

# Hume, Miracles, and Probabilities: Meeting Earman's Challenge

Peter Millican, University of Leeds

## (a) *Earman's challenge*

John Earman abuses Hume's argument against the credibility of miracle reports in *Enquiry X* as being virtually worthless:

- 'a confection of rhetoric and *schein Geld*' (2000: 73)
- 'tame and derivative [and] something of a muddle' (2002: 93)
- 'a shambles from which little emerges intact, save for posturing and pompous solemnity' (2002: 108)

Earman's discussions focus on Hume's famous 'maxim':

The plain consequence is (and it is a general maxim worthy of our attention), 'That no testimony is sufficient to establish a miracle, unless the testimony be of such a kind, that its falsehood would be more miraculous, than the fact, which it endeavours to establish: And even in that case, there is a mutual destruction of arguments, and the superior only gives us an assurance suitable to that degree of force, which remains, after deducting the inferior.' (*E* 10.13, 115-6)

According to Earman:

- The first half of Hume's maxim is merely trivial and tautological (2000: 41; 2002: 97)
- The second half of the maxim is 'nonsensical', involving 'an illicit double counting' of the inductive evidence against any miracle (2000: 43).

The subsequent discussion in Earman's book culminates with a forthright challenge:

Commentators who wish to credit Hume with some deep insight must point to some thesis which is both philosophically interesting and which Hume has made plausible. I don't think that they will succeed. Hume has generated the illusion of deep insight by sliding back and forth between various theses, no one of which avoids both the Scylla of banality and the Charybdis of implausibility or outright falsehood. (2000: 48)

My main aim here is to answer this challenge, by demonstrating a far preferable interpretation of Hume's maxim.

## **(b) Rival interpretations of Hume's maxim**

Here are the three most significant interpretations of (the first half of) Hume's maxim to have been canvassed in the literature over the last decade or so:

$$(1) \quad \Pr(M/t(M)) > 0.5 \rightarrow \Pr(M) > \Pr(\neg M \ \& \ t(M)).^1$$

$$(3) \quad \Pr(M/t(M)) > 0.5 \rightarrow \Pr(M) > \Pr(\neg M/t(M)).^2$$

$$(5) \quad \Pr(M/t(M)) > 0.5 \rightarrow \Pr(M/t(M)) > \Pr(\neg M/t(M)).^3$$

$\Pr(X/Y)$	conditional probability of X given Y
M	the miracle in question occurs
t(M)	appropriate testimony is forthcoming

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<sup>1</sup> Sobel (1991): 232; Gilles (1991): 255; Howson (2000): 242.

<sup>2</sup> Price (1768: 163) is best interpreted like this, according to Earman (2000: 39).

<sup>3</sup> Millican (1993): 490; Earman (1993): 294; Earman (2000): 41; Earman (2002): 97.

*no testimony is sufficient to establish a miracle, unless ...*

introduces a necessary condition for the posterior probability of M, given the testimony t(M), to be greater than 0.5:

$$\Pr(M/t(M)) > 0.5 \rightarrow$$

*... the testimony be of such a kind, that its falsehood would be more miraculous, than the fact, which it endeavours to establish.*

So the miracle would be more probable (i.e. less miraculous) than the falsehood of the testimony:

$$(1) \quad \Pr(M) > \Pr(\neg M \ \& \ t(M)).^4$$

$$(3) \quad \Pr(M) > \Pr(\neg M/t(M)).^5$$

$$(5) \quad \Pr(M/t(M)) > \Pr(\neg M/t(M)).^6$$

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<sup>4</sup> There's a syntactic implausibility here, because in Part i Hume shows no interest in the probability of the testimony's *being presented* – i.e. t(M). See also 'Psychic Sam' below.

<sup>5</sup> (3) sets a threshold for the *initial* probability of M, *before* the testimony is given, which ought to be applied to the *posterior* probability. See the aleph particle detector example.

<sup>6</sup> For objections to (5), see §d below.

**(c) Hume's maxim aims to give a necessary and sufficient condition for credibility**

no testimony is sufficient to establish a miracle, unless the testimony be of such a kind, that its falsehood would be more miraculous, than the fact, which it endeavours to establish: And even in that case ... the superior only gives us an assurance suitable to that degree of force, which remains, after deducting the inferior. ... I weigh the one miracle against the other ... and always reject the greater miracle. If the falsehood of his testimony would be more miraculous, than the event which he relates; then, and not till then, can he pretend to command my belief or opinion. (E 10.13, 116)

So if some testimony does indeed meet Hume's condition – i.e. is such that its falsehood would be more miraculous than the event reported – then that testimony does give assurance, the 'greater miracle' (i.e. the falsehood of the testimony) is to be rejected, and the testifier can aspire to 'command [his] belief'.

*We'll now see examples showing that if Hume does mean either (1) or (3), then his maxim does not give the correct condition.*

## Psychic Sam

Consider the entirely bogus but wealthy ‘Psychic Sam’, who in order to further his reputation adopts a policy of regularly taking out advertisements in a wide range of weekly newspapers, each of which purports to predict the result of a local weekly lottery (the idea being that Sam’s many failures will be overlooked as long as the advertisements are suitably discreet, whereas a single success could be publicized to make his name). Suppose now that I am the last person to buy a ticket before the Little Puddleton lottery, and receive number 3247, although 9999 tickets were originally available. In this case it may well be more likely that I will win the lottery (1 in 3247) than it is that Sam will have predicted my success (say, 1 in 9999), but this clearly does nothing whatever to add credibility to his testimony.

However according to interpretation (1), Sam’s testimony satisfies Hume’s criterion for credibility:

$$(1) \quad \Pr(M) > \Pr(\neg M \ \& \ t(M)).$$

Here the left-hand side of the inequality is  $1/3247$ , but the right-hand side is  $3246/3247 \times 1/9999$ , which is obviously far smaller.

## Aleph particle detector

Imagine that I am conducting an experiment on some type of sub-atomic particle – let's call them 'aleph' ( $\aleph$ ) particles – created by nuclear collisions. Whenever a relevant collision takes place, various particles result, and let us suppose that 1% of these collisions will yield an  $\aleph$  particle (event 'M'). My detector is highly reliable, but not infallible: if an  $\aleph$  particle is present, it will be registered with 99.9% probability, but 0.1% of those collisions that do not create an  $\aleph$  particle will also register on the detector (hence both 'false negatives' and 'false positives' have an identical probability of 0.1%). Now suppose that on the next collision, my detector gives a positive result (testimony 't(M)') – should I believe it?

The initial probabilities of a positive result are:

$$\text{True positive: } \Pr(M \ \& \ t(M)) = 1\% \times 99.9\% = 0.999\%$$

$$\text{False positive: } \Pr(\neg M \ \& \ t(M)) = 99\% \times 0.1\% = 0.099\%$$

A positive result is around 10 times more likely to be true than false, hence  $\Pr(M/t(M))$  and  $\Pr(\neg M/t(M))$  work out as around 91% and 9% respectively. So the 'testimony' of my detector is eminently credible, but according to (3) it shouldn't be:

$$(3) \quad \Pr(M) > \Pr(\neg M/t(M)) \quad [\textit{here } 1\% > 9\%]$$

## **(d) Objections to Earman's interpretation**

$$(5) \Pr(M/t(M)) > 0.5 \rightarrow \Pr(M/t(M)) > \Pr(\neg M/t(M))$$

Earman focuses only on the last two of the points below, presenting them as his main objections *to Hume*. But they can instead be seen as an objections *to his interpretation of Hume*, if there is reason to doubt that the first half of Hume's maxim is really as trivial as Earman claims (cf. the example in §e below), and if sense can be made of its second half (cf. §i ff. below).

- 'Pr(M/t(M))' seems a slightly strained reading of 'the fact, which [the testimony] endeavours to establish'
- 'more miraculous' suggests a comparison between tiny probabilities, but one of Pr(M/t(M)) and Pr(¬M/t(M)) must be at least 0.5
- (5) doesn't fit with the way in which Hume's text identifies and distinguishes the factors that are to be weighed against each other within his maxim (see §f below)
- (5) is trivial: the negation principle implies immediately that  $\Pr(M/t(M)) + \Pr(\neg M/t(M)) = 1$ , and so 'Pr(M/t(M)) > 0.5' is tautologically equivalent to 'Pr(M/t(M)) > Pr(¬M/t(M))'
- The maxim tests Pr(M/t(M)) in its first half, i.e. (5), then absurdly 'double counts' by changing this value in its second half (see §i)

**(e) A diagnostic test ‘... of such a kind ...’**

Suppose that I develop a test to diagnose a debilitating genetic condition which suddenly manifests itself in middle age, but which fortunately afflicts only one person in a million. The test is fairly reliable, in that no matter who is tested, and whether they actually have the disease or not, the chance that the test will give a correct diagnosis is 99.9%, and an incorrect diagnosis only 0.1%. Fred, a hypochondriac, anxious because of his approaching fortieth birthday, comes to my clinic for a test, which much to his horror proves positive. On the basis of this information, is it probable that Fred has the disease?

To put his mind at ease, Fred might ask himself: *‘Is the test of such a kind, that its falsehood would be more surprising, than the disease, which it indicates?’*

In fact the falsehood of the test would be much *less* surprising than it would be for Fred to have the disease. Hence if we calculate the probabilities of a true-positive and of a false-positive result, we find that the latter is far greater (by a factor of 1001, so Fred’s probability of illness is only 1 in 1002):<sup>7</sup>

$$\text{True positive:} \quad \frac{1}{1,000,000} \times \frac{999}{1,000} = \frac{999}{1,000,000,000}$$

$$\text{False positive:} \quad \frac{999,999}{1,000,000} \times \frac{1}{1,000} = \frac{999,999}{1,000,000,000}$$

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<sup>7</sup> Imagine the test being performed on a billion people, one thousand of whom have the disease. We’d expect 999 true positives, and 999,999 false positives (1001 times as many).

Note that the question Fred should ask himself here:

Is the test *of such a kind*, that its falsehood would be more surprising, than the disease, which it indicates?

is *not* the same as the question implied by interpretation (5) of Hume's maxim:

In the light of the test's (positive) result on this particular occasion, would that result's falsehood (i.e. absence of the disease in my particular case) be more surprising than its truth (i.e. the disease's presence)?

Clearly *this* question is merely a rephrasing of Fred's anxious concern – it gives no basis for helping him to assess the relevant risks, and hence can give no comfort to him.

The diagnosis example therefore suggests that there could indeed be a viable non-trivial interpretation of Hume's maxim, in which it is the relative probabilities of the *type* of event, and *type* of testimony, that need to be weighed against each other (rather than those of a particular *token* event and a particular *token* item of testimony). But it remains to be seen whether such an interpretation would be faithful to Hume's text.

## **(f) What is to be weighed in Hume's maxim?**

Let's briefly review how Hume gets to his maxim. He starts from the fundamental claim that testimonial evidence is essentially inductive:

'our assurance in any argument of this kind is derived from no other principle than our observation of the veracity of human testimony, and of the usual conformity of facts to the reports of witnesses' (E 10.5, 111).

He then refines this claim, to take into account how the experienced conformity of facts to testimony has been found to vary according to the nature of the testimony:

There are a number of circumstances to be taken into consideration in all judgments of this kind ... The contrariety of evidence ... may be derived ... from the opposition of contrary testimony; from the character or number of the witnesses; from the manner of their delivering their testimony; or from the union of all these circumstances. ... There are many other particulars of the same kind, which may diminish or destroy the force of any argument, derived from human testimony. (E 10.6-7, 112-3)

It's within this context that Hume turns his attention, in the very next sentence, towards the topic of the miraculous:

Suppose, for instance, that the fact, which the testimony endeavours to establish, partakes of the extraordinary and the marvellous; in that case, the evidence, resulting from the testimony, admits of a diminution, greater or less, in proportion as the fact is more less unusual. (E 10.8, 113)

Here *the unusualness of the reported event* is identified as one additional factor that bears on the credibility of testimonial reports. But Hume then immediately isolates this particular factor, and views it as balanced *on the other side of the scale* against the characteristics of the testimony that incline us to believe it, resulting in ‘a counterpoise, and mutual destruction of belief and authority’ (E 10.8, 113). The extreme case, leading on directly to Hume’s maxim, is where the event

is really miraculous; and ... *the testimony, considered apart and in itself*, amounts to an entire proof; in that case, there is proof against proof, of which the strongest must prevail, but still with a diminution of its force, in proportion to that of its antagonist. (E 10.11, 114)

So we see that in Hume’s maxim, ‘testimony ... of such a kind’ is to be understood as characterising *the testimony, considered apart and in itself*, involving such things as ‘the character or number of the witnesses’ and ‘the manner of their delivering their testimony’, but *not* the unusualness of the reported event.

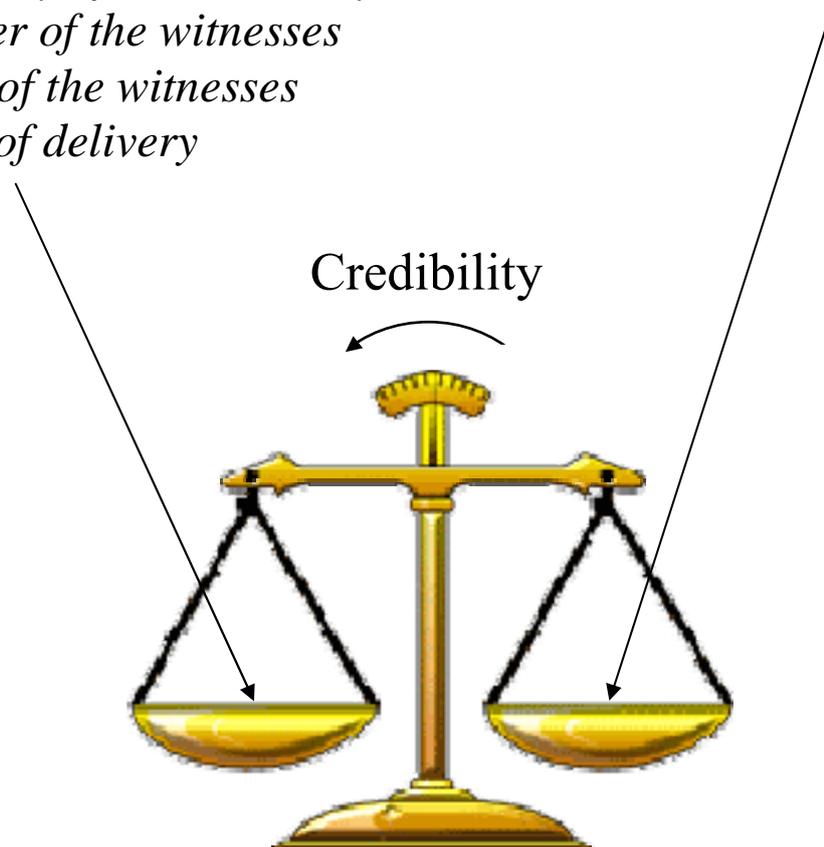
We can visualise Hume's 'counterpoise' in the case of such a 'proof against proof' as involving something like this:

**In favour of the testimony**

*Consistency of the testimony*  
*Character of the witnesses*  
*Number of the witnesses*  
*Manner of delivery*

**Against the testimony**

*Unusualness of the event*



The **overall** credibility depends on this weighing up between the miraculousness of the testimony's falsehood considered apart and in itself (left-hand tray) and the miraculousness of the fact which it endeavours to establish (right-hand tray). So neither of these two factors – contra (5) – can correctly be represented as an **overall** probability measure like  $Pr(M/t(M))$  or  $Pr(\neg M/t(M))$ .

## **(g) A ‘type’ interpretation of Hume’s maxim**

Hume’s idea seems to be that different ‘kinds’ of testimony (specified in terms of the character and number of the witnesses, the manner of delivery etc.) carry a different typical probability of truth and falsehood *independently of the event reported*. Call this *the Independence Assumption*.

Suppose we focus on a particular kind of testimony – whose probability of falsehood is  $f$  – which either asserts, or denies, the occurrence of a particular kind of event – whose probability of occurrence is  $m$ . If event and truth of testimony are probabilistically independent, we have the following situation:

	<b>Testimony true</b> (probability $1-f$ )	<b>Testimony false</b> (probability $f$ )
<b>Event occurs</b> (probability $m$ )	<i>witness asserts E occurred</i> probability $m(1-f)$	<i>witness denies E occurred</i> probability $mf$
<b>Event does not occur</b> (probability $1-m$ )	<i>witness denies E occurred</i> probability $(1-m)(1-f)$	<i>witness asserts E occurred</i> probability $f(1-m)$

Of the four possibilities, two (those shown unshaded) yield positive testimony to the event, namely when either:

(T) The event occurs and is truly reported

initial probability:  $m(1-f)$

(F) The event does not occur but is falsely reported as occurring

initial probability:  $f(1-m)$

When positive testimony has been given, this works out as more likely than not [if and] only if a ‘false positive’ (F) is less likely than a ‘true positive’ (T), hence in accordance with the formula:

$$\Pr(M/t(M)) > 0.5 \rightarrow f(1-m) < m(1-f)$$

which simplifies to:

$$\Pr(M/t(M)) > 0.5 \rightarrow f < m$$

‘ $f < m$ ’ says that *the falsehood of the testimony, considered apart and in itself* is more miraculous (i.e. less probable) than *the event reported, considered independently of the testimony*. So this formula corresponds precisely (or as closely as any such mathematical formula ever could) to the words of Hume’s maxim!

But is this plausible, when Hume's route to his maxim doesn't involve any such mathematics? He starts from the idea of opposing evidences whose force is derived from their inductive consistency. With a miracle report, we have a conflict between the evidence of testimony (presumed to have a consistent correlation with truth) and the evidence of nature (whose consistency tells in the opposite direction, against the miracle):

	<b>Testimony is true</b>	<b>Testimony is false</b>
<b>Nature is 'false'</b>	<i>E occurred</i>	
<b>Nature is 'true'</b>		<i>E did not occur</i>

Hume reduces the issue to a trial of strength between the inductive evidence for the testimony and the inductive evidence for the relevant 'law of nature'. The correspondence between the diagrams shows that our formula conforms exactly to this model, and so *can* plausibly claim to be a faithful formal elaboration of Hume's maxim, rather than an anachronistic distortion.

## ***(h) Is the Independence Assumption viable?***

Suppose that a testifier ‘remembers’ 297 as being the winning number in a lottery, and reports:

*The winning number was 297*

*The winning number was not 374*

Faulty memory will inevitably lead to falsehood in the former case, but not the latter. So here a ‘positive’ claim is less probable than a ‘negative’ claim – independence fails, because the testimony’s probability depends on the report’s content.

Lottery examples have been used against Hume at least since Price (1768), but Hume’s opponents have themselves appealed to the idea of independence – arguing that testimony of certain kinds can be assigned a characteristic probability independently of the event reported, and should therefore be taken equally seriously in miraculous as in other cases (e.g. Price (1768), pp. 163-6; for discussion see Owen (1987) §IV). Moreover Hume shows in Part ii that he is *not* in fact a believer in such independence: he thinks the probability of false testimony (e.g. resulting from wishful thinking or motivated deceit) is vastly increased when the reported event is a religious miracle.

Bearing all this in mind, Hume's strategy for arguing against the credibility of miracle reports seems to be something like this:

1. Suppose that the Independence Assumption is correct – then the Part i argument shows that a miracle report can be credible only subject to Hume's maxim.
2. But now the Part ii arguments are brought in to maintain that the Independence Assumption is, if anything, too generous to the believer – so the maxim gives only an ideal 'best case' for the theist, and in practice miracles cannot achieve even the modest level of credibility that the maxim allows.

Whether this argument strategy is convincing can be debated, but at least *where the Independence Assumption is valid, Hume's maxim, as interpreted here, is both non-trivial and correct.*<sup>8</sup>

For the aleph particle detector the probabilities  $f$  and  $m$  are 1/1000 and 1/100 respectively, and for the diagnostic test they are 1/1000 and 1/1000000; in both cases Hume's maxim gives exactly the right criterion for credibility (i.e. ' $f < m$ ').

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<sup>8</sup> It avoids not only the 'semantic' objections – being both non-trivial and correct (as a necessary *and* sufficient condition) – but also the 'syntactic' objections listed in §d, because it matches so neatly with both the words of the maxim and the surrounding textual context.

## **(i) *The accusation of double counting***

Earman's 'double counting' accusation is as follows:

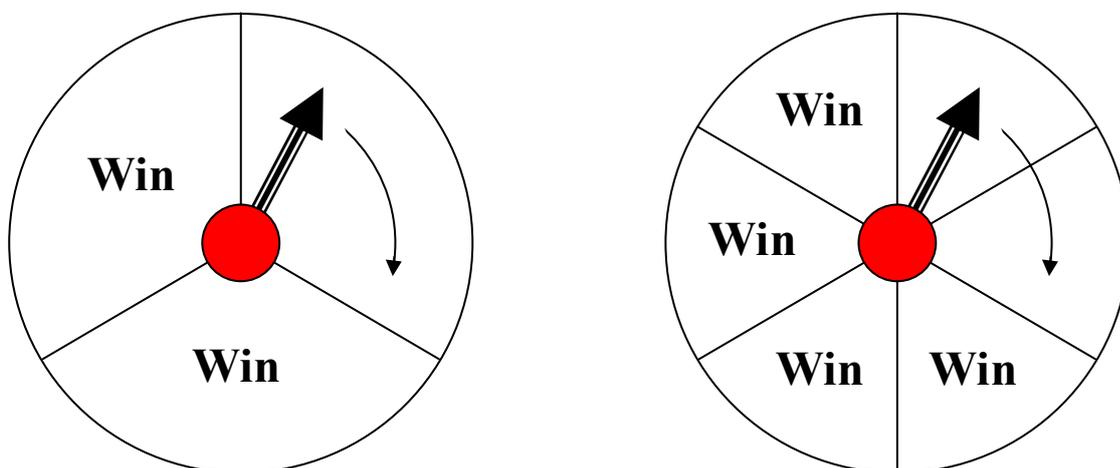
the second half of the Maxim appears to be nonsensical. Recall that it says that '*even in that case* there is a mutual destruction of arguments, and the superior only gives an assurance suitable to the degree of force, which remains, after deducting the inferior'. The italicised phrase suggests that even when the testimony is of such a kind that its falsehood would be more miraculous than the fact which it endeavours to establish there is still a *further* destruction of arguments. Such talk appears to involve an illicit double counting: the weighing up of the countervailing factors ... has already been done, and if the result is that  $\Pr(M/t(M)) > 0.5$ , then that's the way it is, and no further subtraction is called for. (2000: 43)

This accusation misfires against the above interpretation of the maxim, which doesn't involve any calculation of the overall conditional probability  $\Pr(M/t(M))$ , but only a comparison between  $f$  and  $m$ . And where the event reported is in itself highly improbable, Hume is obviously quite right to claim that this overall conditional probability will be diminished relative to  $(1-f)$ , which is *the probability of the testimony, considered apart and in itself*. But can he also be right to describe this diminution of probability as a 'deduction' or arithmetical subtraction?

## (j) **Subtracting Humean probabilities**

First a caveat. Even in his writings on ‘probability’, Hume was not developing a mathematical theory of chance, but was mainly concerned (especially in the *Treatise*) to explain the psychological mechanism whereby we acquire expectations or tentative beliefs of various imperfect degrees of certainty. So the working out of a Humean theory of mathematical degrees of probability must involve some extrapolation beyond what he literally stated.

When Hume talks of subtracting probabilities (e.g. T138, E111, E116, E127), does he mean that evidential force is to be assessed purely by subtracting the number of negative instances from the number of positive instances (so a balance of 3:1 or 4:2 in favour gives twice the evidential force of a 2:1 or 3:2 balance)? If so, his view is incoherent, because a 2:1 balance ought to come out identical to a 4:2 balance, as shown by these random spinners:

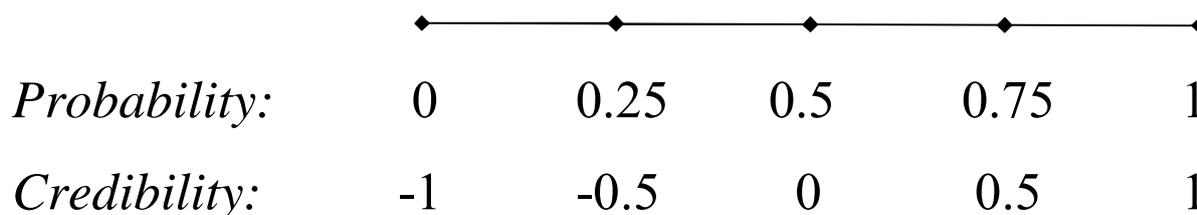


Fortunately Hume's theory is not so simplistic, for he talks of proportionality far more than of subtraction. And in the *Treatise* section on 'the probability of chances' (I iii 11), he elaborates a theory of probability involving a strictly proportionate division of the inductive impulse (induction here being the source of the mind's expectation that the die will land with some face up):

we shall suppose a person to take a dye, [such that] four of its sides are mark'd with one figure ... and two with another; and ... throwing it ... When [the mind] considers the dye as no longer suspended ..., it ... naturally places it on the table, and views it as turning up one of its sides. ... yet there is nothing to fix the particular side, but that this is determin'd entirely by chance ... [which leaves] the mind in a perfect indifference [and] directs us to the whole six sides after such a manner as to divide its force equally among them. ... The determination of the thought is common to all; but no more of its force falls to the share of any one, than what is suitable to its proportion by the rest. 'Tis after this manner the original impulse, and consequently the vivacity of thought, arising from the causes, is divided and split in pieces ... 'Tis evident that where several sides have the same figure inscrib'd on them ... the impulses belonging to all these sides must re-unite in that one figure, and become stronger and more forcible by the union. ... The vivacity of the idea is always proportionate to the degrees of the impulse ... and belief is the same with the vivacity of the idea ... (T127-30)

If subtraction takes place after the proportional division has been applied, then a 2:1 balance of instances will yield a ‘credibility’ of  $2/3 - 1/3 = 1/3$ , while a 4:2 balance will yield  $4/6 - 2/6 = 1/3$ , correctly giving the same result. In general, with  $p$  positive and  $n$  negative instances, the result will be  $(p - n) / (p + n)$ .

What results is a consistent theory of ‘credibilities’ ranging from  $-1$  to  $1$  ( $-1$  being where all instances are negative), mapping onto conventional probabilities as follows:



So if, as a final example, we apply this calculus to an induction from inconsistent experience where the balance of observed positive to negative instances is 3:1, we will derive a ‘credibility’ value of  $(3-1)/(3+1) = 0.5$ , equivalent to a probability of 0.75, just as we would expect on the basis of the traditional ‘straight rule’, which indeed seems the appropriate answer if the balance of past instances is all that we have to go on.

## **(k) ‘Subtraction’ and miracles**

Where the falsehood of the testimony is more miraculous than the event reported, ‘there is a mutual destruction of arguments, and the superior only gives us an assurance suitable to that degree of force, which remains, after deducting the inferior’. Suppose an event M is reported of a type that can be expected to occur only 3 times in 1000, while the testimony is of a kind that can be expected to be false only 1 time in 1000. So *something* improbable has come about,<sup>9</sup> and on Hume’s principle the two improbabilities have to be weighed against each other, using the same kind of ‘subtraction’ as he advocates for standard probabilities. So we must treat this case in the same way as our simple induction based on 3:1 inconsistent experience, yielding a ‘credibility’ value of  $(0.003 - 0.001) / (0.003 + 0.001) = 0.5$ , equivalent again to a probability of 0.75. But the question arises: is Hume right to handle testimony for unusual events using the very same procedure that he uses for straight rule induction?

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<sup>9</sup> Not *very* improbable, to be sure, but the moral stays the same (though the decimal numbers get much harder to read, and the example becomes far less plausible in terms of the supposed achievable strength of human testimony) if 1000 is replaced by a trillion or whatever.

Compare this probability of 0.75 with a Bayesian calculation using these formulae from §g (where  $m = 0.003$  and  $f = 0.001$ ):

$$(T) \quad \Pr (M \ \& \ t(M)) \quad = \quad m(1-f) \quad \textit{true positive}$$

$$(F) \quad \Pr (-M \ \& \ t(M)) \quad = \quad f(1-m) \quad \textit{false positive}$$

Conditionalising on positive testimony having been given:

$$\begin{aligned} \Pr(M/t(M)) &= \frac{'T'}{'T'+'F'} = \frac{m(1-f)}{m(1-f) + f(1-m)} = \frac{0.003 \times 0.999}{0.003 \times 0.999 + 0.001 \times 0.997} \\ &= \frac{0.002997}{0.003994} = \underline{\underline{0.750375\dots}} \end{aligned}$$

The closeness of the two results is no coincidence.<sup>10</sup> For Hume's simple 'subtraction' rule, as described above, will always give a close approximation to the result of the Bayesian calculation *as long as  $m$  and  $f$  are sufficiently small*. In the case of a miracle, of course,  $m$  is certain to be extremely small, and Hume's maxim only sanctions the use of his 'subtraction' rule for the case of miracles where  $f$  is even smaller. So the second half of his maxim turns out to be a useful approximation for calculating the actual probability that underlies the maxim's first half!

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<sup>10</sup> Nor is it counter-intuitive. Hume could have got to his result by thinking of this situation as being rather like a lottery of 1000 tickets in which I've bought 3 blue and 1 white tickets, and discover I've won – what then is the probability that I won with a *blue* ticket?

# ***Postscript: other Earman objections to Hume***

## **Hume on inductive reasoning**

According to Earman, Hume's argument 'reveals the impoverishment of his treatment of inductive reasoning' (2000, Preface). Earman seems to think that Hume's conception of inductive reasoning starts and ends with simple enumerative induction by the (admittedly crude) 'straight rule'. Certainly Hume's *psychology* of probability takes off from this point, but his principles of probable inference do not by any means end there, as can be seen for example from his treatment of:

- analogical reasoning
- general rules, 'methodizing and correcting'
- hidden causes and the search for underlying laws
- proportional inference (e.g. in the Design Argument)
- rules by which to judge of causes and effects
- unphilosophical probability

See for example Garrett (1997), Millican (2002a) pp. 60-3, (2002b) pp. 162-6, and (2002c) pp. 437-40.

## Independent multiple witnesses

Earman makes a great deal of the issue of independent *multiple witnesses*, as a potential counterexample to Hume based on various technical results (2000, pp. 53-61; 2002, pp. 100-102). However most of his discussion seems to ignore entirely the epistemological dimension of how one could possibly *know* that the multiple witnesses in question are genuinely independent. What little he says on this seems extremely naïve:

‘there seems to be no in-principle difficulty in arranging the circumstances so as to secure the independence condition’ (2002, p. 102, cf. 2000, p. 60).

It’s obscure what ‘in-principle’ amounts to here, but it needn’t be of any concern to Hume if it requires freakish combinations of circumstances, or supernatural interventions, which would themselves be ‘miraculously’ improbable. The idea of ‘arranging’ circumstances is also somewhat inappropriate in the case of Humean miracles which are contrary to natural law (and thus wouldn’t include repeatable lawlike faith-healings, for example, even if these were to occur); the phrase also glosses over the gap between such circumstances’ *actually* obtaining, and their being *known* (or reasonably believed) to obtain.

In stark contrast to Earman's naivety, Hume had an intimate acquaintance with man's fondness both for the miraculous and for fraudulent sensationalism (Bede, with his miracle-filled stories of Germanus, Oswald, Aidan, Cuthbert etc., was one of the principal sources for the *History of England*; and Hume played a significant part in the Ossian controversy). He also gave, in his *Natural History of Religion*, a systematic account of how the impulse to religious credulity is an intrinsic element of human nature.

Given this background setting of the 'prior probabilities', it is not nearly as easy as Earman implies even to imagine (let alone to find in reality) a plausible scenario in which it is more rational to believe the supposedly independent multiple witnesses to an alleged one-off miraculous occurrence, than it is to doubt their genuine independence. This sort of point is particularly forceful when applied to the area of Hume's main concern: the miracle stories associated with an established religious tradition, and where we have access only to the 'testimony' preserved within the literature of that same tradition.

## Hume's originality

Earman's dismissal of Hume's originality seems to be based largely on an article by David Wootton (1990: 223, 226-7), who saw Hume's contribution as residing precisely in his maxim. If the maxim is trivial, Hume's contribution is nullified.

However the maxim is *not* trivial, as we've seen, so Earman's attack on Hume's originality fails along with his analysis of the maxim. But we can also go further. Hume was original in:

- His emphasis on the general principle that the evidence of testimony is itself founded on experience, and is thus ultimately *of the same species* as the evidence for the regularities that any miraculous testimony contradicts. (I think this point, which turns the issue into a simple trial of strength, underlies the parallel that Hume sees with Tillotson's argument against transubstantiation).
- The Bayesian thrust of his arguments, in emphasizing the importance of prior probabilities (in the case of miracles) but also 'likelihoods' (e.g. in the *Dialogues*). Given Earman's praise of Price, his dismissal of Hume's view of induction, and his advocacy of Bayesian methods, it is ironic that Hume is far more Bayesian than Price! (Also, it is historically plausible that Hume's *Enquiry* was what gave Bayes the impetus to develop his famous theorem.)

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