A LEAD DOMESTIC 'WINDOWSILL' DIAL

PETER BAXANDALL

I am surprised by how few contemporary accounts I have seen of the domestic use of sundials before they became unnecessary in everyday life. I am tempted to make plausible assumptions unsupported by evidence, no doubt exaggerating their importance in the household scene. BSS member John Baxandall has found the following in a letter from Jane Austen to her sister Cassandra during a passing visit to Godmersham Park, Kent, on 26th October 1813.[1]

> "Owing to a difference of Clocks, the Coachman did not bring the carriage so soon as he ought by half an hour; – anything like a breach of punctuality was a great offence – & Mr Moore was very angry – which I was rather glad of – I wanted to see him angry – & though he spoke to his Servant in a very loud voice & with a good deal of heat I was happy to perceive that he did not scold Harriot at all."

Harriot was Revd George Moore's second wife (they had been married for seven years), the coachman and coaches would I suppose have been housed in the stables with a clock or in what might have now become 'The Old Coach House', the 'Servant' presumably one whose job included the (daily?) synchronisation of the house and estate clocks.

But… where would the time be taken from? Perhaps all that was important was that the clocks should agree both upstairs and down so that when JA in the same letter tells her sister that "we do not dine till ½ past 6" it was the time by one of the house clocks that was followed to avoid a "breach of punctuality" rather than the local Solar or Mean Time.

In finding the time directly (as opposed to relying perhaps on church bells or a clock displayed in a shop window) it might not have been necessary to consult a pedestal or wall sundial in the garden; the household might sensibly have had a horizontal dial small enough to fit indoors next to a window, designed for *use* rather than *show*. The size and lack of elegance should not be held against such a 'domestic' dial, after all a matchstick stuck into a lump of BluTac on a windowsill provides a satisfactory noon mark if that is all one needs.

The domestic dials I have in mind were small (perhaps 4" or less across), simple, and were to be screwed down indoors near enough to a window to catch the sun. Despite their size they are not travelling 'Poke Dials' as described in Mike Cowham's book.[2] It is an easy assumption to make that their miniature style was introduced by clockmakers late in the 17th century as accessories to the increasingly available lantern and long cased domestic clocks: yet again I am in the comfortable arms of the plausible. On the other hand they might have been made for domestic use long before that.

Lee Borrett,[3] a specialist on early rural clocks, writes "However, I have never heard of records about these dials being sold with clocks … but it makes sense that they were!" Other 'clockies' I have talked to (Brian Loomes for example and Dorset's Polly and Michael Legg) are equally uncertain. Perhaps the two were not sold together, perhaps clockmakers and sellers feared that they would undermine a customer's confidence if they offered a sundial to compensate for their clock's inaccuracy?

Thomas Tompion's sundial,[4] currently displayed on a plinth outside a window in Bath across the Pump Room from his marvellous 1709 'watch' (which JA would certainly have known with its third 'sun slower, sun faster' EoT hand), is often quoted as an example of a sundial-clock association,

Fig. 1. Pewter domestic dial, 3.75", Photo: Paul Madden.

Fig. 2. Brass domestic dial, 3.4", Photo: Lee Borrett.

Fig. 3. Bronze domestic dial, 2".

but even that is in doubt as we read in a letter[5] to the *Bulletin* from Sir George White telling us that *that* Tompion dial was "found in some nettles just outside Bath, either at Corston or Corsham" in the 1960s. I myself prefer for family reasons the possibility suggested by Sir George that it was set up initially in the grounds of Corsham Court[6] (from 1946 to 1986 the home of the celebrated Bath Academy of Art). There are two later 18th century BSS Registered sundials in the Corsham grounds, one of them bought from Tho. Wright, perhaps as a replacement when the Tompian dial was stolen?!

Some Domestic Dials

This article is really about a sundial half of whose dial plate was found in 2007 by metal detecting enthusiast and horticulturalist David Green in a freshly ploughed field in the village of Child Okeford between Blandford Forum and Sturminster Newton in Dorset. It is made of lead, the recovered semi-circular shape being very close to the size of the school protractors nostalgically still found in tin boxes of 'Oxford Mathematical Instruments'. A fuller description comes later but before that I would like to show three complete domestic dials that I came across recently and one that is intriguingly damaged.

Figure 1 is from Paul Madden's website[7] where it is described as "18th Century pewter windowsill sundial, 3.75 inches diameter". It is a gem but unfortunately no longer for sale!

Figure 2 shows a brass dial owned by Lee Borrett. It is 3.5 inches AF (Across the Flats) with gnomon angle 48°, perhaps sold as an accessory for a clock.

Figure 3 shows a recent eBay purchase. It is 2 inches AF with a gnomon angle of 45°. Made of a bronze, it is small, light and delightful despite the mistakes in the chapter ring around 6:00pm!

Finally here is another (damaged) lead dial of the domestic type (Fig. 4) about which there has been some public discussion. Perhaps it is very old, perhaps not.

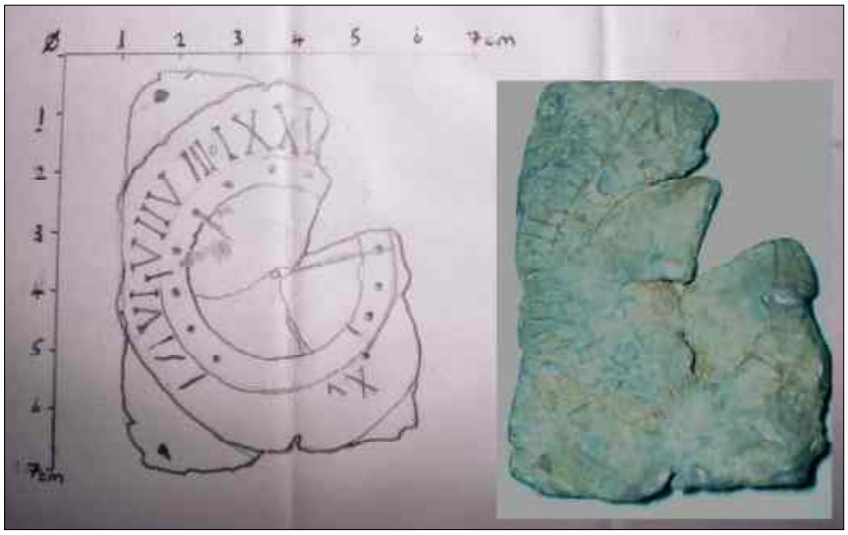

Fig. 4. A damaged lead dial. Photo: Albi Pinnion.

Fig. 5. The lead half-dial as it was found.

A Metal Detected Lead Half-dial

Figure 5 shows a photograph of what was found by the metal detector in Child Okeford. The surviving surface was smoothly curved and was not split. Risking expulsion from the Society I asked neighbour, friend and naturalist Nicky Butt to press the dial flat in a book press and to take the higher resolution photograph in Figure 6.

What remains of the original dial would just fit into a rectangle 5 cm by 10 cm. It is made of lead of thickness varying from 4 mm where the metal has not been corrupted, to 2 mm where it has. I found that a close-up photograph does distort things a bit but by fitting the dial into a semicircular hole cut in the middle of a 4 mm 'canvas board' to extend its surface plane I could line things up, draw circles, bisect chords and measure angles to 'school protractor' accuracy. I don't think it is reasonable to be more precise than that, inscribed marks in lead are inevitably more 'chunky' than in engraved brass.

Fig. 6. The flattened half-dial.

The two semi-circles forming half of the chapter ring are clear, as is a smaller semi-circle bordering some decoration. Hour lines are clearly drawn from 4:00am to noon and there are half-hour punched spots between 3:30am and 11:30am (some only visible after enlargement of the photograph and knowing where to look): there are no 'minute' marks. There is clear evidence of a noon gap and close to its inscribed western line there is the edge of a mortise where I assume a gnomon tenon fitted. There are two fixing holes, one complete and the other broken.

It was the work of someone who found it worthwhile to have punches made, although he was not too careful about the positioning of the Roman numerals. The 'I's and 'X's have been punched using perhaps just an I-punch, the 'V's appear to have at least the broader side punched with the same. There is also an intriguing upper case T close to the broken edge and to the south of the blue-grey stain. That might have been used to guide the construction or it might be part of a maker's mark – it was firmly punched in with what looks like its own punch.

The numerals are oriented to be read from *outside* the chapter ring, as they are on the bronze dial of Fig. 3 but not on the other domestic dials illustrated.

The Numerals

Eagle eyed readers will have noticed in Fig. 6 that some of the Roman numerals viewed from outside the ring look 'wrong' (although the 'V's are the right way up) and the temptation is to blame the maker's ignorance. However, John Lester has drawn attention[8] to a similar feature on a 17th century vertical dial in St Ive, Cornwall in which the numerals (read in that case from *inside* the ring) follow what he describes as an 'anti-clockwise convention'. The shadow of the style passes over the vertical surface anti-clockwise picking out as it does so the components of the numerals in the 'correct' order. Thus as it passes 8:00am (and pm) the shadow would pick out 'V' first then three 'I's. On the dial face that would appear from the inside as IIIV. John tells us that that feature is far from uncommon in Devon and Cornwall and elsewhere.

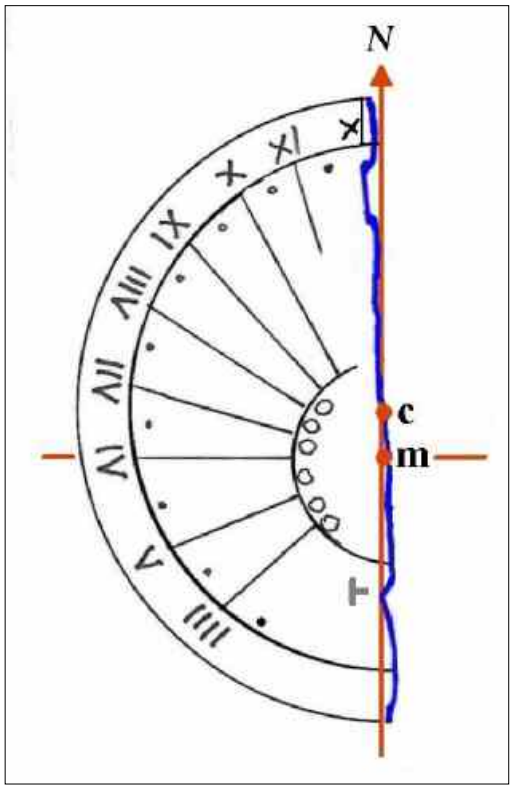

Fig. 7. The centreline.

The lead dial I am discussing would be fixed horizontally, the gnomon shadow moving around the surface in a *clockwise* direction. Figure 6 shows that 7:00am viewed from outside the ring is written IIV. The shadow of the gnomon would pick out the components of the numerals in the 'correct' order, it would allow first 'V' into the sunlight and then the two 'I's. Similarly 11:00am appears from outside the ring as 'IX' which read in a clockwise sense would be first 'X' and then 'I'. I expect that the other side of the noon gap was marked by 'II' so that noon shows as 'II..X' to the outside eye. Matching John's phrase we have here a 'clockwise convention' for horizontal dials.

The Blue-Grey Stain

I was puzzled by the blue-grey corruption of the lead across a parallel strip and was concerned that it might have changed the geometry. I thought that perhaps the whitish surface acquired over the years had protected the lead while the dial was under the ground but that perhaps a stone in Child Okeford's flinty ground pushed by a passing plough-shear had struck across the surface exposing the bare lead leaving it open to chemical action. I am very grateful to Peter Northover,[9] an archaeo-metallurgist from Oxford University, who looked at some photographs and found the time to email his opinion.

> "Both parts of the surface are something I have seen on archaeological lead. The majority of the surface has the sort of stable lead patina you might expect on a sheet (probably mainly oxides and carbonates although some chlorides and chlorophosphates may also be there). The blue-grey strip is where that surface has been disrupted and bare metal has been to some extent exposed and has started corroding again. Microenvironments can vary quite rapidly over a short distance, but your guess of an agricultural chemical is a reasonable one, especially if ploughing has left that part of the dial close to the surface, say just under the bottom of a furrow."

Other chemist and geologist correspondents have agreed and also suggested that the intrusive chemical (it has changed the lead right through from front to back) having a blue effect might have contained copper or even chromium (what did they put in agricultural chemicals?).

The Centreline

Despite the blue-grey stain and the thinning of the lead along it, the halves of the chapter ring 'circles' and the half of the decorative 'circle' are remarkably 'circular' with centres at the points 'c' and 'm' respectively marked on Fig. 7. That the three semi-circles show very little distortion

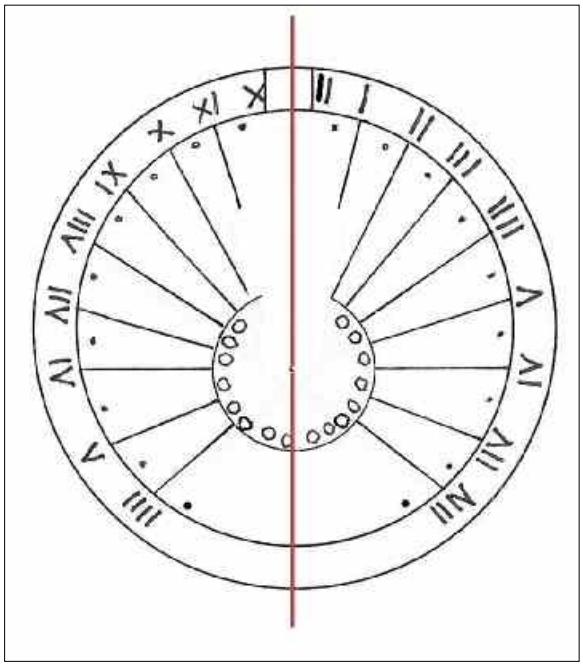

Fig. 8. What the full dial might have looked like.

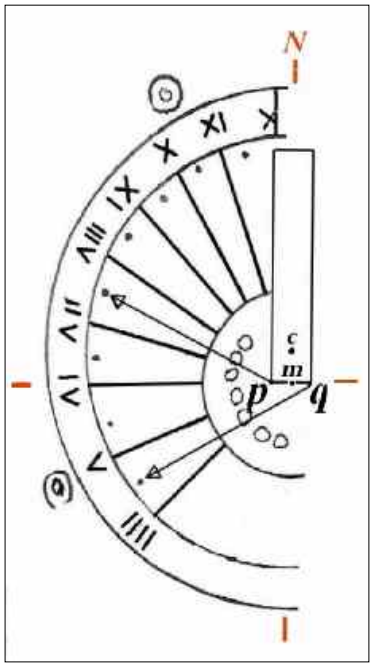

Fig. 9. The gnomon root.

suggests that there has been little distortion overall despite the breaking off from its fixed position on the windowsill, the knocking about and corruption in the ground and the flattening.

That belief is strengthened by noting that the hour lines inscribed in the surface (if there was doubt in drawing them, I was guided by the points where they meet the chapter ring and decorative circle) all pass through or very near (in the case of the 5:00am line) to the point m with the possible exception of the shortened 11:00am line. I regard m then as the 'centre' of the dial and the line through c and m as the 'centreline'. I was pleased to find that the centreline is parallel to the western edge of the noon gap (clearly marked in the fragment) and also to the western side of the gnomon mortise. It appears also to be parallel to the broad cross piece of the maker's T.

The 6:00am hour line passes through m and is at right angles to the centreline there so if the centreline was positioned north-south then the 6:00 hour line would lie west-east as it should. By reflecting the known semicircle in the centreline, I have (Fig. 8) my first sketch of what the dial face might have looked like. The outside of the chapter ring has a diameter of about 9 cm.

The Gnomon and its Root

Blandford Forum (50° 51' N, 02° 10' W) six miles south east of the village would be a significant trading centre for Child Okeford in the 17th century and afterwards. We know[10] that one of Blandford's leading instrument makers in the early 18th century had a copy of Thomas Stirrup's *Horometria: Or the Compleat Diallist* of 1652 published by Leybourn. Blandford was something of a centre of clock selling from the early 18th century, the earliest Blandford maker listed in Tom Tribe's *Dorset Clocks and Clockmakers*[11] is "Baker, Thos 1690-1720".

In exploring further how the dial might have looked when it was new, I assumed that it was made locally, that the maker knew what he was doing and that he either completed an accurate drawing himself or followed an accurate template for Blandford's latitude.

Having found the centreline the problem now was to find the root where the gnomon sits on the dial face. The southern edge of the root would lie along the 6-6 line, the point m being its mid-point as shown in Fig. 9. The end of the mortise (see Fig. 6) is a guide to where the northern edge lay so I just need to find the other two edges, the western and eastern sub-styles. They would be parallel to the centreline and symmetrically placed on either side through the (yet to be found) vertices p and q respectively of the southern edge.

The shadows of the western and eastern styles on the top of the gnomon would cross the dial plate in lines that for this account I shall call '*shadow lines'* to distinguish them from the inscribed hour lines. *It is the shadow lines that would show the time on the chapter ring.*

The hour lines inscribed in the surface of the dial (except for the 6-6 line) cannot be shadow lines. The shadow lines before 6:00am pass through the point q, and between 6:00am and noon through p. The switch of the origin from q to p so early in the morning (and back again in late afternoon) although well understood always (when remembered) comes as a pleasant surprise – it curiously is not allowed for in W Richardson's Appendix (Plate 1) to Mrs Gatty's famous book.[12]

The points p and q were found by drawing the correct shadow lines for Blandford's latitude on a sheet of (transparent) OHP acetate, fixing the half dial inside the canvas board and sliding the acetate over the extended dial plate to find remarkably (rather like breaking a code) that there are origins for which the shadow lines would cross the chapter ring at the correct Blandford local solar time on the hour and the half hour. Well, that is true except for 5:00am and 5:30am in the middle of the corruption where they are 1° behind. Perhaps this reverse engineering is too generous to the maker, he might have got it totally wrong but at least I believe now that there are origins which work, and in his favour after finding p and q experimentally I found that m *is* the mid-point of pq and that the line through p parallel to the centreline, effectively the shadow line just before noon, passes along the western edge of the noon gap marked in the lead.

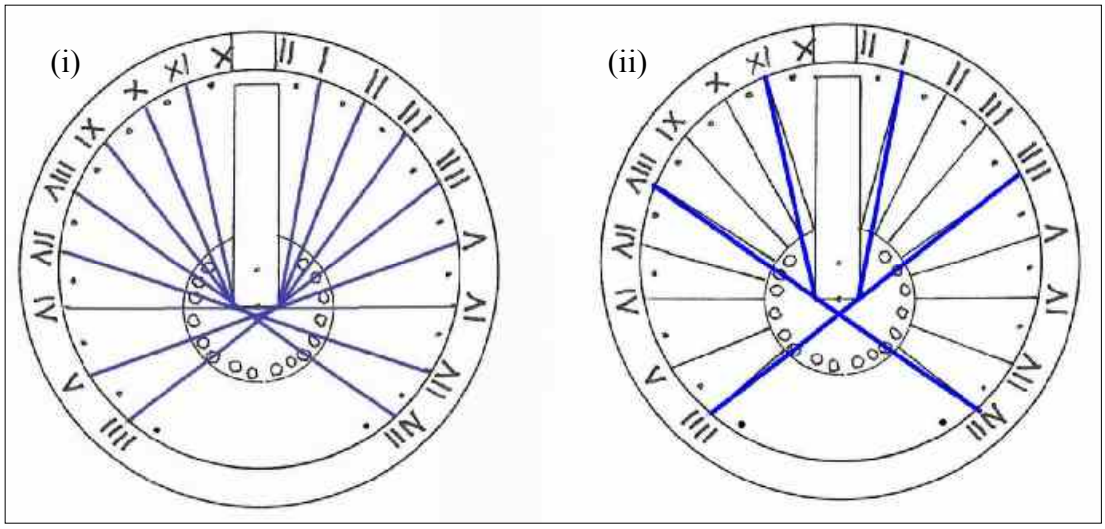

Fig. 10. (i) Shadow lines only (ii) hour lines and some shadow lines.

Figure 10(i) shows the shadow lines only on the full dial face and Fig. 10(ii) shows how those shadows lines would relate to the hour lines at 4:00 am and 4:00pm; 8:00am and 8:00pm; 11:00am and 1:00pm. The origin switches back from q to p at 6:00pm.

The distance between p and q gave a gnomon thickness 8 mm, double the thickness of the uncorrupted lead.

The Edge and the Back

Figure 11 shows the edge and the back of the half dial with the positions of c (the centre of the chapter ring circles) and m (the centre of the dial) and the upper case T marked.

The dial would have to lie flat on the windowsill. There is no sign of a mortise near c or m but there are indentations nearby which perhaps were cut to accommodate a flange that could then be screwed through into the gnomon. The northern end of the gnomon would be held in the mortise clearly shown in Fig. 11 where there are signs of perhaps a split tenon having been folded over. Perhaps a lead gnomon was held in that way or perhaps it was made of some other material?

The Regular Octagon

Accepting that the dial was originally the familiar regular octagonal shape, the question arises as to how the dial face fitted into it. It is common in octagonal dials (the dials shown in Figs. 2 & 3 for example) for the centre line to lie along a short diameter of the octagon, perpendicular to two opposite sides, where the AF measurement is taken. When that is done (Fig. 12) it looks alright but the screw holes and the worn edges seem randomly placed.

However, if the screw holes are placed more naturally within the vertices of the octagon (Fig. 13) then the worn edges fit well and the whole picture looks more comfortable.

For me that change was something of a revelation and begged the question as to why the arrangement is not the usual one. The centre (noon) line would be skewed 8.5° clockwise from its conventional position. It is important to remember that that angle is determined by the centres c and m only and does not depend on assumptions about the dial being made for Blandford's latitude nor on whether arguments about the gnomon's thickness are sound. Three possibility come to mind (the second one suggested to me by the Editor to balance my enthusiasm).

First, the dial might have looked something like it does in Fig. 12 and fixed in position using a compass.

Secondly, the dial might have been made for a *particular* windowsill and designed so that by placing one of the flat edges neatly adjacent to the window the centre line would be in true north-south orientation. If that is true I do not have anything exciting to say, and I have no more idea about the dial's date than I have about the dates of the dials illustrated earlier, particularly since I am uncertain about associating them with the sale of clocks. I do wonder whether a clockmaker would make a dial out of lead, and if he did whether anyone who could afford a clock would want such a down market accessory.

Fig. 11. The edge and the back of the lead half-dial.

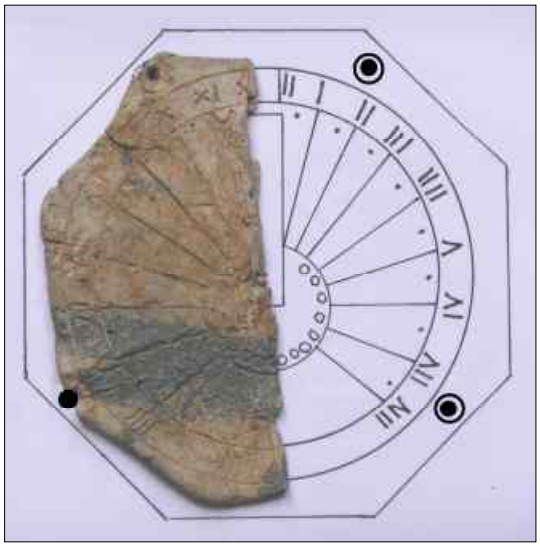

Fig. 12. Misfit?

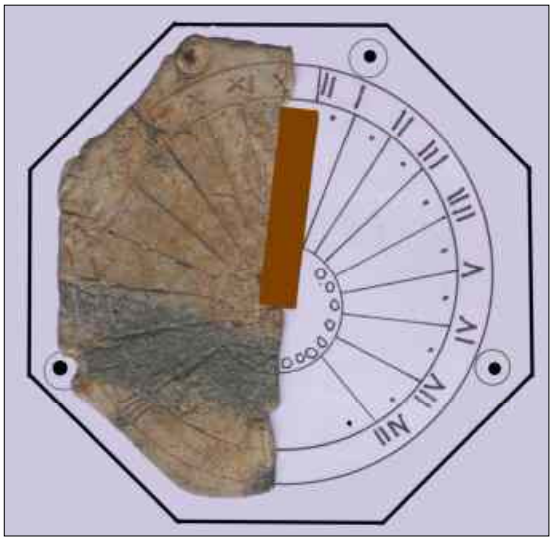

Fig. 13. How the dial might have looked from above with the gnomon in place.

A third possibility is that the skewed centreline compensated for magnetic variation.[18] The customer (*any* Blandford customer) would be shown figure 13 and told to use a compass to fix the short diagonal of the octagon in the *magnetic* north-south direction (lead would not affect the compass needle). The gnomon would then be correctly positioned for a variation of 8.5º W. Fig. 13 is reminiscent of the design of some 17th and 18th century pocket sundials[2,13] which guide the user in that adjustment, but I don't know of any (other) fixed horizontal sundial with that feature. I expect to though – quite soon after this article appears!

Under that third possibility I would be able to say something about when the dial was made. The variation was 8.5º W in London in 1710 and judging by Edmund Halley's 1701 'Chart of the Variations' reproduced in Hester Higton's book[13], in Blandford it might well have been much the same. Authorities have warned about using the variation to date pocket sundials because of the way it changes from place to place but 1710 seems a reasonable guess for this domestic dial. It has to be confessed that the variation was also 8.5° W in London in the 1950s!

Conclusions

I found studying this domestic dial increasingly interesting. It was surely 'country made' (of lead rather than expensive brass) with its delineation based on an accurate template, the allowance for magnetic variation suggesting a maker who kept in touch with contemporary 'philosophical' interests. I am comfortable with the 1710 date, the technicalities were known by then in Blandford and there would have been customers there as well.[10, 11]

The conventions expected of the outstanding London instrument makers in the early 18th century might not have been so well established away from the capital, allowing country makers to do things in their own way without confusing the user.

Positioning the numerals to be looked at from outside the chapter ring on such a small horizontal dial is not unreasonable, and neither is arranging them to be read clockwise as the shadow passes. Using the dial to find the time it would be enough to see where the shadow lines cross the chapter ring.

Why was the dial thrown away – and when? Clocks became more reliable through the 18th century and it would be easier to take the 'mean time' that they displayed as a basis for household management rather than the sun's time. It would, however, still have been prudent to have had a domestic 'time finder' together with a list of EoT correspondences as a check. William Emerson (mathematician, eccentric and dial enthusiast) wrote[14] in 1770

> "…yet these (*clocks and watches*) are often out of order, apt to stop and go wrong, and therefore require frequently to be regulated by some unerring instrument,.. And therefore whether we have any clocks or not we should never be without a dial".

There would be no need for that check though in many homes after a daily time signal was delivered down the 'electric telegraph' to country towns in the 1850s from the Greenwich Royal Observatory. In a letter[15] from the Electric Time Company on 30th October 1852, Station Masters and Telegraph Offices were told "You are at liberty to allow Clock and Watch makers to have Greenwich time providing…" . We know that indeed they proudly displayed it in their windows (passing on the time of day).

In 'Scientific Instruments 1500-1900' (page 18) Gerard L'E Turner wrote[16] "From then [the mid -19th century] on, the sundial ceased to be of any practical importance, and remained merely as a decorative object." The lead dial would not be saved by having any decorative value but it might have been used to regulate clocks for a further decade or two in a remote area.

Perhaps I have made too much of such a simple artefact but I have learned a lot. I would like to know more about who made and sold domestic dials. Were they made by clockmakers, or 'clock-assemblers' (many country clocks were made up from bits bought in from elsewhere)? Were they sold with clocks and displayed in clock sellers' windows, or were they only available from the hardware shop lower down the High Street?

ACKNOWLEDGEMENTS

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Author's address:
baxpr@talktalk.net