10

Miscellaneous Items

Boswell: 'But of what use will it be, Sir?'
Johnson: 'Never mind the use; do it.'

James Boswell.
The Life of Samuel Johnson, LL.D.

10.1 Introduction

There are several manuscript items by Thomas Bayes in the Library of the Royal Society, viz. (i) a letter to John Canton on infinite series that was published in the *Philosophical Transactions*, (ii) another letter, also to Canton, commenting on some remarks by Thomas Simpson on errors in observations, and (iii) some notes on electricity, commenting on Hoadly and Wilson's *Observations on a Series of Electrical Experiments*. The first of these items is in the Royal Society's Miscellaneous Manuscripts collection [MM.1.17], and is printed elsewhere in the present treatise; the remaining two are in the Canton papers [Ca.2.32].

Recently D.R. Bellhouse discovered a set of manuscripts, some in Bayes's hand and others mentioning his name, among the Stanhope of Chevening papers [UC1590/C21] in the Centre for Kentish Studies in Maidstone, Kent, England. Bellhouse has given details of this important find elsewhere; nevertheless, for the sake of completeness of the present study, we give a brief discussion of these manuscripts here.

As regards the presentation of the Royal Society documents here, the reader is asked to note the following conventions, the first of which holds throughout the first few sections of this chapter and the others are particularly pertinent to §10.4. Words in crotchets preceded by the sign of equality, [= text], are expansions of abbreviations used by Bayes, and words in crotchets, [text], are words in the original that are missing from Bayes's version. Things such as 'w[h]ere' indicate that the encrotcheted matter is missing in the original manuscript. Words that are underlined appear in Bayes's manuscript but not in Hoadly and Wilson's book, whereas words in braces, {text}, are as in Hoadly and Wilson's text, Bayes's word (or words) preceding this formulation. Note that Bayes uses the symbol ·.· as a general punctuation mark for a comma, a colon, a semi-colon or a full stop. Bayesian abbreviations, such as 'rem.' for 'remember' and 'appear^{nces}' for 'appearances', have not been written out in full where the words abbreviated are thought to be patent and, in §10.4, where they occur in the expanded form in Hoadly and Wilson's book.

10.2 A Letter from Bayes to Canton

S^{r}.

Y^{ou}. may rem. a few days ago we were speaking of M^{r}. Simpson[1] attempt to show y^{e} great advantage of taking y^{e} mean between several Astron. observations rather than trusting to a single observation carefully made in order to diminish y^{e} errors arising frō [= from] y^{e} imp[er]fection of instrum^{ts}. & y^{e} organs of sense. We both agreed that y^{e} former method was undoubtedly the best upon y^{e} whole & prtlrly [= particularly[2]] adapted to prev^{t}. any considerable error, w^{ch} might possibly be committed in a single observation. But I really think ~~he~~ M^{r}. Simpson has not justly repres^{ted}. its advantage: neither is it by far so great as he seems to make it.
According to him by multiplying our observations & taking the mean we always diminish y^{e} probability of any given error, & that very fast. e.g, if a single observatiō may be relied on to 5″, & you take the mean of six observations it is above 5000 to 1 that your conclusion do's not differ 3″ from the truth, & by sufficiently increasing the number of observations you may make it as probable as you please that the result do's not differ from the truth above a single second or any small quantity whatsoever. Now that the Errors arising from the imperfection of instrum^{ts}. & y^{e} organs of sense shou'd be thus reduced to nothing or next to nothing only by multiplying the number of observations seems to me extremely incredible. On the contrary the more observations you make with an imperfect instrum^{t}. the more certain it seems to be that the error in your conclusion will be proportional to the imperfection of the instrum^{t}. made use of. for were it otherwise there wou'd be little or no advantage in making your observations with a very accurate instrum^{t}. rather than with a more ordinary one, in those cases w[h]ere the observation cou'd be very often repeated: & yet this I think is what no one will pretend to say. Hence therefore as I see no mistakes in M^{r}. Simpsons calculations I will venture to say that there is one in y^{e}. hypothesis upon which he proceeds. And I think it is manifestly this,

when we observe with imperfect instruments or organs; he supposes that the chances for the same errors in excess, or defect are exactly the same, & upon this hypothesis only has he shown the incredible advantage, which he wou'd prove arises from taking the mean of a great many observations. Indeed M^{r}. Simpson says that if instead of that series of numbers which he uses to express the respective chances for the different errors to which any single observation is subject any other series whatever shou'd be assumed the result will turn out greatly in favor of the method now practised by taking a mean value. But this I apprehend is only true where the chances for the errors of the same magnitude in excess or defect are upon an average nearly equal. for if the chances for the errors in excess are much greater than for those in defect, by taking the mean of many observations I shall only more surely commit a certain error in excess. & vice versâ. This I think is manifest without any particular calculation. & conseq^{tly}. the errors which arise from the imperfection of the instrument with which you make a careful observation cannot in many cases be much diminished by repeating the observation ever so often & taking the mean.