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21L.017 The Art of the Probable: Literature and Probability  
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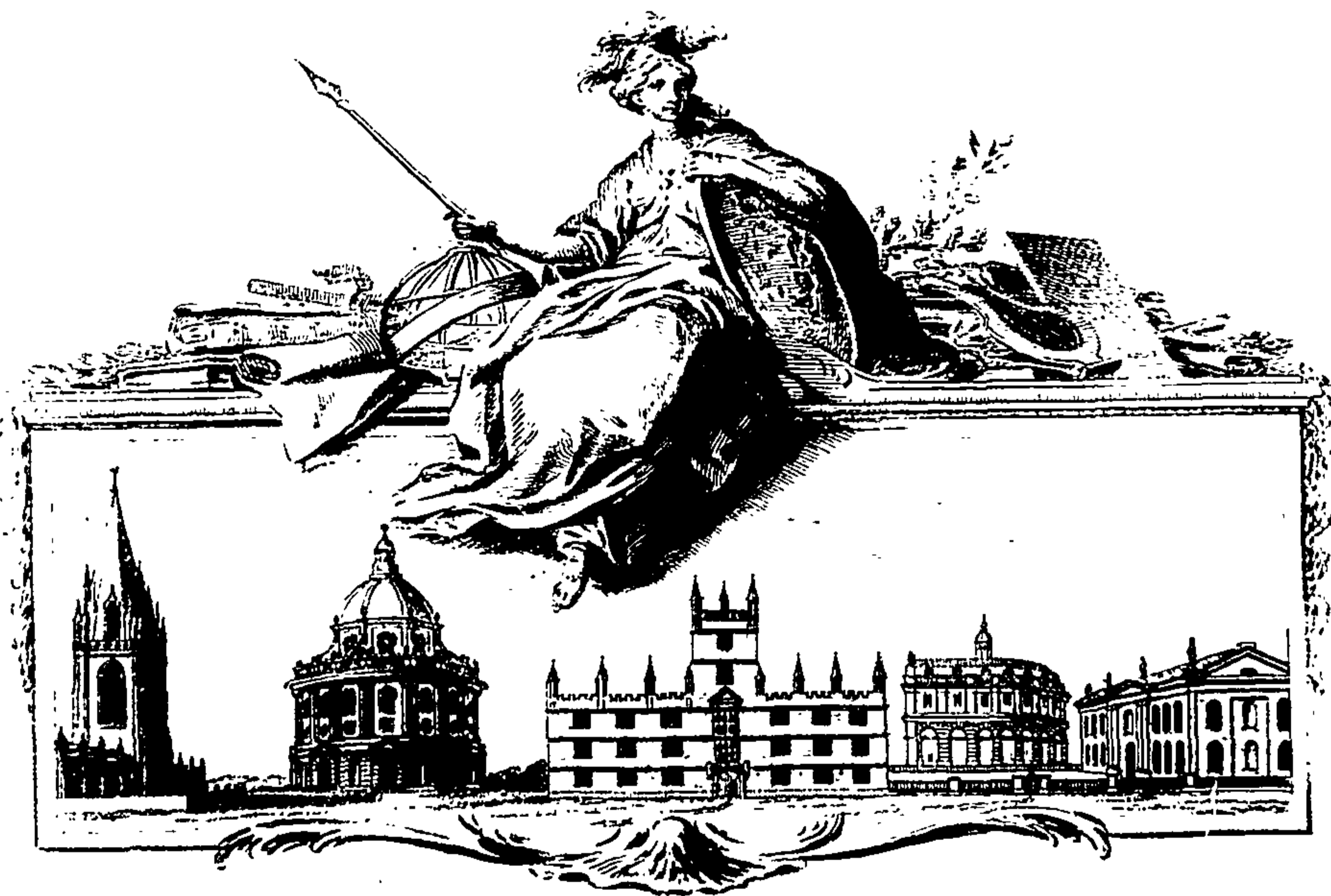
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THE  
WORKS

OF THE

RIGHT REVEREND FATHER IN GOD,  
GEORGE HOOPER, D.D.

LATE LORD BISHOP OF  
BATH AND WELLS.



O X F O R D,

Printed at the THEATRE for JAMES FLETCHER in the *Turl*; and Sold by  
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M D C C L V I I.

A  
CALCULATION  
OF THE  
CREDIBILITY  
OF  
HUMAN TESTIMONY.

First printed in the PHILOSOPHICAL TRANSACTIONS, for  
the Month of *October*, 1699.

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A  
 CALCULATION  
 OF THE  
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 HUMAN TESTIMONY.

**M**ORAL *Certitude Absolute* is that in which the Mind of Man entirely acquiesces, requiring no further Assurance: As if one, in whom I absolutely confide, shall bring me word of 1200*l* accruing to me by Gift, or a Ship's Arrival; and for which therefore I would not give the least valuable Consideration to be ensured.

*Moral Certitude Incomplete* has its several Degrees to be estimated by the Proportion it bears to the *Absolute*. As if one, in whom I have that degree of Confidence, as that I would not give above One in Six to be ensured of the Truth of what he says, shall inform me, as above, concerning 1200*l*: I may then reckon that I have as good as the Absolute Certainty of a 1000*l*, or Five Sixths of Absolute Certainty for the whole Sum.

The *Credibility* of any Reporter is to be rated (1) by his *Integrity*, or Fidelity; and (2) by his *Ability*: and a double *Ability* is to be considered; both that of *Apprehending* what is delivered; and also of *Retaining* it afterwards, till it be transmitted.

“What follows concerning the Degrees of Credibility is divided into *Four Propositions*. The *Two First* respect the *Reporters* of the Narrative, as they either Transmit *Successively*, or Attest *Concurrently*: the *Third*, the *Subject* of it, as it may consist of several *Articles*: and the *Fourth* joins those three Considerations together, exemplifying them in *Oral* and in *Written* Tradition.

a This *Transaction*, though first published by the Author some Years after the *Discourse on* LEAST, is now placed before it, on account of the relation it has to the foregoing *Discourses on* INFALLIBILITY, where the same sort of *Calculation* is made use of, to shew the *Uncertainty* of ORAL TRADITION. See *Dyc.* I. Chap. IV. &c.

## P R O P O S. I.

*Concerning the Credibility of a Report, made by Single Successive Reporters, who are equally Credible.*

LET their Reports have, each of them, Five Sixths of Certainty; and let the First Reporter give me a Certainty of a 1000*l*, in 1200*l*: it is plain that the Second Reporter, who delivers that Report, will give me the Certainty but of  $\frac{5}{6}$ ths of that 1000*l*, or the  $\frac{5}{6}$ th of  $\frac{5}{6}$ ths of the full Certainty for the whole 1200*l*. And so a Third Reporter, who has it from the Second, will transmit to me but  $\frac{5}{6}$ ths of that Degree of Certainty, the Second would have delivered me, &c.

That is, if,  $a$ , be put for the Share of Assurance a Single Reporter gives me; and,  $c$ , for that which is wanting to make that Assurance complete; and I therefore supposed to have  $\frac{a}{a+c}$  of Certainty from the First Reporter; I shall have from the Second,  $\frac{a^2}{a+c^2}$ ; from the Third,  $\frac{a^3}{a+c^3}$ .

And accordingly if,  $a$ , be = 100; and  $c = 6$ , (the number of Pounds that an 100*l*, put out to Interest, brings at the Year's end;) and consequently my Share of Certainty from One Reporter, be =  $\frac{100}{106}$ ; which is the present Value of any Sum to be paid a Year hence: The Proportion of Certainty coming to me from a Second, will be  $\frac{100}{106}$  multiplied by  $\frac{100}{106}$ , (which is the present Value of Money to be paid after Two Years;) and that from a Third-hand Reporter, =  $\frac{100}{106}$ , thrice multiplied into itself; (the Value of Money payable at the end of Three Years,) &c.

## Corollary.

And therefore, as at the Rate of 6 *per Cent* Interest, the present Value of any Sum payable after Twelve Years, is but Half the Sum: So if the Probability or Proportion of Certitude transmitted by each Reporter, be  $\frac{100}{106}$ ; the Proportion of Certainty after Twelve such Transmissions, will be but as a Half; and it will grow by that Time an equal Lay, whether the Report be true or no. In the same manner, if the Proportion of Certainty be set at  $\frac{100}{101}$ , it will come to a Half from the 70th Hand: And if at  $\frac{100}{101}$ , from the 695th.

## P R O P O S. II.

*Concerning Concurrent Testifications.*

IF Two Concurrent Reporters have, each of them, as  $\frac{5}{6}$ ths of Certainty; they will both give me an Assurance of  $\frac{35}{36}$ ths, or of 35 to one: If Three; an Assurance of  $\frac{215}{216}$ , or of 215 to one. For

For if One of them gives a Certainty for 1200*l*, as of  $\frac{2}{3}tbs$ ; there remains but an Assurance of  $\frac{1}{3}tb$ , or of 200*l* wanting to me, for the whole. And towards that the Second Attefter contributes, according to his Proportion of Credibility: That is, to  $\frac{2}{3}tbs$  of Certainty before had, he adds  $\frac{2}{3}tbs$  of the  $\frac{1}{3}tb$  which was wanting: So that there is now wanting but  $\frac{1}{3}tb$  of a  $\frac{1}{3}tb$ , that is  $\frac{1}{9}$ ; and consequently I have, from them both,  $\frac{35}{36}tbs$  of Certainty. So from Three,  $\frac{215}{216} \text{ } \textcircled{c}$ .

That is, if the First Witness gives me  $\frac{a}{a+c}$  of Certainty, and there is wanting of it  $\frac{c}{a+c}$ ; the Second Attefter will add  $\frac{a}{a+c}$  of that  $\frac{c}{a+c}$ ; and consequently leave nothing wanting but  $\frac{c}{a+c}$  of that  $\frac{c}{a+c} = \frac{c^2}{(a+c)^2}$ . And in like manner, the Third Attefter adds his  $\frac{a}{a+c}$  of that  $\frac{c^2}{(a+c)^2}$ , and leaves wanting only  $\frac{c^3}{(a+c)^3}$ ,  $\textcircled{c}$ .

Corollary.

Hence it follows, that if a Single Witness should be only so far Credible, as to give me the Half of a full Certainty; a Second of the same Credibility would (joined with the First) give me  $\frac{3}{4}tbs$ ; a Third,  $\frac{7}{8}tbs$ ;  $\textcircled{c}$ : So that the Coattestation of a Tenth would give me  $\frac{1023}{1024}tbs$  of Certainty; and the Coattestation of a Twenty-first,  $\frac{2097151}{2097152}tbs$  or above Two Millions to One,  $\textcircled{c}$ .

P R O P O S. III.

*Concerning the Credit of a Reporter for a Particular Article of that Narrative, for the whole of which he is Credible in a certain Degree.*

**L**ET there be Six Particulars of a Narrative equally remarkable: If he, to whom the Report is given, has  $\frac{2}{3}tbs$  of Certainty for the whole, or Sum, of them; he has 35 to one, against the Failure in any One certain Particular.

For he has Five to One, there will be no Failure at all: And if there be; he has yet another Five to One, that it falls not upon that single Particular of the Six. That is, he has  $\frac{2}{3}tbs$  of Certainty for the whole: and of the  $\frac{1}{3}tb$  wanting he has likewise  $\frac{2}{3}tbs$ , or  $\frac{2}{9}tbs$  of the whole more; and therefore that there will be no Failure in that single Particular, he has  $\frac{5}{6}tbs$  and  $\frac{5}{36}tbs$  of Certainty, or  $\frac{35}{36}tbs$  of it.

In General, if  $\frac{a}{a+c}$  be the Proportion of Certainty for the whole; and  $\frac{m}{m+n}$  be the Chance of the rest of the particular Articles *m*, against some one, or more of them *n*; there will be nothing wanting to an absolute Certitude, against the not failing in Article, or Articles, *n*, but only  $\frac{n^c}{(m+n)^c \times (a+c)^c}$ .

## P R O P O S. IV.

*Concerning the Truth of either Oral or Written Tradition, (in Whole, or in Part,) Successively transmitted, and also Coattested by several Successions of Transmittents.*

(1) **S**UPPOSING the Transmission of an *Oral Narrative* to be so performed by a Succession of Single Men, or joined in Companies, as that each Transmission, after the Narrative has been kept for Twenty Years, impairs the Credit of it a 12th part; and that consequently at the Twelfth Hand, or at the end of 240 Years, its Certainty is reduced to a Half; and there grows then an even Lay (*by the Corollary of the first Proposition*) against the Truth of the Relation: Yet if we further suppose, that the same Relation is Coattested by Nine other several Successions, transmitting alike each of them; the Credibility of it, when they are all found to agree, will (*by the Corollary of the second Proposition*) be as  $\frac{1023}{1024}$  of Certainty, or above a Thousand to One; and if we suppose a Coattestation of Twenty, the Credibility of it will be, as above Two Millions to One.

(2) In *Oral Tradition*, as a Single Man is subject to much Casualty, so a Company of Men cannot be so easily supposed to join; and therefore the Credibility of  $\frac{100}{106}$ ths, or about  $\frac{12}{20}$ ths, may possibly be judged too high a Degree, for an Oral Conveyance, to the Distance of Twenty Years. But in *Written Tradition*, the Chances against the Truth or Conservation of a single Writing are far less; and several Copies may also be easily supposed to concur; and those, since the Invention of Printing, exactly the same: several also distinct Successions of such Copies may be as well supposed, taken by different Hands, and, preserved in different Places or Languages.

And therefore if Oral Tradition by any one Man or Company of Men might be supposed to be Credible, after Twenty Years, at  $\frac{12}{20}$ ths of Certainty; or but  $\frac{2}{10}$ ths; or  $\frac{1}{5}$ ths: a Written Tradition may be well imagined to continue, by the Joint Copies that may be taken of it for one Place, (like the several Copies of the same Impression,) during the space of a 100, if not 200 Years; and to be then Credible at  $\frac{100}{101}$ ths of Certainty, or at the Proportion of a Hundred to One. And then, seeing that the Successive Transmissions of this  $\frac{100}{101}$  of Certainty will not diminish it to a Half, until it passes the Sixty ninth Hand; (for it will be near Seventy Years, before the Rebate of Money, at that Interest, will sink it to Half:) It is plain, that Written Tradition, if preserved but by a Single Succession of Copies, will not lose Half of its full Certainty, until Seventy times a Hundred (if not Two Hundred) Years are past; that is, Seven Thousand, if not Fourteen  
Thousand

Thousand Years. And further, that, if it be likewise preserved by Concurrent Successions of such Copies, its Credibility at that Distance may be even increased, and grow far more certain from the several agreeing Deliveries at the end of Seventy Successions, than it would be at the very first from either of the Single Hands.

(3) Lastly, In stating the Proportions of Credibility for any Part or Parts of a Copy, it may be observed, that in an Original not very long, good Odds may be laid by a careful Hand, that the Copy shall not have so much as a Literal Fault: But in one of greater Length, that there may be greater Odds against any Material Errour, and such as shall alter the Sense; greater yet, that the Sense shall not be altered in any Considerable Point; and still greater, if there be many of these Points, that the Errour lights not upon such a single Article; *as in the Third Proposition.*

F I N I S.

