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CONTENTS

EDITORIAL

Covid restrictions were much reduced in the second half of the year and David Pawley was able to arrange a Newbury meeting in September. This was our first get-together for two years and there is a full report on pages 35 to 40. We were also able to hold a formal Annual General Meeting; the Minutes are duly published in this issue.

The first article is by John Davis who provides a scholarly analysis of a dial by a previously unknown 17th century dialmaker, John Sill.

I follow with a note of congratulations to the German *Fachkreis Sonnenuhren* on their fiftieth anniversary. The *Fachkreis* may be the longest-established national sundial society in the world.

Three articles, by Piers Nicholson, Kevin Karney and Chris Lusby Taylor, relate to the splendid new sundial in Fleet Street which is the subject of our cover picture.

Ben Jones describes an intriguing practical difficulty installing a gnomon and a describes a clever solution.

Fabio Savian has been pondering producing an English edition of the French Republican Calendar; something that he has published in Italian for a number of years. I outline his proposal.

Julian Lush reviews monograph no. 14, *The Portable Saxon Sundial at Canterbury Cathedral* by John Davis.

Dennis Cowan provides us with another article in the Thomas Ross series; this one investigates something of a puzzle.

Kevin Karney describes an intriguing mean time horizontal sundial which he designed to mark a Golden Wedding.

Very sadly, Fiona Vincent died in September; her obituary has been written by John Davis. Fiona was especially important to the Editorial team since she was our regular proofreader. We shall miss her astute comments and observations.

Frank King

JOHN SILL OF ULVERSTON
An Unrecorded Cumbrian Dialmaker

JOHN DAVIS

It might be thought that, after many decades of research by horological historians, there were no further clockmakers or (sun)dialmakers left to be uncovered. This is easily disproved by the sundial in Fig. 1 which has recently come to light and which proves to be the work of a previously unrecorded maker with a name which links him to an existing group of clockmakers in an area of Cumbria which seems to have been unusually fertile for horological activities.[1,2,3] Its history and provenance are virtually non-existent, having been bought in a job-lot at an auction in Wiltshire. It is clearly well weathered and it is easy to see that the gnomon is not original though it is perfectly functional and shows that the dial was at some time valued highly enough to have been repaired by a craftsman.

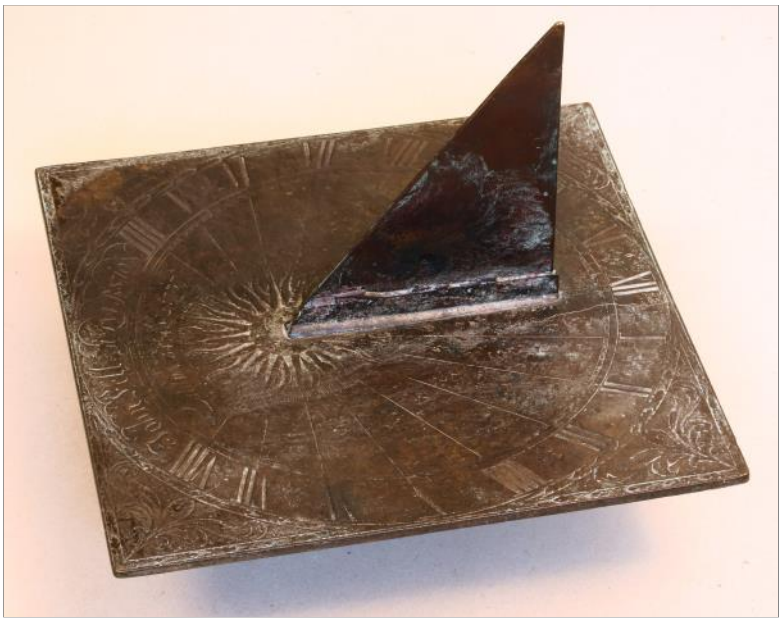

Fig. 1. A general view of the John Sill dial. The colour has been lightened somewhat for improved visibility.

The Dial Plate

The dial plate is 204 mm square (a nominal 8″) and a substantial 2.8 to 3.8 mm thick (a rather generous 1/8″) so that the whole dial weighs 1.485 kg. This is rather thicker than the standard for dials of the 17th and 18th centuries which are generally only half that thickness and it gives the impression that the brass plate could have originally been prepared for making a longcase clock movement. There are no holes for attaching the dial to a pedestal though it has clearly been installed on one for many years. The plate is now very dark but generally in good condition though it does show one hairline crack running in from the edge at the 12:15 mark and penetrating the thickness. This is likely to be a typical stress-relief effect known as season-cracking.

The weathering and heavy patina make reading the engraving difficult (and even more difficult to photograph so all the photographs have been enhanced: Fig. 2). The signature, on the southern edge of the plate and orientated to be read from the north, starts off with a clear 'John' and continues with what could be either 'Sill' or 'Sell' (though the first letter could possibly be an 'F'). This is followed with a place name which ends, it seems, in '…rston' though the first part is unclear. Luckily, the second line provides a

Fig. 2. Left: the dial plate. Note the sun-in-splendour and the foliate engraving in the spandrels. Right: an expanded view of the signature, latitude and date.

valuable clue as it states that the dial latitude is “54^{D} 40^{M}”. This is a long way north of Wiltshire and makes Cumbria a distinct possibility: looking in a gazetteer for places there ending in ‘….rston’ showed only one possibility – Ulverston. This would fit into the available space and with the eye of faith can be read. The latitude of Ulverston is actually 54° 12′ so the dial was not made for the maker’s home town, but the nearest large centre is Penrith at 54° 39.8′ which would be a near-perfect match.[4]

With the aid of a strong raking light, the second line of engraving also provides a date of 1737 and that certainly would fit the general style of the dial.

The dial has been expertly engraved by a professional. The chapter ring features Roman numerals from IIII to VIII orientated to be read from the centre like a clockface: the London outward-facing style had yet to reach Cumbria. The first ring inside the numerals is divided into halves and quarters in a broad band with the half-hours being marked by a symbol which could quite easily be found on a clock. Inside this is a narrow ring divided into 5-minute segments with alternate segments hatched – this is difficult to see now and even harder to photograph.

Fig. 3. The two oak leaf borders (note the inner one reversing direction in the centre), the inner 5-minute division ring, the foliate spandrel decoration and the half-hour symbols.

There are narrow ‘running oak leaf’ borders (sometimes called wheatear borders) around the chapter ring and around the perimeter (Fig. 3). In the former case, the direction of the leaves reverses every 45° which shows attention to detail. It is often thought that this form of border is a ‘trademark’ for makers in the London guilds but it seems either that this is not always the case or, just possibly, that John Sill trained in London.

Other decoration includes a ‘sun-in-splendour’ centred at the toe of the gnomon which has 20 straight rays with intermediate wavy ones, the whole circle then filled with radial lines. This again shows attention to detail. There are also foliate infills in the four spandrels, mirroring perhaps the cast decorations often applied to clock dials.

Fig. 4. Side view showing the gnomon with extended tenons, with the colour considerably lightened. Inset: enlargement of the centre tenon showing the hole for an original taper pin, the undercut shape and also the way the replacement triangular piece has been inset into the remains of the original gnomon.

The Gnomon

The replacement triangular sheet gnomon (Fig. 4) is functional if not aesthetically pleasing. It is only about 1.6 mm thick which is slightly less than the noon gap on the chapter ring, and it has been fitted into a slot which has been machined (or filed?) into the top of the remains of the original gnomon, of which only the bottom strip remains, with its three tenons holding it to the dial plate. The angle of the new piece is 53° which is a reasonable match to the dial design. The tenons themselves are extended in length to allow them to key into the pedestal. They are now soldered to the plate but a small hole is visible in one of them showing that originally taper-pins would have held them in place – another clockmakers’ technique.

The bottom of the remains of the original gnomon, where it sits on the dial plate, is slightly wider than the noon gap and on close inspection it can be seen that this is due to a small ‘foot’ which has been cast into it to provide stability, yet another indication of a thoughtful maker.

Materials Analysis

A dial with a date and a place of manufacture provides a very useful point in the database of alloy usage with which unmarked dials can be compared so I was keen to make an X-ray fluorescence (XRF) analysis of its composition. The technique employed was the same as that reported in earlier articles[5] and the key results are presented in Table 1. Only for the first line of the table, for a spot on the back of the

Area	Cu	Zn	Sn	Pb	Ag	Ni	Fe	As	Sb	Bi	Comments/ Others
Back (cleaned area) at S	74.2	22.3	0.25	2.01	0.07	0.07	0.60	0.49	0.02	nd	
Back (uncleaned area)	78.4	16.8	0.30	2.68	0.08	0.04	0.75	0.83	0.03	0.04	
Front (uncleaned area) at S	75.6	17.6	0.32	2.36	0.15	0.05	0.64	0.7	0.03	0.03	Se 2.49%
Gnomon tenon (original, cleaned)	74.8	10.7	1.46	11.7	0.08	0.07	0.66	0.33	0.19	0.04	3 mm dia area inc. solder
Replacement gnomon (average E & W sides)	86.3	11.8	0.01	nd	nd	0.03	0.04	0.65	0.01	0.04	Se 1.71%

Table 1. Alloy compositions of the components of the John Sill dial (in wt.%, rounded to one or two places of decimals) as measured by XRF by the author using a Thermo-Scientific Niton XL3t analyser with a 90 second sampling time, a 40 kV primary beam and a Peltier-cooled silicon drift detector. nd = not detected.

dial which was fully cleaned of the patina to expose the underlying core metal, is the quantification reliable. For the uncleaned areas, the major difference is that the zinc level will be depressed by several percent due to 'dezincification' caused by weathering, and there will be a minor increase in the tin (Sn) level with a smaller rise in the lead (Pb) reading.

The dial plate can be seen to be made from a fairly typical medium-zinc 'brass', actually a quaternary alloy with the significant tin content found in English material (compare this with the much lower tin and higher zinc of the alloy imported from the Low Countries used for the 'palimpsest' dial reported earlier[6]). The levels of the minor constituents (silver, nickel and arsenic) are again characteristic of that found for copper mined in Cornwall. They are all very similar to those found in the 1695 Penrith dial for Lawrence Swarbeck described in Ref. 2 although the lead and iron levels are slightly lower. That dial was also a 1/8″ plate and ascribed to a clockmaker so it seems that there was only a small advance in smelting technology in the approximately half a century between the two dials.

Only the ends of the tenons of the original gnomon were accessible for analysis and even with the smallest available area analysed it was not possible to exclude totally the surrounding solder. It can be inferred, though, that the 'brass' was from a very similar source – possibly even the same – as the dial plate. The solder can be identified as a standard tin-lead alloy with a little antimony (Sb) which was standard until the UK law changed in 1986 promoting the use of lead-free solders.[7]

The replacement gnomon is clearly from a much more recent, unleaded brass with far lower levels of minor constituents (the high arsenic (As) level observed is likely to be from the patina). It makes use of electrolytically-refined copper and hence will be later than around 1900. Even allowing for dezincification, though, the zinc level is low for the most common modern brasses where it might typically be 37 to 40%. This suggests that the material chosen has been a special purpose 'gilding brass' variety, selected perhaps because of its colour.

One very surprising aspect of the analysis was the detection of selenium (Se) on the front of the dial plate but not on either the cleaned or the uncleaned areas on the back. It was also found on both sides of the replacement gnomon, with the dial plate having a somewhat higher level than the gnomon (see the Comments column in Table 1). I have not observed selenium on any sundial previously but the signal was strong and unmistakable.[8] Since it was only on one side of the dial plate the selenium was not likely to be distributed uniformly throughout the bulk but rather to be concentrated on the surface, with the result that the quantification must be treated with extreme caution as the algorithm assumes a homogeneous semi-infinite specimen. Nevertheless, the value was high enough to demand an explanation.

Selenium is a relatively rare element in the Earth's crust. It is a micro-nutrient essential for plant and animal growth so small amounts are often added to food supplements and to agricultural fertilizers though at higher concentrations it is toxic. It weathers from the rocks and soil and so can be found in rainwater[9] which I initially thought might be a source for that on the dial: the fact that the measured concentration was higher on the horizontal surface of the dial plate than on the vertical sides of the gnomon could be thus explained. Eventually, though, I remembered that selenious acid, H_2SeO_3, (and/or selenium dioxide) was sometimes an ingredient in the treatments used to induce an artificial patina on copper alloys. I have several commercial patination fluids in my cupboard to produce a variety of patina colours (mainly the blue-green widely associated with weathered copper), but only one was labelled as containing the toxic selenious acid. However, on testing them all I found another that also indicated the presence of selenium.[10] The full ingredients of these commercial liquids are generally not disclosed but I did find a safety sheet for the very popular metal blacking fluid supplied by Birchwood Casey in the USA and this is reproduced in Table 2: it shows selenious acid as a component. As a test, I applied Kansa Craft's 'Black for copper' to a freshly-cleaned modern brass sample and it turned a very dark brown within seconds. Analysis of this specimen showed a

Component	Formula	Percentage
Selenious acid	H_2SeO_3	1 to 5%
Phosphoric acid	H_3PO_4	7 to 13%
Cupric sulphate	$CuSO_4$	1 to 5%
Ammonium molybdate	$(NH_4)_2MoO_4$	1 to 5%
Zinc sulphate	$ZnSO_4$	1 to 3%
Water	H_2O	Balance

Table 2. The constituents of the 'black for metal' fluid supplied by Birchwood Casey.[19]

selenium level of 2% which is very close to the levels observed on the John Sill sundial and the colour was similar to that of the gnomon. The conclusion, then, is that the dial restorer artificially patinated the new gnomon and, to ensure a good match to the dial plate, treated that too – an action that modern conservators would consider very bad practice. I believe that the reason the dial plate showed a higher level of selenium than the gnomon is that it had a rather rough, eroded surface when compared to the fresh metal of the gnomon and it hence provided more surface area to retain the fluid.

John Sill

The name 'John Sill' appears only once the *Index of British Mathematicians*[11] but the entry is for someone living in Wallington near Baldock with dates of before 1754 to after 1769 so this is unlikely to be our dialmaker. Brian Loomes' list of *Watchmakers and Clockmakers of the World*[12] does not list him but does include Richard, Joseph and William Sill, all of Wigton, Cumberland, as successive generations of the same dynasty of clockmakers, with Richard being born c.1680. An article by Loomes on James Hendrie of Wigton[13] describes what he calls the 'Wigton school' of clockmaking active from at least 1718 to 1768 and mentions Richard and Joseph Sills as working for Hendrie. It seems likely that John Sill was another part of this same family, previously unknown. James Hendrie also made at least one sundial which is still in Cumbria and is dated 1724:[14] it is well made but has numerous stylistic differences from the John Sill one so there is no obvious direct link.

Evidence that there was a branch of the Sill family living somewhere in Cumbria other than Wigton is provided by a tombstone at Cartmel Priory which gives dates for several generations of John Sills.[15] The earliest of these John Sills was born in 1735, only two years before the date of the dial but his father is given as Thomas so he could not have been the maker either. Cartmel town is on the Cartmel peninsula on the southern edge of Cumberland and just to the east of Ulverston (and only a few miles north of Grange-over-Sands where the BSS held its 2009 conference). There is also evidence that the Sill family were engaged in slave trading with one source stating:[16]

> "The Sill family were long established landowners in Dent [Cumbria, inland to the east of Kendal, latitude 54° 16′] and during the 18th century some members of the family became involved in the West Indies trade and in owning a plantation in Jamaica. John Sill (1724-74) was described at the time of his death as being 'of Jamaica'. He seems to have been involved in the trade between Lancaster and the West Indies (but not the triangular route via West Africa) and he owned a plantation called Providence in Montego Bay in Jamaica."

The John Sill who was born in 1760 and lived at The Hill, Cartmel, was, according to his 1845 will, a significant landowner. One of the other Johns mentioned on the tombstone is a cousin but there is no direct mention of clockmaking.[17] In contrast to this well-off arm of the family, the John Sill who was baptised at St Mary's church, Ulverston, in 1837 was the son of a Mary Sill whose abode is given as the Ulverston workhouse so the family had very mixed backgrounds.[18] At present, the maker of the sundial has not been fully identified but the question has been referred to local genealogists. Although it has been assumed that the name on the sundial is that of the maker, there is a possibility that it refers instead to the original owner.

Conclusions

A chance find at a local auction has proved to be by an unknown maker and shows that it has been previously recognised as an item worthy of skilled restoration. It extends the range of dials and clocks made in the relatively remote region of Cumbria in the 18th century and also gives an insight into the restoration practices of the past.

ACKNOWLEDGEMENT

I thank our Registrar, John Foad, for information about the James Hendrie dial at Bowness on Solway.

NOTES and REFERENCES

1. Sue Manston: 'A Couple of Cumbrian Dials. Part 1, The Ambleside dial', *BSS Bull*., 30(iii), 8–12 (September 2018).
2. Sue Manston and John Davis: 'A Couple of Cumbrian Dials. Part 2, The Penrith dial', *BSS Bull*., 30(iii), 19–22 (September 2018).
3. John B. Penfold: *The Clockmakers of Cumberland*, Brant Wright, Ashford (1977).
4. In the 18th century, English latitudes were usually known to better than 10 arcminutes and often to within a few arcminutes.
5. See, for example, John Davis: 'A Palimpsest Horizontal Dial, *BSS Bull*., 33(ii), 2–7 (June 2021) and the references therein.
6. Davis, n. 5.
7. Although it has been illegal to use leaded solders for water-pipes in the UK since 1986, and European law also now insists on lead-free solders for electronic circuit boards, most amateur workshops still have a good stockpile of the much more effective 60:40 tin-lead variety so the type of solder is not a good guide to dating the repair.
8. The main Se K_α peak at 11.20 keV is in a region with no other elements nearby. The secondary K_β peak at 12.52 keV does interfere with the Pb L_β peak at 12.61 keV so the signal from

the dial plate was obscured but on the unleaded gnomon material it was clear-cut.
9. L.H.E. Winkel, 'The role of atmospheric deposition in biogeochemical selenium cycling', in *Selenium Research for Environment and Human Health: Perspectives, Technologies and Advancements*, London, Taylor & Francis, CRC Press (2019).
10. The commercial fluid called "Black for Copper" and produced by Kansa Craft was correctly labelled as containing selenious acid. Carr's Metal Black also contained a rather smaller amount of selenium but a bottle simply labelled "Schwarz für Kupfer" did not.
11. R.V. and P.J. Wallis: *Index of British Mathematicians*, Newcastle-upon-Tyne, PHIBB (1993).
12. Brian Loomes: *Watchmakers and Clockmakers of the World. Complete 21st century edition*, London, N.A.G. Press (2006).
13. Brian Loomes: 'James Hendrie of Wigton', *Clocks Magazine* (August 1988), online at *https://www.brianloomes.com/collecting/hendrie/*
14. The dial is SRN 0674 at Bowness on Solway (recorded and photographed by the late Robert Sylvester). It is dodecahedral in shape and has lost its gnomon: it is signed "James Hendrie fecit", to be read from the south of the dial.
15. Anon: 'The Sill Family of Cartmel. A Landowner and a Seaman' on the website of the Cartmel Peninsula Local History Society, *https://cplhs.files.wordpress.com/2015/08/the-sill-family-of-carmel.pdf*
16. '"The Abominable Traffic": Cumbria's connections to the history and legacy of slavery' (teaching pack) online at *https://cumbria.gov.uk/elibrary/Content/Internet/542/795/41053132443.PDF*
17. See n.14.
18. 'Baptisms at St Mary in the Parish of Ulverston', online at *http://www.lan-opc.org.uk/Ulverston/stmary/baptisms_1836-1838.html*
19. *https://www.birchwoodcasey.com/content/datasheets/Brass%20Black%20Touch-Up.pdf*

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Fachkreis Sonnenuhren – Fiftieth Anniversary Congratulations

Frank H. King

The *Fachkreis Sonnenuhren* (Special-interest Circle for Sundials) was founded in Germany fifty years ago, on 25 September 1971. Later that year, it was incorporated into the *Deutsche Gesellschaft für Chronometrie* (the German Society for Time Measurement). The *Fachkreis Sonnenuhren* is believed to be the longest-established national sundial society in the world.

The half-centenary has been marked in many ways, notably with a book, *50 Jahre Fachkreis Sonnenuhren 1971-2021*, published in German, 213 pp, A4, hardback, illustrated in colour. ISBN 978-3-00-069112-6.

There was also a commemorative conference in August. The British Sundial Society and the North American Sundial Society were amongst the twelve national sundial societies that sent messages of congratulation. The book gives an extensive history of the *Fachkreis Sonnenuhren* and there is much biographical information too.

During the course of the year just ending, I have enjoyed a prolonged exchange of e-mails with Michael Hromek. It was he who originally proposed publishing a commemorative book and he became its principal editor. We discussed several notable diallists who have been members of both the *Fachkreis* and the BSS. In particular, the noted French diallist, René Rohr, was an early member of the *Fachkreis* and the founding Vice-President of the BSS. Many members may also remember Anton Schmitz who died in 2019 and whose daughter Ursula Schmitz is still a member.

Amongst numerous fascinating details discussed by Michael Hromek was the difficulty of exchanging information with fellow diallists living in East Germany. The East German *Sektion Gnomonik* was state monitored, the East German authorities being very suspicious of any technical information passing between East and West.

I am sure that all members of the British Sundial Society will join with me and wish the *Fachkreis Sonnenuhren* our best wishes for the next 50 years.

Frank King, Chairman BSS

THE FLEET STREET HERITAGE SUNDIAL IN CENTRAL LONDON

PIERS NICHOLSON

My article 'A New Sundial in Central London', published in the March 2020 issue of the *BSS Bulletin*[1] introduced the planned Fleet Street sundial but ended at December 2019, at which point there was still considerable uncertainty about whether we could get the permissions, the finance and the team together to make it happen.

This article takes the story up to the opening of the completed dial (Fig. 1) on 21 October 2021.

Fig. 1. The completed Fleet Street Heritage Sundial.

It started with the planning permission, which has to be done through an online portal. I was fortunate in being able to speak to people in the planning department from time to time. My initial idea to have the mastheads of two or three current newspapers (with the hope of raising some revenue) was thrown out at once – the City of London does not permit advertising, so all the newspaper headlines had to be defunct titles. My second thought was to include the badges of three livery companies, but that too was counted as advertising (even though there are many examples of such badges on display in the City).

I also wanted some plaques, at eye level, on the freedom of the press, the sundial, and the newspaper industry, all to be set within an 11 metre wide list of all the national newspapers from *The Daily Courant* in 1702 onwards. However, the planners would not sanction the list of newspapers because it would include some current titles and that would be advertising! Full planning permission was finally given in December 2019.

We had deferred looking for the money to build the sundial until we had planning permission. This seemed to be a sound decision at the time, but it meant that our timing could not have been worse, since people had too many other things to think about at the beginning of the Covid pandemic. We had some individual donations amounting to some £3000, which was a good start but insufficient for the whole project. Fortunately we discovered that the City of London had a Community Infrastructure Levy Neighbourhood Fund, who, at the third application, came to our rescue.

The sundial could not be designed until the exact declination of the wall relative to true North was known. The hour lines of dials facing near to East are very sensitive to even minor changes in the declination. There is no great problem in measuring the declination if one has access to the front surface of the wall, and one is certain that the face of the wall is in one plane. But access was only possible with scaffolding or a cherry picker, which would have cost money we did not have; the wall was about 150 years old, and had a pronounced step in the middle of the sundial area.

An attempt was made to get the declination from a surrogate. The coping at the head of the wall casts a shadow on the pavement when the sun is highest in the sky, so theoretically the declination of the coping could be determined from the exact time when this shadow was the same distance from the foot of the wall as the overhang of the coping. The shadow, of course, is not very clear at 17 metres distance, it moves very quickly, and it was difficult for one person not in the first flush of youth to determine the exact time when the edge of the shadow is the same distance out from the wall as the overhang of the coping.

Fig. 2. Steven Whitaker painting the Royal coat of arms.

The final solution was to get a laser survey of the wall done. This produced a point cloud of several million (x, y, z) coordinates of every point on our wall. This was ably interpreted by Chris Lusby Taylor, who found out that the wall declines 3.75 degrees North of East, and that it is 0.21 degrees out of plumb. The step was later measured to be approximately 6 cm at one end and 4 cm at the other. Kevin Karney, who had been associated with the project for some years, did the final delineation of the sundial.

We decided that the sundial would be painted on the wall, and were very fortunate to find a signwriter, Steven Whitaker, who did a magnificent job, particularly on painting all of the detail of the Royal coat of arms on the *News Chronicle* masthead (Fig. 2).

The erection of the scaffolding (Figs 3 and 4) should have been very straightforward. We had obtained a quote some months before, so we told them to go ahead. But we needed to get a licence from the City of London to put it up, and the licence we received had the name of Fleet Street and not Bouverie Street on it. That took another week to sort

Fig. 3. The scaffolding at the end of August 2021: the wall is ready for the border and hour lines to be painted.

Fig. 4. The author on the scaffolding.

out. The highway authority will only allow the work to start on a weekend, and the environmental department will not allow any noisy work to happen after noon on Sunday. That imposed another three days of delay. These were just two of the many glitches in this phase of the project.

We went out to a public consultation on the question of which newspaper mastheads should be included on the sundial in addition to *The Republican*, which would appear at the top since it was actually published by Richard Carlile, who had his printing office at 62 Fleet Street. The four mastheads which received the most votes were *The Morning Post*, *Pall Mall Gazette*, *News Chronicle* and *The Daily Herald*. The other four on the ballot paper were *The Manchester Guardian*, *Daily Sketch*, *News of the World*, and *Daily Worker*.

Fabrication of the gnomon did not go as easily as expected. I had hoped that the fabricators who make my stainless steel sundials in Norfolk would be able to do it, but they could not meet the delivery date because they were installing some large and complicated new machinery. A fabricator in Devon said they could do it, but were unable to get their design signed off by structural engineers. This

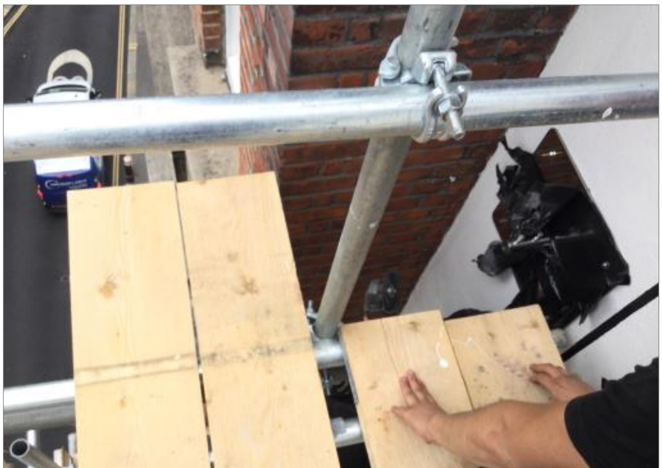

Fig. 5. October 2021: working on the installation of the gnomon.

Fig. 6. At the opening on 21 October 2021.
Left to right: Piers Nicholson with the Lady Mayoress, Hilary Russell, and Kevin Karney.

Fig. 7. Cutting the ribbon.

meant we had to extend the scaffolding date by another month. Fortunately, this meant that the original firm could now make the gnomon in time, so it was delivered on 7 October. Chris and I with our builder Ern installed it the following Monday, weaving it out of the way of the scaffold poles (Fig. 5).

We had originally planned to repaint only the top portion of the wall white, but decided this would look strange, and that we should paint the whole wall white. But the painters were unable to get at the top portion of the unpainted wall because the scaffold did not have the requisite boards on its low stages, and it was not possible to get ladders up between the scaffolding. So this part of the job had to be left till the scaffolding came down.

Looking back, the main difficulty was that of executing a series of complicated processes with no previous experience. Throughout, I have had a lot of support from the committee of the Castle Baynard Ward Club, from the Fleet Street Sundial CIC, John Latham and Nigel Springer (who represents the owners of the wall), and from my fellow members of the British Sundial Society.

It all worked out all right in the end. The scaffolding came down on 14 October, the wispy sunshine that day indicated that everything was fine, and this was confirmed in the stronger sunshine next day. The three plaques were installed on 15 October, and everything was then ready for our official opening.

After many delays, consultations and glitches, the sundial was finally opened by the Lady Mayoress of London, Hilary Russell, on 21 October 2021. It was a cold grey day at the time the ribbon was cut before a very small audience, and we then held the main event in a spacious heated room kindly made available by C. Hoare and Co. at their bank just along the street.

REFERENCE

1. Piers Nicholson: 'A new sundial for central London', *BSS Bulletin*, 32(i), 23-25 (March 2020).

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At the Newbury Meeting (1)

Wendy in the kitchen.

Irene Brightmer, John Davis and Sue Manston in the garden.

THE FLEET STREET HERITAGE SUNDIAL:
Gnomonic Delineation with Uncertainty

KEVIN KARNEY

Last year, Piers Nicholson approached me, asking for help in the design of his Fleet Street Dial. I thought that this would be a straightforward job. I asked for the design parameters:

- Dial size (*about* 10 metres × 10 metres).
- Declination (a *few* degrees north of East).
- Inclination (*about* vertical).
- There was a step in the wall (*about* a third of the way down and *some* centimetres wide).
- Gnomon length and height (*no idea*).
- Gnomon position (*somewhere* near the top left-hand corner of the wall).
- Newspaper names to be drawn between the hour lines (which newspapers – *undecided*).

Nothing was fixed – so the design tool had to be flexible.

Clearly the standard design programs would not provide the flexibility required, so I created a model in a Python-based graphics package that directly produces PDF images. I used a free package named 'PlotDevice'. Therein, I coded the gnomonic heart of the model using the routines of Denis Savoie and Robert Sagot.[1]

These routines trigonometrically calculate the shadow point of any nodus above any plane for any hour angle. They also check if the hour is during daylight and ensures the sun is not behind the plane. The algorithm also provides the location of the dial's origin (the point at which a polar gnomon through the nodus would meet the plane – i.e. the root of the gnomon in a standard dial. At a given hour, connecting the shadow of the nodus to the dial's origin provides the hour line.

Piers' idea was to have the gnomon attached to two vertical legs – with the feet of the legs attaching directly to the vertical wall near the dial's top left-hand corner. The quality of the wall's brickwork was also unknown – so, from a structural point of view, the gnomon length and length of its legs could not be too long.

By a process of graphical iteration, the first tentative designs were made – showing the sun's shadow path at midwinter, equinox and midsummer (Fig. 1). With a taller gnomon, one gets fewer hour lines in a given dial area and vice versa. We were looking for a design that had hour lines that were 'sensible', i.e. give enough space for the newspaper names and represented the time in multiples of 10 or 15 minutes.

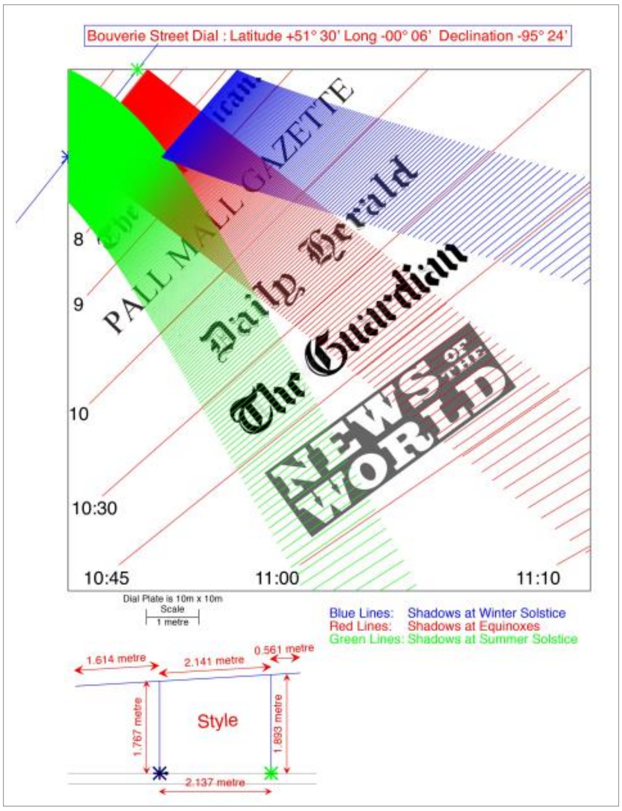

Fig. 1. Showing the shadow path at different times of the year.

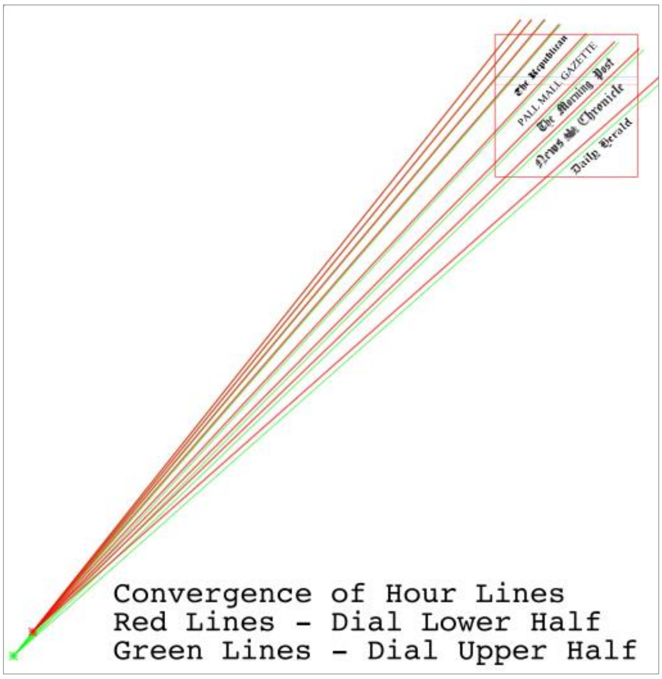

Fig. 2. Showing how the gnomon origin moves with the imposition of the step in the wall.

Fig. 3. Fitting the newspaper names across the step.

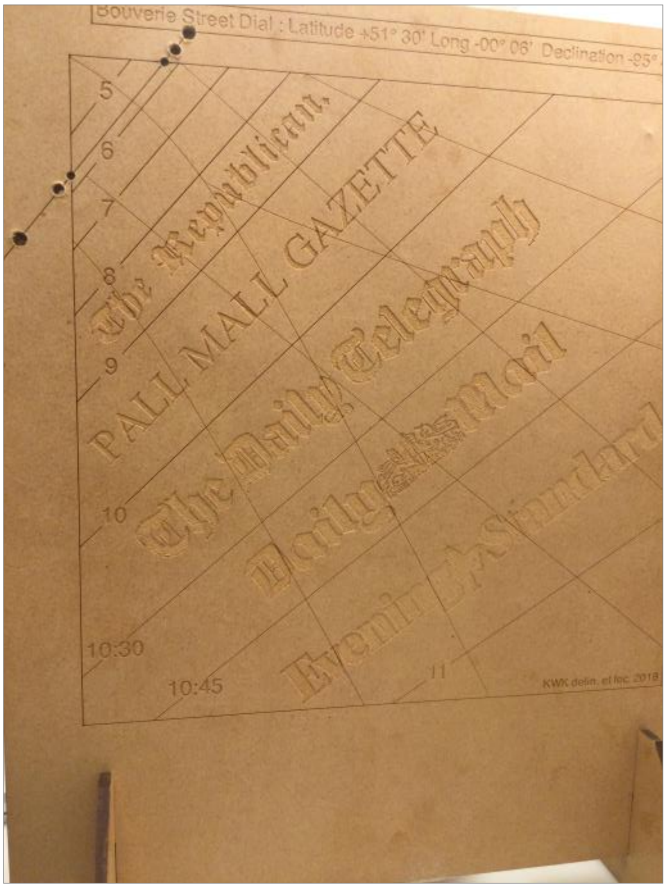

Fig. 4. An initial laser-cut model, used to help acquire both funding and approval.

Next it was necessary to account for the step in the wall. An outward step of x cm effectively means that the nodus height is reduced by x cm. Thus the dial's origin changes and hour lines are no longer parallel in the upper and lower halves of the dial (see Fig. 2). Note how far the dial origin is from the dial itself with a wall declination a few degrees off East.

Still with basic measurement uncertainty, the newspaper names (themselves uncertain) had to be ordered and fitted in so that the step passed in a gap between the words (see Fig. 3). Some consideration was given to shifting the upper parts of the names to be central between the hour lines when viewed full on, but this was abandoned on visual grounds. This seems to have been justified by the final result.

Piers was still seeking both financing of the dial and approval from the City of London authorities. To aid this the model was used to generate an 1:100 scale image that I used to laser-cut a model of the dial, as seen in Fig. 4, without its gnomon.

There followed many iterations of a design (rather than gnomonic) nature. Finally, all the measurement uncertainties were resolved by Chris Lusby Taylor's laser survey (see pages 13-16 of this issue of the *Bulletin*). This provided all the basic measurements – the wall size, the declination, the wall inclination (effectively vertical), the position and size of the step. The laser survey did reveal unevenness in the surface of the wall. This could have been included in the design but this was abandoned since it would have led to (slightly) wavy hour lines and substantial marking difficulties for the painter.

Public vote and instructions from the City of London authorities fixed the newspaper names and a final design could be produced (Fig. 5).

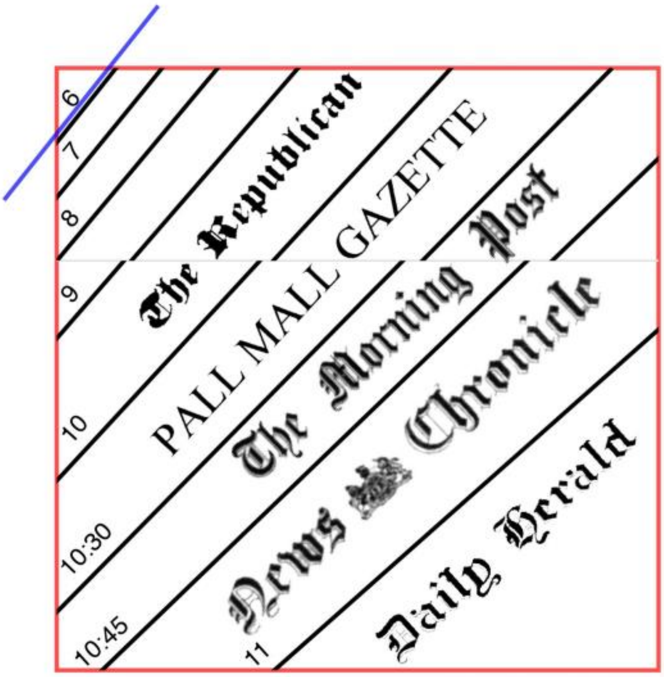

Fig. 5. Final approved design.

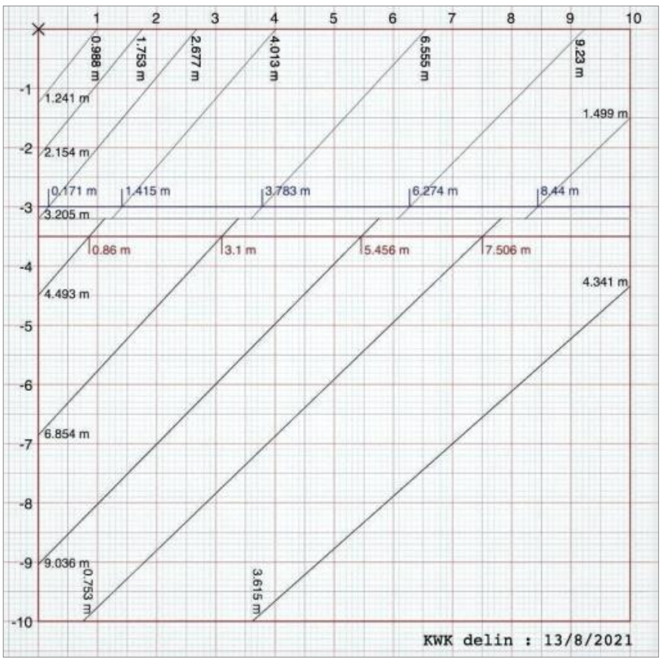

Fig. 6. Painter's instructions.

The final use for the computer model was to produce the painter's instruction (see Fig. 6). The red and blue lines were produced a few centimetres above and below the step to ease the painter's marking out.

All that was left was to produce the graphics for the roadside ceramic plaque (Fig. 7), which attempts to educate the public why the sundial seldom provides the same reading as their watch…

Postscript

I cannot overemphasize either the utility or the pleasure of using a graphical computer-based model. A change of any parameter (e.g. declination) requires a one-line change in the code and produces an instantaneous result. Python is an exceptionally easy language to learn. I also strongly recommend that gnomonists become familiar with the routines of Savoie and Sagot. By including the equation of time and longitude into the hour angle, one can easily calculate an analemma.

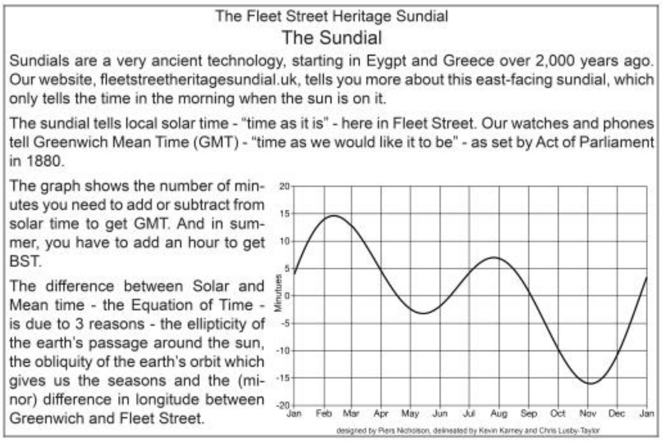

Fig. 7. The explanatory plaque.

REFERENCE

1. Jean Meeus: 'Calculation of a Planar Sundial', ch. 58 in *Astronomical Algorithms*, 2nd ed., Willman-Bell, Inc., Richmond (1998), pp. 401-8.

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'Sunclock' at Bodelwyddan Castle, Rhyl, North Wales

This beautiful picture sent to us by Douglas Hunt shows the analemmatic human sundial or 'Sunclock' on the north-west lawn at Bodelwyddan Castle, Rhyl, North Wales. Installed around 2012–13, all parts of the dial are reconstituted stone, with Roman numerals on a double ring (GMT/BST) of hour-markers.

The sundial. Photo courtesy of Douglas Hunt and Bodelwyddan Castle.

The castle was originally built as a manor house around 1460, remodelled in 1805 into a Greek Revival style, and further modified between 1830 and 1832 to convert it into the castellated style. During the Great War the house was used by the Army as a recuperation hospital; in 1920 it became a girls' school, which closed in 1982.[1]

Later run by Clwyd County Council as a stately Home and Country Park, it had a museum plus a collection from the National Portrait Gallery at one time, but this closed in 2019. Part of the site had previously been developed into a luxury hotel, and in 2021 it was announced that Bourne Leisure (a subsidiary of Warner Leisure Hotels) had purchased the freehold interest in the castle and were planning to carry out a "full refurbishment" of the property.[2]

There is a rather older sundial in the Castle garden: an early 19th century horizontal by Troughton of London (SRN 3863). According to the Fixed Dial Register, it was discovered in the fish pond in the 1970s and re-erected in 1993.

References

1. For more details, see the Wikipedia entry for Bodelwyddan Castle.
2. *https://www.rhyljournal.co.uk/news/19414972.company-officially-take-ownership-bodelwyddan-castle-deal-secured/*

CHN

POINT CLOUDS: A REVOLUTIONARY NEW WAY TO SURVEY, DELINEATE AND VISUALISE SUNDIALS

CHRIS LUSBY TAYLOR

Imagine a digital camera that can record not just the direction to, and colour of, each of several million points but the exact distance to every point, and thus its position in space. Such images could be processed to calculate how they would look from any other point in space. Well, that is exactly what the latest laser scanners can do, capturing an image that includes the colour and position of up to a million points a second. These images are called point clouds. They are used for the 3D maps on your computer or phone. And, because they are quick and cheap to capture and are accurate to a few millimetres, they are being used for many surveys of buildings, inside and out.

As well as allowing 3D objects such as buildings to be viewed on a computer screen, point clouds can be processed in many ways. Of interest when planning a sundial:

- Scanners can use GPS to record the absolute positions of all points in space.
- Software can calculate the average inclination and declination of any wall or other surface.
- The time at which each point will be shaded by a proposed gnomon can be calculated and the points' colours changed, for instance to draw hour lines or realistic shadows. These hour lines will only be straight if the surface is flat.
- The modified image can be viewed with interactive 3D software on a computer to see how it will look from any viewpoint.
- Positions and dimensions of any feature can be measured.

The point cloud is simply a computer data file that contains an unstructured list of the positions and colours of, typically, millions of points. There is no guarantee that they are in any particular order.

Application of Point Clouds to the Fleet Street Heritage Sundial

Piers Nicholson had, for a long time, identified a large wall at 62 Fleet Street, seen in Fig. 1, as calling out to become a sundial. He had in mind a design that would celebrate the history of Fleet Street, and indeed this very building, as the centre of journalism and printing. The wall faces slightly north of due east and is about 11 metres wide and 16 tall – so large and so high that traditional surveying methods

Fig. 1. Google Maps' 3D view of the site of our sundial. Imagery ©2021 Google.

would have struggled to establish the exact declination of the wall or to verify that it really was flat. So Piers commissioned a point cloud laser survey and asked me to calculate a 10 metre square sundial based on it. Kevin Karney was also on board, charged with planning the layout of the dial which was to feature the mastheads of several newspapers that had once made Fleet Street so famous. By this time Piers had secured funding and the support of the Corporation of the City of London. The story behind all this is fascinating but outside the scope of this article.

Laser scanners incorporate GPS receivers and use advanced techniques to minimise errors, so can record absolute positions and directions with great accuracy. For some purposes absolute position is important, direction not so. For sundials it is the other way round. So I specified that the survey should use true north–south and east–west axes, not magnetic or grid axes. Unfortunately, the surveyors ignored this and it was not until asked to confirm the axes that they admitted they had used the Ordnance Survey's British National Grid. This grid is only accurately aligned to north–south at longitude 2° W. In London the axes are nearly 2° out. The OS publish formulae to calculate the offset at any location, which I was able to use to correct the coordinates.

There are a lot of file formats in which point clouds can be stored. Binary formats are the most compact but hard to work with so I had asked for an ASCII file in the .PTS format. Although by many standards ours was a modest point cloud, it was still a 2.6 GB file, so the first operation was to discard all points outside our wall. This reduced it to around 9 million points and a mere 500 MB.

These points are roughly 3 mm apart and with an accuracy of a few millimetres, so capture even tiny irregularities in the wall.

When using laser scanners to create point clouds it is common practice to put a distinctive reflector somewhere in the scene to act as a datum from which other features can be measured. We did not have this but identified an architectural feature near the top left corner of the wall that served as an origin for coordinates.

From this point, we suggested that a horizontal line could be drawn across the wall and an approximately vertical one downwards at right angles to it. These could then be used for marking out the dial.

Sundial Calculations on Point Clouds

There exist commercial programs to perform a lot of simple operations on point clouds, but, curiously, none that model sundials. So I wrote all the programs needed to do so, using the language Python. The only other software used was a free point cloud viewer, which was used to create all the following images of the dial.

Using this viewer, it became apparent that the wall is almost perfectly vertical but has a narrow ledge near the top (visible in Fig. 1). The width of the ledge is not constant, implying that the walls above and below are not quite straight. To calculate the parameters of the plane that best fits a large number of points, there exist methods very similar to the well-known least-squares method of fitting a line to a set of points in a plane. Using them, I calculated the inclination and average declinations of the wall areas above and below the ledge, so that Kevin could use traditional sundial design formulae when designing the dial layout. My software could calculate and output hour line coordinates but could not provide the graphics in a form he could use. The design was to be dominated not by hour lines but by huge images of newspaper mastheads, all to be hand drawn. By adjusting the gnomon height and position, selecting 'hour' line times and choosing the best order for the mastheads, Kevin was able to give each title similar prominence and to avoid having the ledge cut any letter in two.

The wall faces just north of due east, so the gnomon needed to be near its top left corner and would be nearly parallel to the wall. The hour lines would all be nearly parallel to one another. Starting from an assumed position for the gnomon I calculated the exact time when each of the 9 million points within the dial would be shaded by it. This is surprisingly easy, using vector mathematics. If we had wanted also to draw declination lines with respect to a nodus, that would have been equally easy.

The Vector Mathematics

This is a digression into the vector mathematics. Skip this section if you wish.

Starting with the assumed position on the wall of one leg of the gnomon and the length of the leg, I first scan the wall area around the leg to determine the normal to the wall at that point, since the leg will be perpendicular to the wall. This gives the 3D coordinates of a point on the gnomon which I will refer to as the nodus, although it is an arbitrary point along the gnomon unless we want to draw its declination lines.

Now, for every point on the dial we have its 3D coordinates and therefore can subtract from them the coordinates of the nodus, giving the vector R of the sun's ray at the moment this point is in the shadow of the nodus. The distance from the dial point to the nodus is given by the magnitude or modulus of R, which I will call D, so $D = \|R\|$.

The axes are due east, due north and vertical. We know our latitude, so the polar gnomon points in direction $P = [0, \sin(\text{lat}), \cos(\text{lat})]$ and the noon equinoctial sun is in direction $N = [0, -\cos(\text{lat}), \sin(\text{lat})]$. The vector dot product of R and P gives the sun's declination at which this point on the dial will be shaded by the nodus, so we could use it to plot declination lines if desired. Simply put:

$$\sin(\text{dec}) = (R \cdot P)/D$$

where $R \cdot P$ is the dot product of R and P.

The hour angle h is 0 at solar noon and increases by 15° per hour. The hour angle at which our point is shaded by the gnomon is found from:

$$\tan(h) = R_E/(R \cdot N)$$

where R_E is the component of R in the east direction.

So, with just one dot product and one arc tangent, we have the exact time at which this point on the dial will be shaded by our polar gnomon. And, without getting involved in hyperbolae, we can draw declination lines, too. We just need to do it for every one of the 9 million points on the dial.

Painting a Sundial on a 3D Image

The first program recoloured any point that was found to be within 1 minute of being on an exact quarter hour (Figs 2, 3). For each hour (including, for instance, 10:30 and 10:45), it also calculated the best-fit straight line to all these points. It then drew these straight lines in purple by adding new points to the point cloud, floating slightly above the wall surface so that they would not get hidden by its irregularities. To label them, I later added Roman numerals with additional points. The 3D viewer lets you see the irregularities of the wall. In the event, all the straight hour lines turned out to be within a couple of minutes of the actual shadow (Fig. 3).

In order to assist the signwriter who was to paint newspaper mastheads between the hour lines, I also

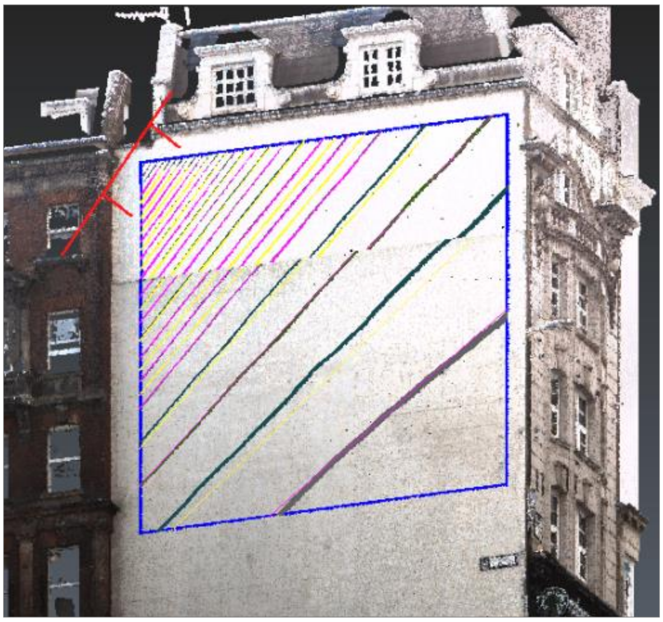

Fig. 2. 3D model with sundial painted on it and gnomon added.

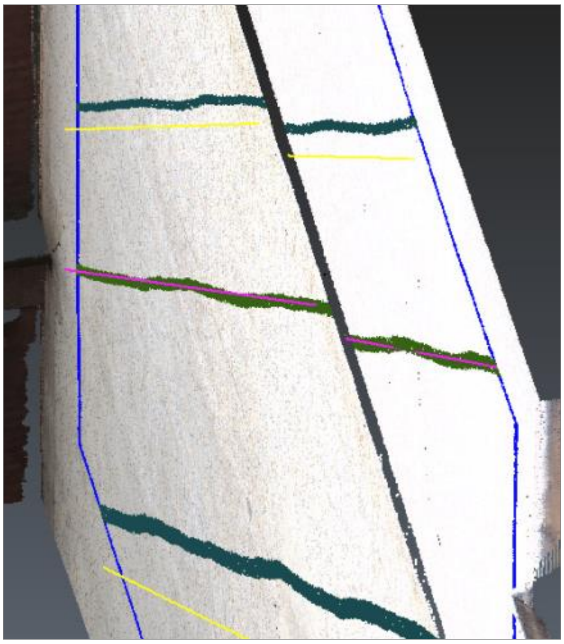

Fig. 3. Oblique view of a true hour 'line' and its best-fit straight line approximation.

calculated and drew the bisectors of the angles between them with yellow lines (Figs 2, 3). However, as we shall see, these had to be abandoned.

Gnomon Design Issues

It had been decided that the gnomon should consist of a stainless steel tube. One design issue with such a large east-facing dial is what diameter to make the gnomon. The human eye is very good at judging the centre of the shadow of a rod or tube. It is very bad at judging the edge of the shadow of a solid, so thin gnomons are best. But if the distance from the tube to the dial is greater than 106 times its diameter the shadow will be all penumbra, which is less distinct than true, fully shaded umbra. So it would be desirable, if possible, to have a gnomon of diameter at least 1/106 of the maximum distance to the dial. But in this case the dial is up to 13 metres from the gnomon, so this calls for a gnomon 12 cm diameter. A steel tube this size was felt to be unacceptably heavy, and the shadow would have been too wide earlier in the morning, so I wrote a program to model the actual shadow of a thinner gnomon.

The way it does this is, for each point in the dial, to find if the gnomon's shadow is at all obscured at that point at any exact quarter hour. If so, we calculate what proportion of the sun is shaded there by the given diameter of gnomon. We then repaint the point white if in full sun, black if fully shaded, the appropriate level of grey in between. The resulting 3D image clearly shows the exact appearance of the dial at every hour. Near the gnomon the shadows are narrow and crisp. Far from it they become wider and less distinct. However, the model gave confidence that even a relatively narrow gnomon should cast a visible shadow on a

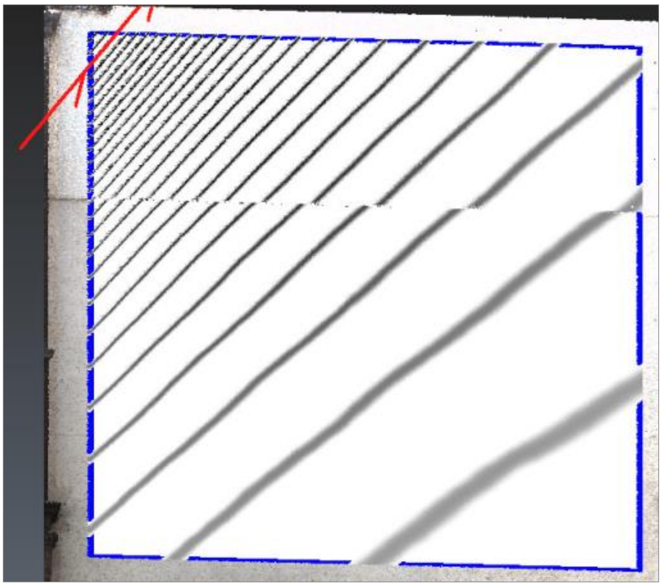

Fig. 4. Accurately calculated shadows, for 3 cm diameter gnomon, every 15 minutes.

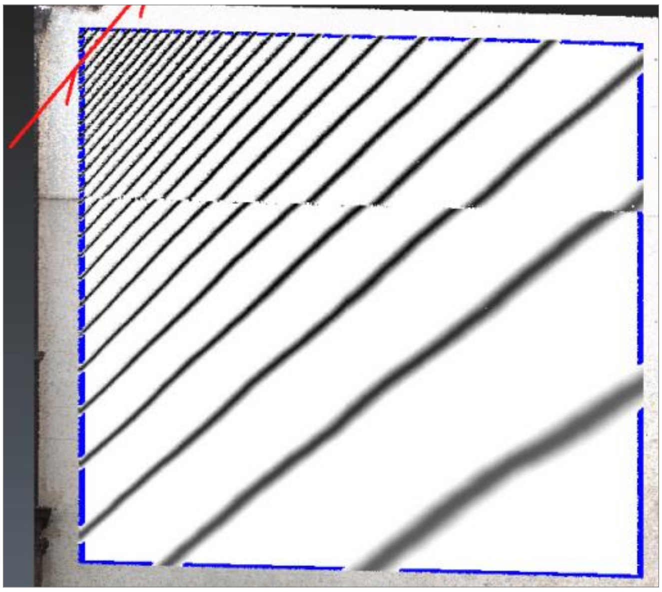

Fig. 5. Accurate shadows for 5 cm diameter gnomon.

Fig. 6. The finished dial seen from Fleet Street at 11:30 am BST on 21 October, when EoT was 15 minutes, so the dial correctly shows 11:30 + 0:15 – 1:00 = 10:45 sun time.

sunny day (Figs 4, 5). While a fatter gnomon or, perhaps, one with a different cross-section, might be more satisfactory for part of the dial, the chosen design is elegant and works well most of the time.

While the wall is, in many respects, ideal for a monumental sundial, it has, as mentioned, one unfortunate feature: the ledge about 10 metres up and around 4 to 8 cm wide. Viewed by, say, an ant sitting on the gnomon the hour lines look dead straight. But viewed from the ground below they have a distinct 'N'-shaped kink at the ledge. If we only had to worry about the hour lines there would be little problem as the kinks are not wide enough to confuse you. But we wanted to fill the gaps between the hour lines with the newspaper mastheads. If these were to replicate the same kinks they would look very odd from Fleet Street, where most passers-by are, since it is to the north. So the signwriter, Steven Whitaker, painted the mastheads to look good from Fleet Street.

Summary

This article has concentrated on just one aspect of this impressive dial – the use of 3D point clouds to survey a site and lay out a sundial. In the author's opinion point clouds have huge potential to make accurate sundials without the complex mathematics and uncertainties inherent in traditional surveying and layout methods. The proposed dial can be shown on a screen as a 3D model viewable from any position. Accurate dimensions can be measured. Irregularities in the surface can be seen and are automatically accommodated.

There are a lot of companies now offering point cloud surveys as a service. It is very quick and not hugely expensive. I recommend it to you.

The dial, and three plaques accompanying it and explaining it and the history it celebrates, were formally unveiled by the Lady Mayoress of London, Mrs Hilary Russell, on 21 October 2021 (Fig. 6). This is the culmination of a huge amount of work over 14 years by Piers Nicholson, to whom all credit is due. It will be one of the largest timepieces in London – more than twice the area of each Big Ben clock dial.

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MINUTES OF THE 31st BSS ANNUAL GENERAL MEETING

Newbury, 25 September 2021

The AGM was chaired by Frank King (Chairman) with Chris Williams (Secretary) in attendance.

1. Receive 2020 accounts and trustees' report

The 2020 accounts and trustees' report was circulated to all members in the March 2021 *Bulletin*. As no comments had been received by the Secretary, they were taken as read.

2. Election of charity trustees

Graham Stapleton retired by rotation from the office of elected charity trustee. Graham was willing to continue to serve and offered himself for re-election.

Graham Stapleton was elected to the office of elected charity trustee.

Jackie Jones and Frank King, nominated trustees since April 2020, resigned and offered themselves for election.

Jackie Jones and Frank King were elected to the office of elected charity trustee.

3. Appoint examiner for 2021 accounts

Counterculture LLP were (re)appointed to examine the 2021 accounts.

4. AOB

No other business was raised.

Secretary
1 October 2021

FIONA VINCENT November 1949 – September 2021

It is with great sadness that I report the sudden and unexpected death of Fiona Vincent in early September. Fiona was actually born in St Pancras, London, but the family moved to Edinburgh soon after as her father's career in the insurance industry took him there: Scotland became very much her home. At George Watson's Ladies' College she excelled at mathematics – as many school book prizes testify – and from there she went to St Andrews University to study maths with astronomy. She stayed on at the School of Physics and Astronomy to take her Ph.D. in astronomy.

Fiona and Roger. Photo courtesy of Jim Burke, processed by Arie de Ruiter.

Her early post-doctoral career included a spell with the BBC World Service in London but in 1978 she escaped back to Scotland and married Roger Stapleton. In 1982 she was appointed City Astronomer for Dundee, a post which she held until 1994. In this role she directed a major redevelopment of Mills Observatory (then Britain's only full-time public observatory) and she was also able to design two sundials for them.

From 1996 to 2016 Fiona held an Honorary Lectureship in the School of Physics and Astronomy at St Andrews. There, together with Roger, she pursued a vigorous outreach programme for primary schools throughout Fife and Tayside, of which the St Andrews mobile planetarium was the centrepiece. She presented some 200 shows from 1996 to 2003. Until 2012 Fiona maintained a monthly web page on 'What's in the Sky', which enjoyed a high profile among local astronomical societies affiliated to the British Astronomical Association and the Scottish Astronomers' Group.

Fiona and Roger were amongst the first tranche of members of the BSS in 1989 (membership number 72), where their application shows that their particular interests included Recording and Education. Fiona contributed several articles and letters to the *BSS Bulletin*, particularly on the subject of moondials. She also became the supplier of the solar and lunar data for the annual BSS Datacard and, for the last few years, was the proofreader for the *Bulletin*. She was ideally suited to this last role as she was very thorough and had previously shown a sharp eye for unintentionally hilarious typographical errors and ambiguities in peer-reviewed astronomical publications, which she exposed mercilessly as a regular contributor to the Here and There column of *The Observatory* magazine.

In 1998 she delivered a series of lectures on *Positional Astronomy* for the undergraduate astronomy module in the School of Physics and Astronomy at St Andrews. The URL of the superb lecture notes she prepared for the students quickly escaped into the wild on the then-new World Wide Web; they quickly established themselves as the world's go-to site for information on the subject. Fiona continued to maintain these pages in response to user feedback for a further 23 years. Today they still provide the top hits for Google searches for 'positional astronomy' or 'spherical trigonometry'. Any Trekkies out there might know that she was pleased to share her name with the fictional starship *USS Fiona Vincent NCC-8010*!

Fiona acted as a tutor and study advisor on several Open University astronomy courses, including a third-year course on astrophysics incorporating remote-observing projects with robotic telescopes operated by the OU on the islands of Mallorca and Tenerife. Closer to home in St Andrews, she maintained active research in astrometric and photometric studies of asteroids and other small solar-system objects from the home observatory she and Roger operated. It was in their beautifully-cultivated garden whose hedges were carefully designed as a shield against encroaching light pollution, and which, naturally, featured sundials designed by Fiona.

Recently, she became interested in medieval astrolabes, reading Geoffrey Chaucer's original *Treatise* on the subject and also resurrecting her school German to read the key literature on medieval star lists. She was a great help in putting astrolabe star data into modern co-ordinates.

She had been planning to attend next year's Conference and will be sadly missed there.

John Davis with major input from Roger Stapleton

AN INGENIOUS GNOMON AT PRINCETHORPE COLLEGE

BEN JONES

Princethorpe College near Rugby, Warwickshire had a new teaching block built in 2014. The architect had sketched a sundial design for the south-facing wall of the new classrooms and asked me to carve the dial.

There were two ways of carrying out this work. One was for the dial to be carved in my workshop and then delivered and fitted while the new wall was being built. The other method was to wait until the block was in place and for me to work on site.

In the end the work was carried out after the block had been fixed in place and all the sun-obscuring scaffolding was down and all the frantic building work with its need for co-ordination between contractors was finished (Fig. 1). The job then involved simply travelling to Rugby twice, once on a sunny day to find the declination of the block and later to stay for a couple of dry days to set out, carve the dial and fix the gold-plated gnomon and sun disk (Fig. 2).

Fig. 2. The finished dial at Princethorpe College.

My experience of fixing dials tells me that walls are rarely plumb or straight. This is not a surprise when dealing with a Devon cobb cottage, but it has been a shock to find that modern brick and block walls can be an inch or more out over the width and height of a dial plate. This wall, however, was beautifully built and when surveyed the dial block was found to face directly south just as the architect's drawings said it would.

Fig. 1. The site.

The longitude-adjusted dial face was marked out using a unit square and the lines and numerals were incised with mallet and chisel. The dial block is reconstituted stone and measures 1040 mm tall by 890 mm wide by 100 mm thick.

The school's motto is *Christus Regnet* (may Christ reign) and this was used as the sundial's motto. Visually it would have been nicer if this could have been carved in lettering that matched the carving of the dial. But it was decided to use the same typeface lettering cast in reconstituted stone that was used elsewhere on the building and there was no viable method of carving the dial to match the cast lettering.

My favoured method of fixing a rod gnomon is to have the rod's end sharpened to a point. This makes placing the centre of the gnomon in the very centre of the dial a simple process. This particular sundial, however, required a decorative gold-plated sun disk to be fixed right where my gnomon point would have touched the dial plate. The ingenious solution to this problem came from P.J. Dove, a

Fig. 3. Close-up of the dial, showing the bent tip of the gnomon.

clever engineer, who made the gnomon with a detachable point. Once the gnomon was firmly fixed in place the point was bent and then unscrewed, allowing the sun disk to be fitted (Fig. 3).

The gnomon was held at the correct angle to the dial face by the gnomon's point and a board clamped to the gnomon's longest supporting leg. This board also held the gnomon perpendicular to the dial face and over the substyle line. A carpenter's square and bevel gauge were deployed to check all this. With everything clearly in place there was no panicky aligning the gnomon and checking it before the resin set.

My advice is to drill all the holes or cut the slot for the gnomon and make sure the gnomon fits and is correctly aligned before carving any hour lines.

Having a semi-circular hour ring at the top of the dial meant that the numerals had to be smaller and more closely spaced than if they had been set round the edge where there would have been more space for them. Where the architect got this idea from, I never did find out but it is pretty and slightly unusual. With space at a premium the XI and I were replaced with diamonds and the two VIs were omitted. This helped to make the numerals look less cramped.

To put some 'spring' into an otherwise rigid semi-circular chapter ring my would-be 'VI lines' are raised up very slightly. This seemed a reasonable cheat to me as they are not numbered and the sun will never reach them or the recessed face of the dial at VI.

The gnomon possibly looks a bit short. This comes from the architect's sketched design. I made it so that the gnomon's shadow reaches the bottom of the panel at noon on the summer solstice.

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PLINY REVISITED

JOHN LESTER

In an earlier article[1] I discussed the types of sundial listed by Pliny. Pliny the Elder (Gaius Plinius Secundus, AD 23–79) wrote his *Natural History* in thirty-seven books which covered every imaginable topic so that we should not be surprised that he included sundials among these. In Book VII, Section LX we find the following passage which has not appeared in the *Bulletin* before:[2]

> "We have it on the authority of Fabius Vestalis that the first sundial was erected 11 years before the war with Pyrrhus at the Temple of Quirinus by Lucius Papirius Cursor when dedicating that temple which had been vowed by his father; but Fabius does not indicate the principle of the sundial's construction or the maker, nor where it was brought from or the name of the writer who is his authority for that statement. Marcus Varro records that the first public sundial was set up on the Beaks during the First Punic War after Catania in Sicily had been taken by the consul Manius Valerius Messala and that it was brought from Sicily thirty years after the traditional date of Papirius' sundial BC 264. The lines of this sundial did not agree with the hours, but all the same they followed it for 99 years, till Quintus Marcius Philippus who was censor with Lucius Paulus placed a more carefully designed one next to it, and this gift was received as one of the most welcome of the censor's undertakings. Even then however the hours were uncertain in cloudy weather, until the next Lustrum, when Scipio Nasica the colleague of Laenus instituted the first water-clock dividing the days and the nights equally, and dedicated this time-piece in a roofed building, BC 159. For so long a period the divisions of daylight had not been marked for the Roman public."

Note that the "Beaks" were raised platforms adorned with the beaks of captured warships, from which orations and pleadings were delivered.

REFERENCES

1. John Lester: 'Pliny the Elder and Gnomonics', *BSS Bull.,* 25(ii), 7 & 27 (June 2013).
2. Pliny & H. Rackham (translator): *Natural History*, Harvard University Press, Loeb Classical Library (1938).

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THE FRENCH REPUBLICAN CALENDAR IN ENGLISH

A Proposal by Fabio Savian

FRANK H. KING

In recent years, the noted Italian diallist, Fabio Savian, has been publishing an Italian version of the French Republican Calendar and he is now considering an English version. At the recent BSS Newbury meeting, Sue Manston gave a brief description of her copy of the current calendar.[1] This consists of eight wire-bound A3 sheets (14 printed sides and a blank backing sheet).

Fig. 1. The French Republican Calendar for Year III of the First French Republic engraved by Philibert-Louis Debucourt in 1794. Details of the 12 months are shown in the 12 columns in the rectangular panel. The engraving is replete with allegorical detail including a discarded sundial. Photo: Wikimedia Commons Licence.

The Original Year III Calendar

The outside front cover is largely taken up by a reproduction of the calendar published in Year III of the First French Republic. This is shown in Fig. 1.[2]

The engraving above and around the rectangular panel is full of allegorical detail which is easier to see on the A3-size cover. Some of the details are discussed below, including the seemingly abandoned vertical sundial.

The calendar proper is confined to the rectangular panel in which 12 columns can be seen, one for each month of the year. Each month has 30 days, a total of 360 days. A footnote below the columns explains that there are five additional days at the end of the year.[3] These became known as complementary days and were designated as a holiday period. Roughly every four years, a sixth complementary day was needed to prevent the autumnal equinox falling on the second day of the following year. Somewhat confusingly, such years were called *années sextiles* or sextile years (with the Julian and Gregorian Calendars, they are bissextile years). Alluding to the Olympiads of Ancient Greece, a four-year period was referred to as a *Franciade*.

The calendar made no use of the seven-day week. Instead, each month was divided into three 10-day periods called *décades*. Rather than using names like Monday, Tuesday and Wednesday, the days in each *décade* were referred to as *primidi*, *duodidi*, *trididi*, … (first day, second day, third day, …). The first day of the first month was always the day of the autumnal equinox, as observed at the Paris Observatory.[4] This day marks the cusp of Libra. Each subsequent month is deemed to be associated with successive signs of the Zodiac. This is clearly false thinking since the sun does not move along the ecliptic at a constant speed and it is incorrect to assign 30 days to each sign. Moreover, the complementary days seem not to belong to any sign!

Apart from the occasional sixth extra day, every year was set out in the same way. This suggests that once you had bought one calendar, there was little point in ever buying a new one (unless you used the calendar as an engagement diary and had written all over it!). The only change would be the year number.

Fig. 2. Fabio Savian's rendering of the month of Nivôse (French). This is Nevoso in Italian and Snowy in English.

In practice, the calendar included just a little almanac information: the dates of the different phases of the moon (which necessarily change from year to year). Also, for the benefit of those who resisted the new ways of thinking, the calendar included guides showing where you were on the Gregorian Calendar.

The Fabio Savian Italian Edition

The Italian version of the French Republican Calendar, designed by Fabio Savian, allocates a whole side of A3 to each month. In the top half there is an elegant photograph of a sundial and in the bottom half there is the date information. Fig. 2 shows the layout for the month of *Nevoso*, the fourth month of the year. The current year is 230, which began on 22 September 2021 (the most recent autumnal equinox). This year happens to be a sextile year and runs up to and including 22 September 2022, because next year's autumnal equinox falls on 23 September. Recognising that modern users would be lost without knowing where we are in the seven-day week, the 30 days of each month are arranged in seven columns headed *Lunedi* to *Domenica* (Monday to Sunday). The names of the months, and the days of the week, are in Italian.

In effect, this is two calendars in one. Each French Republican month of 30 days typically spans the last third of some Gregorian month and the first two-thirds of the next. In Fig. 2, days 1 to 11 have grey headings which show dates from 21 to 30 December 2021; days 12 to 30 have black headings which show dates from 1 to 19 January 2022. It is all beautifully designed. It is easy to use it as a regular Gregorian Calendar and, with very little practice, you will soon feel at home with the French Republican Calendar.

Unlike the original, Fabio Savian's calendar does not include information about the phases of the moon but, rather more usefully for diallists, it shows the solar declination and the equation of time values for every day of the year. It also marks the equinoxes and solstices, and which sign of the Zodiac applies on each day of the year (as noted, the original calendar did not get this right). Readers with keen eyesight will note the shining sun on day 1 in Fig. 2. This indicates the day of the winter solstice (21 December 2021) but the Zodiac sign below is for Sagittarius and not for Capricorn. Fabio Savian made a design decision to show the sign which applies for the majority of the day.

Calendrier Républicain

One may infer at least a hint of the thinking of the designers of the Calendar from the cover of the Year III Calendar itself. Near the bottom of Fig. 1 there is a dominant heading *CALENDRIER RÉPUBLICAIN*. Below this there is an information panel which is shown enlarged in Fig. 3. As with many features of the front cover, it is well worth downloading the original 11.8 MB file so that you can explore the smallest details of the engraving.[5]

The following is a transcription of the information in the panel:

> *Sur un Sommet élevé, la Philosophie assise sur un siege de marbre décoré des images de la Nature féconde, et ayant pour Diadême le bonnet de / la Liberté, foule a ses pieds les gothiques monumens d'erreur et de superstition sur lesquels etoit fondée l'ignorante et ridicule division des tems, et puise dans le grand livre / de la Nature, les principes et*

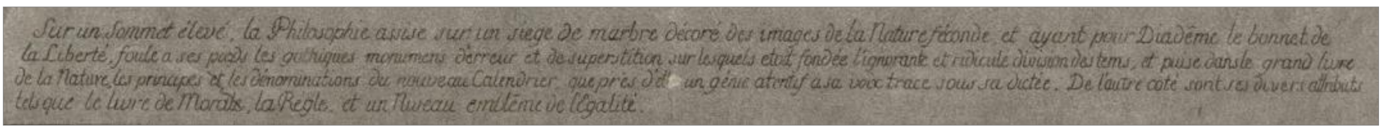

Fig. 3. Information panel at the bottom of Fig. 1.

les dénominations du nouveau Calendrier, que près d'elle un génie atentif a sa voix trace sous sa dictée. De l'autre coté sont ses divers attributs / tels que le livre de Morale, la Régle, et un Niveau emblême de l'Egalité.

A rough translation is:

> On a lofty Summit, Philosophy seated on a marble seat decorated with images of fruitful Nature, and having for [a] Diadem the cap of Liberty, tramples at her feet the Gothic monuments of derision and superstition on which was founded the ignorant and ridiculous division of times, and draws from the great book of Nature, the principles and names of the new Calendar, which near her, a genius attentive to her voice writes at her dictation. On the other side are its various attributes such as the book of Morals, the Rule and a Level emblem of Equality.

In short, much of what had gone before was founded on ignorance, particularly the traditional way of dividing time. One of 'the Gothic monuments of derision' being trampled at Philosophy's feet is the Gregorian Calendar (Fig. 4).

More prosaic details about the Calendar are being written by the winged genius and can be read from his scroll in Fig. 5.

The following is a transcription of the scroll:

> *L'Ere des Francais / compte de la foundation / de la Republique 22.S^{te} / 1792 de l'ere vulgaire. / jour ou le Soleil est / entré dans le signe / de la Balance. / L'année est divisée en / 12 mois de 30 jours. / Chaque Mois en 3 parties / de 10 jours nomées. / Décades. / il i a 5 jours...*

Another rough translation is:

> The French Era is counted from the founding of the Republique [on] 22 S[ep]te[mber] 1792 of the vulgar era, [the] day where the Sun entered the sign of Libra. The year is divided into 12 months of 30 days. Each Month [is] in three parts of ten days called. Décades. there are 5 days…

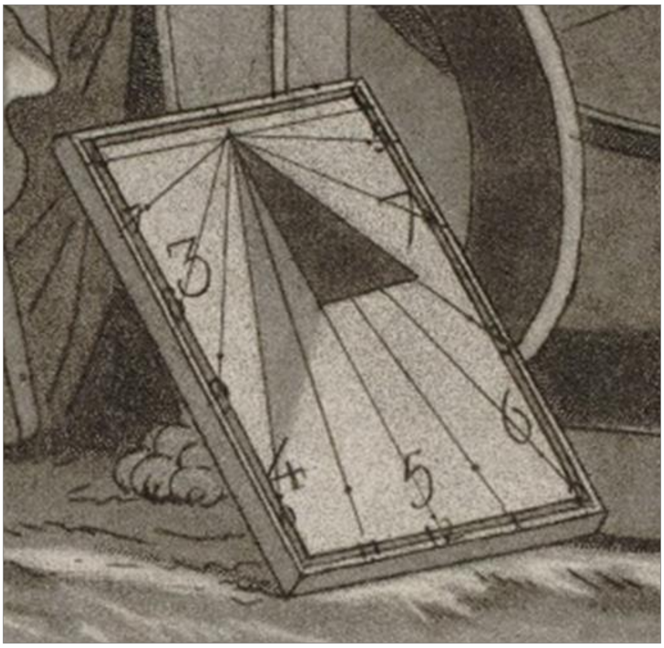
Fig. 6. The discarded sundial.


Fig. 4. The trampled Gregorian Calendar.


Fig. 5. The scroll being written by the winged genius.

The winged genius was not very good at punctuation!

The Discarded Sundial

Fig. 6 shows an enlarged view of the sundial which is at the base of the globe.

At first glance, the sundial appears to be a vertical direct-south-facing sundial that indicates French Revolutionary Time which was based on a 10-hour day, so midday is labelled 5. Something is not quite right though because the two horizontal lines should mark hours 2½ and 7½ but the labelling implies that they actually mark hours 2 and 8. On closer inspection it is clear that this is really a normal vertical direct-south-facing dial and the hour lines are labelled from 6 am to 6 pm. Even in this enlarged view, these labels are not easy to see. The suggestion is that this sundial has been discarded because it shows 'the ignorant and ridiculous division' of the day! Someone has tried to relabel it with grossly over-sized French Revolutionary hours but has realised that the hour lines are not in the right places so this sundial has been cast aside.

A Sample Month

Fig. 7 shows an enlarged view of the first *décade* of the fourth month, *Nivôse* in French. Between a pair of brackets there is an explanation that the 30 days of this month

Fig. 7. The first Décade *of* Nivôse.

correspond to the period from 21 December [1794] to 19 January 1795.

Immediately below this note there is the symbol for Capricorn which is assumed to apply for the whole month. This gross simplification is too much for Fabio Savian who labels each day of the year with the appropriate sign. As noted above, he shows Sagittarius for the first day of this month.

Next there are the principal phases of the moon for the month. The information is given rather cryptically but, expanded, we have:

> *nouvelle lune 1, premier quartier 9,*
> *pleine lune 15, dernier quartier 23.*

The three columns for the days show the ordinal names (*primidi*, *duodidi*, *tridirdi*, …), the cardinal names (1, 2, 3, …), and the colloquial names. The designers came up with 366 different names. The motivation was to have secular alternatives to Saints' names and there were no hard rules except that the numbers ending in 5 were animals (here *Chien* is Dog) and numbers ending in zero were named after tools (here *Fléau* is a Flail).

One detail is that day 5 of *Nivôse* corresponds to Christmas Day. Naming this day Dog was, perhaps, a subtle way of emphasizing the designer's distaste for the Roman Catholic Church.

The Proposed Fabio Savian English Edition

Thumbnail versions of the 14 printed pages of the Italian edition of the current year are shown in Fig. 8. The inside of the front cover explains various features of the calendar and identifies the twelve sundials in the photographs.

The proposed English edition for the year 231 (which begins on 23 September 2022) would have the same format. Fabio Savian is open to suggestions for the 12 sundial photographs. The names and words would be English equivalents and here there is a slight problem. It is easy to translate the names of days, such as *Chien*, into English and there is no difficulty with the days of the week. The names of the months are more challenging. The French names were:

> *Vendémiaire Brumaire Frimaire*
> *Nivôse Pluviôse Ventôse*
> *Germinal Floréal Prairial*
> *Messidor Thermidor Fructidor*

These are neologisms which allude to the different times of year. There have been many attempts to produce English equivalents; some are light-hearted, as in a satirical poem by George Ellis (1753-1815):

> Snowy Flowy Blowy
> Showery Flowery Bowery
> Hoppy Croppy Droppy
> Breezy Sneezy Freezy

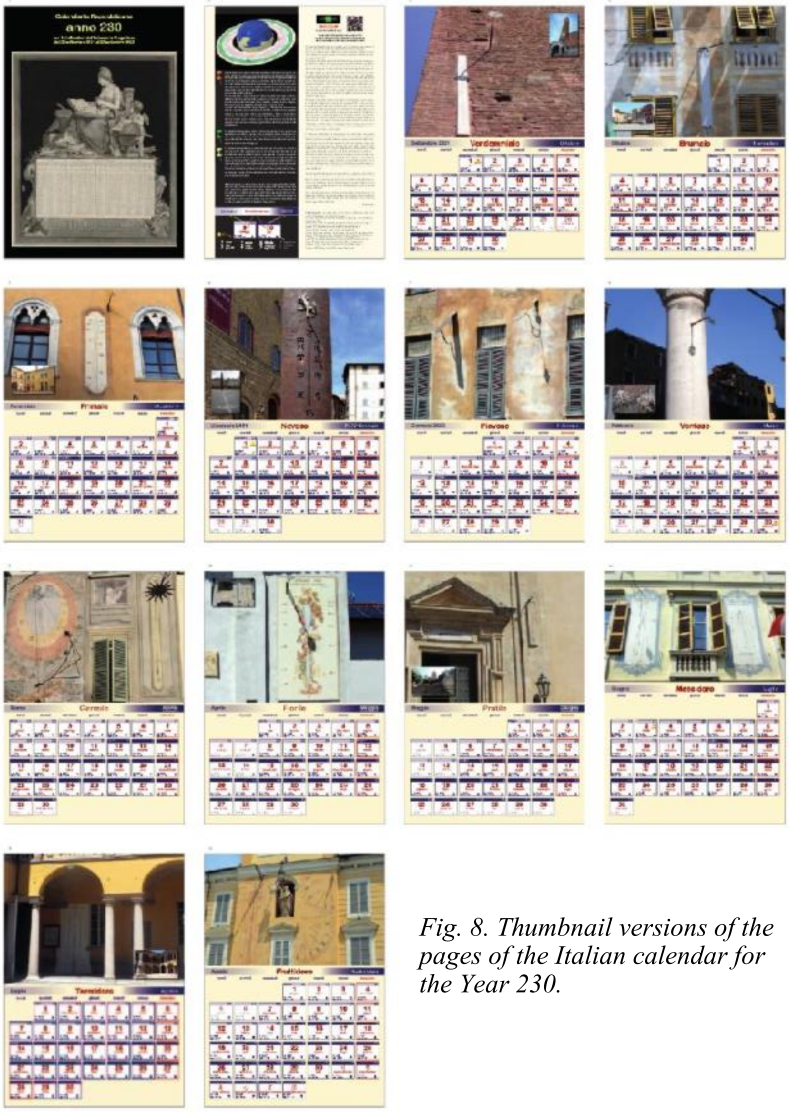

Fig. 8. Thumbnail versions of the pages of the Italian calendar for the Year 230.

The historian Thomas Carlyle proposed the following more serious list in 1837:

Vintagearious Fogarious Frostarious
Snowous Rainous Windous
Buddal Floweral Meadowal
Reapidor Heatidor Fruitidor

These are the names which Fabio Savian is proposing to use.

The French Revolution, the First French Republic and Napoleon

There are numerous accounts of the French Revolution, the First French Republic and Napoleon on the Internet.[6] It is useful to note some key dates. The French Revolution began in 1789 and ended in 1799 when Napoleon came to power. Prior to the Revolution, France was governed by three estates: the clergy, the nobility and the commoners. Of the three, the Revolutionaries had a particular distaste for the clergy, equating them to the Roman Catholic Church, one of 'the Gothic monuments of derision and superstition'.

A particularly significant date is 22 September 1792 when King Louis XVI was deposed and the monarchy was replaced by the First French Republic. This date later became the epochal date of the French Republican Calendar; it marked the start of Year I of the Republic. No calendar was published in Year I but, two years later, the Year III Calendar was published (Fig. 1) and runs from 22 September 1794.

In 1799 Napoleon became First Consul of the Republic and, in 1804, the Senate proclaimed him Emperor of the French. This marked the end of the First Republic. Napoleon was not an instigator of the Revolution and took no part in the introduction of the French Republican Calendar, indeed he abolished it; France reverted to the Gregorian Calendar on 1 January 1806. The calendar lasted longer than Decimal Time which was mandatory for only a matter of months (from September 1794 to April 1795).

Fabio would like a minimum order of 20 English editions. The cost is not yet decided but it will be of the order of £15 including postage. I would undertake the administration including the distribution. Members interested in obtaining a copy of the English edition are invited to send an e-mail message to me together with the preferred postal address. Members interested in the Italian edition may order from Fabio Savian. There is no French edition yet!

ACKNOWLEDGEMENTS

I am most grateful to Fabio Savian for introducing me to this calendar. I should also like to thank Graham Stapleton for many hints about the interpretation of the Year III Calendar. There are numerous intriguing features in the Debucourt engraving and the notes above do scant justice to just a fraction of them. I also received invaluable advice from Sue Manston.

REFERENCES and NOTES

1. Sue Manston's Newbury Talk. *BSS Bulletin*, 33(iv), 36 (December 2021).
2. The Calendar shown in Fig. 1 is reproduced in the Wikipedia entry on the French Republican Calendar. The original is in the Musée Carnavalet, in Paris, catalogue number G.4140. It is 429 mm × 367 mm. See *http://en.m.wikipedia.org/wiki/French_Republican_Calendar*
3. The footnote below the columns of the calendar gives the following explanation about the end of the year:
   Les Sanculottides. 5 Jours. Consacrés aux Fetes.
   Les Sanculottides literally means 'those without knee breeches' and alludes to the more educated Revolutionaries who sided with the poorer classes, knee breeches being the dress of the upper classes.
   The five days (*5 Jours*) at the end of the year were, for a short time, referred to as *Les Sanculottides* and were designated as a holiday period (*Consacrés aux Fetes*). The description *Les Sanculottides* did not last long. From Year IV, they were referred to as Complementary Days (*Jours Complémentaires*).
4. A day ran from midnight to midnight, as observed at the Paris Observatory. It seems clear that local apparent midnight (inferior solar transit) was used and not mean midnight. If the moment of the autumnal equinox is less than eight minutes after midnight in Paris, then that moment will be *before* midnight in Greenwich. This gives scope for confusion but, fortunately, only about one year in 200.
   A distinction is made between the Paris Observatory and the Paris meridian line and it is probably the latter which was used. To the French, the Paris meridian line was the prime meridian, or longitude zero. Different sources give different values for its longitude relative to the Greenwich meridian, but it is about 2° 20′ 14″ E.
5. To see a high-resolution version of the calendar, visit the Wikipedia entry, open the photograph, click *Details*, and download the original file. This is 5784 × 6810 pixels and 11.8 MB.
6. The Internet abounds with articles on the French Revolution, the First French Republic and Napoleon. Useful introductions may be found at:
   http://en.m.wikipedia.org/wiki/French_Revolution
   http://en.m.wikipedia.org/wiki/French_First_Republic
   http://en.m.wikipedia.org/wiki/Napoleon

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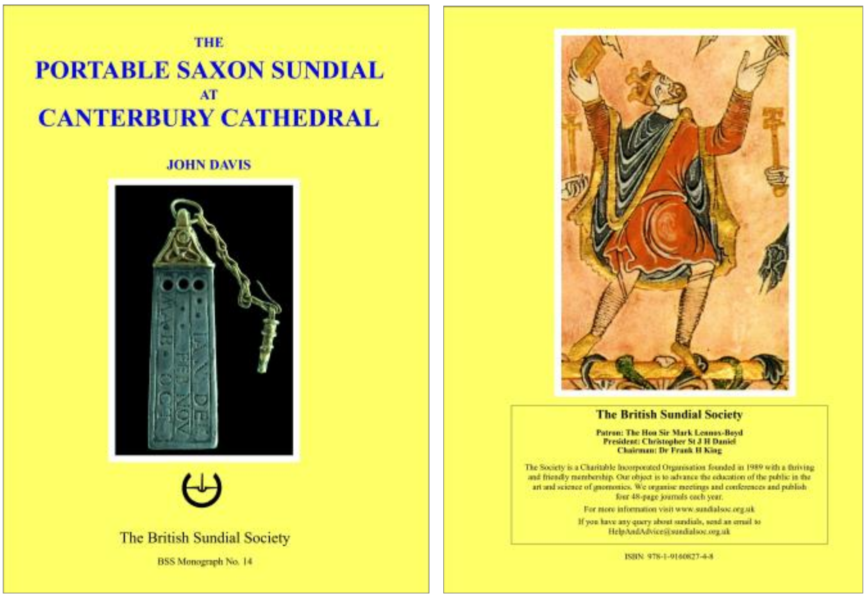
At the Newbury Meeting (2)

Peter Ransom sets up the laptop computer, watched by Chris Lusby Taylor and Kevin Karney.

BOOK REVIEW

The Portable Saxon Sundial at Canterbury Cathedral
by John Davis. BSS Monograph No. 14.
ISBN 978-1-9160827-4-8 (2021). A4,
32 pp, soft covers.
Price £10 + p&p from BSS Sales.



The front and back covers of the Monograph, with the sundial and King Edgar the Peaceful.

It is remarkable how so small an object – 2½ inches in meaningful units – merits so much enquiry. The sundial, for it certainly is that, is of course unique, indisputably Saxon, exquisitely designed and fabricated in the precious metals silver and gold with jewels and clearly made as a working article or useful adornment for a monastic cleric. Yet, to gain a fuller appreciation, there was much about this remarkable object still calling for examination.

In this Monograph, John Davis has met this call with the most thorough and comprehensive account hitherto of the various aspects of the sundial and its historical setting. His well-illustrated studies fall into a number of sections:

- In the introduction, the Saxon sundial's uniqueness and the need to fill the gaps in its study are explained.
- A section covering the dial's provenance and previous publications reviews the rather inadequate earlier accounts published since the sundial's unearthing in 1938 and considers comparisons with other portable dials. There has been uncertainty as to the positioning of the gnomon prong and speculation about the precise operation of the dial.
- The main features of the piece, hanging from a chain and with a separate gnomon, are described and discussed in great detail.
- The longest section of the Monograph, dealing with the analysis of its materials, provides a highly technical examination of its silver and gold composition.
- There is an informative historical discussion of the Saxon kings and monastic times when the dial was created. Some early attributions were made to St Dunstan, 10th-century Benedictine cleric who survived the turbulent transition between King Eadwig and King Edgar to become Archbishop of Canterbury, but despite several lively St Dunstan illustrations from early manuscripts, there is a lack of evidence to support his connection with the dial.
- A note on how and where the Saxon dial was made is inconclusive although the methods were fairly standard for the time.
- The penultimate section describes some of the numerous replicas (some fine, others not so fine) that have been made since the discovery of this famous dial.
- In the short concluding section it is suggested that the dial was made soon after King Edgar's reform of the currency, and noted that it reflects the increasing importance of timekeeping at the turn of the 1st millennium. Suggestions for future investigations are made.

Discovered by chance in 1938 in Canterbury under a tombstone in the Cloister Garth, its purpose is clear – an implement to tell, by the sun, the times of day to celebrate the three prescribed daily offices/masses. The intricate variations in reading these times throughout the year are clearly allowed for in alternative positioning of the gnomon – a separate prong with insert slots. Yet one prevailing mystery remains: exactly how should the gnomon be suspended and read? The Monograph discusses this problem with alternative possibilities in detail but without achieving a definite conclusion. The Saxons still hold the secret.

Having learned so much from this Monograph, perhaps one is inclined to make one's own dial replica for today's purposes. But, if not to say mass, to mark what regular daily events? Exercise, stimulation? Perhaps just morning coffee, lunch and afternoon tea.

The original Saxon sundial is part of the Canterbury Cathedral Collections but is not currently on permanent display.

Julian Lush

IN THE FOOTSTEPS OF THOMAS ROSS

Part 37: The Crossford Conundrum

DENNIS COWAN

Crossford is a village near Dunfermline in Fife and only about four miles from my home. There is a fine sundial on the main road opposite the golf club at Pitfirrane and I have passed it many times. It is a sandstone cube with inlaid marble panels on each face, with each face being around 300 mm square, and it is mounted on the central of three gate pillars at the entrances to what are now two houses and a garage (Fig. 1).

Fig. 1. The sundial located on the central of the three gate pillars.

But there has been something strange going on and it was BSS member, the late Robert Sylvester, who first brought it to my attention several years ago. There are three differing views of this sundial available: a sketch from Ross in 1892, a photograph from Sylvester from 1991 and my photograph from 2010, and although similar at first glance, they are all different in some way. Neither Sylvester nor I had been able to speak to any of the residents on our respective visits.

But let's start at the beginning, in 1892. Thomas Ross says in volume 5 of *The Castellated and Domestic Architecture of Scotland*[1] that this cube sundial is:

"*A well shaped dial of this century. It forms the termination of a gate pillar adjoining the public road at Pitfirrane*."

His sketch shows the south and west faces (Fig. 2). The south face does not look right, though, as it appears to have hour lines above the equinoctial line, which is not correct for a south facing dial, and the gnomon looks to be too low.

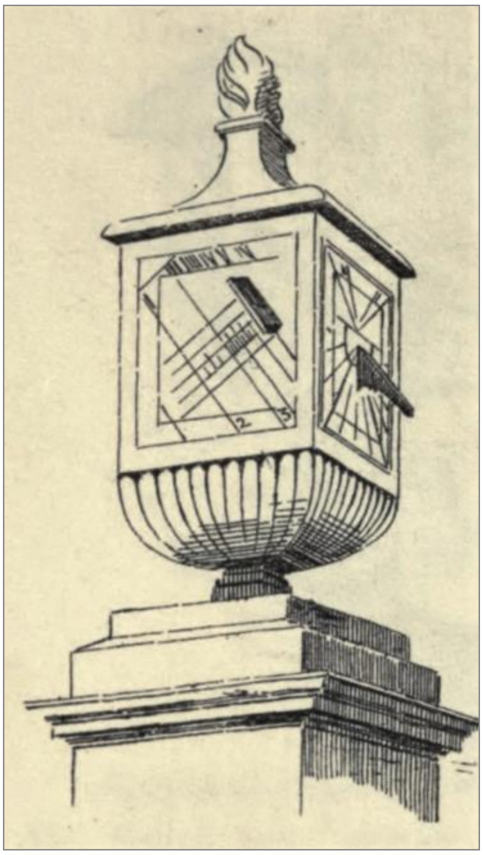


Fig. 2. Ross's sketch showing the south and west faces. The incorrect positioning of the gnomon and the hour lines above the equinoctial on the south face can be clearly seen.

Fig. 3. Sylvester's 1991 photograph of the south face. The east and west gnomons can also be seen.

Moving on to 1991 when Robert Sylvester saw this dial, some things had changed. The finial was missing, the south face marble panel appeared to be held in place by retaining clips (Fig. 3) and there were several cracks in the west face. In Sylvester's photograph there is no defined edge at the bottom of the cube which is quite clear in Ross's sketch. Furthermore, when Sylvester photographed the fluted area underneath the cube, it appeared to be in two parts whereas Ross's sketch clearly showed it as one piece. Although not evident in his photograph, Sylvester confirmed that there were hour lines above the equinoctial as shown in Ross's sketch.

The missing finial, the break in the fluted area and the damage to the west face probably suggests that there had been some major trauma at some point in its history.

Fig. 4. The east face today showing the finial, gnomon and a blank south face.

When I first photographed this dial in 2010, there was a finial present, but a gnomon on only the east face (Fig. 4), whilst in Sylvester's photograph from 1991 gnomons were present on the east, south and west faces (presumably the north face was blank, which I confirmed at a later visit). However, the gnomon currently sits on the 7 am hour line rather than the 6 am where it should be. The numerals are Arabic at the bottom, but Roman at the top. Unfortunately the Roman numerals for 4 am and 5 am are shown as III and IIII respectively (Fig. 5).

Alternatively, it could be that the III and IIII are correct and all the other numerals are wrong. This would mean that the gnomon is on the correct line at 6 o'clock, albeit rather thick and with no gnomon gap. Altogether it is most confusing.

Fig. 5. Close-up of the east face showing the incorrect gnomon position and the wrong Roman numerals for 4 am and 5 am.

The south face is now blank, so that has been replaced, and you could say that the west face is very strange. In his report, Sylvester noted that the west face was cracked in several places. There clearly has been a new panel produced for this face, but the hour lines appear to be copied from the east face and are clearly incorrect, and the numerals are all over the place. Some of the Arabic numerals at the bottom do not correspond with the Roman numerals at the top. Furthermore eight appears to be shown as XIII whilst seven is IIV. A gnomon has never been fitted (Fig. 6).

Fig. 6. The very wrong west face probably copied from the east face, and showing the incorrect Roman numerals. No gnomon has been fitted.

The roof is more squared off now rather than gently sloping as in Sylvester's photograph and the finial has been replaced, but not as it was in 1892.

So what has happened? The dial certainly appears to have been worked on by someone who has had little or no knowledge of sundials or even of Roman numerals. But why?

I visited the dial again in 2021 and this time I was able to speak to the residents. The left hand drive is shared and leads to houses 12A and 12B. When I spoke to the owner of 12A first, he was not entirely sure whether the sundial was his or not. He did tell me though that he had moved into that house in 1999 and the sundial was then as it is now, so that confirmed that the changes were made sometime between Sylvester's visit in 1991 and 1999. He also told me that these two houses were built in 1978 by Anderson the builder as his last two works, and were built in what was then his builder's yard.

He suggested that I should speak to the owners of number 12B, which I did. They too were not sure to whom the sundial belonged, but said that I should speak to the owners of number 10. This was an older house probably from the 1930s or thereabouts and the right hand drive led to their garage, whilst the pathway to the house was 20 or 30 yards away. Luckily both the owner and his wife were at home and they had no doubt that the sundial was in fact theirs.

Their house has belonged to the Thomsons, a prominent Dunfermline furniture and electrical retailing family, for many years and the current owner inherited it from his aunt. He confirmed that the land on which the other two houses were built once belonged to their family and had been sold to Anderson the builder.

Crucially he did know that the dial had been knocked off its pillar by a delivery van in around 1995 or 1996 and that he had at one time seen the receipt for the repair work by a stonemason. He remembered thinking that it had been quite expensive. Someone also told him that it had been mounted upside down. I said that it hadn't been, but I did advise him of all the problems with it as described previously. This story may serve as a warning not to get restorations to sundials performed, at significant cost, without taking advice from someone who knows what they are doing. Being a good stonemason is not enough!

So there we have it. There have probably been two instances of trauma for this dial. The first one has not been able to be dated, but could it have happened when the grounds were in use as a builder's yard? However, there was clearly some kind of damage caused at some point, as during my 2021 visit I confirmed that the fluted area was in two parts and had been joined together with cement. This was also evident in Sylvester's photograph. This quite possibly was at the same time that the finial was knocked off, and the cracking to the west face maybe happened at that time too.

There is more certainty with the later damage. It is clear now that the differences between 1991 and 2010 were caused by the aforementioned delivery van in the mid-1990s and the dial had subsequently been very poorly repaired.

So at last the problem has been largely resolved, although it has taken some eight years after Robert Sylvester first advised me of the situation. I am only sorry that he is not here to read the outcome of my investigations.

REFERENCE

1. D. MacGibbon and T. Ross: *The Castellated and Domestic Architecture of Scotland – Volume 5,* David Douglas, Edinburgh (1892).

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At the Newbury Meeting (3)

Elspeth Hill looking after BSS Sales.

Chairman Frank King in his sundial face mask.

Postcard Potpourri 57 – Halifax Parish Church

Peter Ransom

This lovely picture of dial SRN 0287 shows the value of old postcards when it comes to sourcing intricate detail that may have been lost over time. With a high-resolution scan of the dial part of the card, all of the original inscriptions can be read. The motto

> True as the Dial to the Sun
> Altho' it is not shone upon

is adapted from Samuel Butler's satirical poem *Hudibras,* Part III, Canto II, line 175 (1678).

Compare details from the card with the picture I took of the dial in August 2019 (below right). The 2008 picture in the 2020 Fixed Dial Register looks far more like the one on the card than the more recent one, so perhaps some conservation is needed urgently.

The card is unused, with "Copyright Printed in Halifax by Lilywhite Ltd., Dunkirk Mills, Halifax, Eng." on the reverse. Arthur Frederick Sergeant (1882–1952), who founded Lilywhite in about 1910, was a keen photographer who had previously set up the Halifax Photographic Company in New Brunswick Street, Halifax. In 1910 the firm operated from Dunkirk Mills, West End, Halifax, but in about 1921 transferred to Lumb Mills (a former textile mill), Mill Bank, Triangle, Halifax, where 200 people were employed. Thus, we can date this card as being over 100 years old.

Clockwise from top right: the postcard; my photograph of the dial taken in August 2019; close-up of the card showing inscriptions.

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A CELEBRATION SUNDIAL – USING CAD-CAM

KEVIN KARNEY

In 2015, my wife and I received an email 'save this date' invitation from some dear friends to their golden wedding celebration the following year. The invitation was very specific that the couple wanted their friends at the celebration but no presents. Unusually, the email was not 'bcc-ed', so the addresses of all 65 guests were available. Thinking that 'no presents' is an invitation to disobey, I contacted the children of our friends to see if their parents might like a sundial in the garden as a joint gift from all those invited to the party. The answer was 'yes', so I emailed all 65 potential guests and invited them to contribute £10 towards the cost of the dial. No-one declined.

Fig. 1. Ham House dial (SRN 6055).

My Requirements

1. It was to be a horizontal dial with standard polar gnomon, but graphically it was to be a hectemoros (or spider) dial reading both GMT and the times of sunrise and sunset throughout the year (see Appendix 1).
2. General details and size of the dial and gnomon design were to be taken from the beautiful 18th century dial in the National Trust's Ham House garden in Richmond (Figs 1 and 2).

Fig. 2. General plate definition from the Ham House dial.

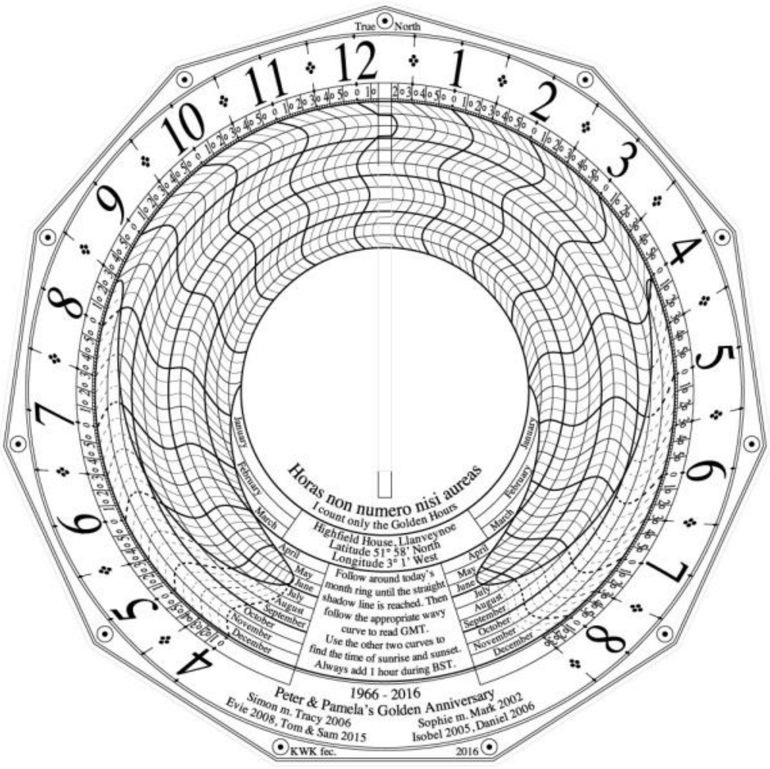


Fig. 3. The approved design.

3. The somewhat complex calculations involved in creating a hectemoros dial were to be auditable (see Appendix 2).
4. The outer shape of the dial was to be hendecagonal (11-sided). An odd-numbered polygon allows one vertex to be north-pointing. Eleven-sided was chosen – making the general shape to be somewhat circular (thirteen sides looked too much like a circle and nine sides looked odd).
5. The numerals and all the other dial furniture were to be mathematically skewed to point exactly towards the appropriate side of the gnomon foot in a fashion impossible with the standard graphics programs (see Appendix 3).
6. The chapter ring was to be rotated to correct for the longitudinal error.
7. The dial was to be made of 5 mm marine-grade bronze.

CAD-CAM Design and Manufacture

The design was generated in a very versatile Python-based drawing package, called Nodebox.[1]

Initial designs were iterated until approved by the children. Only textual changes and the use of Arabic in place of Roman numerals were requested. The final approved design is shown in Fig. 3.

The graphical design of the dial for both time and sunrise/sunset was audited against NASA/JPL Horizons.[2] The design was re-coloured to suit the laser cutter software. It was cut and assembled out of 5-mm plywood in FabLab of Cardiff Met University,[3] in order to see the final effect (Fig. 4).

The design file was then re-coloured once more (Fig. 5) to suit the requirements of the water-jet-cutting company (Precision Waterjet Ltd of Lyme Regis).[4] The company, who spend most of their time drearily cutting the same pieces of aluminium for the aircraft industry, appeared delighted with such a specialist task. They were instructed to acquire the bronze and were told which critical pieces (the gnomon slot) were to be marginally undercut. The waterjet cutting graphic is shown in Fig. 6.

I filed down the rough edges of watercuts so that the gnomon filled its slot tightly. On the advice of the etchers

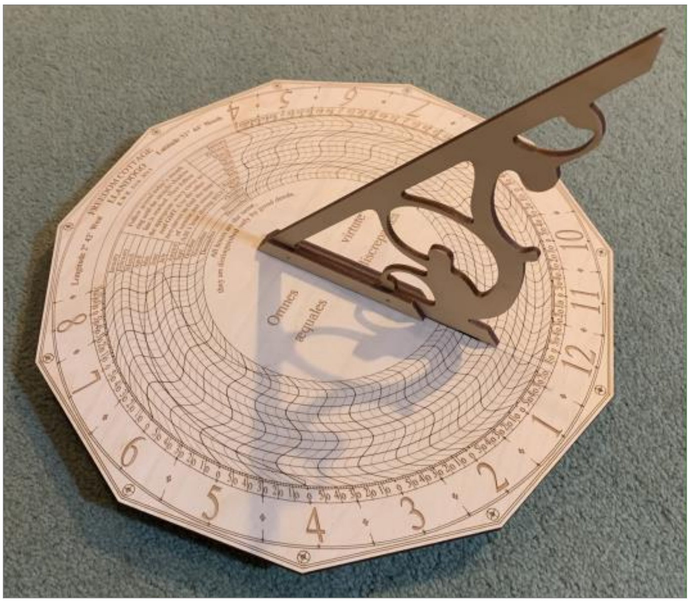


Fig. 4. Laser cut design maquette. (This image is for a different dial, but the same software code, somewhat modified.)

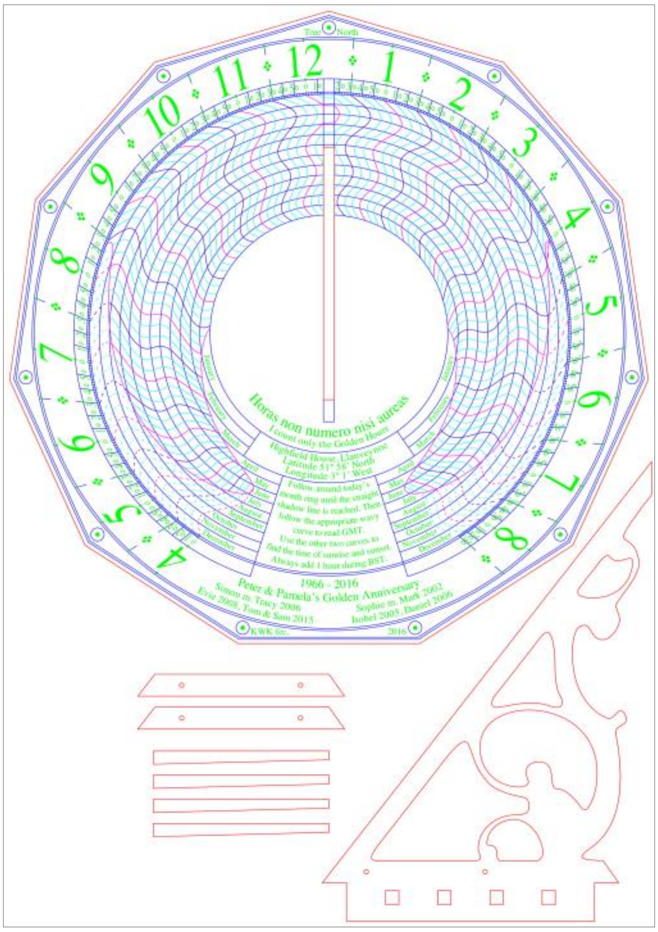


Fig. 5. Laser cutting graphic.
Red lines are cut through. Green areas are raster engraved (the laster head is moving backward and forth, as in an ink jet printer). Other colours are vector cut, where the laser head moves from one (x,y) point to another. The different colours indicate the depth of engraving (i.e. the line thickness).

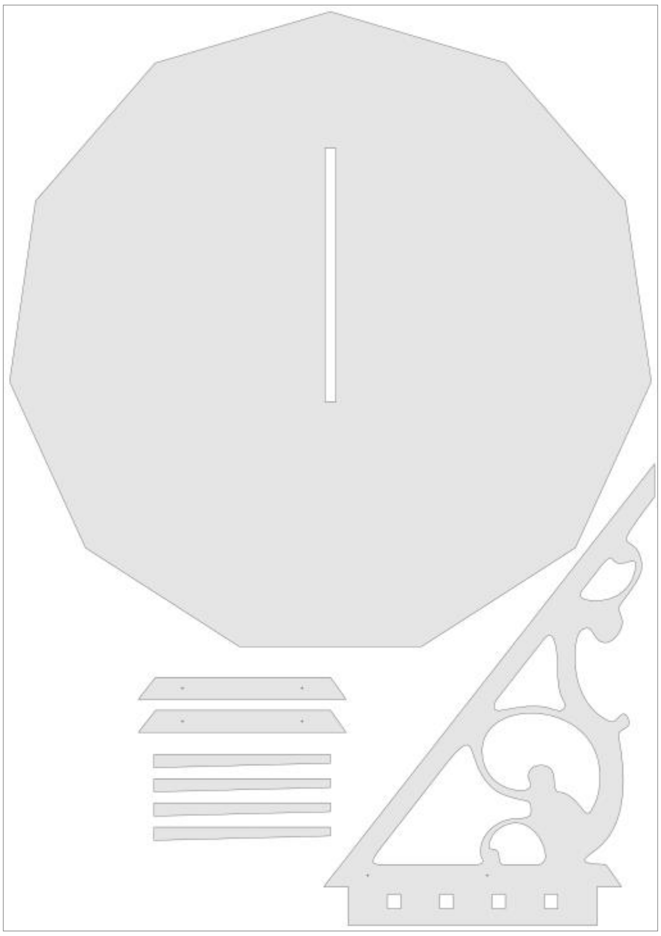


Fig. 6. Waterjet cutting graphic.
The two top pieces to the left of the gnomon are the cheeks to go either side of the gnomon. The four pieces below are wedges under the dial plate to attach the gnomon.

Fig. 7. Elite Engraving's advertising brochure. (The blue and white colouration of the dial is the reflection of the sky and clouds.)

(Elite Engraving of Bristol),[5] I lapped the dial surface down to 6000 grade dry sand paper and immediately wrapped the surface with cling film to prevent oxidation and greasy fingers upsetting the adhesion of the etching film.

The completed design was sent to all the party guests for final approval; two of them came back with corrections to the motto's Latin spelling!

Elite Engraving did a beautiful job of etching the bronze and filling the engraving with black. They were so pleased with the result that it was added to their advertising literature, as can be seen in Fig. 7.

Finally, two coats of hard micro-crystalline wax were applied to protect the surface of the bronze from bird fouling and to slow the rate of tarnishing.

Why this Approach

The overall advantages of this software-driven approach are three-fold.

- Consistency: The same basic design file allows consistency through the design/manufacture process.
- Adaptability: Very few changes to the code allowed significant changes to the graphics. (See the Audit graphic in Appendix 2.)
- Versatility: Change a few parameters in the design program, and have the graphics for a different location or text (Fig. 7). A similar single design file has been used to create the etching graphics for 35 individual Spot-On stainless steel sundials.

Fig. 8. The dial as presented.

Presentation

The dial, once assembled and having been Brasso-ed to within an inch of its life (Fig. 8), was put in a hendecagonal box, laser-cut to exactly the right size, using the laser-cut prototype as the lid. It was presented with great ceremony in the Army & Navy Club in London, being covered with a sheet, as if it were a celebration cake, and rolled in on a trolley by the club staff. The presentation came with a booklet explaining the theory of such dials, details of how to erect/set the dial once a plinth was acquired, and how to read the GMT time & sunrise/set.

The total cost of the dial was some £530, which left £120 towards the cost of the plinth. This was made later by a craftsman out of locally quarried sandstone.

Four Years Later

Fig. 9 shows the dial four years later; some of the black engraving fill was coming loose and there was some limited bird fouling, and while the bronze was in good shape, the sandstone plinth had suffered minor frost damage, but our friends are still pleased with their gift!

Fig. 9. The dial four years later.

APPENDIX 1
How to Use a Hectemoros Dial

Fig. 10 shows how to read GMT time:

On 14 September, follow the red circular arc round the dial to the point where it meets the shadow of the gnomon. Then follow the Equation of Time curve outwards to the chapter ring.

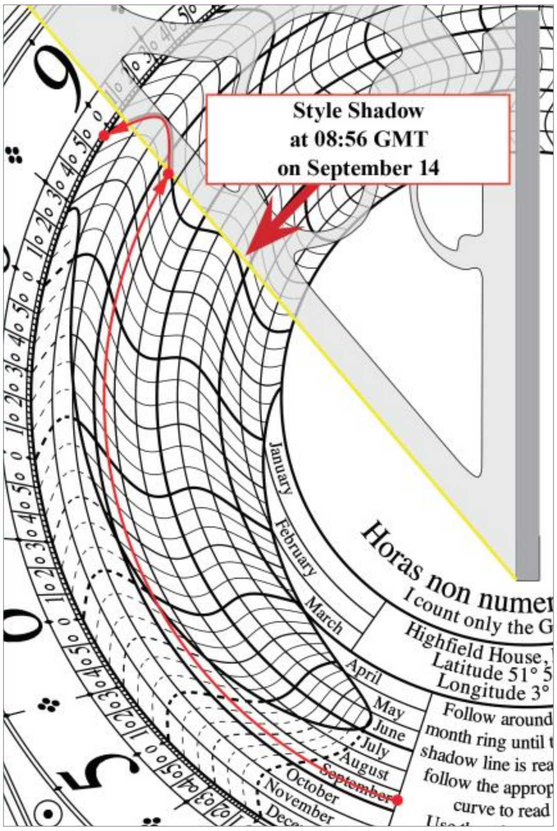


Fig. 10. Reading GMT time.

Fig. 11. shows how to read time of sunset:

On 14 September, follow the blue circular arc round the dial to the point where the magenta curve is met, and then follow the Equation of Time curve to meet the time chapter ring.

For sunrise, follow the same process on the left side of the dial.

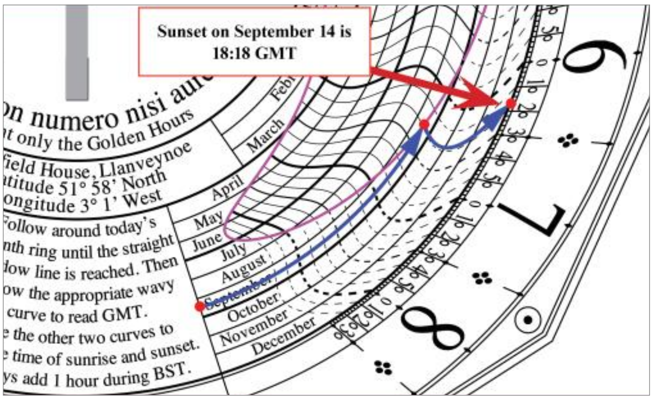


Fig. 11. Reading the time of sunset.

APPENDIX 2
Auditing the Calculations

NASA JPL Horizons program will output local apparent (solar) time for a given location. From this, the hour angle and the hour line angle are readily computed for various dates and GMT times (1 November at 7:50 am GMT in Fig. 12). As can be seen below, the hour line angle from Horizons (−55.3°) matches that on the dial.

Longitude	-3.00883333	Local Apparent Solar Time from Horizons					Latitude	51.972537
		2016	2017	2018	2019	Average	Hour Angle	Hr Line Angle
01-Jan	7:50 am	7.5789	7.5729	7.5746	7.5767	7.5758	-66.3633	-60.9
01-Feb	7:50 am	7.4083	7.4065	7.4071	7.4075	7.4073	-68.8899	-63.9
01-Mar	7:50 am	7.4283	7.4275	7.4267	7.4257	7.4271	-68.5942	-63.5
01-Apr	7:50 am	7.5697	7.5685	7.5674	7.5658	7.5678	-66.4823	-61.1
01-May	7:50 am	7.6817	7.6813	7.6808	7.6799	7.6809	-64.7859	-59.1
01-Jun	7:50 am	7.6682	7.6688	7.6694	7.6695	7.6690	-64.9651	-59.3
01-J[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.5685	-66.4729	-61.1
01-A[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.5270	-67.0943	-61.8
01-S[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.6323	-65.5149	-60.0
01-Oct	7:50 am	7.8067	7.8052	7.8041	7.8028	7.8047	-62.9297	-57.0
01-Nov	7:50 am	7.9063	7.9061	7.9064	7.9063	7.9063	-61.4059	-55.3
01-Dec	7:50 am	7.8138	7.8153	7.8171	7.8187	7.8162	[illegible]	[illegible]

Hour Angle = 15° x (Av Local Apparent Solar Time - 12)
Hr Line Angle = atan[sin(Latitude) x tan(Hour Angle)]

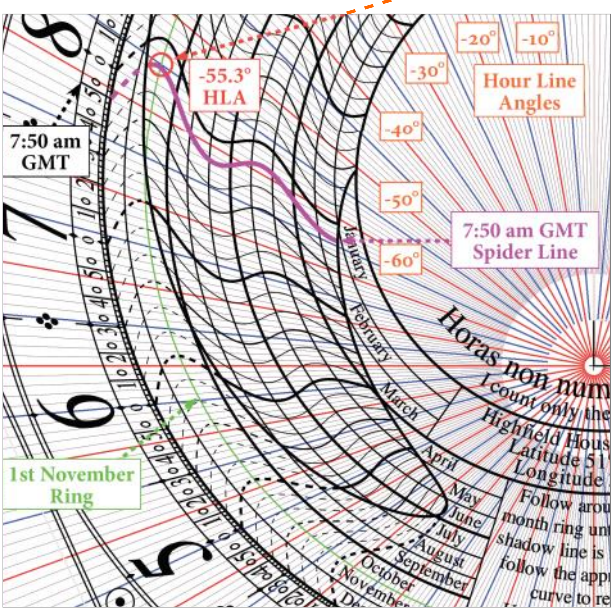


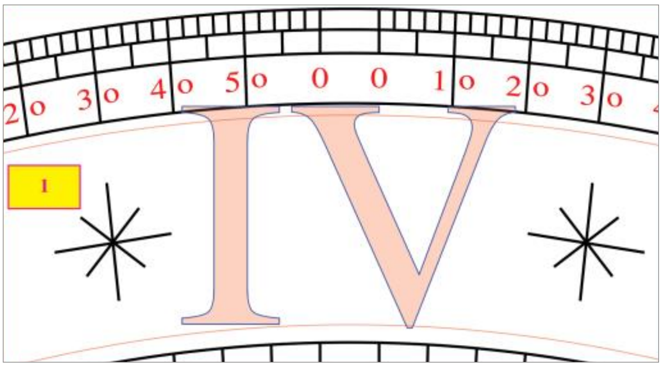
Fig. 12. Output from Horizons providing local apparent (solar) time from which the hour line angle is readily calculated.

APPENDIX 3
Precise Skewing of Fonts and Dial Furniture

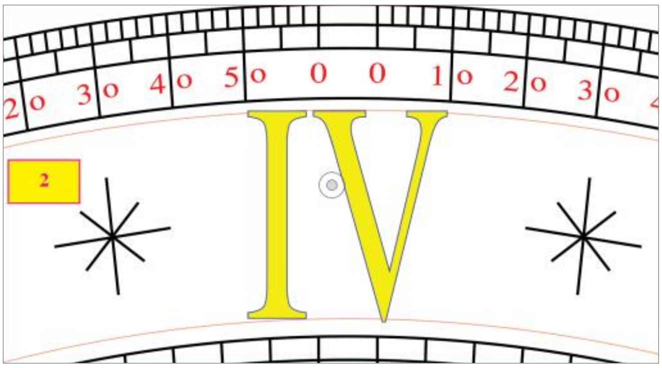
Caveat

Legitimately, it can be argued that this section is creating a mountain out of a molehill. But computers are computers and can perform algorithms quickly, precisely and repetitively. So why not make the mountain!

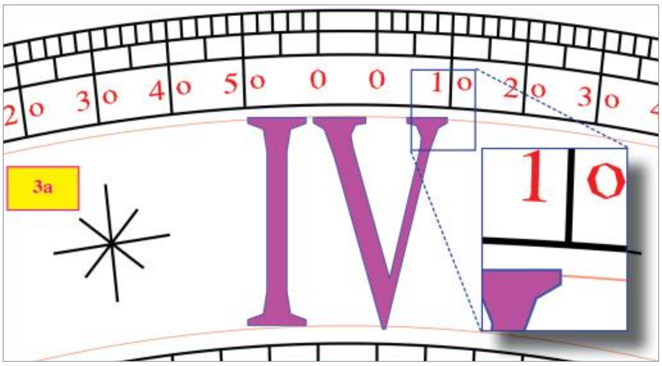
For aesthetic and practical reasons, the hour numbers on a sundial (and, if possible, all other dial furniture) should be skewed so they point toward the appropriate side of the foot of the gnomon. This allows the eye to be drawn to the dial's important time-telling shadow, rather than to the shadow of the back of the gnomon. (The back side of the gnomon is



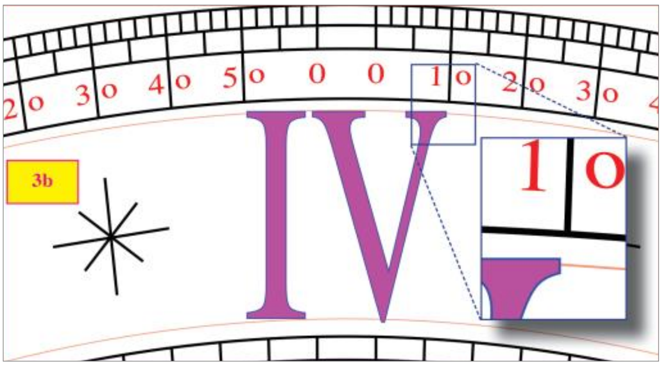
Step 1: The original text (or any other vector shape).



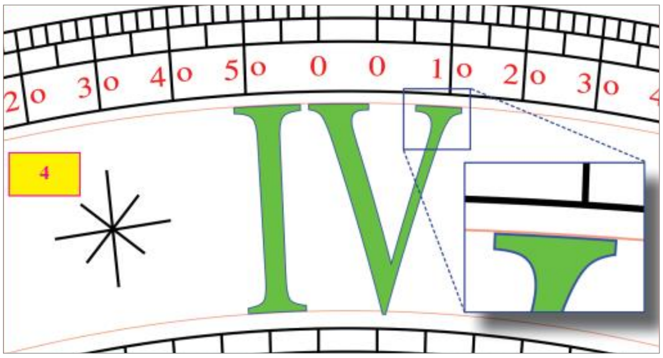
Step 2: Simple linear squeezing of font points and their Bezier control points to exactly fit any height or width requirements.



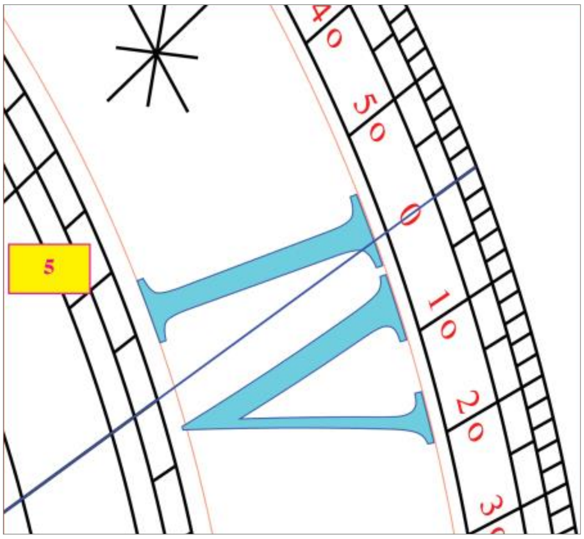
Step 3a: The font's Bezier curves are converted to single *straight line segments. See magnified inset.*



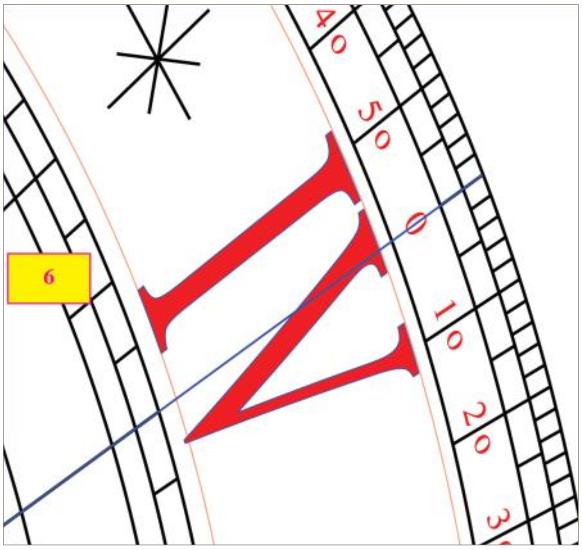
Step 3b: Font Bezier curves are converted to multiple *straight line segments (and appear as curves) – see inset – and appear once more as curves.*



Step 4: Font points previously 'linearized' are 'circularized' so that
(a) originally vertical lines point to the centre of the circle,
(b) originally horizontal lines curve around circles – see inset.
The character string now 'points' towards the centre of the dial.



Step 5: A simple rotational transformation to bring the mid-point of the character string in line with the dial's appropriate hour line.



Step 6: A complex slant transformation so that:
(a) previously radial lines point towards the foot of the gnomon,
(b) segments previously on the circumference of a circle are maintained on the original circle, but shifted along it by (a) above. Note that all the small numerals and the crossed ornament are also transformed.

typically a complex pattern so that the eye is *not* drawn to its shadow.)

Using a graphics application such as Adobe Illustrator to produce such skewing is imprecise and tedious. However, a package like NodeBox, which draws according to programmed instructions, can do the job repetitively and precisely.

Any character or number in a computer is stored as a series of drawing paths (Bezier curves). This example shows how NodeBox allows a character's drawing path to be transformed with precision.

Simple font transformations can be done by applying the transformation (rotations, scaling, translations or skewing) equally to the character string's Bezier points and controls. However, complex transformations on Bezier controls, particularly with tightly serifed fonts, can lead to weird results. Moreover, most standard transformations leave straight lines as straight lines. In this application, both the character string's Bezier curves and straight line segments are split into any number of very small straight segments, which are then subject to the complex transformations. For this dial, all numbers, large and small – as well as all the small ornamentations – were transformed in this way. There are six steps in the transformation.

The Finished Result

Look, for example in Step 6, at the 'I' in the 'IV'. The two sides of the I appear parallel, but are not. Each side points *exactly* to the gnomon foot and the top/bottom are *exactly* circular on the dial's centre point.

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2. *https://ssd.jpl.nasa.gov/?horizons*
3. *https://www.fablabcardiff.com*
4. Precision Waterjet Ltd, 1 Uplyme Road Business Park, Lyme Regis, Dorset, DT7 3LS.
5. Elite Engraving Ltd, 6 Park Road, Kingswood, Bristol, BS15 1QU.

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NEWBURY ONE-DAY MEETING

25 September 2021

In 2020, Covid-19 restrictions meant that the annual Newbury meeting could not be held, but by September 2021 they had been lifted sufficiently for an in-person event to go ahead. Thus around 30 BSS members met at the usual venue of Sutton Hall, Stockcross; others were prevented from attending by difficulties caused by the national fuel shortage at the time.

As usual, the event was splendidly organised by David Pawley and his team, who had to contend with more administrative chores this year, thanks to the necessary extra Covid precautions. From the kitchen Wendy provided us with tea, coffee, biscuits and other nibbles throughout the day.

Morning

Peter Ransom, our Master of Ceremonies, welcomed everyone and commented how nice it was to see everyone "in the flesh" again, although sadly some empty seats in the hall reflected the fact that we had lost some members since the last meeting.

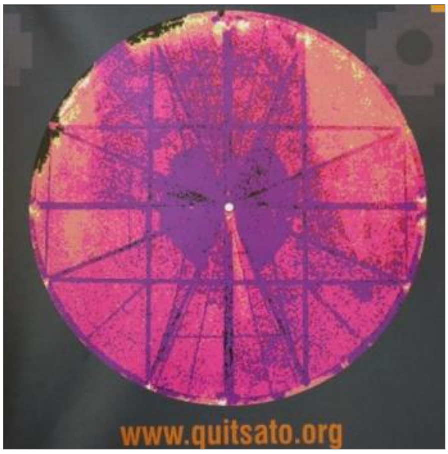
Martin Jenkins: *Dialling Snippets*

The first part of this presentation looked at some history behind the 1908 Pilkington and Gibbs dial originally made for a Mr Charles Dales, optician of Bournemouth (Fig. 1). Mr Dales was a man of many talents, advertising not only the fact that he was the first optician in Bournemouth but also that he would provide lantern shows on request. More importantly, however, was that the research brought to light that he was the Meteorological Registrar to the County Borough of Bournemouth in the early 1900s. Maybe the dial was part of his 'weather observation recording equipment'?

Fig. 1. The Pilkington & Gibbs dial. Photo: Janet Jenkins.

Next was a brief look at the *raison d'être* behind the design of the Battle of Britain 80th Anniversary commemorative dial (Fig. 2). Martin explained that it was because of the link between Exeter Flying Club, one of the founding members, Wing Commander E. King, and the fact that Exeter airfield was a Spitfire base in 1944. The dial indicates Italian hours in the mode of hours remaining to sunset, Babylonian hours indicating hours passed since sunrise, and GMT, known to pilots as Zulu Time.

Fig. 2. Battle of Britain dial.
Photo: Janet Jenkins.



Figs 3, 4 & 5. The Quitsato dial. Images by Oriens Geovision of Ecuador.

This was followed by a brief look at some dials in Colombia and Ecuador. Of most significance was the dial on the equator at Quitsato (Fig. 3). This dial is claimed to be the only monument of its type actually on the equator and at the highest point on the equator (Fig. 4). Its other claim to fame is that because it is constructed of two types of stone, having different thermal properties, infrared images can be taken of it from space (Fig. 5).

The final part of the presentation took the form of a warning not to trust well known dialling software. Assuming that 'all was well' in the design of a new dial, Martin had made a significant error in the time/dating notation of a circular local mean time dial. A new dial will now be manufactured during the winter recess!

Sue Manston: *French Republican Calendar*

Sue Manston showed a calendar produced by Fabio Savian in Italy (Fig. 6). Based on the French Republican calendar, it has twelve splendid photographs of Italian sundials. The year runs from Autumn Equinox to Autumn Equinox, and each month has thirty days, with an extra five or six days added to the last month. The months have evocative names (e.g. snowy, rainy, windy, flowery, grassy) and every day has a name (e.g. a fruit, a flower, an animal, a vegetable). Each day is marked

with the Equation of Time, the Sun's declination and the zodiac sign. Fabio is considering making an English version of the calendar; Sue asked anyone interested in purchasing one to let her know.

See also the article by Frank King on pages 20-24 of this issue of the *Bulletin*.

Fig. 6. The front cover of Fabio Savian's French Republican Calendar.

Frank King: *Reflecting on Reflections – New uses for old sundials*

Frank King addressed some of the questions that he had posed at the 17 April BSS Zoom Event and which were published in the report of that event in *Bulletin*, 33(ii), 37-39 (June 2021). He noted that, if the faces of a gnomon were highly reflective, then, at certain times of day, sunlight reflecting off these faces would fall as patches of light onto the surface of the dial plate.

Fig. 7 shows a horizontal sundial in plan and elevation. The design latitude is 50° North. The gnomon is in the form of a right-angled triangle and all four exposed surfaces are supposed to be reflective. The plan view shows the shadow at 7 h on the day of the summer solstice. The south edge of the shadow falls on the

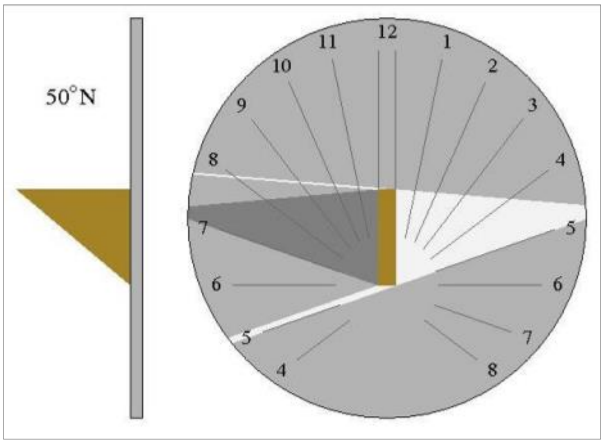


Fig. 7. Diagram of a horizontal sundial designed for 50° North shown in plan and elevation. The shadow and the bright patches are as for 7 h on the day of the Summer Solstice.

Fig. 8. Dial by Leeke and Wilding. Photo: Peter Ransom.

7 o'clock hour line and the north edge of the shadow indicates the solar azimuth. This is an embryonic double-horizontal sundial with no azimuth scale marked at this stage. The large bright patch on the east side of the gnomon results from the sun reflecting off the east face. It is the mirror image of the shadow. [It will not always be so precise a mirror image.] The south edge of the large bright patch serves as countdown indicator and, in the figures, it indicates that there are five hours *until* midday. The north edge serves as another solar azimuth indicator. Strictly, it indicates 180°–*azimuth*. The reflection off the south sloping face of the gnomon has parallel sides and the south edge serves as another countdown indicator indicating five hours until midday. The reflection off the vertical north face of the gnomon also has parallel sides and the north edge serves as another indicator of solar azimuth, strictly the negative of the azimuth angle measured relative to true north. The reflection off the vertical north face will soon disappear. The sun will be south of due east and will therefore no longer shine on the vertical face. A little over an hour later, just after 8 h, the reflection off the sloping face will disappear too. The sun will still reflect off this face but the reflections will be upwards into the sky and not downwards onto the dial plate. Inside the arctic circle, the reflections off the sloping face can fall on the dial plate from 6 am to 6 pm. There can never be reflections off the sloping face before 6 am or after 6 pm because the sun is always on the wrong side of the plane of the sloping face at these times.

John Davis: *The Portable Saxon Sundial at Canterbury Cathedral*

John Davis gave an illustrated talk on the portable Saxon sundial at Canterbury Cathedral, highlighting the key points of Monograph no. 14 reviewed on page 25 of this issue of the *Bulletin*.

Peter Ransom: *Leeke and Wilding – an unusual Shrewsbury partnership*

Peter Ransom had purchased an unusual dial a few months ago, because of the fact that it had two names on the dial plate: Jn Leeke Calculavit / 1721 / R Wilding Sculp / SALOP (Fig. 8).

He explained that he was interested because he works in a similar way: he calculates the hour lines for people who

then produce the dial because, he said, he is not skilled at engraving on metal or stone. He made a rubbing of the Leeke and Wilding dial and reverse engineered the angles; these agree with the latitude of Shrewsbury, suggested by the word SALOP (this is an alternative name for Shropshire or Shrewsbury).

He had found very little about Jn Leeke, apart from an old record that a John Leeke was buried in St Chad's Old Churchyard in 1776; in addition, there is a vertical dial on the Home Farm at Longford, Shropshire, with some connection to Leeke.

There is more known about R Wilding, who was a gunsmith in Shrewsbury. The name on the dial is most likely to be Richard Wilding Junior (1678–1755). He made a number of guns, and eleven are in existence that bear his signature. Brian Godwin wrote an article on the Wildings of Shrewsbury for *Classic Arms & Militaria magazine,* Vol. XVI, Issue 5, August 2009, and Peter was extremely grateful for his help with information about Richard Wilding.

The gnomon is broken and Peter is grateful to John Davis who has since tested the metal, which is reasonable quality cementation brass of the period

Fig. 9. Re-painted vertical sundial designed in 1988 by Peter Drinkwater and new EoT plaque.

Fig. 10. Lead sundial SRN 1837 at Hall Green, Birmingham in need of repair.

Fig. 11. Two sundials on the Horniman Museum Sundial Trail after repair and cleaning.

with a relatively high tin level, probably indicating that it was cast in England.

David Brown: *London Buses, and what I did on my (enforced) 'hols' a.k.a. Covid months*

Lockdown during 2020 did not hamper the workshop activities of David Brown: three sundials made several years ago were cleaned, restored and re-installed; larger projects took longer, such as the restoration of a large polyhedral dial in Gloucester described in *Bulletin*, 33(i), 2-7 (March 2021) and the re-creation of a sundial on the chimney of a restored mill cottage in Wiltshire described in *Bulletin*, 32(iv), 38-41 (December 2020).

A large painted vertical sundial on a private house near Salisbury designed by the late Peter Drinkwater was repainted by a local decorator (Fig. 9) and David added a slate Equation of Time correction curve nearby. The BSS Help and Advice service drew his attention to the 1766 sundial on a buttress of a Grade II* listed church in Birmingham (Fig. 10) which turned out to be made of lead sheet and badly in need of restoration – a possible project for 2022. Two sundials on the Horniman Museum sundial trail needed attention – a hemicyclium he had made when the trail was set up several years ago needed a clean and a new gnomon, and a double equatorial designed by John Moir needed cleaning (Fig. 11). Nearer to home, he created a vertical sundial on a previously blank stone wall of an Arts and Crafts house near Andover (Fig. 12).

It is said – possibly erroneously – that one must wait ages for a London bus to arrive but eventually two will come at once. This was rather like the two analemmatic sundials, commissioned independently in 2017, but which after many delays due to financial constraints and Covid restrictions were ceremoniously 'opened' to the public within two hours of each other on 18 September. One was on Kings Langley Common, Hertfordshire (Fig. 13) and the other replaced an earlier one in the Market Place at Ringwood, Hampshire (Fig. 14).

This talk was followed by a short AGM (see page 16) and then lunch.

Afternoon

Chris Lusby Taylor and Kevin Karney: *Fleet Street Sundial*

Chris Lusby Taylor and Kevin Karney have both been working with Piers Nicholson on his huge Fleet Street Heritage Sundial,

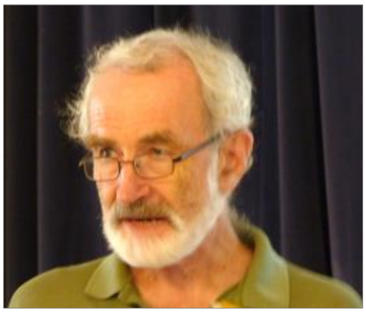
Fig. 12. Vertical declining dial cut into the stone of a private house.

Fig. 13. New analemmatic sundial on Kings Langley Common.

Fig. 14. New analemmatic sundial in Ringwood Market Place, replacing SRN 5063.

which should have been unveiled by the time you read this.

Chris discussed how the wall was surveyed using the new 3D point-cloud technology that is revolutionising surveying and mapping. A laser scanner provides millions of accurate positions and colours of points on the wall. Software can display it on a screen from any angle. Chris wrote programs to draw a gnomon and a sundial on the wall by calculating exactly when each of its 9 million points would be shadowed by the gnomon. This works, regardless of any irregularities in the wall, with very simple mathematics. Best-fit straight hourlines, desired for aesthetic reasons, were also calculated, as were the dimensions of the gnomon and stylus,



allowing the final delineation to be audited.

For more details, see the article by Chris on the use of point clouds on pages 13-16 of this issue of the *Bulletin.*

Kevin presented the means by which the Fleet Street dial was programmatically delineated using the routines of Robert Sagot and Denis Savoie. This allowed instant design changes to be made as various measurements materialised (e.g. the wall's declination, size and other oddities such as the step in the vertical wall). It also allowed a wide variety of newspaper names to be displayed, until the City of London finally decided that no existing newspaper names could appear. Finally this

approach allowed the painter's measurement instructions to be accurately displayed.

For more details, see the article by Kevin on pages 10-12 of this issue of the *Bulletin*.

Peter Ransom: *A Duo of Dials*

Peter explained that he had been involved in the calculations of two dials since the last Newbury meeting. The first was in December 2019 at Coulsdon on the site of the old Cane Hill Asylum, which is now a new housing development. He worked with the artist Holly Graham who was commissioned to erect a vertical declining dial on the site. After discussing the work, they then worked with sixth formers at Coulsdon College, where Peter did a sundial workshop with them, making equatorial dials from wire coat hangers and small plastic bottles. The pandemic slowed work for a time, but in October 2020 the dial was unveiled and is shown in Fig. 15 with Holly. Full details about the dial and the history of the site can be found at *https://insidecroydon.com/2020/10/29/91091/*

Photo: Mike Shaw

Fig. 15. Holly Graham and her dial at Coulsdon, Surrey.

Fig. 16. Claire Mason with the finished dial.

The other dial is a 50th Wedding Anniversary dial for a couple in Hampshire. They contacted Peter last July and after following their brief, he did the calculations, produced a maquette and marked out the slate for Claire Mason, a local carver, to engrave. It was done and erected in time for the anniversary this year (Fig. 16).

Martin Jenkins: *A Noon Line Discovered*

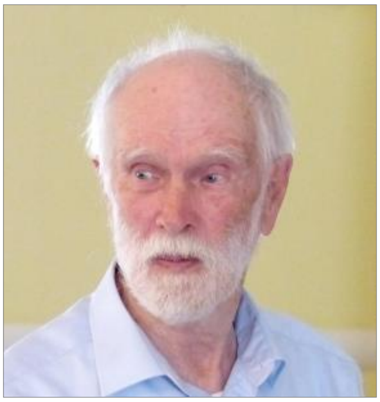
This short presentation reported the recent discovery by member Ben Jones of a noon line on the church of St Peter ad Vincula in Combe Martin, North Devon. It is thought that the dial is quite unusual in that it uses the edge of the east side porch wall to cast a distinct shadow across three line-engraved stones (Fig. 17). One protruding stone in the wall indicates noon (Fig. 18), while the other two stones in the ground would appear to indicate the solstices. It is hoped that further investigations will confirm these assumptions.

Figs 17 and 18. Newly discovered noon line at the church of St Peter ad Vincula, Combe Martin, Devon. Photos: Janet Jenkins.

Patrick Arnold: *Springfield Mass Dials*

A short talk was given by Patrick Arnold on the three scratch dials to be found on the wall of Springfield church, Essex.

Two of the dials are of the circular type with lines radiating from the centre. The one to the left of the chancel door has been scratched too close to a piece of projecting masonry, the shadow of which masks the dial. The dial to the right of the chancel door has been scratched lower and is not affected by the shadow of a projecting piece of masonry.



Having shown photographs of the church and its dials Patrick moved on to show a photograph of a curious dial neatly scratched on the stonework to the left of the chancel door. This dial is a network of intersecting lines which Patrick freely admitted made no sense to him (Fig. 19). He appealed to the members present if they could help in the translation of the meaning of the lines on this unique dial. Nobody could help but one humorous member suggested it was an illustration of a netball game.

Patrick plans to return to Springfield to obtain some accurate dimensions of the

Fig. 19. Mystery scratch dial at Springfield Church, Essex.

dial, in an attempt to unravel the logic of the man who scratched it about 500 years ago.

Patrick has roamed all over Essex and has amassed photographs of all the scratch dials in the county that have survived the ravages of time and human intervention. The collection from more than 400 parishes now numbers some 70 dials.

Finally, Peter Ransom proposed a vote of thanks to David Pawley and Wendy for organising a most enjoyable day, and to all the speakers. He wished everyone a safe journey home, being thanked in turn for once again ably acting as our MC.

Notes by the speakers
Speaker photos by Mike Shaw
Photos from the talks by the speakers, unless otherwise indicated