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Locke on measurement☆

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ABSTRACT

Like many virtuosi in his day, the English philosopher John Locke maintained an active interest in metrology. Yet for Locke, this was no mere hobby: questions concerning measurement were also implicated in his ongoing philosophical project to develop an account of human understanding. This paper follows Locke's treatment of four problems of measurement from the early Drafts A and B of the *Essay concerning Human Understanding* to the publication of this famous book and its aftermath. It traces Locke's attempt to develop a natural or universal standard for the measure of length, his attempts to grapple with the measurement of duration, as well as the problems of determining comparative measures for secondary qualities, and the problem of discriminating small differences in the conventional measures of his day. It is argued that the salient context for Locke's treatment of these problems is the new experimental philosophy and its method of experimental natural history.

> 'Tis of great use to the Sailor to know the length of his Line, though he cannot with it fathom all the depths of the Ocean. 'Tis well he knows, that it is long enough to reach the bottom, at such Places, as are necessary to direct his Voyage ... Our Business here is not to know all things, but those which concern our Conduct. If we can find out those Measures, whereby a rational Creature put in that State, which Man is in, in this World, may, and ought to govern his Opinions, and Actions depending thereon, we need not be troubled, that some other things escape our Knowledge.[1]
>
> (*An Essay concerning Human Understanding* (hereafter *Essay*) I. i. 6 [underlining added])

It is hardly surprising that the philosopher John Locke (1632–1704) had a penchant for metrical metaphors, for from the mid-1660s measurement was part and parcel of his everyday adult life. There are many facets to Locke's interest in metrology: he had an abiding interest in classical and biblical weights and measures[2]; he was fascinated by comparative weights and measures from different countries and regions; he helped devise a system of weights and measures for the Carolina colonies in connection with his work for the Lords Proprietors; and he argued in print about currency valuation. Locke's two original contributions to the *Philosophical Transactions* of the Royal Society both contain measurements and for most of his adult life he used instruments to take daily measurements of meteorological conditions.[3] Furthermore, while Locke was not a central player in the development of the science of metrology in his day, he did rub shoulders with most of the major figures and was fully apprised of developments in the field. In fact, Locke came up with three separate proposals for the standardization of measures that he hoped would be adopted by

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[1] See also Locke (1975) (hereafter *Essay*) I. i. 2, 3, II. xxviii. 20 and Locke (2006, p. 269).

[2] See Locke's annotated copy of Cumberland (1686), Bodleian Library (hereafter Bodl.) shelfmark Locke 8.177a, Harrison and Laslett (1971, #900). For lists of biblical money, weights and measures in Locke's journal from November 1677, see Bodl. MS Locke f. 2, pp. 338–45.

[3] See Locke (1697) and (1705). Locke's weather charts are in Bodl. MS Locke d. 9.

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the republic of letters, or, even better, by the government of his day. He devised a decimal standard for length, he put forward a recommendation against the devaluation of English silver coin and a proposal for calendar reform.[4] As things transpired, only the second of these proposals was adopted, and in this Locke seems only to have had a minor role.[5]

More importantly, however, Locke was one of the first English philosophers to implicate measurement in a broader philosophical project.[6] This paper argues that problems of measurement held an enduring and important place in the writing of Locke's famous *An Essay concerning Human Understanding*. It argues, further, that Locke's ongoing interest in metrology and his attempt to develop a standard of measure for length, are best understood as continuous with his broader philosophical project in the *Essay* which, in turn, is set within the broader context of the emergence of experimental philosophy and its program of natural history in the last four decades of the seventeenth century. Thus, if we are to get the measure of Locke as a philosopher we have to deal with the place of measurement in his thought: not simply his profound interest in metrology, but the central place of measurement in an experimental philosopher's conception of how we acquire knowledge of the natural world.[7]

At the outset of his quest to develop a theory of how the understanding acquires knowledge of the natural world, questions concerning the nature of measurement and a realisation of the need for standards of measure were in play. From then on, Locke's thoughts on these matters developed in tandem with a series of exciting developments in the science of metrology in his day, developments to which he was not merely an eye-witness but also a minor participant. In fact, Locke's journal, correspondence, notebooks, books and papers give us an almost unprecedented insight into how his involvement with developments in metrology intersected with the evolution of his famous *Essay*.

The sections that follow are in rough chronological order. Section One sets out the broader methodological context in which Locke undertook his long-term project to develop an account of human understanding. Section Two discusses Locke's proposed system of weights and measures for the Carolina colonies and examines his treatment of four problems of measurement as they appear in Drafts A and B of the *Essay* which date from c. 1671. Section Three traces the seam of evidence of Locke's interest in metrology and the development of his standard for length during his travels in France in the latter half of the 1670s. Section Four examines Locke's familiarity with the problem of longitude in the late 1670s. Section Five treats of measurement in the first edition of Locke's *Essay* and Section Six deals with developments in the 1690s after the publication of the *Essay*.

1. Measurement, experimental philosophy and natural history

By the mid-seventeenth century experiment had come to play a central role in the practice of natural philosophy. So important was it that a new natural philosophical methodology emerged in England in the 1660s that came to be called experimental philosophy.[8] It goes without saying that the primacy of observation and experiment in natural philosophy brought the problem of the standardization of measures to the fore. Quantities such as weight, length, time, and temperature were in desperate need of universal standards of measure. Furthermore, recent developments in natural philosophy had given rise to the need for measures of *newly discovered* qualities such as the spring or pressure of the air, the need for the *determination of constants*, such as the speed of sound and light, and the need for *accurate determinations* of location and elevation. In short, in the second half of the seventeenth century metrology obtained an importance that it had never before experienced. Of course, metrology had always been an essential feature of astronomy, but even that science was caught up in the new push for exactitude in the multiplication of observational data.[9]

It was not long before there was an institutional response to these issues. The standardization of length was the most pressing problem. It was addressed by the Royal Society of London as early as 1662. William Petty reported on his observations concerning Christopher Wren's suggestion that the pendulum be taken as a standard of length at the end of January 1662[10] and at the next meeting Wren was asked to find an alternative to the pendulum as a unit of measure. Various issues relating to the proposal were discussed, such as decimalization of the sub-units of length, relation to current local and international standards of length, etc.[11] An important treatment of the issues later appeared in John Wilkins' *An Essay Towards a Real Character and a Philosophical Language* of 1668, which reiterated that the determination of a natural standard or universal measure 'hath been esteemed by Learned men as one of the *desiderata* in Philosophy'.[12]

Yet there is a more specific context in which the place of measurement in natural philosophy in late seventeenth-century England needs to be understood and this is experimental natural history. Francis Bacon's vision for an architectonic – as distinct from classificatory – form of natural history that would include observations and experiments of phenomena from the heavens to the depths of the oceans, gave a central role to quantification: 'I demand that every thing to do with natural phenomena, be they bodies or virtues, should (as far as possible) be set down, counted, weighed, measured and defined'.[13] This new form of natural history was enthusiastically embraced and developed in the nascent Royal Society in the 1660s and its leading exponent was Locke's close friend and mentor Robert Boyle.[14] Boyle's own elaborate 'Designe' for natural history called for instructions on 'how to procure, æstimate, prepare and in some cases better *Mathematicall Instruments*, as Quadrants, Telescopes, Microscopes, &c. *Mathematical Tooles*, as Ballances, Statera's, Standards for measure &c.'.[15]

One such Baconian project was Boyle's history of the air which commenced with his ground-breaking *Spring of the Air* in 1660.[16] It is well known that in the spring of 1666 he supplied Locke with a barometer in order for him to measure the air pressure in the Mendip mines. The mission proved abortive, but within weeks Locke began his own contribution to the project by keeping

[4] On Locke's recommendations against the raising of the value of money, see *Further considerations concerning raising the value of money*, Locke (1991, Vol. 2, pp. 410–81). For Locke's proposal on calendar reform, see Milton (2006).

[5] For background and analysis of Locke's contribution to the English monetary crisis of 1695, see Patrick Kelly, Introduction, Locke (1991, Vol. 1, pp. 1–109).

[6] A number of English philosophers and mathematicians before Locke discussed measurement. For the case of Francis Bacon, see Rees (1985), Pastorino (2011), Jalobeanu forthcoming and below. For Isaac Barrow, see Barrow 1684, lectures VI and VII.

[7] Sadly, space does not permit a discussion of the cognate issue of Locke's view of the ontological status of space and time.

[8] See Anstey and Vanzo (2012).

[9] See van Helden (1989) for further discussion.

[10] All dates are New Style unless otherwise indicated by '(OS)'.

[11] See Birch (1756–1757, Vol. 1, pp. 74–5).

[12] Wilkins (1668, p. 191).

[13] Francis Bacon, *Parasceve* in Bacon (2004, p. 465); see also *Novum organum* I, 98, Bacon (2004, p. 157). For Bacon's conception of natural history, see Jalobeanu (2015) and Anstey (2011, chap. 3).

[14] See Anstey and Hunter (2008).

[15] Boyle (2008, p. 1).

[16] Boyle (1999–2000, Vol. 1, pp. 141–301).