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Ockham's broom

October 17, 2009 @ 10:10 am · Filed by Mark Liberman under Humor

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Yesterday in the Journal of Biology, the editor introduced a new series (Miranda Robertson, "Ockham's broom"):

> Although it is increasingly difficult to gauge what people can be expected to know, it is probably safe to assume that most readers are familiar with Ockham's razor – roughly, the principle whereby gratuitous suppositions are shaved from the interpretation of facts – enunciated by a Franciscan monk, William of Ockham, in the fourteenth century. Ockham's broom is a somewhat more recent conceit, attributable to Sydney Brenner, and embodies the principle whereby inconvenient facts are swept under the carpet in the interests of a clear interpretation of a messy reality. (Or, some – possibly including Sydney Brenner – might say, in order to generate a publishable paper.)

Robertson points out that sweeping things under the rug is often a necessary condition for scientific progress:

> While Ockham's razor clearly has an established important and honourable place in the philosophy and practice of science, there is, despite its somewhat pejorative connotations, an honourable place for the broom as well. Biology, as many have pointed out, is untidy and accidental, and it is arguably unlikely that all the facts can be accounted for early in the investigation of any given biological phenomenon. For example, if only Charles Darwin had swept under the carpet the variation he faithfully recorded in the ratios of inherited traits in his primulas, as Mendel did with his peas, we might be talking of Darwinian inheritance and not Mendelian (see [3]). Clearly, though, it takes some special sophistication, or intuition, to judge what to ignore.

Her reference [3], by the way, is Jonathan C Howard, "Why didn't Darwin discover Mendel's laws?", J Biol 8:15, 2009. Howard argues that Darwin failed to discover the "laws" of (Mendelian) inheritance because he was unwilling to sweep under the rug the complexities that he observed in his genetic experiments — many of which involved, like most genetic phenomena, non-Mendelian inheritance. Meanwhile, it's worth noting that R.A. Fisher ("Has Mendel's work been rediscovered?" Ann. Sci. 1:115-137, 1936) made a detailed argument that Mendel's results must have been fraudulent (or, as Fisher quaintly put it, "are the product of some process of sophistication"), given how close they were to the expected values of the random process involved even in "mendelian" inheritance. Here's one of the summary tables from Fisher's argument:

TABLE IV.—*Measure of Deviation Expected and Observed in* 1863.

	Expectation.	χ^2 observed.
Trifactorial experiment	17	8·9374
Bifactorial experiment	8	2·8110
Gametic ratios	15	3·6730
Repeated 2 : 1 test	1	0·1250
Total	41	15·5464

The discrepancy is strongly significant, and so low a value could scarcely occur by chance once in 2000 trials. There can be no doubt that the data from the later years of the experiment have been biased strongly in the direction of agreement with expectation.

As Fisher explained, "Fictitious data can seldom survive a careful scrutiny, and, since most men underestimate the frequency of large deviations arising by chance, such data may be expected generally to agree more closely with expectation than genuine data would. "

Arthur Koestler (in *The Case of the Midwife Toad*, 1971) suggested that perhaps Mendel explained his theories to the monks who were tasked with carrying out the experiments, and they simply reported back the results they understood him to want, rather than actually carrying out the onerous task of hand-pollinating numerous plants according to a complicated schedule.

Sydney Brenner's comment, I've heard, was that Mendel "didn't invent the numbers, but he certainly knew when to stop counting". I haven't been able to find out where that quote comes from either, so perhaps it's from the same source as *Ockham's broom*.

Meanwhile, though I've failed to find either of those citations, reading through Brenner's old "Loose Ends" columns at Current Biology led me to some other gems, such as his innovative solutions to various problems of "Academic dynamics", including the *Pharaoh Configuration*:

> This is a scheme which offers a solution to the fundamental problem of all scientific departments, which is how to get rid of the old — both people and science — and create space and resources for the young and the new. Our elegant answer is to treat all scientists as Pharaohs; thus, when a senior scientist retires, he and all of his research associates, post-docs, students and technicians are sacrificed and buried in a specially constructed pyramid, together with all of their equipment to enable them to continue research in the after Life Sciences. At one blow, space would have been created for a new professor and a new group, without any arguments and with none of the rancour that usually accompanies such events.
>
> It is obvious that this needs to be carried out only once. Thereafter, all that would be required at the appropriate time is for two men to arrive, equipped with surveying equipment and tape measures. A new pyramid would be laid out in plain sight of the present occupants, who would instantly vacate the premises.

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28 Comments

1. **only asking said,**

   October 17, 2009 @ 10:39 am

   This is amusing, and I like the thrust, and I don't want to be a party-pooper … but I am puzzled by the definition of Occam's razor as "roughly, the principle whereby gratuitous suppositions are shaved from the interpretation of facts". I thought the Razor urged us to prefer the simpler explanation to the more complex. The more complex theory does not have to have "gratuitous suppositions", merely to be more complex. Or am I missing something?

2. **Suleiman Razumovsky said,**

   October 17, 2009 @ 11:44 am

   Certainly Ockham's broom operates as a daily practical heuristic for physicians, who must pluck a diagnosis out of a noisome olio of patient complaints. Of all the candidates, one must choose one based on its probability, incidence, and on one's ability to explain away the contradictions in the history. Sometimes, the diagnosis also wins out which is more treatable.

3. **John Lawler said,**

   October 17, 2009 @ 11:56 am

   It's been pretty widely discussed, and restated (even in Latin). Ockham's actual pronouncements are:

   Numquam ponenda est pluralitas sine necessitate.
   'Pluralities are never to be multiplied without necessity.'
   (*Super Quattuor Libros Sententiarum* (ed. Lugd., 1495), i, dist. 27, qu. 2, K)

   Frustra fit per plura quod potest fieri per pauciora.
   'It is pointless to do with more what can be done with less'
   (*Summa Totius Logicae*, i. 12)

4. **Tim Silverman said,**

   October 17, 2009 @ 1:10 pm

   @only asking: It's precisely the absence of gratuitous suppositions that make the simpler theory better. The alternative would be that the more complex theory involved *necessary* extra suppositions, i.e. that without the extra suppositions, the simpler theory is wrong. Obviously you don't, in general, want to reject a correct theory in favour of a wrong theory simply because the wrong theory is easier to understand—that is the way of the crackpot.

   Occam's broom tries to raise the issue of when you *do* want to accept a theory that is, strictly speaking, wrong: basically when the missing parts refine the basic picture rather than overthowing it completely; and often as a temporary measure before investigating the refinements more fully.

5. **John Cowan said,**

October 17, 2009 @ 2:52 pm

My father was a philosopher, but he was a lawyer too, and a lawyer's notion of "fact" is rather different from other people's (roughly speaking, a "fact" is anything both parties agree on before the trial other than the law itself). He used to outrage budding scientist me by saying that it was necessary to design one's data just as carefully as one's theory.

6. **Andrew said,**

October 17, 2009 @ 3:07 pm

Tim Silverman: I think to speak of *extra* suppositions in this context is a bit misleading; it suggests that the complex theory includes the same suppositions as the simpler one, and then extra ones as well; this would have the consequence that you could get from the complex theory to the simple one just by removing some of its suppositions, which is what Robertson's phrasing seems to imply. But while a complex theory will generally contain *more* suppositions than a simple one, it will also – unless it's very badly constructed – have a different structure from the simple one, so that within it each supposition does some work; you can't get a simpler theory just by leaving some out.

7. **Dan Lufkin said,**

October 17, 2009 @ 3:48 pm

A little Googling is a dangerous thing …

http://uk.geocities.com/frege@btinternet.com/latin/mythofockham.htm

I chanced on this while checking whether Einstein ever actually said, "A theory should be as simple as possible, but no simpler." Probably not.

Dan

8. **Yuval said,**

October 17, 2009 @ 4:11 pm

An etymological remark: the name "Ockham's razor" does not derive from "shaving off unnecessary explanations", but rather from Ockham's example: the assumption that the razor he sees every morning when he wakes up is in fact the same razor, and not a different one replaced by some invisible entity.

9. **Tim Silverman said,**

October 17, 2009 @ 4:30 pm

@Andrew: but in fact, when going about simplifying a theory, one does indeed try to dispose of useless suppositions with no observable consequences (or premises which whose removal doesn't alter the conclusion). It's not the only thing one does, but it's normal for the early forms of theories to contain extraneous stuff that turns out not to be necessary, even though at first it seemed to be. Also, people sometimes try to sneak their pet metaphysics into a theory, and it's normal to make the objection that it doesn't add anything observable and is therefore useless and should be removed.

If it's simply a contest between two different theories, one of which happens to be simpler, then the key decision depends on which best explains the data. That's a different issue.

10. **D.O. said,**

    October 17, 2009 @ 6:01 pm

    I am somewhat confused. Ockham's broom is defined as ignoring the inconvenient facts in developing theory. In Mendelean genetics that's supposed to be all other forms of inheritance except single allele traits. Inventing facts for the theory where it's supposed to work is a whole different thing. Cold fusion, anyone?

11. **empty said,**

    October 17, 2009 @ 8:26 pm

    Ockham's example: the assumption that the razor he sees every morning

    Do you have a source for that?

12. **roscivs said,**

    October 17, 2009 @ 11:45 pm

    Wikipedia claims that "The term "Ockham's razor" first appeared in 1852 in the works of Sir William Hamilton, 9th Baronet (1788–1856), centuries after Ockham's death". My guess is that the "razor he sees every morning" bit is a story told much later.

13. **J. Goard said,**

    October 18, 2009 @ 12:39 am

    Am I going to be the first to point out how much the history of linguistic nativism has involved sweeping away many factors which are *prima facie* relevant to language, then often using, as premises, the absence or insignificance of what has been ignored?

    Communicative function, frequency of exposure to words and constructions, domain-general capacities for schematization and analogy, memory and attention, theory of mind and intention-reading, evolutionary plausibility with respect to the language-relevant aspects of the human phenotype, evolutionary aspects of language change, details of stages in L1 acquisition…

14. **Layra said,**

    October 18, 2009 @ 2:49 am

    The interpretation of Ockham's razor that I've always heard is that with two theories that have the same explanatory power and match the data to the same accuracy, simpler becomes a matter of the existence of fewer distinct entities (hence the term "pluralities").
    Often the issue isn't that there are two theories, one of which is a version of the other with more suppositions, but rather that each theory is already in its minimal state, i.e. for each theory, all of its accompanying suppositions cannot be removed without reducing the accuracy of the theory, and the

suppositions are at least partially disjoint. Then removing suppositions from either theory leads in the wrong direction, and asking which theory has more suppositions isn't a well-defined question because there's no natural mapping between the sets of suppositions; that depends heavily on wording and what notions are grouped together as being a single "supposition".
Instead we count how many new (physical) entities each theory posits, both as postulates and as consequences; in this case the difference is usually some versus none, or many specific entities versus a few general entities.
Thus we cut out supernatural interference when natural causes can reproduce the same effect, we cut out the luminiferous aether when observational distortion alone will suffice, we unify theories and entities as much as possible, and a lot of people have issues with string theory, which proposes a lot of new entities whose existence has never been hinted at by data. Even though this may lead to theories which are inherently more difficult to explain, require more seemingly digressive abstraction or more convoluted worldviews, and hence to "more complicated" theories, this is the use of Ockham's razor that I've come across. At least in terms of trying to justify why Einstein's Relativity is simpler than Newtonian Mechanics despite the explanations of the framework being orders of magnitude longer.

15. **Kapitano said,**

    October 18, 2009 @ 4:23 am

    Was it JBS Haldane who said "A little inaccuracy saves a ton of explanation"?

    By analogy, a little pruning of statistical outliers saves a dozen auxiliary ad-hoc hypotheses.

16. **Kapitano said,**

    October 18, 2009 @ 4:24 am

    There's another quote usually attributed to Einstein: "Make your explanations as simple as possible, but no simpler".

17. **Jay Lake: [links] Link salad's dam breaks open many years too soon said,**

    October 18, 2009 @ 9:40 am

    […] Ockham's Broom — When a razor just isn't enough. […]

18. **Dave2 said,**

    October 18, 2009 @ 3:55 pm

    empty, roscivs:

    I think Yuval was simply making an extremely dry joke. Nobody could possibly believe that "Ockham's razor" comes from a razor example.

19. **N said,**

    October 18, 2009 @ 4:15 pm

I must agree with J. Goard. It seems that one needs to appropriately use both tools when approaching a problem. We should not discount evidence (using our broom) that could help us arrive at a solution. And likewise we should not assign weights to different pieces of evidence in an ad hoc and self-serving manner.

20. **arc said,**

    October 18, 2009 @ 8:02 pm

    As it happens, I've been trying to get a variant of 'Ockham's Razor' into the language myself now for some time, without much success. Perhaps you guys can help me – anyone friends with the OED crowd? I'd very much like my own Word Induction Ceremony.

    The phrase is 'von Daniken's Bludgeon', and in contraposition to the Razor (as it is normally understood), which is the principle by which we reject complex theories in favour of simple ones, the Bludgeon is the principle by which we reject simple and conservative theories in favour of complex, otiose, and fanciful ones. For example, how could such primitive, unchristian people as the Egyptians move such massive, massive blocks of stone? von Daniken's Bludgeon enjoins us to ignore such unhelpful suggestions as inventive use of pulleys and earthworks in favour of the much more interesting notion of alien intervention.

21. **dr pepper said,**

    October 18, 2009 @ 9:54 pm

    Velikovsky got there long before Daniken.

    There was a bronze age sundial that was determined to be made for a different latitude from where the archaeologists found it. Velikovsky rejected the explanation that the sundial had been moved in favor of the idea that a planetary flyby had caused and earthquake which moved the city.

22. **Richard Howland-Bolton said,**

    October 19, 2009 @ 9:10 am

    @ Dave2
    "making an extremely dry joke" surely this can't be right.
    It couldn't apply to Occam since electric razors weren't even invented till the 1920s.

23. **Name said,**

    October 19, 2009 @ 1:42 pm

    talk about being caught between Scylla and Charybdis!

24. **Scriptor Ignotior said,**

    October 19, 2009 @ 8:42 pm

    John Lawler:

> Numquam ponenda est pluralitas sine necessitate.
> 'Pluralities are never to be multiplied without necessity.'

Not quite. *Pluralitas* is singular. Just one plurality is necessary here, as Ockham would be the first to point out :). And *ponenda* is a gerundive (feminine singular, in accord with *pluralitas*) of *ponere* meaning "to put, to propose", not "to multiply". So:

> [A] plurality is never to be proposed without necessity.

And while I nitpick:

> Frustra fit per plura quod potest fieri per pauciora.
> 'It is pointless to do with more what can be done with less.'

This is one case in which it is valuable to preserve a traditional distinction between *fewer* (for countables) and *less* (for uncountables only). *Plura* and *pauciora* here have to do with "a greater number" and "a smaller number". So:

> It is pointless to do with more what can be done with fewer.

This matters because Ockham is concerned with multiplication of distinct *explanantia* (the entities or postulates used in explaining the *explananda*), not with increasing the quantity or complexity of some single *explanans* (or some single "body of explanans", if *explanans* is taken as a mass noun). Perhaps all this is worth noting, because these Ockhamist principles (of whatever exact provenance) are as notoriously misquoted as they are misunderstood. Another early and respectable formulation, differing slightly in its theoretical import, is this:

> Frustra fit per plura quod potest fieri **per unum**.

See sources here.

25. **outeast said,**

October 20, 2009 @ 8:09 am

I don't think it's especially rewarding to look to what William himself meant by the razor, since the basic principle predates him and the concept itself has been refined much since his death. Referring to 'simpler' and 'more complex' arguments is not a good shorthand, though – 'God Did It' is a bloody simple explanation for almost anything, for example, but is not preferred by the razor.

In any case, it's good to remember it's only a rule of thumb for assessing the relative potential worth of competing hypotheses, not a law. Likewise, the broom defined here is a potentially useful way of narrowing a dataset to something that can be used to develop a good hypothesis, not a justification for cherry picking.

26. **Anon said,**

October 20, 2009 @ 5:07 pm

'God Did It' is a bloody simple explanation for almost anything, for example, but is not preferred by the razor.

That's because it isn't a simple explanation. The assumption that an all-powerful, all-knowing eternal being exists and cared enough to do X is fairly complex if you ask me.

I would think that the facts concerning god (or any other force) would have to factor in the inherent complexities contained within but not explicitly mentioned by the explanation.

27. **Atheism: A belief? - Page 78 - Religious Education Forum said,**

    March 18, 2011 @ 12:16 pm

    […] just interested in picking and choosing the facts that support your position and ignoring the rest. Occam's Broom, basically. […]

28. **Every living entity comes from another living entity - Page 3 - Religious Education Forum said,**

    July 18, 2011 @ 9:28 am

    […] supports just as much the principle that life comes from things that are born. You're engaging in Ockham's Broom: you're picking and choosing the pieces of evidence that suit your preconceived hypothesis, while […]

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