

Francis Bacon's comments on the power of negative observations in his *Novum Organum*, first published in 1620

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Bacon's *Novum Organum* was first published in 1620 as the second part of *Instauratio Magna*, an intended six-part work on a new method of investigating the natural world. One may translate *Novum Organum* as 'new instrument' or 'new method'. The projected *Instauratio* was never completed and only fragments of it were published. It was to have contained an account of the current knowledge of the world, of the false or inefficient methods of examining it which were to be discarded, of the method or instrument which was to replace these (the *Novum Organum*), followed by examples of the use of the instrument, then, finally, an account of the world of Nature re-analysed with the new instrument. It is hardly surprising that the work was never completed. For more details, see, for example, Kitchin's Introduction to his edition of the *Novum Organum*.¹

In Aphorism 46 of the *Novum Organum*, Bacon comments on the relative importance of positive and negative instances of the occurrence of an event on the extent to which a general proposition about the event is believed.² The following is a translation by Spedding, Ellis and Heath:³

... independently of that delight and vanity which I have described, it is the perpetual error of the human intellect to be more moved and excited by affirmatives than by negatives; whereas it ought properly to hold itself indifferently disposed towards both alike. Indeed in the establishment of any true axiom, the negative instance is the more forcible of the two.

However, I do not think that this translation expresses Bacon's meaning precisely. The last sentence is certainly imprecise and rather obscures Bacon's important contention, which is that the 'negative instance' is the more effective *in establishing*

the truth of any axiom (my italics). The point is, surely, not whether the 'axiom' is finally believed to be true but the greater weight carried by negative instances in deciding on its truth (or falsity).

The first English translation was made by M.D. (unidentified as far as I can discover) and was published in 1676. It is excellent, and stays close to Bacon's Latin, using elegant Carolingian English.⁴ As it may not be easily understood by modern readers, I have provided below a new translation, based on the 1620 and 1645 editions of the *Novum Organum*. It remains close to the Latin but I hope may be more easily understandable.^{2,5}

The text starts by introducing the problem of biased reporting:

The human understanding draws everything else to be in harmony with, and to support, those things which once please it, either because they are [generally] received and believed, or because they delight it. And, though it must be admitted that the force and the number of instances that occur to the contrary is greater, it [the understanding] either does not heed them or it disdains them; or, if it does take notice of them, it distances itself from them and dismisses them – and that not without great and pernicious prejudice – so that the authority of those previous beliefs remains inviolate.

The passage continues with an illustration of why causal inferences require comparisons:

In this respect, he [Diagoras the atheist^a] rightly replied, who, when he was shown, on tablets hung up in a temple, those who had given votive offerings so that they might be saved from the perils of shipwreck, and was pressed for an answer whether he nevertheless denied the power of the Gods, asked in

his turn ‘And where are those shown who died after they had called on the Gods?’

This is more or less the reason for all superstitions, such as [belief] in astrology, in dreams, in the fates and suchlike, in which men delight; they pay heed to those that come to pass but, on the contrary, when they are false – which happens much the more often – they neglect them and pass them over.

And this evil creeps, persistently and most subtly, into the philosophies and the sciences, in which that [opinion] which is once accepted infects all the rest (even though these are much better established and more powerful) and reduces them to agree with it.

Bacon then returns to the problem of biased reporting:

Moreover, as we have said, [even in cases] where delight and vanity were absent, an error ever present in, and peculiar to, human understanding is that it is more moved and excited by an affirmative than a negative; whereas, by all that is proper, each of these should have equal weight. But, on the contrary, in determining the truth of any axiom, the force of the negative has the greater influence.

Bacon’s contention might be seen as an adumbration of Popper’s claim – though Bacon’s contention is weaker than Popper’s – that the basis of belief in the truth of some statement about the world should depend on the possibility of refuting the statement – that is, of showing it to be false – and not directly on evidence which supports it.⁶ That is to say, a well-formulated proposition is to be believable until it has been refuted. The business of scientific enquiry is to set up hypotheses that are capable of refutation and then, if experiment does not refute them, to hold the hypotheses as credible only as long as they remain unrefuted. Hypotheses that are not capable of refutation are not well-formulated and are of no value unless or until methods are developed to make them refutable.

Note

- a. Diagoras, the atheist. Cicero tells the story (*De Natura Deorum*, III, 37); Cicero speaks of ‘tabulis pictis’, that is, pictures or portraits of those saved from shipwreck and Diagoras says simply ‘And where are those portrayed who were shipwrecked and perished at sea?’ Bacon is more specific; adding the ‘after they had called on the Gods’ which is, presumably, to be understood in Cicero’s tale.

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References

1. Bacon F and Kitchin GW. *Francisci Baconi de Verulamio, summi Angliae Cancellari, Novum Organum, sive Indicia Vera de Interpretatione Naturae* [Edited, with English notes and appendices by the Rev. G.W. Kitchin, Student and tutor of Christ Church, Oxford]. Oxford: E Typographico Academico, 1855.
2. Bacon F. *Franc. Baconis de Verulamio/Summi Angliae Cancellarii/Novum organum scientiarum*. Lugd. Bat. apud Adrianum Wiingaerde, et Franciscum Moiardum, 1645:45–46.
3. Spedding J, Ellis RL and Heath DD. *Francis Bacon: The Works*. Vol. VIII. Boston: Taggard and Thompson, 1963.
4. Bacon F. *The novum organum of Sir Francis Bacon, Baron of Verulam, Viscount St. Albans epitomiz’d, for a clearer understanding of his natural history translated and taken out of the Latine by M.D.* London: Thomas Lee, 1676:5.
5. Bacon F. *Francisci de Verulamio, Summi Angliae Cancellarii, Instauratio magna*. Vol. I. London: Bonham Norton and Ioannem Billium typographum regium, 1620, pp.60–61.
6. Magee B. *Karl Popper*. London: Fontana, 1975.