

GRAPHICAL DETAILS: THE SECRET LIFE OF CHRISTOPHER WREN'S
DRAWING OF THE WEATHER CLOCK

by

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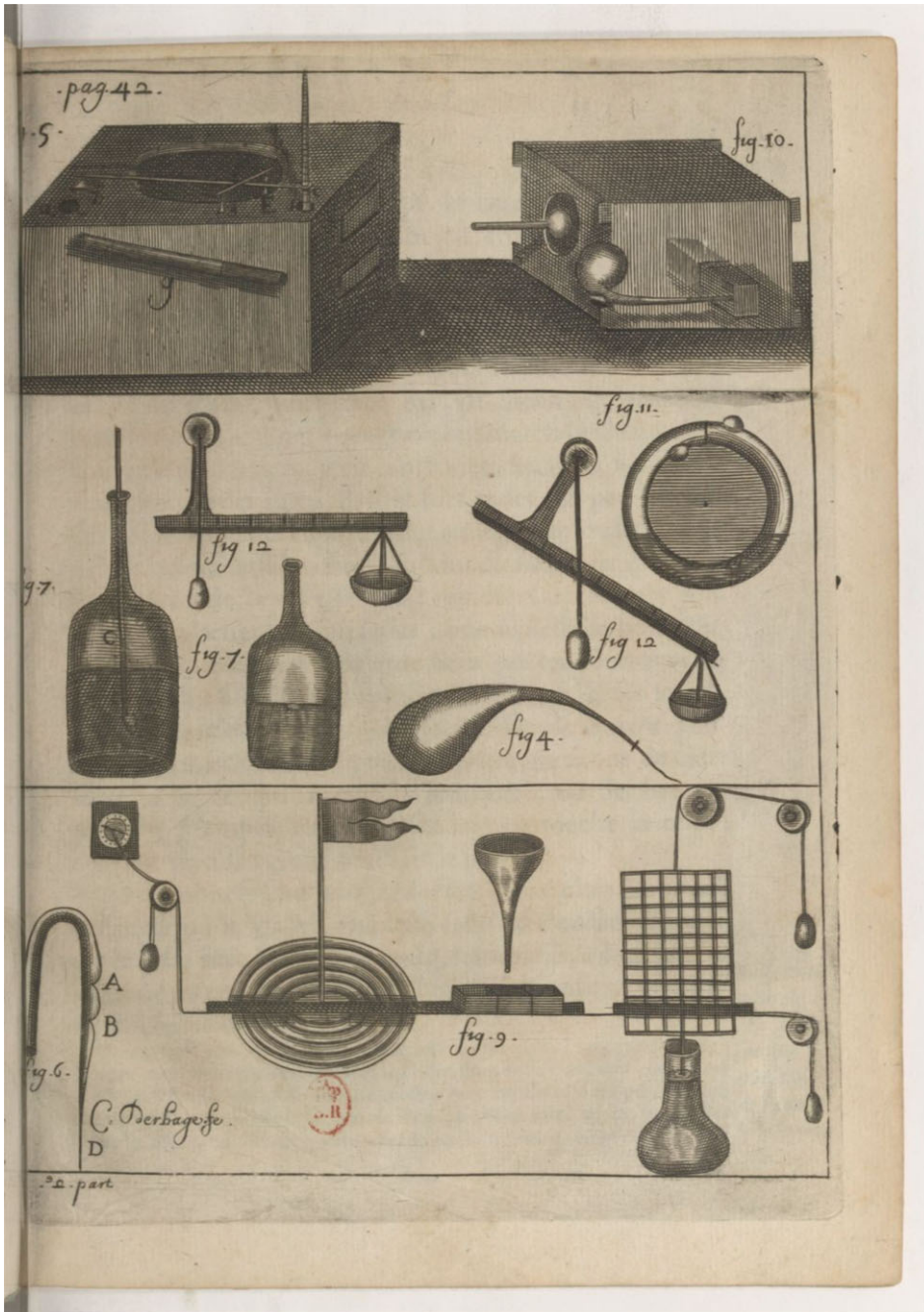
Historians have unanimously credited Christopher Wren with having constructed a weather clock (a self-registering instrument) in the early 1660s. This conclusion was based on the account of the French diplomat Balthasar de Monconys, which included a sketch uncannily similar to an undated drawing by Wren of the weather clock. By critically re-examining the available sources, I argue that one can infer that Wren never actually constructed a weather clock. What Monconys saw and sketched was, in fact, a drawing produced by Wren for a meeting of the Royal Society that took place on 8 January 1662. I further show that there is strong evidence to assume that Wren's drawing for the Royal Society is the undated drawing preserved at the Royal Institute of British Architects. The new context in which I place Wren's drawing provides an incentive to look at it with fresh eyes. Though the drawing does not represent a device actually constructed by Wren, it still bears (unexpected) connections to the material world that surrounded him. The analysis of the drawing developed in this article will be relevant for historians interested in the role that images can play as historical evidence.

**Keywords: Christopher Wren, drawings, material culture, weather clock,
history of meteorology, scientific instruments**

On 11 June 1663, during his travels through England, the French diplomat Balthasar de Monconys paid a visit to the 30-year-old Christopher Wren in Oxford, who at the time was serving as Professor of Astronomy. Wren made a strong impression on Monconys as one of the 'most cordial and forthcoming' of his acquaintances in England because, 'though he did not wish his ideas to be divulged, nevertheless, he spoke most freely about his clock' which made a thermometer, a wind vane and a rain gauge keep their own register. Monconys's detailed account of the device, which came to be known as a weather clock or a meteorograph, was accompanied by a 'rough sketch (vn grossier dessein)' (figure 1).¹ While allowing that this 'must have been drawn afterwards from memory, or from a rapid

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¹ Balthasar de Monconys, *Journal des voyages de Monsieur de Monconys*, 3 vols (Chez Horace Boissat & George Remeus, Lyon, 1665–1666), vol. 2, p. 53: 'i'y allay encore plus pour voir M. Renes grand Mathématicien quoy que petit de corps, mais des plus



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Figure 1. Monconys's 'rough sketch' of Wren's weather clock (Fig. 9 in Balthasar de Monconys, *Journal des voyages de Monsieur de Monconys* (Chez Horace Boissat & George Remeus, Lyon, 1665–1666)). (<https://gallica.bnf.fr>. © Bibliothèque nationale de France.) (Online version in colour.)

sketch', and that it might only show a 'sealing-wax and string model', W. E. Knowles Middleton, one of the most authoritative sources on the history of meteorological instruments, concluded that 'The important thing is that what de Monconys saw at Oxford in June 1663 had an actual physical existence.'² Jim Bennett reached the similar conclusion that 'The first account we have of a working weather clock comes from the visit the French traveller Balthazar de Monconys made to Wren at All Souls College, Oxford, in June 1663', where 'He was shown a weather clock.'³

Despite the fact that Monconys never claimed to have seen Wren's weather clock and only remarked that Wren 'spoke most freely' about it, all of Monconys's readers have uncritically assumed that his account must have been based on some physical object that he actually saw.⁴ However, in his account Monconys made clear and consistent distinctions between the instruments he saw and those he was only told about.⁵ Why, then, the unanimously unquestioned assumption that Monconys's account says more than it actually does?

The reason is found not in the text but rather in Monconys's sketch. It is easier to explain away a word rather than imagine how an elaborate technical scheme could have been drawn based on an oral account alone. No room for doubt seems to be left when considering the undated drawing by Wren himself (figure 2), which, though incomparably superior in draughtsmanship, represents a strikingly similar setup. Details never mentioned in Monconys's text—like the weights and pulleys—appear in both drawings. It has become almost impossible to look at the two drawings side by side without imagining that they

ciuels & des plus ouuerts que i'aye trouuez en Angleterre: car quoy qu'il ne veuille pas que ses pensées soient diuulgées, Il ne laissa pas de me dire fort librement celle de son Horologe du temps.'

2 W. E. Knowles Middleton, 'The first meteorographs', *Physis* 3, 213–222 (1961), at p. 214, emphasis added. This conclusion is repeated in W. E. Knowles Middleton, *Invention of the meteorological instruments* (Johns Hopkins Press, Baltimore, 1969), pp. 245–254, esp. p. 246: 'by June, 1663, at Oxford, he [Wren] had a meteorograph which registered not only the temperature and the direction of the wind but also the rainfall'. See also W. E. Knowles Middleton, *A history of the thermometer and its use in meteorology* (Johns Hopkins Press, Baltimore, 1966), p. 42.

3 Jim Bennett, 'The instruments', in *The image of Restoration science: the frontispiece to Thomas Sprat's History of the Royal Society (1667)* (ed. Michael Hunter), pp. 79–127 (Routledge, London, 2016), at p. 96, emphasis added. The same point, that Monconys described a weather clock that he actually saw, is also made in Bennett's earlier monograph on Wren: see J. A. Bennett, *The mathematical science of Christopher Wren* (Cambridge University Press, Cambridge, 1982), pp. 84–85; see also J. A. Bennett, 'Christopher Wren in mid-career', in *All Souls under the Ancien Régime: politics, learning, and the arts, c.1600–1850* (ed. S. J. D. Green and Peregrine Horden), pp. 76–91 (Oxford University Press, 2007), at p. 80.

4 Monconys, *op. cit.* (note 1), vol. 2, p. 53, emphasis added. Samuel Sorbrière (secretary of the Montmor Academy) met Monconys during his trip to London and was shown his diary where 'he talks about multiple inventions that are hard to believe, if we do not see them at work (si l'on ne les voit pratiquées); about one instrument which marks on its own all the changes of the air'; Samuel Sorbrière, *Relation d'un voyage en Angleterre* (Chez Louis Billaine, Paris, 1664), pp. 67–68. Notice that, though Sorbrière met with Monconys in person, the claim about the weather clock was solely based on Monconys's diary and not on any personal communication. The same conclusion, based solely on reading Monconys, was also reached by the late nineteenth-century German historian of meteorology Gustav Hellmann: see Gustav Hellmann, 'Die Ältesten Meteorographen', *Meteorol. Z.* 14, 102–105 (1897), at p. 105. Finally, the same claim can be encountered in the most recent works on Wren, such as Anthony Gerbino and Stephen Johnston, *Compass and rule: architecture as mathematical practice in England, 1500–1750* (Yale University Press, New Haven, 2009), p. 86.

5 For example, on 12 June, the day after he was told about the weather clock, Monconys returned to converse with Wren 'who told me about the construction of a drum thermometer (qui me dit la maniere d'un Thermometre avec vn tambour)'; the next day, Monconys reached London, where he 'also saw (vis) the machine of Mr. Wren [Renes] for measuring heat & cold, which is made out of tinplate, consisting of a drum': Monconys, *op. cit.* (note 1), vol. 2, pp. 54–56, emphasis added. For a detailed account of Monconys's dealings with the Royal Society and British instrument makers, see J. A. Bennett, 'Shopping for instruments in Paris and London', in *Merchants and marvels: commerce, science, and art in early Modern Europe* (ed. Pamela Smith and Paula Findlen), pp. 370–395 (Routledge, New York, 2002); Bennett (2007), *op. cit.* (note 3); Peter De Clercq, 'The travel journals of Balthazar de Monconys (1608–1665) and Zacharias Conrad von Uffenbach (1683–1734)', *B. Sci. Instrum. Soc.* 128, 2–14 (2016).

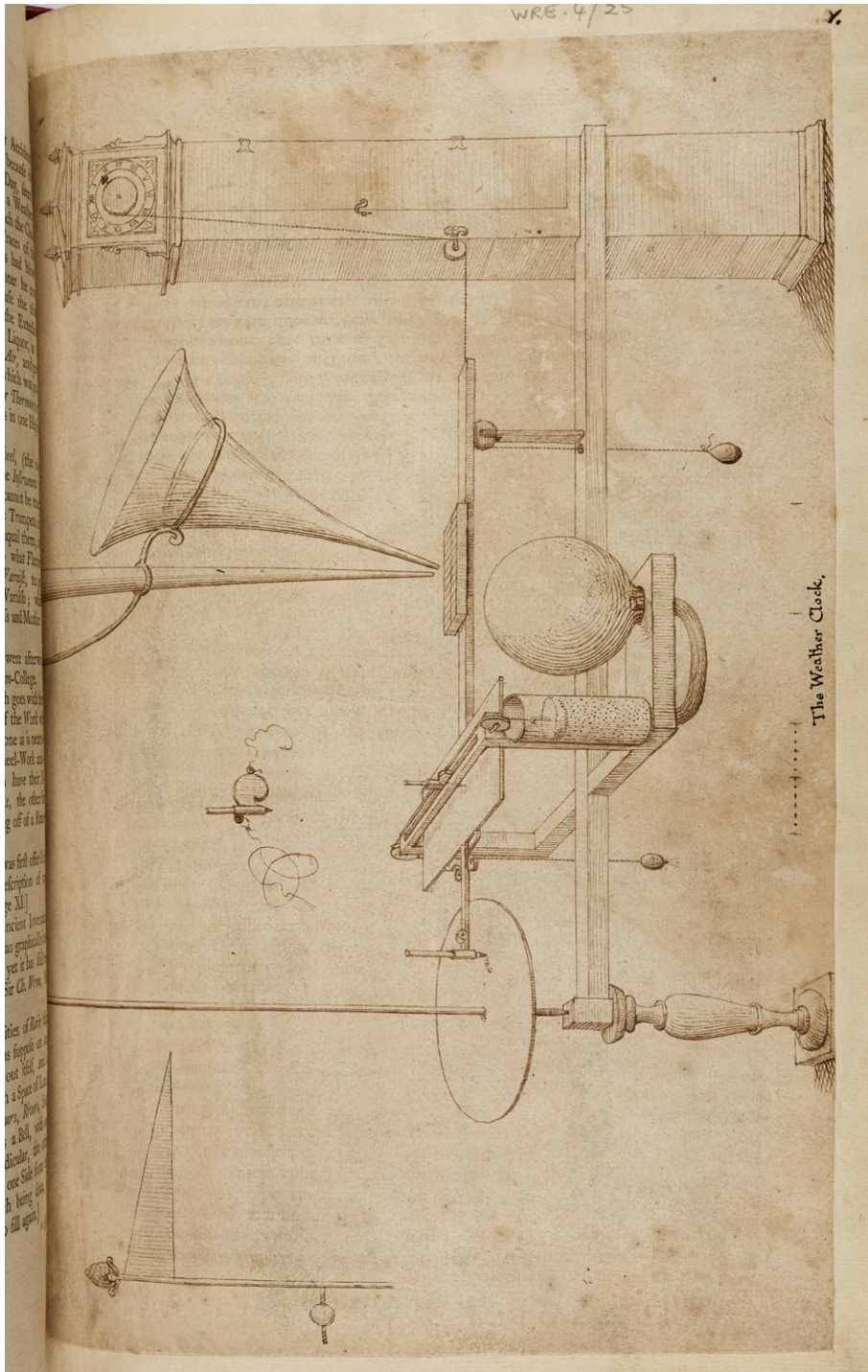


Figure 2. Wren's drawing of the weather clock preserved in the 'heirloom' copy of the *Parentalia*. (RIBA Collections, VOS/233. © RIBA Collections.) (Online version in colour.)

resemble each other because they both represent the same physical object—some version of the weather clock that had actually been constructed.

Though often reproduced, Wren's meticulous drawing has thus far been only cursorily examined by historians, who have limited themselves to describing its general setup, most often by citing Monconys's account of Wren's device. The limits of this interpretative approach—of looking at Wren's drawing through the lens of Monconys's text and sketch—are revealed by the failure of commentators to make sense of the double row of boxes below the large funnel (see figure 2). On this point, Monconys offers no help because he only mentions a 'funnel into which it can rain' and his own sketch depicts a single row of vessels. Without Monconys's assistance, some commentators expressed their surprise that the 'rack carries at the right a rain-gauge which appears to be double', while others fully acknowledged their bemusement: 'There seem to be two rows of boxes for the rain, and I do not understand this.'⁶ Paradoxically, though Monconys's 'rough sketch' has been deemed less reliable by all commentators, it has become the guide for making sense of Wren's carefully drawn sketch of his own instrument.

In the first part of this paper, I will show that one can infer, with a fair degree of confidence, that Wren produced his drawing for a meeting of the Royal Society that took place on 8 January 1662. Furthermore, one can be confident that this drawing was in Wren's possession when Monconys visited him at Oxford, and that what Monconys saw and sketched was this drawing and not an object that Wren had actually built. These results are important not only because they rectify a unanimously accepted misconception but also because they bring into focus the challenge of interpreting misplaced images. Early modern drawings and prints have often been copied or literally cut out of their original location (letters, books, etc.) to be bound in a collection or archive.⁷ These displacements have often obscured the original purpose or circumstances for which an image was produced.⁸ The textual sources surrounding Wren's drawing provide a rare glimpse into the life of a drawing: the purpose for which it was created, its movements, particular moments in which it was contemplated, or the impressions it left in the mind of some viewers. Though this approach cannot always be replicated, it should enrich the possible scenarios imagined by historians for a drawing.

In the second part, I will provide a close analysis of Wren's drawing to reveal his graphical strategy of enacting for an audience the construction and operation of a weather clock. Recent scholarship—from historians of science, technology, architecture and art—has carefully investigated the role of images in the production, communication and reception of science at the Royal Society.⁹ While these studies have engaged with the broader context of the

6 Hebbel E. Hoff and Leslie A. Geddes, 'The beginnings of graphic recording', *Isis* 53, 287–324 (1962), at pp. 297–298; Middleton (1969), *op. cit.* (note 2), p. 247.

7 Sietske Fransen, 'Antoni van Leeuwenhoek, his images and draughtsmen', *Perspect. Sci.* 27, 485–544 (2019). On the seventeenth-century practice of collecting architectural drawings and prints, particularly relevant for Wren's career as an architect, see Matthew Walker, *Architects and intellectual culture in post-Restoration England* (Oxford University Press, Oxford, 2017).

8 For the challenges of determining the original purpose and circumstances of a technical drawing, see Wolfgang Lefèvre (ed.), *Picturing machines, 1400–1700* (MIT Press, Cambridge, MA, 2004).

9 For a review of the secondary literature on scientific images see Alexander Marr, 'Knowing images', *Renaissance Quart.* 69, 1000–1013 (2016). For the visual culture and graphical practices of the Royal Society, including references to Wren, see Sachiko Kusakawa (ed.), 'Making visible: the visual and graphic practices of the early Royal Society', *Perspect. Sci.* 27, no. 3 (2019). See also Matthew C. Hunter, *Wicked intelligence: visual art and the science of experiment in Restoration London* (University of Chicago Press, Chicago, 2013); Sachiko Kusakawa, *Picturing the book of nature: image, text, and argument in sixteenth-century human anatomy and medical botany* (University of Chicago Press, Chicago, 2012); Stephen Johnston, 'Wren, Hooke and graphical practice', *J. Hist.*

visual culture and the graphical practices of the early modern period, this paper is focused on the close analysis of a single drawing or, even more specifically, of details of a drawing. This narrow choice of focus is deliberate and is a provocation to historians to look at images not only as scientific objects but also as forms of historical evidence.

Though historians have more things than ever to say about images (and, as Lorraine Daston has remarked, ‘it is now astonishing to recall how blind historians of science once were to anything but words’), there is a risk that images have little left to show or say to historians.¹⁰ How can one both ‘think about images beyond representation’, as Daston urges, and also use images as historical evidence? To tackle such a question, Peter Burke proposed a method inspired by Giovanni Morelli, Aby Warburg and Erwin Panofsky, which claims that ‘So far as the history of material culture is concerned, the testimony of images seems to be most reliable in the small details.’¹¹ However, some readers have wondered whether Burke’s visual ‘traces’ truly ‘add to existing knowledge rather than reiterate information available from written sources’.¹² This line of criticism could be extended to much of the recent literature on scientific images, which, while talking about images, does not allow the images themselves to talk. This issue has been raised most staunchly by Horst Bredekamp, who insists that one should see an image not just as an instrument, something carrying a message in the manner of speech, but rather as an actor or a ‘living image’ which can ‘seize’ the spectator.¹³ So far Bredekamp’s approach, which emphasizes the autonomy of images and their formal properties, has found little appreciation among historians of science who value the significance of communities, materials and techniques in the making of images.¹⁴ One could say that Bredekamp’s ‘living images’ have not yet given the testimony a historian would hope for.

My analysis of Wren’s drawing will navigate these two extremes. My goal is not to use textual sources to explain the image, but rather to produce unknown and unexpected results about the drawing’s surrounding world that I can then corroborate, or at least make plausible, using textual sources. This will allow me to connect Wren’s world of paper to the material world that surrounded him and that is reflected not so much in the objects that are represented (weather glasses, clocks, etc.) but rather in small graphical details, which are passed over as insignificant ornaments when regarded in isolation, but which can

Astron. **41**, 381–392 (2010); Sven Dupré, ‘Newton’s telescope in print: the role of images in the reception of Newton’s instrument’, *Perspect. Sci.* **16**, 328–359 (2008); Anthony Geraghty, *The architectural drawings of Sir Christopher Wren at All Souls College, Oxford: a complete catalogue* (Lund Humphries, Aldershot, 2007).

10 Lorraine Daston, ‘Beyond representation’, in *Representation in scientific practice revisited* (ed. Catelijne Coopmans, Janet Vertesi, Michael Lynch and Steve Woolgar), pp. 319–322 (MIT Press, Cambridge, MA, 2014), at p. 319.

11 Peter Burke, *Eyewitnessing: the uses of images as historical evidence* (Reaktion Books, London, 2001), p. 102. For the classic account of the model of interpretation of clues and details, see Carlo Ginzburg, ‘Morelli, Freud and Sherlock Holmes: clues and scientific method’, *Hist. Workshop*, 5–36 (1980); Carlo Ginzburg, *Clues, myths, and the historical method* (Johns Hopkins University Press, Baltimore, 1989), pp. 87–113. See also Wolfgang Schäffner, Sigrid Weigel and Thomas Macho (eds), *Der liebe Gott steckt im Detail. Mikrostrukturen des Wissens* (Fink, Munich, 2003); Daniel Arasse, *Le détail. Pour une histoire rapprochée de la peinture* (Flammarion, Paris, 2008).

12 Helena Waddy, ‘Eyewitnessing: the uses of images as historical evidence’, *J. Soc. Hist.* **36**, 767–768 (2003), at p. 768. Michael Baxandall has similarly pointed out that ‘one cannot help feeling that much depends in practice on prior knowledge of the social reality from other sources’: Michael Baxandall, ‘Review of eyewitnessing: the uses of images as historical evidence’, *Engl. Hist. Rev.* **117**, 642–644 (2002), at p. 643. This danger was acknowledged by Burke, *op. cit.* (note 11), p. 40: ‘Iconology is still more speculative, and there is a risk of iconologists discovering in images exactly what they already knew to be there, the *Zeitgeist*.’

13 Horst Bredekamp, *Image acts: a systematic approach to visual agency* (Walter de Gruyter, Boston, 2018).

14 For a review of Bredekamp’s approach from the perspective of history of science, see Marr, *op. cit.* (note 9), pp. 1001–1002. For an application of Bredekamp’s method of analysis to scientific images, see Horst Bredekamp, Vera Dünkel and Birgit Schneider (eds), *The technical image: a history of styles in scientific imagery* (University of Chicago Press, Chicago, 2019).

provide novel insights when contrasted with each other.¹⁵ Though using a different approach, historians of architecture have accomplished a similar goal in connecting Wren's architectural drawings to the buildings constructed after his designs.¹⁶ While some of these insights might come to be established with some degree of certainty, others will challenge historians, within the bounds of historical rigour and method, to *imagine* new scenarios and ways of looking at a drawing.

THE SECRET LIFE OF A DRAWING

Wren's manuscript drawing of the weather clock is preserved at the Royal Institute of British Architects (RIBA) in the 'heirloom' copy of the *Parentalia, or, Memoirs of the family of the Wrens* (1750)—a collection of documents compiled by Wren's son and published by his grandson.¹⁷ After a careful analysis of its manuscript versions (the earliest dating back at least to 1719, four years before Wren's death), Jim Bennett concluded 'that in general *Parentalia* seems to be a fairly accurate record of primary sources'.¹⁸ However, the comments made by the son regarding the primary sources are less reliable, and sometimes completely misleading.¹⁹ One such example is the claim, unanimously accepted by historians though lacking any support in the primary sources, that Wren first imagined the weather clock, or even constructed a version of it, during his teenage years when he boarded with the physician Charles Scarborough in 1647.²⁰

15 On images that have been neglected because of their aesthetic or decorative qualities, see Susan Dackerman, *Prints and the pursuit of knowledge in early modern Europe* (Yale University Press, New Haven, 2011); Gülru Necipoğlu and Alina Payne (eds), *Histories of ornament: from global to local* (Princeton University Press, Princeton, 2016). On the material culture of the Royal Society, see Rob Iliffe, 'Material doubts: Hooke, artisan culture and the exchange of information in 1670s London', *Brit. J. Hist. Sci.* **28**, 285–318 (1995); and Rob Iliffe, "'In the warehouse": privacy, property and priority in early Royal Society', *Hist. Sci.* **30**, 29–68 (1992).

16 Anthony Geraghty, *The Sheldonian Theatre: architecture and learning in seventeenth-century Oxford* (Yale University Press, New Haven, 2013); Derek Keene, Arthur Burns and Andrew Saint (eds), *St. Paul's: the Cathedral Church of London, 604–2004* (Yale University Press, New Haven, 2004); David McKitterick (ed.), *The making of the Wren Library, Trinity College, Cambridge* (Cambridge University Press, Cambridge, 1995).

17 Christopher Wren, *Parentalia, or, Memoirs of the family of the Wrens* (Printed for T. Osborn, in Gray's Inn, and R. Dodsley, in Pall-Mall, London, 1750).

18 J. A. Bennett, 'A study of *Parentalia*, with two unpublished letters of Sir Christopher Wren', *Ann. Sci.* **30**, 129–147 (1973), at p. 140.

19 Experiments or apparatus mentioned by Wren as something that *might* be performed or constructed were presented by the son as completed works; for examples, see *ibid.*, p. 141.

20 The claim is based on a letter (written in Latin and reproduced in *Parentalia*) sent by Wren to his father while he was staying with Scarborough, in which two inventions are mentioned: 'Ætherocriticon *scilicet*; & Memoriale Cylindrum, *cujus ope, noctu & in tenebris scribitur*': Wren, *op. cit.* (note 17), p. 185. When introducing the letter, Wren's son presented the two instruments as an 'Invention of a *Weather Clock*; and an *Instrument* to write in the Dark'. The identification of the 'Ætherocriticon' with the weather clock has been uncritically accepted and obscured by the translation from Latin into English, as in Lena Milman, *Sir Christopher Wren* (Duckworth and Co., London, 1908), p. 19: 'a Weather clock namely, with Revolving Cylinder, by means of which a Record can be kept through the night' (in this translation, the 'Memoriale Cylindrum' which in the Latin letter was a separate invention has become a component of the weather clock). Even the most recent studies about Wren have employed Milman's translation and its unwitting attribution: Gerbino and Johnston, *op. cit.* (note 4), p. 84; C. S. L. Davies, 'The youth and education of Christopher Wren', *Engl. Hist. Rev.* **123**, 300–327 (2008), at p. 308. Lisa Jardine, *On a grander scale: the outstanding career of Sir Christopher Wren* (HarperCollins, London, 2002), p. 59, includes a new translation of the Latin letter in which the original name 'Ætherocriticon' has been preserved (though the translation dubiously renders the description of the 'Memoriale Cylindrum' as 'for which I wrote the text at night and in darkness'). Most likely, the 'Ætherocriticon' referred to a 'pneumatic engine'. The short biography of Wren from the *Biographia Britannica* (1766) plausibly associated the poem 'In Automaton ΑΙΘΕΡΟΚΡΙΤΙΚΟΝ, *Chordâ Musicâ animatum*' (by which Wren dedicated the instrument to his father) with another dedication in Latin made by Wren to his father ('*Permitte mihi*

Though the drawing is undated, its content can be read against textual sources to reconstruct an order of events. One crucial document is an undated address in the form of a letter from Christopher Wren to the president of the Royal Society.²¹ The address proposed a plan to the members of the Society for how to become ‘benefactors to mankind’ by ‘advancing 1. knowledge. 2. profit. 3. health; and conveniences of life’ through a ‘history of the seasons’: ‘an excellent work ... desir’d by all modern philosophers, though no body hath had yet the patience to pursue it’. Such a history, if carried with ‘patience for some years’, was the only ‘certain way of learning to prognosticate’ the changes of the weather. The project was ‘of little trouble’ and ‘of no difficulty’, though it required ‘a little time’ and ‘patience’; the ‘greatest difficulty’ was raised by keeping a diary of the winds because ‘it seems to require constant attendance’.²²

Luckily, two extant innovations eased such observations. The inconvenience of accurately determining the orientation of a weathercock positioned on top of a building could be resolved by projecting its position onto an ellipsis drawn on the glass of a window. Such a method of observation ‘hath been put into execution with very good effect, and some other useful additions at *Oxford*’.²³ The second innovation allowed one to carry out observations during the night, by using ‘a vane as it is at *Whitehall*, shewing by an index within the room’ the changes of the wind.²⁴ Wren considered that these existing improvements were ‘not yet enough, for many changes may happen while the observer is absent or asleep’. To account for such a scenario, he envisioned a further improvement, which ‘may be framed’, though some might have regarded it as a mere ‘promise’:

I might seem to promise too much, should I say, an Engine may be framed, which if you visit your Chamber but one half Hour in the Day, shall tell you how many Changes of Wind have been in your Absence, though there were Twenty, and at what Hour every

obsecro ...’) of a ‘pneumatic engine’: Wren, *op. cit.* (note 17), pp. 182–185; *Biographia Britannica* (Printed for W. Innys, London, 1766), vol. 6, part II, p. 4360.

21 The address, for which the original has been lost, has been preserved only as a transcript in *Parentalia*. Though no mention of such an address was registered in the minutes of the Royal Society, its contents are unmistakably referenced in Thomas Sprat, *The History of the Royal Society of London, for the Improving of Natural Knowledge* (London, 1667), pp. 312–313.

22 Wren, *op. cit.* (note 17), pp. 221–224 (common nouns have been lower-cased, according to modern rules). For the practices and challenges of keeping a weather diary in the second half of the seventeenth century, see Richard R. Yeo, *Notebooks, English virtuosi, and early modern science* (University of Chicago Press, Chicago, 2014), pp. 188–195. On the experience and recording of the weather in the eighteenth century, see Jan Golinski, *British weather and the climate of Enlightenment* (University of Chicago Press, Chicago, 2007).

23 Wren was installed as Savilian Professor of Astronomy at Oxford in May 1661, before which he had served as Professor of Astronomy at Gresham College in London since 1657. It is most likely that the method of observation referred to here was ‘put into execution’ during his studies at Oxford. Wren entered Wadham College in 1650 and was elected a fellow of All Souls’ College in 1653, where he resided until moving to London in 1657. During this period he was an active member of a select group of natural philosophers centred around John Wilkins (the warden of Wadham), Seth Ward, John Wallis, Jonathan Goddard, Lawrence Rooke and Robert Hooke (who joined the group in 1655). The Oxford group was involved with experiments, astronomical observations and perfecting various instruments (including meteorological instruments such as a thermometer and a hygrometer). Several of the members of the group were physicians, and Wren had an interest in medicine throughout his early career. Thus, it is plausible that this method of reading the weathercock had been developed at this early stage. On Wren’s role in the Oxford group, see Davies, *op. cit.* (note 20); Lisa Jardine, ‘The 2003 Wilkins Lecture: Dr Wilkins’s boy wonders’, *Notes Rec. R. Soc. Lond.* **58**, 107–129 (2004); G. H. Turnbull, ‘Samuel Hartlib’s influence on the early history of the Royal Society’, *Notes Rec. R. Soc. Lond.* **10**, 101–130 (1953). On Wren’s interest in meteorology more broadly, see Bennett (1982), *op. cit.* (note 3), pp. 77–86.

24 Wren could have been present at Whitehall both before and after the restoration of Charles II (Wilkins, Wren’s mentor, had married Oliver Cromwell’s sister in 1656). For Wilkins’s presence at Whitehall, see Jardine, *op. cit.* (note 20), p. 129. The weathercock described by Wren is similar to that of Ignazio Danti, Professor of Astronomy at Bologna, where the rotations of the vane were transmitted by a vertical shaft to a dial. For a description and drawing of Danti’s instrument, see Middleton (1969), *op. cit.* (note 2), pp. 176–177; Ignazio Danti, *Primo volume dell’uso et fabbrica dell’astrolabio et del planisferio* (Florence, 1578), pp. 273–281.

Change happened, and whether it were soft, stiff, or vehement. Neither shall the Instrument be out of Tune, or if it be, your own Hand may rectify it.

Neither shall the Thermometer need a constant Observance, for after the same Method may that be made to be its own Register.²⁵

I have analysed this address so closely because it shows the very special context and manner in which Wren's 'engine' was introduced to the Royal Society. First, though Wren acknowledged that he 'might seem to promise too much', he did not mention any previous attempt to build such an 'engine'. Thus, Wren was only describing a *conceivable* ('may be framed') instrument, not one that was already operational, as those at Oxford and Whitehall. Second, he did not reveal anything about the actual design of the instrument (how it actually operated) and described only its purpose (to register the changes of the wind in the absence of the observer). Third, the need for such an engine was motivated by a specific problem: the difficulty raised by keeping a diary of the wind throughout both day and night. Fourth, Wren only remarked in passing that his engine could incorporate a thermometer, by 'the same method'. Fifth, he did not explicitly mention that his engine could also be used to register the quantity of rain or humidity, though these were quantities of interest in his 'history of the seasons' and he did discuss a novel design for a hygrometer. In contrast to the address, the drawing of the weather clock did include instruments to register both the amount of rain and, as I will show in the next section, humidity.

Though the records of the Royal Society do not make an explicit reference to Wren's address, the minutes of the meetings for the month of January 1662 include the following relevant entries:

- 1 January Dr Wren intreated to draw up a Scheme for a weather ~~glass~~ clock, against next day.
- 8 January Dr Wren brought in a Scheme of a weather clock.
- 22 January Dr Wren shewed his experiment of filing a vessel with water, which emptied itself when filled at a certain height.
- 29 January Dr Wren read a paper concerning weather-glasses.²⁶

The initial entry in the Journal Book for 1 January stated that Wren was asked to 'draw up a scheme' for the following meeting, but then an interjection was made in the wide blank margins of the journal that specified the nature of this scheme—'for weather glass'; the margin was then further amended to read 'for a weather clock' (figure 3). This entry in the Journal Book was later transcribed in Birch's *History of the Royal Society* as 'Dr. Wren to draw up a scheme for a weather-cock [*sic*], against the next meeting'—a small typo which has probably thrown off historians for more than a century.²⁷

²⁵ Wren, *op. cit.* (note 17), p. 224.

²⁶ JBO/1/59–63, Royal Society Archives (RSA), London; Thomas Birch, *The History of the Royal Society of London* (Printed for A. Millar, London, 1756), vol. 1, pp. 68–74.

²⁷ Though in an earlier article Bennett reproduced the entries in Birch's *History* for 1 and 8 January (without flagging the typo), in his monograph on Wren he only engaged with the entry from 29 January. This led him to conclude that, as late as June 1663 (when Monconys visited Wren at Oxford), 'There is no clear link to the Royal Society at this stage.' See Bennett (1982), *op. cit.* (note 3), p. 84; Bennett (2016), *op. cit.* (note 3), p. 96. For a general comparison of the Journal Book and Birch's *History*, see Michael Hunter, *The Royal Society and its Fellows, 1660–1700: the morphology of an early scientific institution* (British Society for the History of Science, Oxford, 1994), p. 83.

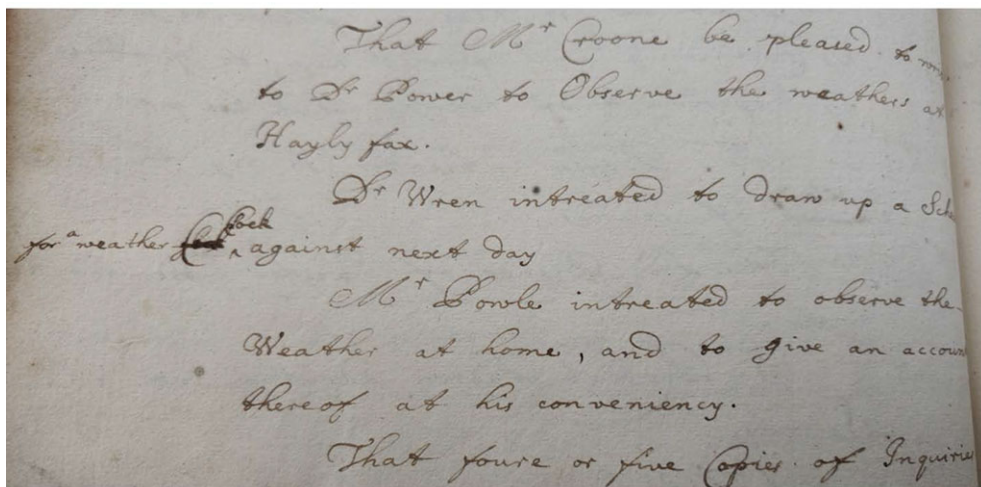


Figure 3. The entry for 1 January 1662 from the Journal Book of the Royal Society (RSA JBO/1/59, Royal Society Library, London. © The Royal Society.)

What did the members of the Society know about ‘a weather clock’ to motivate such an abrupt and surprising request? The minutes only show that during the same day some discussions about weather observations had ensued.²⁸ It is plausible that the Society’s interest in weather observations and in the scheme of the newly named instrument was sparked by Wren’s address, which could have been read that very day or shortly before. The opening of the address (‘Mr. President, We begin a new year, and therefore may pause a little, and look back on what we have done ...’) makes it clear that it was to be delivered on the occasion of a new calendar or administrative year.²⁹ While on its own this passage is not sufficient to determine exactly when the address was written and delivered, the naming of the instrument—referred to only as ‘an engine’ in the address, but as a ‘weather clock’ in the minutes for 1 and 8 January—does suggest a particular order of events.

²⁸ Dr Power was asked to observe the weather at Halifax, while Mr Powle was asked to ‘observe the weather at home, and to give account thereof at his conveniency’. Birch, *op. cit.* (note 26), vol. 1, p. 68.

²⁹ Bennett suggested, based on contextual evidence, that the undated address ‘was probably delivered at the beginning of 1662’. J. A. Bennett, ‘A note on theories of respiration and muscular action in England c. 1660’, *Med. Hist.* **20**, 59–69 (1976), at p. 63; Bennett (1982), *op. cit.* (note 3), p. 79. Bennett’s conclusion can be further supported by a piece of evidence that has not yet been taken into account: the letter was addressed to a ‘Mr. President’. After the first charter of the Royal Society (15 July 1662, read on 13 August 1662), Lord Brouncker was appointed as the first President, a position he held until 1677. When Wren wrote to Lord Brouncker (for example, in the letter he sent him on 30 July 1663), he addressed him as ‘My Lord’ (a title consistently used in the minutes). However, before the first charter was passed, a president was elected monthly. Because the minutes record the names of the presidents only occasionally, we do not know who presided in December 1661 or January 1662. Among the known presidents before Lord Brouncker are Mr Robert Boyle, Sir Robert Moray and Dr John Wilkins, all of whom it would not have been unusual to address as ‘Mr President’. The only letter reproduced in Birch’s *History* addressed to a ‘Mr. President’ was read on 12 June 1661; the letters to Lord Brouncker (including when President) published by Birch are addressed ‘My Lord’. See Birch, *op. cit.* (note 26), vol. 1, pp. 26, 288. On the presidents of the Royal Society before the first charter, see E. S. de Beer, ‘The earliest Fellows of the Royal Society’, *Notes Rec. R. Soc. Lond.* **7**, 172–192 (1950). The name ‘Royal Society’ does not appear in the text of the letter but only in the heading under which it was published, consistent with the fact that the Society’s official name was only adopted in its first charter: Michael Hunter, *Establishing the new science: the experience of the early Royal Society* (Boydell Press, Woodbridge, 1989), p. 16.

I would like to suggest the possibility that the drawing preserved at RIBA is the ‘scheme of a weather clock’ brought before the Royal Society on 8 January 1662. That Wren could have drawn such an exquisitely detailed drawing in less than a week should not come as a surprise. After the Great Fire of London swept the city between 2 and 6 September 1666, on or about 11 September, he gave Charles II a plan for totally rebuilding London.³⁰ Still, it is immediately clear that Wren did not have the opportunity to carefully consider all the implications of the scheme. The row of boxes in which the rainwater was funnelled was placed on top of a horizontal ruler which seems to have rested its whole weight only on a pulley and a pencil. Furthermore, the level of the rainwater in the boxes would have been affected by evaporation, especially when the engine was designed to function unattended for 12 hours or more. This problem was later explicitly acknowledged by Wren: ‘I doubt too whether they would not be drie, ere the observer comes to looke in them.’³¹ This grave challenge must have become obvious to him soon after he presented the scheme (maybe it was even pointed out during the discussion) because, on 22 January, he presented the Royal Society with an experiment by which a vessel of water could be made to empty itself when filled to a certain level. This mechanism was later developed by Robert Hooke to create a tipping-bucket rain gauge that he incorporated in the weather clock he built for the Royal Society.³²

The following week, on 29 January, Wren read a paper ‘concerning weather-glasses’; John Evelyn, who luckily attended the meeting, took note of it in his diary: ‘Dr. Wren produced his ingenious *Thermometer*’—a reference to Wren’s circular thermometer (also known as the ‘weather-wheel’).³³ Wren was dissatisfied with the construction of the usual thermometers (such as the one depicted in figure 2) because he considered that the liquid that trapped the air in the glass exercised a varying degree of exertion depending on its vertical level.³⁴ He circumvented this problem by shaping the air reservoir as a drum surrounded by a tube with liquid such that, when the air expanded and pushed the liquid upwards, the drum rotated around its centre to re-balance. On 12 June 1663, Wren informed Monconys about his thermometer design, which Monconys got to see the next day in London, where Wren had left it with Dr Goddard.³⁵

Thus, by 29 January 1662, three of the four meteorological instruments depicted in the RIBA drawing had been supplanted by new designs. One would guess that, if Wren had to redraw his scheme after this date, the new drawing would have reflected these new changes, something the RIBA drawing fails to take into account. However, this is no

30 Kerry Downes, *The architecture of Wren* (Granada, London, 1982), p. 11.

31 Christopher Wren, Letter to John Wilkins, 26 November 1663, MS EL/W3/4, RSA.

32 For a reconstruction of Hooke’s tipping bucket, a design probably inspired by Wren’s, see Asit K. Biswas, ‘The automatic rain-gauge of Sir Christopher Wren, F.R.S.’, *Notes Rec. R. Soc. Lond.* **22**, 94–104 (1967).

33 Though Evelyn does not describe Wren’s thermometer sufficiently to be certain of this identification, the circular thermometer (or the ‘weather wheel’) is the only known thermometer by Wren worthy of such praise. When in July 1663 the Royal Society was preparing for the promised visit of Charles II, Wren wrote to Brouncker to suggest that his ‘Weather-wheel’ could be a worthy spectacle: Wren, *op. cit.* (note 17), pp. 225–226; Bennett (1982), *op. cit.* (note 3), pp. 84–85.

34 Wren’s criticism of the usual design of thermometers was only articulated in writing by his Oxford friend Thomas Sprat. See Sprat, *op. cit.* (note 21), p. 313.

35 Monconys, *op. cit.* (note 1), vol. 2, pp. 54–55. The Royal Society minutes from 6 July 1663 state that Wren ‘mentioned the turning glass thermometer with an index, left with Dr. Goddard’: see Birch, *op. cit.* (note 26), vol. 1, p. 271. It would not have been unusual for Wren to leave an instrument with a close collaborator, after having presented it to the Society, such as the ‘the Vessel for cooling and percolating the Air at once, I formerly show’d the Society, and left in Mr. Boyle’s Hands’: see Wren, *op. cit.* (note 17), pp. 225–226. See also Bennett (1982), *op. cit.* (note 3), pp. 81–85.

counterfactual scenario. After a hiatus of more than a year, Wren's weather clock is mentioned again in the registers of the Royal Society, on 2 September 1663, when a proposal was made to renew the call for a history of the weather. Given the topic, it was 'thought proper, that Dr. Wren should be written to, to send to the society a scheme of his weather-engine, formerly proposed, in order to see whether it needed any addition or not'. While at the next meetings there was some confusion about who was responsible for writing to Wren at Oxford, the request was always for the same thing—a *scheme*: 'Dr. Wren's scheme for the observation of all the changes of weather' (16 September) or 'his [Wren's] scheme of the instrument for observing all kinds of weather' (23 September). Finally, on 2 December, John Wilkins

acquainted the Company, that he had received an answer from Dr Christopher Wren concerning his proposed Weather-Clock, together with the Scheme thereof. The Amanuensis was ordered to draw the Scheme in great, against the next Meeting, at which it should be considered, together with the letter describing it.³⁶

Though Wilkins announced that the amanuensis would copy and enlarge Wren's scheme, the drawing preserved in the archives of the Royal Society (figure 4) is almost certainly the original one sent by Wren to Wilkins along with his letter, because the fold marks on the drawing identically match those of the letter.³⁷

Wren's reply to Wilkins is most revealing. It opened with an apology for the delay ('If you will pardon me for being a little late in observing your Commands ...'), which would have been unjustified if he had sent the scheme 'formerly proposed' to the Society on 8 January. He further remarked that he 'enclosed the Designe I promised of the Weather Clock, changed a little into a more convenient forme', again referring back to a previous design with which the Society would have been familiar. After describing what was depicted in the drawing (the weather glass had been replaced with the circular thermometer K in figure 4), Wren ended the letter with a note about what the Society might expect to find in this scheme: 'I have willingly in this last contrivance omitted the Boxes, because I thinke they may be better disposed themselves; & I doubt too whether they would not be drie, ere the observer comes to looke in them.' The 'Boxes' present in the previous scheme (and which Wren expected the Society or Wilkins to remember more than a year and a half later) were now 'willingly' omitted: that is, not because of forgetfulness or hastiness, but rather because of a careful consideration that evaporation would render them impractical. This was the contraption that Wren had already considered to be impractical by 22 January 1662, which shows that the Society was familiar with only one drawing.

This exchange proves that Wren did not leave his first drawing with the Society or any of its Fellows, as he did with the second drawing of the weather clock, included in the letter to Wilkins. When writing to Wren, the Society assumed that the drawing was still in his possession, an assumption that was never contradicted by Wren. Thus, one can be fairly certain that, when Monconys visited Oxford in June 1663, Wren had the first drawing that

³⁶ Birch, *op. cit.* (note 26), vol. 1, pp. 299–337.

³⁷ The drawing has been preserved in the Register Book of the Royal Society, RSA RBO/2i/78; see also Wren, *op. cit.* (note 31). While sometimes images were copied, it was also a common practice to cut out images from the original correspondence and paste them into the administrative books: see Sietske Fransen, Katherine M. Reinhart and Sachiko Kusukawa, 'Copying images in the archives of the early Royal Society', *Word Image* 35, 256–276 (2019). For different clues that allow drawings to be matched to the letters from which they have been extracted, see Fransen, *op. cit.* (note 7).

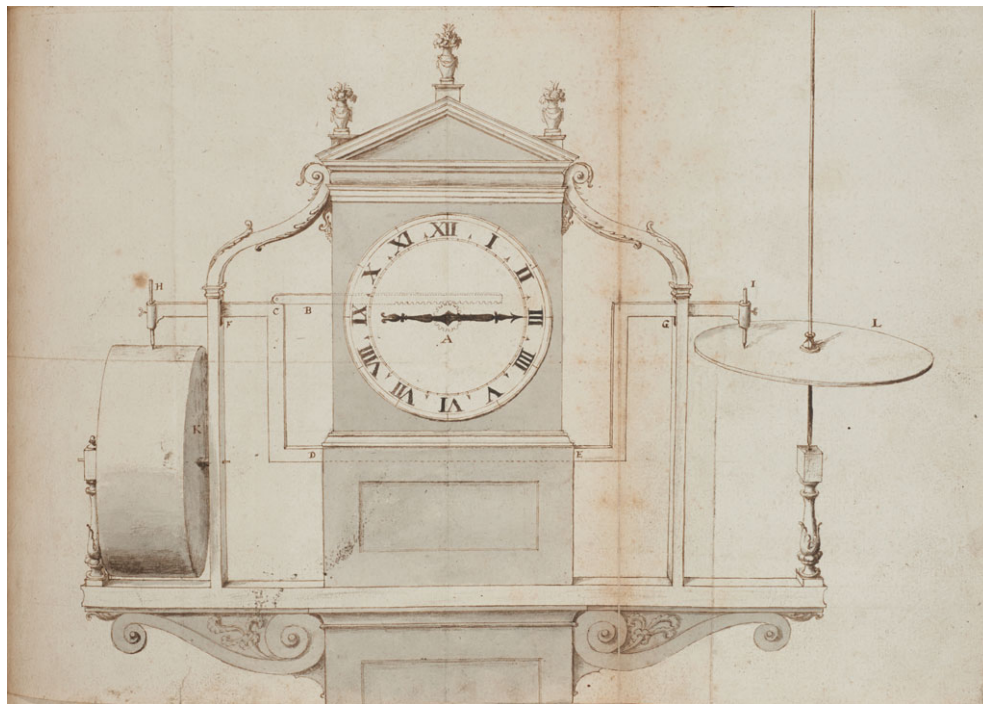


Figure 4. Drawing of a weather clock sent by Wren to John Wilkins, 26 November 1663. (RSA RBO/2i/78, Royal Society Library, London. ©The Royal Society.) (Online version in colour.)

he presented to the Royal Society and that it was a drawing that included a row of boxes—a contraption that is also present in Monconys's sketch. This makes it quite plausible that Wren could have shown Monconys this drawing, or some version of it. An example of such viewing of others' drawings is provided by Wren himself, who, during an eight-month trip to Paris in 1665–1666, was introduced to Gianlorenzo Bernini, who had just arrived in the city to present his designs for the east front façade of the Louvre. In a letter to a friend, Wren confessed that 'I would have given my Skin' to come into the possession of these designs:

but the old reserv'd Italian gave me but a few Minutes View ... I had only Time to copy it in my Fancy and Memory; I shall be able by Discourse, and a Crayon, to give you a tolerable Account of it.³⁸

While Wren, a talented draughtsman, might have been able to copy a drawing first in 'fancy and memory' and then on paper, Monconys failed in several revealing ways. His travel notes were only 'jotted down every evening upon arrival at his inn', as his son acknowledged when he published posthumously 'as it was' the 'rather confused rough draft (*un brouillon assez confus*)' that his father left behind after his sudden death in 1665.³⁹ In his description of the weather clock, Monconys mentioned that the 'heat & cold

³⁸ Wren, *op. cit.* (note 17), p. 262. Wren's trip to Paris and the unknown identity of the letter's recipient are discussed in Lydia M. Soo, *Wren's 'tracts' on architecture and other writings* (Cambridge University Press, Cambridge, 2007), pp. 93–102.

³⁹ Monconys, *op. cit.* (note 1), p. 8; De Clercq, *op. cit.* (note 5), p. 2.

[are registered] by a thermometer that raises or lowers a tablet', a nonsensical proposition, implausible to have arisen from Wren's description and drawing of the weather clock.⁴⁰ However, such a misunderstanding could have easily been caused by a careless sketch by Monconys that used perspective inconsistently. Monconys's carefully phrased description of the weather clock (and his encounter with Wren) were probably written down at a later time and based mainly on a hasty sketch that represented the tablet of the thermometer flat against the page.⁴¹ The reproduction of a drawing from memory, and the changes associated with it, offers a different perspective on the theme of copying images that has preoccupied historians of visual culture and graphical practices.⁴²

The alternative—that Monconys's sketch was based on a physical version of the weather clock—becomes untenable in light of the exchange between Wren and the Royal Society, in which it was never indicated that Wren took any steps towards constructing such an instrument. This would be an inexplicable omission if Wren had indeed showed Monconys a physical version of the clock on June 1663, but then failed to mention anything about it in his letter to Wilkins from November 1663 (not to mention that by the end of January 1662 Wren had already rejected the use of boxes for rain and had designed a new type of thermometer).

Though one cannot be certain, it is likely that the undated drawing from RIBA is the first drawing that Wren presented to the Royal Society and, most probably, to Monconys.⁴³ As I have argued above, when closely read, the records of the Royal Society impose certain constraints for when such a drawing could have been made, making it unlikely that Wren would have drawn it after January 1662. The level of detail, which will be discussed below, also suggests that this was not a simple sketch, but rather a vivid make-believe. One can imagine that, if not cautioned about it, Monconys might have believed that this was the drawing of an engine actually built by Wren. This would explain the great ambiguity in the text, where, though Monconys never claimed to have seen Wren's engine, he described and drew it with such a level of detail that several generations of historians could not imagine anything else.

DRAWING DETAILS AND ENACTING CONSTRUCTIONS

Carved pineapple finials on the clock pediment and wind vane, gilded spandrels on the dial, a swan-neck latch and flagged hinges on the longcase, a vase-shaped spindle leg, scrolled brackets on the tablet, beaded strings! It is tempting to assimilate these graphical details to the 'concrete' and 'futile' details that Roland Barthes identified in descriptive passages from realist literature in his essay 'The reality effect'. These 'useless details', Barthes

40 Monconys, *op. cit.* (note 1), p. 53.

41 Because Monconys's original drawing has not been preserved, this interpretation depends on the engraving published in the *Voyages*, which could have been based on subsequent drawings that were redrawn to match the textual description.

42 See the classic study of Samuel Edgerton on how drawings of machines that relied on perspective were misunderstood and misdrawn by Chinese copyists: Samuel Y. Edgerton, 'The Renaissance artist as quantifier', in *The perception of pictures* (ed. Margaret A. Hagen), vol. 1, pp. 179–212 (Academic Press, New York, 1980). For the practice of copying in creating knowledge in the early modern period, see *Word Image*, 35, no. 3 (2019).

43 There is no evidence for Wren producing multiple copies of the first drawing he presented to the Royal Society (8 January 1662), or a reason why this should have happened. It is most likely that this drawing stayed in his possession and was passed to his son along with the other papers collected in the *Parentalia*.

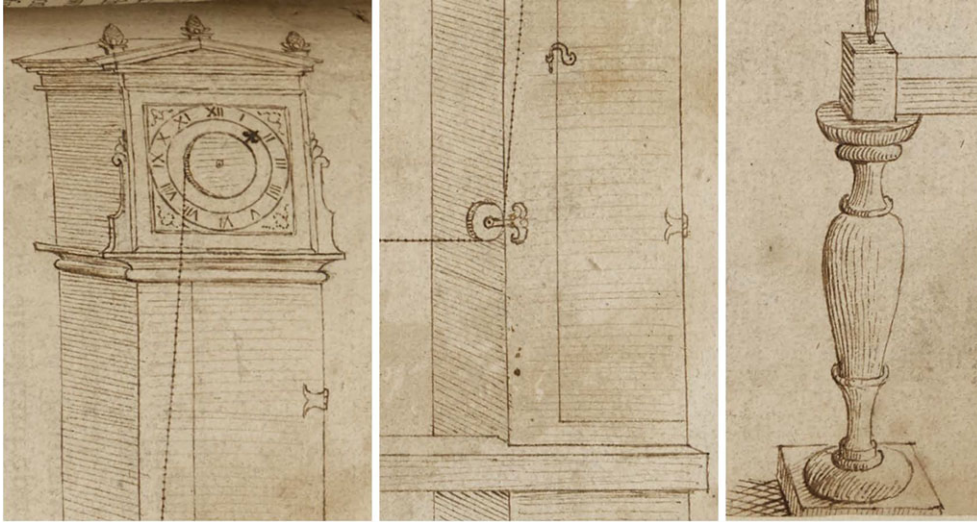


Figure 5. Details of construction of the weather clock (detail from figure 2). (Online version in colour.)

argued, did not represent reality but rather signified it within a system of cultural rules of representation, as if to ‘say nothing but this: *we are the real*’. For Barthes, the ‘useless details’ were ‘irreducible residues of functional analysis’, not unlike ornaments in functional architecture.⁴⁴ While the seemingly superfluous ornaments in Wren’s drawing could be interpreted, following Barthes, as signifying a particular system of representation (i.e. realism rather than reality), disjoint from the function of the drawing, I will argue that these details betray a particular purpose (or function) when they are contrasted with each other.⁴⁵ Take the leg that supports the beam on the left end—the seamless integration of shaft, coves and bead is broken abruptly by the flat blocks of discrepant sizes placed below and above it (figure 5). The same goes for the longcase clock, which at the upper end supports an elegant hood, but at the other has been coarsely cut by a beam. While any cabinet maker would have smoothly joined all the pieces, Wren emphasized every protrusion.

These details were no mere fancies, but details of construction that go unnoticed if one reduces the drawing to a mere configuration of objects. Worse still, such a blind interpretation will not even properly identify and make sense of all the instruments. As a careful consideration of the drawing shows, most of Wren’s attention and effort was focused not on the general configuration but on the particulars. In what follows, I will start with a couple of examples to show Wren’s deep concern with imagining and making visible the subtle construction and operation of his engine. I will then examine the double row of boxes that has so far stumped all commentators. Finally, after the eye has adjusted to connect Wren’s scattered details, I will try to make sense of the longcase, which so

44 Roland Barthes, ‘The reality effect’, in *The rustle of language*, pp. 141–149 (University of California Press, Berkeley, 1989), at pp. 146–148, emphasis in original. While Barthes identified the ‘reality effect’ with respect to literary text, the concept has also been used for analysing paintings: see Hanneke Grootenboer, *The rhetoric of perspective: realism and illusionism in seventeenth-century Dutch still-life painting* (University of Chicago Press, Chicago, 2005), pp. 160–161.

45 For a history of ornaments and their function, see Necipoğlu and Payne, *op. cit.* (note 15).

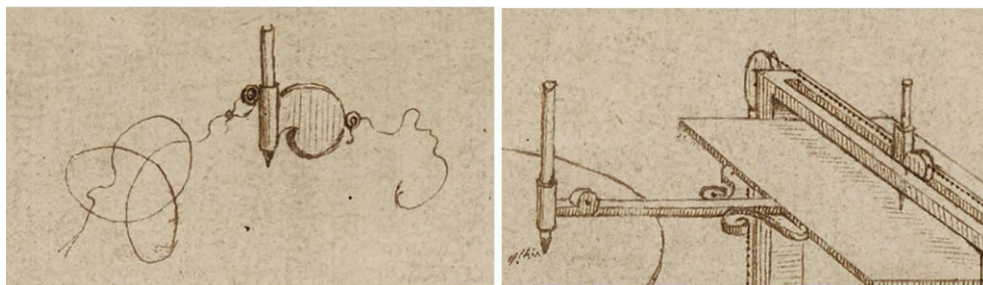


Figure 6. Pencil holders (detail from figure 2). (Online version in colour.)

stunningly resembles seventeenth-century architectural clocks while at the same time breaking with all known cases and patterns.

Pencil holders

The method for registering temperature was ingeniously simple: the clock moved a tablet which was marked by a pencil moved by the changing level of liquid in the thermometer. However, Wren intuited that this straightforward method could fail in practice if the two strings attached to the pencil were misaligned, causing the pencil tip to slip or even flip off the tablet. His solution, enlarged above the tablet, was a special holder that would stabilize the pencil when pulled in two different directions (figure 6). The pencil marking the changes in wind direction was also placed in a special holder that was attached to the ruler through a mechanism resembling the hinge of a compass—either to make sure that the pencil was pressed against the disc, or to allow for the removal of the disc without any smudges. These were no mere abstractions but rather a variation of the ingenious brass handle that Wren designed for his instrument ‘for drawing the out-lines of any object in perspective’, such that the pencil ‘may be kept very firm, so as always to touch the Paper’ (figure 7).⁴⁶ A similar concern with details was displayed in his work with astronomical instruments, to which he ‘added many sorts of Retes, Screws, and other devises to Telescopes, for taking small distances and apparent diamets to Seconds’.⁴⁷

Counterweights

The wind vane had an unusual addition: a protruding rod with a spherical object, whose purpose is revealed by the slanted lines that suggest a screw shaft on which the position of the sphere could be adjusted to counter-balance the weight of the vane (figure 8). This detail is particularly intriguing because, even in the eighteenth century, few wind vanes were balanced by counterweights.⁴⁸

46 ‘The description of an instrument invented divers years ago by Dr. Christopher Wren, for drawing the out-lines of any object in perspective’, *Phil. Trans. R. Soc. Lond.* 4, 898–899 (1669). The earliest mention of Wren’s instrument for perspective dates to 1653. Monconys saw such an instrument in June 1663, built by Anthony Thompson, in Henry Oldenburg’s possession. He was so enchanted with the design that he ordered one for himself. See Bennett (1982), *op. cit.* (note 3), pp. 17, 74–76.

47 Sprat, *op. cit.* (note 21), p. 314. See also Bennett (1982), *op. cit.* (note 3), pp. 26–43.

48 Middleton (1969), *op. cit.* (note 2), p. 177.

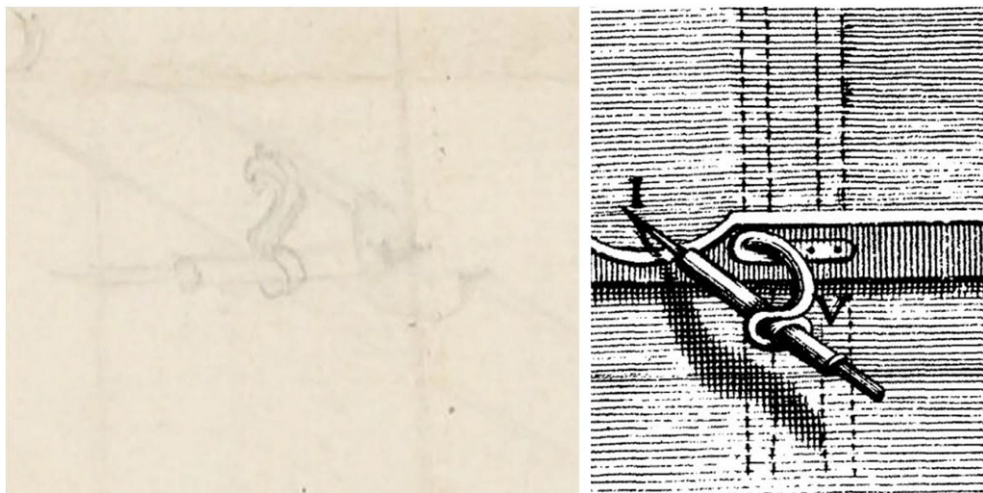


Figure 7. The brass handle of Wren's instrument for perspective (detail). (All Souls IV.156, Drawing 382a, recto, Bodleian Library, Oxford. © The Warden and Fellows of All Souls College, Oxford.) (Online version in colour.)

Chains and pulleys

Instead of using a straight line to depict the string that passed over the pulleys, Wren added equally spaced dots to indicate a chain or string of beads, which would be grabbed by the teeth of the pulleys without slipping. This detail was crucial if one considers closely how the long board was actually supposed to move. At first sight, it might seem that the board was pulled by the string to the right, but this assumption is put in doubt by the pulley and the weight below the board. It is more plausible that the string was only attached to the weight below the board; when the clock pulled up the weight, it also rotated the pulley, which would have moved the board to the right (figure 9).⁴⁹

Boxes and funnels

The purpose of the double row of 12 boxes has so far bemused all commentators, who have only seen a large funnel and have assumed that it was meant for accumulating rainwater in the boxes below (figure 10).⁵⁰ However, Wren's graphical details guide us to imagine a different picture. One should notice the apparently intricate and nonsensical manner in which the large funnel is suspended: it is attached to a tapering pole by a ring that would slide down if it were not for the vertical wire extending upwards. Moreover, it is absurd to imagine that rainwater could be collected inside the space in which the engine was placed. If the wind vane was clearly depicted as being located outside the space of the engine, why would Wren employ a different graphical device for the rain funnel? In fact, the mouth of the *actual* rain funnel was placed outside the drawing (rendering it invisible to the viewer) and was continued

⁴⁹ While the instrument for perspective made use of a system of pulleys and weights, in the preserved manuscript drawing Wren did not employ the graphical detail of the dots to represent the strings—either because he insisted on other details of construction or because slipping would not have been an issue. See All Souls IV.156, Drawing 382a, recto, Bodleian Library, Oxford, <https://digital.bodleian.ox.ac.uk/inquire/p/27269622-4037-4caf-9998-285f658b9d92> (accessed 4 October 2021).

⁵⁰ Hoff and Geddes, *op. cit.* (note 6), pp. 297–298; Middleton (1969), *op. cit.* (note 2), p. 247.

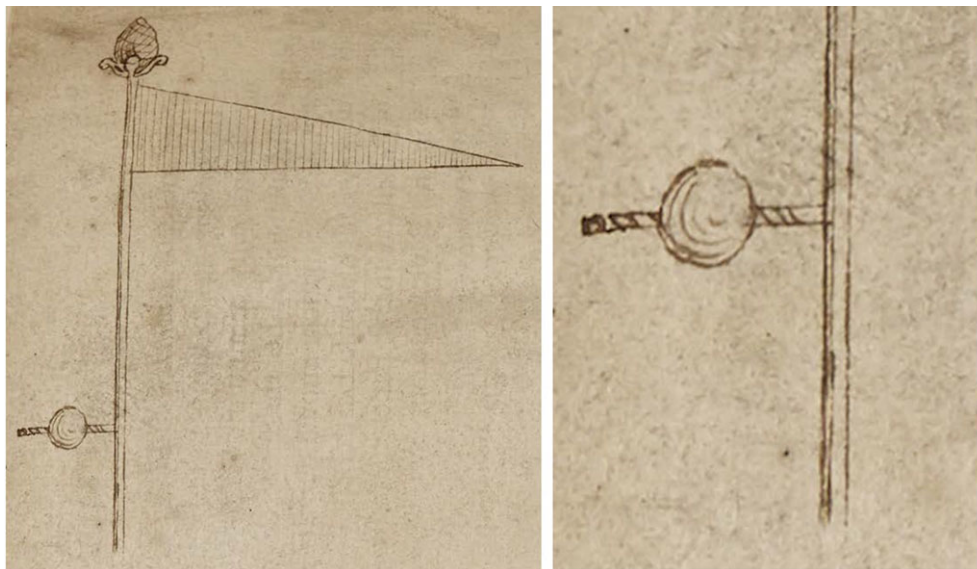


Figure 8. The wind vane and detail of its counterweight (detail from figure 2). (Online version in colour.)

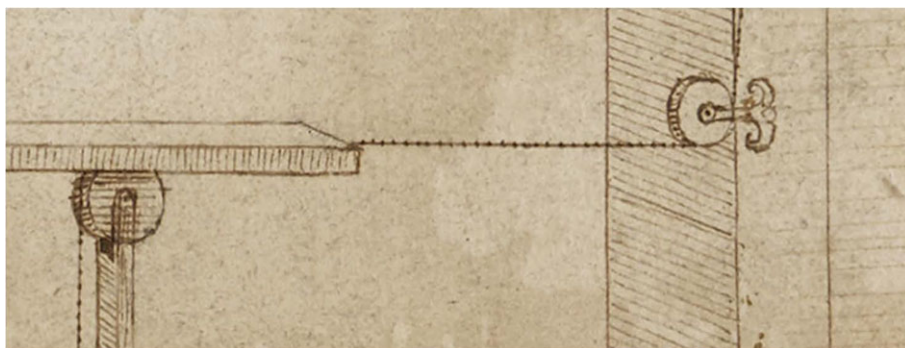


Figure 9. While it looks as if the board is pulled by the string, in fact it is more plausible that it was supposed to be moved by the pulley rotating beneath it (detail from figure 2). (Online version in colour.)

inside the drawing by the tapering pole, which (far from being a support) was used to channel the rainwater into one of the two rows of boxes. The large funnel (which until now has been mistaken for a rain funnel) is in fact a condensation hygrometer, used to measure humidity within the room.

This interpretation explains all the graphical details: the system of rings is used to support two funnels; the rain funnel is narrow (a wise choice if one wants to avoid overflowing the rather small boxes), while the funnel of the hygrometer has to be as wide as possible to collect the condensed air; finally, each funnel corresponds to a different row of boxes. This interpretation is further confirmed by textual sources. In his address to the Royal Society, Wren dismissed as unreliable the usual hygrometers (lute strings or oat beards) and promised instead to produce ‘a peculiar Manner’ to measure humidity ‘by collecting the

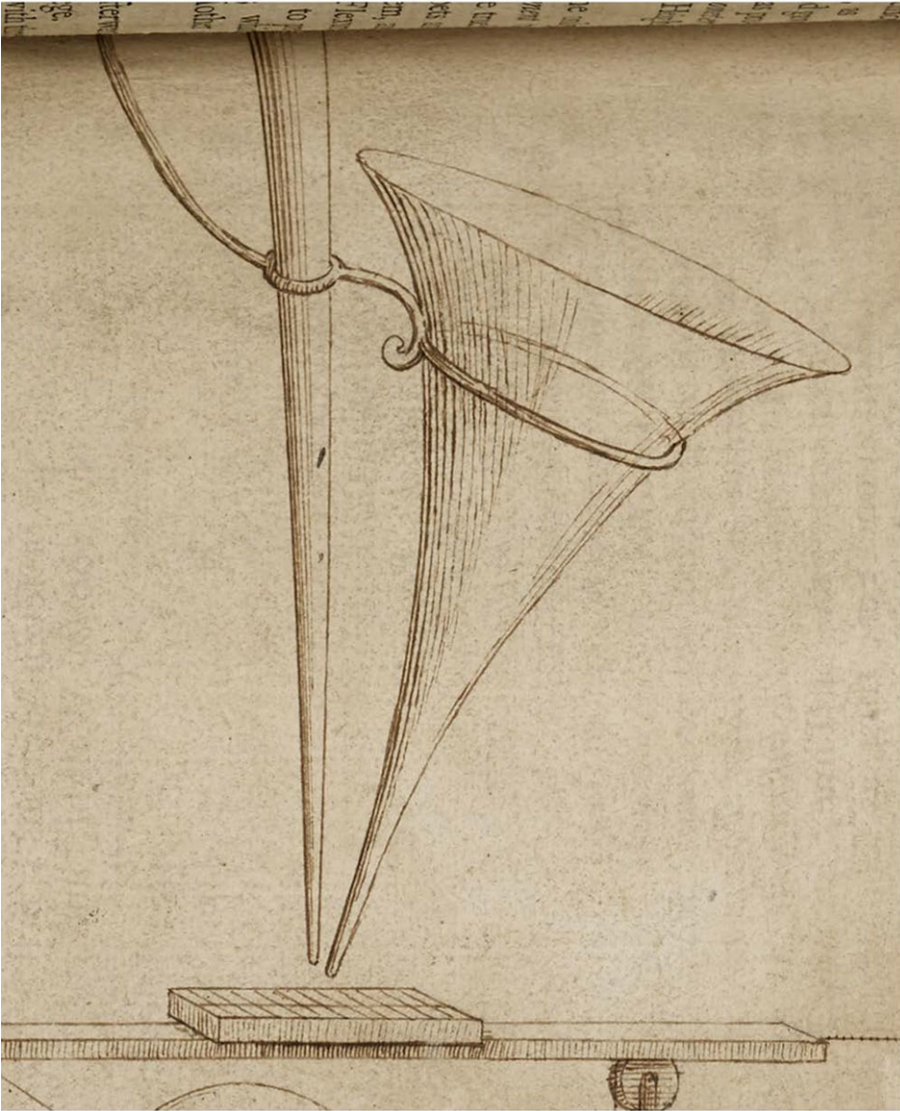


Figure 10. The mysterious funnel and double row of boxes (detail from figure 2). (Online version in colour.)

very Moisture of the Air'.⁵¹ The method, as Wren explained it to Monconys a year later, consisted in putting

*a very big, & wide glass funnel, with a very narrow nozzle, into a cellar, or a very humid & shady place, & out of the way of the wind, but near a window, & hung from the ceiling, so that there is not the width of two fingers between the funnel and the roof or vault.*⁵²

⁵¹ Wren, *op. cit.* (note 17), p. 224.

⁵² Monconys, *op. cit.* (note 1), vol. 2, p. 54, emphasis added. See also Middleton (1969), *op. cit.* (note 2), pp. 110–113. Such a hygrometer might have been invented by Wren as early as 1650: see Turnbull, *op. cit.* (note 23), pp. 111, 123.

Clocks

Though to a modern reader the longcase clock is the most familiar object represented by Wren, for his audience, in January 1662, it would have been a rather unusual sight. In June 1657, Salomon Coster, a Dutch clockmaker from The Hague, was granted the first patent to manufacture Christiaan Huygens's recently invented pendulum clock. By October 1658, pendulum clocks were also advertised in England by the clockmaker Ahasuerus Fromanteel, who became for almost a decade the foremost English manufacturer of pendulum clocks.⁵³ Until the anchor escapement was introduced (around 1670), pendulum clocks relied on a verge escapement with a short pendulum rod (about 4–6 inches), whose movement could be enclosed within the hood. The earliest pendulum clocks were all spring-driven and designed to be placed on tables or hung on walls through hook holes.⁵⁴ While the first weight-driven pendulum clocks were similarly suspended on walls, with the weights hanging exposed beneath the hood like many of their pre-pendulum predecessors, they had to be supported by brackets because they were considerably heavier than the spring-driven clocks. The emergence of the longcase, where a trunk rather than a wall bracket supported the hood, is difficult to pinpoint because many of the surviving longcase clocks appear to have 'started life as hooded wall clocks'.⁵⁵ One case maker, Joseph Clifton, luckily left a brass token inside the trunk of a longcase dated to 1663.⁵⁶ Another surviving longcase (probably made for Henry Howard, the grandson of the 2nd Earl of Arundel and a generous host of the Royal Society) has been considered by some experts to be 'the earliest known longcase clock', dating to c. 1660–1662.⁵⁷ From all available evidence, therefore, Wren's drawing of the weather clock contains the oldest surviving drawing of a longcase clock.⁵⁸

The matter becomes even more intriguing if one compares Wren's drawing with some of the earliest surviving examples. The hood of Wren's clock matches almost to a fault the very distinctive style of Fromanteel's clocks, which (irrespective of whether they were spring- or weight-driven, table-top, wall-mounted or longcase) had 'almost from the very beginning' dials with a matted central zone, silvered chapter rings, and spandrels with winged cherub heads; the hoods were commonly decorated with a triangular pediment, side columns and finials.⁵⁹ There is only one discrepant and bizarre detail that does not match: the

53 Ahasuerus Fromanteel probably learned about Huygens's invention from his son John, who worked as an apprentice in Salomon Coster's workshop in The Hague from September 1657 to May 1658: see Percy G. Dawson, C. B. Drover and Daniel W. Parkes, *Early English clocks: a discussion of domestic clocks up to the beginning of the eighteenth century* (Antique Collectors' Club, Woodbridge, 1982), p. 74.

54 *Ibid.*, p. 113.

55 *Ibid.*, p. 163. For examples of wall clocks with architectural cases and resting on carved-brackets, see *ibid.*, pp. 488–492.

56 *Ibid.*, p. 52.

57 Jeff Darken (ed.), *Horological masterworks: English seventeenth-century clocks from private collections* (Antiquarian Horological Society, in co-operation with the Museum of the History of Science, Oxford, 2003), pp. 38–41; Michael Hurst, 'The first twelve years of the English pendulum clock', *Antiquarian Horology* 6, 146–156 (1969), at p. 147.

58 The two drawings of the weather clock have been used as evidence in a provocative, but ultimately unpersuasive, argument that the architectural design of the longcase clock was due to Wren: L. L. Fabian, 'Could it have been Wren?', *Antiquarian Horology* 10, 550–570 (1977).

59 For the description of Fromanteel's dials and their style, which clearly distinguished them from those of Salomon Coster, see Dawson, Drover and Parkes, *op. cit.* (note 53), pp. 74–140, esp. p. 91. For the style of Fromanteel's hoods, which were probably crafted by a single case-maker, see *ibid.*, pp. 141–162. For the particular style of Dutch clocks between 1660 and 1680, see R. Plomp, *Spring-driven Dutch pendulum clocks, 1657–1710* (Interbook International, Schiedam, 1979), pp. 28–38. For Fromanteel's use of the same-styled hood for spring- or weight-driven, table-top, wall-mounted or longcase clocks, see Dawson, Drover and Parkes, *op. cit.* (note 53), pp. 163, 144, 157. For the period relevant for this comparison, 1658–1662, Fromanteel's clocks are the only relevant

decorations on the sides of Wren's hood; all known exemplars either are decorated by columns or are unadorned. The similarities vanish when one compares the trunks. All surviving longcases have a plinth—a base wider than the trunk which is essential for the overall stability of a structure that stands just over 6 feet high—and, in 'most if not all cases until nearly the end of the seventeenth century', the plinth was supported by bun feet. Only later were the bun feet replaced by a moulded skirting, similar to the base on which Wren's clock rests.⁶⁰ The door of the clock provides another jarring difference: while for Wren's clock the door is asymmetrically cut and attached with external strap hinges and a latch, surviving longcases have symmetrical doors, with locks and internal strap hinges, and panels as decorations.

Such asymmetries—between drawing and material objects—show that these graphical details are not representational artefacts, conventions or embellishments, but rather meaningful traces. The most compelling solution of this tension is to assume that a Fromanteel hooded wall clock had been subsequently encased with a trunk. The material record shows that it was not uncommon for hooded wall clocks to be supplemented with trunks of inferior quality (with no decorations) made by joiners and not professional case-makers.⁶¹ One such example is the 'split-seconds' clock commissioned from the clockmaker Joseph Knibb by James Gregory in 1673 for his future astronomical observatory at the University of St Andrews. This clock started life as a wall clock but was subsequently converted into a longcase.⁶² A possible trace of such a conversion can be found in Wren's drawing. The side decorations on the hood, which are bizarre and unrecognizable in this context, look strikingly similar to the brackets that would have supported hooded wall clocks (figure 11). Even the size of these decorations, incongruously spanning only two-thirds of the dial, matches the depth of the hood.

It is clear that, for Wren's engine, a clock supported by a longcase was more convenient than a hooded wall clock because it integrated the clock with the instruments as their support and not only as their driving force; thus, one could freely move and orient the engine as required by the meteorological instruments. The longcase was also a more convenient graphical solution as it did not require the backdrop of a wall, nor did it distract the viewer's attention with its hanging weights, which could have then been mistaken for the other weights of the engine. If Wren was indeed representing a novel object convenient for his purpose but unfamiliar to his audience, then the graphical details mentioned above could have been added to retrace the steps by which the familiar hooded wall clock was to be transformed. In this light, Monconys's box suspended in mid-air is not so much the simplified version of a recalled drawing (as one might first think), but rather the drawing of the recalled object with which Monconys would have been most familiar—a hooded wall clock.

examples as 'No examples of pendulum clocks by any other maker are known which can be said to have been made much before about 1665'; clocks from other manufacturers show evidence that they were only later converted to pendulum control: see *ibid.*, pp. 84, 62.

⁶⁰ Tom Robinson, *The longcase clock* (Antique Collector's Club, Woodbridge, 1995), pp. 28, 83; Dawson, Drover and Parkes, *op. cit.* (note 53), p. 169.

⁶¹ *Ibid.*, pp. 491–495.

⁶² Ronald A. Lee, *The Knibb family, clockmakers* (Manor House Press, Byfleet, 1964), pp. 154–156. See also the 30-hour clock by Joseph Knibb on a hooded bracket converted into a longcase where the original brackets are visible: Dawson, Drover and Parkes, *op. cit.* (note 53), p. 492.



Figure 11. (left) Two examples of Knibb hooded wall clocks (Richard Garnier and Leo Hollis, *Innovation and collaboration: the early development of the pendulum clock in London* (Fromanteel Limited, Santon, Isle of Man, 2018)); (right) the decorations of Wren's clock (detail from figure 2). (Online version in colour.)

Wren could have also provided a faithful representation of a clock with which he was familiar, and that underwent the transformations that have been detailed in the drawing. One potential candidate is the 'large pendulum clock, made by Fromantel' that was gifted to the Royal Society by Bishop Seth Ward to commemorate the death of Lawrence Rooke. Rooke died in June 1662; by July the clock 'was set up in the room, where they [the Royal Society Fellows] met in Gresham-college'.⁶³ Besides being 'esteemed a great Rarity' and being doubtfully praised by one contemporary as 'One of the first Pieces that was made in *England*' according to Huygens's directions, Ward's clock must have had some personal connection to Rooke.⁶⁴ Ward, who had occupied the Chair of Astronomy at Oxford before Wren, tutored Rooke, Wren and Robert Hooke in astronomy. In an autobiographical note, Hooke remarked that, at Ward's recommendations, 'I apply'd my self to the improving of the *Pendulum* for such Observations [in astronomy], and in the Year 1656, or 1657, I contriv'd a way to continue the motion of the *Pendulum*'.⁶⁵ Like Hooke, Wren and his 'honored friend' Rooke (professors at Gresham College of Astronomy and Geometry respectively) were at the time making astronomical observations while entertaining the hope of finding a method for solving the longitude problem.⁶⁶

Thus, it should not come as a surprise if Ward's 'large pendulum clock' might be connected to Rooke's and Wren's astronomical observations. The 'large pendulum clock',

63 Birch, *op. cit.* (note 26), vol. 1, p. 98. The clock was still at the Royal Society when Birch wrote this note but since then all traces of it have been lost.

64 Walter Pope, *The Life of the Right Reverend Father in God, Seth, Lord Bishop of Salisbury* (Printed for William Keblewhite, London, 1697), p. 121; William Derham, *The Artificial Clock-Maker* (Printed for James Knapton, London, 1696), p. 96.

65 Robert Hooke, *The Posthumous Works of Robert Hooke* (ed. Richard Waller) (London, 1705), p. iv. Hooke's autobiographical note is not innocent and much is hidden in the vacillation between 'the Year 1656, or 1657' as it puts into doubt Huygens's priority. In his criticism of Huygens's *Horologium oscillatorium* (1673), Hooke went even further: 'Dr. Wren, Mr. Rook, Mr. Ball & others made use of an Invention of Dr. Wren's for numbring the vibrations of a pendulum a good while before Monr. Zulichem [Huygens] publisht his' (Hooke quoted in Bennett (1982), *op. cit.* (note 3), p. 49).

66 See Bennett (1982), *op. cit.* (note 3), pp. 26–54. For Hooke and Wren's interests in and experiments on pendulums, see Louise Diehl Patterson, 'Pendulums of Wren and Hooke', *Osiris* 10, 277–321 (1952).

which probably referred to a longcase (rather than a pendulum with a long rod), might therefore not have fully originated with Fromanteel as all commentators have invariably assumed. Instead, a hooded wall clock could have been fitted with a trunk to allow its use in a space without walls, such as the courtyard of Gresham College, where Wren had mounted a 35-foot-long telescope in 1658.⁶⁷ The example of James Gregory's split-seconds clock at the University of St Andrews shows that this would not have been unlikely, especially when such observations were not carried out in a tailor-made space such as an observatory.⁶⁸ Placing the wall brackets as side decorations would have been a whimsical solution that allowed one to keep these parts safe in case the clock was to be remounted in the future.

CONCLUSION

Much more than being an embellished depiction of meteorological instruments, Wren's original drawing is the equivalent of a tailored suit that has been inverted to make visible the stitches and the seams. Yet this effect is so subtle that it can easily pass unnoticed. Why not choose more obvious and well-established graphical conventions, such as an exploded view or a cutaway?⁶⁹ Unlike drawings or prints of machines that had to be intelligible on their own, or that belonged to well-established genres with particular styles and conventions, Wren's drawing was made for a unique occasion: an oral presentation. Details that might have been lost in a private engagement could now be articulated and emphasized. Even more, one can imagine how Wren would have pointed out details to animate his drawing: how the counterweight could be screwed to assure the vertical stability of the wind vane; how the pencils would be kept pressed on the surface of the tablet; how the pencil or the disc of the wind register could be removed by using a hinge; how the chain would engage the teeth of the pulley to move the main board. It is certain that Wren would have had many things to say about the clock: how long it could work unattended, how precise it would be, etc. Those in the audience would have concluded, if Wren did not explicitly say it, that such an engine could be easily, cheaply and quickly constructed from scraps that were probably available at Gresham College. With the exception of the glasswork, making such an engine did not require an instrument maker but a carpenter. Thus, Wren's drawing was more than a mere plan or design: it was supposed to entice its audience and persuade them of its feasibility by showing how certain technical difficulties could be solved.

In the second drawing of the weather clock presented to the Royal Society (figure 4), instead of details of construction, Wren employed *finishing details*. Though the gilded spandrels on the dial have been removed, carved floral inlays are distributed around the edges—the horizontal brackets, the legs, the pediment—framing the unembellished instruments. The vase-shaped support legs are now continued by blocks matching them in size. While dotted lines show how the crooked rack enters the hood and is moved by the clock, the circular thermometer, with its intricate drum and surrounding liquid tube,

67 Bennett (1982), *op. cit.* (note 3), p. 23.

68 Helen C. Rawson, 'James Gregory, the University Observatory and the early acquisition of scientific instruments at the University of St Andrews', *Notes Rec.* 69, 109–133 (2015).

69 For examples, see Lefèvre, *op. cit.* (note 8); Hunter, *op. cit.* (note 9).

remains opaque. The finishing details are also extended to the shading, the hatching lines being replaced by ink wash. While in the first drawing Wren separated the meteorological instruments from the clock acting as a driving force, the second drawing is centred on the face of the clock, with the two meteorological instruments symmetrically disposed on either side. In this drawing, Wren employs graphical details not only to convey how a finished weather clock might look but also to imagine a scientific instrument that would be worthy to be displayed (or gifted) during a royal visit, such as that for which the Royal Society was preparing in July 1663.

Though I have stressed the importance of the material world that surrounded Wren, the analysis of graphical details could also be taken in a different direction. One last look at Wren's first drawing might leave one wondering about its centre, where, floating in mid-air, there is a pencil—an appropriate symbol for Wren. However, the careful and measured composition of the overall drawing seems to be put into question by the scrawling on the sides of the pencil: on the left a trefoil knot, on the right a swirling line; the end of both lines is split like the tongue of a serpent. Is this a 'useless' (i.e. meaningless) detail? It is tempting to make a guess and interpret these curlicues as a remembrance by Wren of his father, the Dean of Windsor, who had died only a few years earlier in 1658. The *Parentalia* note that the 'one thing mentioned by him [Dean Wren] as his own invention', and described in a marginal note in Henry Wotton's *Elements of architecture*, was 'the Serpentine', a new manner for 'disposing the current of a river to a mighty length in a little space'.⁷⁰ Dean Wren, who was 'well skilled in all branches of the mathematics', had similar interests to those of his son, who inclined towards mechanics and practical mathematics.⁷¹ As a sign of gratitude, the young Wren dedicated to his father an 'astronomical instrument' and a 'pneumatic engine' by composing Latin poems which have been preserved, along with the drawing of the weather clock, in the heirloom copy of the *Parentalia*.⁷² The aim of these remarks is not to claim that one can fully know the intent behind these lines, but rather to show how even the most apparently meaningless and superfluous detail may guide historians to see the life hidden beyond the representation.

DATA ACCESSIBILITY

This article has no additional data.

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⁷⁰ Wren, *op. cit.* (note 17), p. 142.

⁷¹ *Ibid.*; Bennett (1982), *op. cit.* (note 3), p. 16. On Dean Wren's scientific marginalia, see Jardine, *op. cit.* (note 20), pp. 114, 147.

⁷² See above n. 20. On Dean Wren and his relationship to his son, see Jardine, *op. cit.* (note 20).