objectivity is a Chimera

Goodman, *Fact, Fiction, and Forecast*

Inductive learning is possible only against a background of substantive belief about what the world is like.

Our Predicament

We can't proceed without preconceptions. So we need some way of differentiating between unacceptable and acceptable preconceptions (i.e., between those that frustrate our desire to reach the truth and others).

An Natural Idea

* A preconception is harmless if it doesn't prevent you from getting closer and closer to the truth in the long run—and harmful if it does.

Objectivity as Convergence to the Truth

Definition. A method for addressing a problem is *convergently objective* if and only if applying the method is (virtually) guaranteed to lead to beliefs that converge to the truth, as more and more evidence accumulates.

Proposal. If our method is objective in this sense, then we should believe its outputs. On the other hand, if our method is not objective in this sense, then we should not believe its outputs.

The proposal above is plausible—and endorsed by many scientists and philosophers. Let's investigate its consequences by considering some simple problem situations and asking what methods for addressing those problems are good methods for finding the truth.

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* Whether a method is a good one depends on the problem: sipping and tasting is a good way to distinguish between water and wine, but a lousy method for distinguishing between water and heavy water.
* For some problems, there may be no good methods—e.g., for determining whether or not you are a victim of an deceitful evil genius.

Problem: Two Headed?

A coin is tossed repeatedly and you are told the outcomes. You have to determine whether the coin is normal or is two-headed.

* A Good Method: believe that the coin is two-headed unless and until it comes up tails.
* A Bad Method: believe that the coin is normal, no matter what you find out about the outcomes.

Problem: Biased Coin?

A is tossed repeatedly and you are told the outcomes. The coin has a certain chance p of coming up heads on any toss. You have to determine p.

* The Straight Rule: if the coin has come up Heads m time in n tosses, guess that the p is given by $\frac{m}{n}$
* This is a good method—no matter what the true chance is, your guesses are (virtually) guaranteed to converge to the truth.

Problem: Frost Fair on the Thames (I)

Nature is revealing an infinite binary sequence to us, one bit per year (starting in 1400). 1 means that the River Thames freezes that year (otherwise 0)

Problem: Frost Fair on the Thames (I)

Frost Fair Years to date: 1408, 1435, 1506, 1514, 1537, 1565, 1595, 1608, 1621, 1635, 1649, 1655, 1663, 1666, 1677, 1684, 1695, 1709, 1716, 1740, (1768), 1776, (1785), 1788, 1795, 1814

Problem: Frost Fair on the Thames (I)

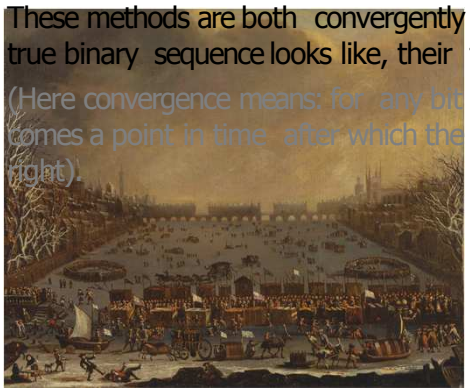
Suppose that each year, after reviewing the record so far, we are asked to guess what the whole sequence looks like. Call this guess our *forecast*

Two Forecasting Methods, Personified

Ms. Zero: write out the record of how things have gone so far—and then assume it will all be zeroes from now on.

Mr. Nietzsche: write out the record of how things have gone so far—and assume that this pattern will repeat *ad infinitum*.

Two Forecasting Methods, Personified



These methods are both convergently objective: no matter what the true binary sequence looks like, their forecasts converge to the truth.

(Here convergence means: for any bit in the true sequence, there comes a point in time after which the forecasts always get that bit right).

Problem: Frost Fair on the Thames (II)

The first Frost Fair problem was easy. Let's consider a variant. Suppose that year, after reviewing the data so far, you are asked to guess whether the frequency of frost fair years is one in a hundred.

Ms Zero: no. Whatever data I see, I will always say no.

Mr. Nietzsche: it depends—yes, if the rate of frost fairs in the historical record is exactly one in a hundred, otherwise no.

These methods are not convergently objective. Consider the sequence in which the Thames freezes just in 1499, 1599, and so on. For this sequence the right answer is Yes. But our methods output a sequence of answers that fail to converge to the this answer.

Ms Zero will say No no matter what data she sees—and "No, No, No, . . . " does not converge to Yes.

Mr. Nietzsche will say Yes in 1500, in 1600, etc.—and will otherwise say No. So he flip-flops between Yes and No *ad infinitum*—so his guesses do not converge at all.

More generally: for this problem every method is either:

* closed-minded (sometimes makes up its mind unshakeably after seeing a finite amount of data)—and for some data sequences will output a sequence of guesses that converges to the wrong answer.
* open-minded (no matter what data it has seen, there are things that could come next that would make it change its mind)—and for some data sequences will flip-flop *ad infinitum* between Yes and No.

So for this problem there is no method that is convergently objective (= guaranteed-to-converge-to-the-truth).

Disaster

We have been pursuing the suggestion that you should believe the outputs of convergently objective methods but not of non-objective methods. But look where this leads:

> Ms Zero and Mr. Nietzsche should believe their forecasts about the pattern of frost fair years—but should be agnostic about whether the overall rate of frost fair years is one in a hundred.

This is a disaster. Imagine if Newton said "The data show that gravity varies as the inverse of the square of distance. But don't ask me whether gravity varies inversely as *some* power of distance!"

A Depressing Conclusion

As reasonable as it sounds, the suggestion that we should believe the outputs of methods guaranteed to converge to the truth and doubt the outputs of others has to go—and with it, the most promising idea for drawing the boundary between acceptable and unacceptable preconceptions.

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As reasonable as it sounds, the suggestion that we should believe the outputs of methods guaranteed to converge to the truth and doubt the outputs of others has to go—and with it, the most promising idea for drawing the boundary between acceptable and unacceptable preconceptions.

We must either sometimes believe the output of a method that is not guaranteed to converge to the truth and/or sometimes disbelieve a method that is guaranteed to converge to the truth.

Thank you!

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