Medieval portable instruments are rare so, when one is located, there is a significant challenge to interpret how it was intended to be used as the corpus of other material with which it can be compared is a relatively small. An example is the device shown in Fig. 1: it was located in a field near Shotesham (about 10 km south of Norwich) by the metal detectorist Peter Aspinall in March 2003 and reported to the Portable Antiquities Scheme who classified it as a sundial. An attempt was made to sell it at auction but this was unsuccessful, perhaps because there was no precedent for such an item, and it reverted to the ownership of the landowners where it was found.

Description
The device seen in Fig. 1 is just 36.8 ± 0.2 mm in diameter (approximately 1½”) and 0.9 ± 0.1 mm thick, evidently of a copper-based alloy of some description. It has four very small ‘lugs’ approximately evenly spaced around the edge. It is not certain whether these lugs have retained their original size or are the remnants of much longer spokes; i.e. the disc may have been the hub of a larger device. One lug, though, can be seen through a microscope to have the engraved radial line through it running right over the tip, suggesting that it has not been truncated. The reverse face is basically blank but has a rectangular block or ‘handle’ of copper alloy, approx. 14 × 9 × 4 mm, rivetted to the centre of the disc.

The front surface is engraved as shown and has a small hole, nominally 1 mm diameter, in the centre. This hole may have been for inserting a perpendicular pin gnomon or compass needle pivot. It penetrates through the disc and at least 3 mm into the rectangular block. The whole device is in remarkably good condition.

Engraving
The engraving of the device, showing that it could function as a compass and as a horologium, is remarkably fine. The lettering in particular has been cut very deeply by a narrow burin. Viewed with a stereoscopic microscope, it can be seen that it has an included angle of 40° or even less. The circles and longer lines are shallower and appear to have been made with a scribing point but the subdivisions of the scales have probably been cut with the burin.
The face is divided in four quadrants by a pair of diameters, one of which is continuous over the tops of the rivet heads. In the centre, the cardinal points of the compass are labelled, in Latin, MI (meridies, south), OCI (occidens, west), SE (septentrio, north) and ORI (orienis, east). The engravings are oriented so that the abbreviations stand on the lines to which they refer and, in Fig. 1, East is positioned upwards as was conventional for medieval maps even into the middle of the 15th century.\(^2\)

The compass is further subdivided into 16 directions around the periphery of the disc, being labelled clockwise alphabetically A to Q (omitting J) starting with East (the most important point) at the top and with the letters again standing on the lines to which they refer. The form of the letters may be described as Early Gothic or Lombardic Capitals and are difficult to date, though they do seem to be of 14th-century or possibly earlier.\(^3\) The use of letters to label directions is quite standard for the Middle Ages (e.g. on the 16-fold divisions of a windrose) and Chaucer even used letters to denote the 24 equal hours around the edge of his astrolabe.\(^4\)

The basic horologium scale is a division into approximate 30° segments, starting at the north (‘noon’) line and measured symmetrically though the East and West points towards the South. These segments are numbered both ways 6, 12, 18, 25. Note that the final number is not 24 as would be expected by a simple arithmetic sequence: the medieval numeral ‘4’ is a quite different shape looking like a Greek ‘alpha’ on end and the character engraved here is very clearly the medieval ‘5’ – see Fig. 3. These numbers, although engraved centrally in their segments, refer to the lines to their right, as is standard for medieval instruments.\(^5\) Notice how the numerals in the upper half of the device are oriented inwards but those in the lower half are outwards with the result that the device has clearly been designed to have been read with the orientation shown, with East at the top, rather than symmetrically like a watch.

The time segments are further sub-divided by a number of short radial lines into nominally 5° segments and it is these which are counted by the numerals. Between the North and the East/West lines, there are six divisions per segment but to the south of the East/West line it is clear that there is an extra division with a longer dividing line, as will be discussed below. The actual spacing of these small divisions is somewhat variable and leads to the impression that the division was performed by eye.

To the south (right) of the numerals are the letters AN and PO, again oriented to be read from the ‘bottom’ of the disc. It might be suggested that these are abbreviations for anti meridian and post meridian but, if so, the positioning is problematic.

**Function**

In what way could this device have acted as a sundial? To modern eyes, a dial delineated with equi-angular spacing immediately suggests an equatorial (or equinoctial) sundial and the Norfolk device could indeed function as such, for the summer half of the year, if it was fitted with a perpendicular pin gnomon in the centre hole, aligned to the north celestial pole and with the plate tipped to the co-latitude of the location. But there is no reliable evidence that such devices, or any dial with a polar-aligned gnomon, existed in Europe until the early 15th century. By the mid-15th century, pocket compendia consisting of a compass, equatorial dial and a primitive nocturnal were available.\(^6\) Evidence of a stone equinoctial dial from the late medieval period has also recently been uncovered in Bristol.\(^7\)

However, the presence of the engraved compass directions on the Norfolk horologium strongly suggests that it was...
Horologium cum sole
Constituatur lapis planus et politus
diatriatalius erectus quasi ad altitudinem
trium pedum et in eius suprema superficie
fiat circulus quantumcumque voliens
et in centro erigatur stilus ad
libitum cuius umbra servetur quando crescit
et decrescit et cum brevissima fuerit, viae-
tur locus crideri quo direrext umbram signetur
quae locus. Quia est ibi semper meridies in illa regio-
ne. Qui circulus dividatur in quartas partes secundum eundem
punctum umbra qui sit: A septemtrionalis,
B meridionalis, C orientalis, D occidentalis.
Cum grado sol umbram fecerit super
CD, tunc erit sol in capite arietis vel
libre. Eadem die observetur umbra
quando fuerit super lineam BA, tunc est
meridies.

Sun Dial
Make a flat and smooth stone
erected more or less at a height of
three feet and on it upper face
trace a circle wide as you like
and in the middle put up a style long
as one likes which shadow is used when elongate
and it shorten, and when it will be shortest, one can see
the direction shown by the shadow and sign
that place. That it will be always noon in that direction. In some
way the circle should be divided in four parts following his
shadows’ points that are: A North,
B South, C East, D West.
When the sun shadow falls over
CD, then the sun is in the first degree of Aries or
Libre. In that day will be observed the shadow
When it will be on line BA, then is
Noon.

Fig. 5. Transcription (with contractions expanded) and translation (courtesy of Mario Arnaldi) of MS Rawl. D. 939 f.5r.

designed to be held horizontally, with a vertical gnomon
and hence looks back to an earlier form of timekeeping.
The standard timekeeper in the middle ages was, of course,
the mass or scratch dial. This was usually a vertical device
with a horizontal gnomon, placed on a south-facing wall.
Two recent studies of these devices are by Arnaldi and
by Scott & Cowham. Both of these studies also show that
horizontal dials, broadly following the principles of the
vertical mass dial, did also exist but in much small num-
bers. A study of five small stone examples of horizontal
stone mass dials showed them all to be delineated at 15°
intervals over the full circle, rather than just the region
where a shadow of a vertical gnomon might fall. Some of
these devices, e.g. the one from Nendrum, Co. Down in
Ireland, are also discussed by Arnaldi. None of them have
sub-divided time scales.

A contemporary manuscript which may be describing a
device using the same principles is in the Bodleian Library,
MS Rawl. D. 939 f.5r (Fig. 4). The manuscript is described
by the library scholars as English, from the second half of
the 14th century, and it definitely had Chaucer’s mean-
ter! There are some references in the literature to use of
the term around 1330 and it definitely had Chaucer’s mean-
ning by 1370, though its use seems to have died out by the
middle of the 15th century. The correlation of time with
distance was not uncommon in the Middle Ages.

The sub-division of the hour into thirds has a very long
history. King Alfred the Great (r. 877-899) had a candle
clock in which each candle, burning for 4 hours, was
marked in 12 segments. Later, c.1368, a waterclock de-
scribed on tablets found at the Cistercian Abbey of Villers-
la-Ville in Brabant had a wheel labelled with 24 letters of
the alphabet, each calculated to indicate approximately a
third of an hour.

The mileway divisions on the Norfolk device continue for a
further 7 units to the south of the East/West line, which we
take as the sunrise/sunset at the equinoxes. This is one unit
beyond the two-hour major spacing of the rest of the scale.
The significance of this is probably that the sunrise/sunset
times on the summer solstice at Norwich, latitude 52½° N,
are 3:42am and 8:18pm LAT, very close to two hours and
one mileway before and after, respectively, the equinoctial
times. It is most important to remember, however, that the
shadow of the vertical gnomon will not fall on these lines at
the solstitial sunrise/sunset: the device is not calculated as a
horizontal azimuthal dial.
The positions of the final (25th) mileway divisions at the southern ends of the timescale are rather variable. The two lines, approximately to the southeast and southwest, are longer than the other sub-divisions and more similar to the 30° sector lines. The line to the southeast, passing towards the compass point ‘C’, makes an angle of 52.5° to the meridian line so that the interval between 24 and 25 is significantly larger than the others. Although it is tempting to suggest that this angle has been selected because it is the local latitude, this is probably only coincidental as the corresponding line on the southwest side, passing towards the compass point ‘H’, makes an angle of 57° to the meridian line which does not appear to have any geographical significance.

The letters AN and PO each stand the wrong side of the meridian line to refer to the morning (anti meridian) and afternoon (post meridian) shadows of a central pin gnomon. They would be correctly positioned if it is to be taken that they refer to the direction to the sun, rather than of its shadow but this is at odds with the fact that the timescale has its gap at the south. They may, of course, stand for something totally different, such as the name of the maker or owner, though it is difficult to get away from the idea that they are related to the function of the device.

Two other physical features of the device invite speculation. One is the block rivetted on the back. This is aligned in the E-W direction and is too small to be comfortably held in the fingers though it does suggest a use as some form of handle or mounting. It could perhaps have been fitted into a larger handle of, for example, wood, with its rectangular shape ensuring correct alignment. Alternatively, it may have held the device into a larger mechanism.

The other feature is the set of four small lugs on the periphery. These are only approximately equi-spaced around the circumference, and are offset from the cardinal directions by between 25° and 30°. They clearly appear to be intentionally made but their purpose can only be guessed at. The possibility that they are the remains of ‘spokes’ so that the original device would have been a rather larger volvelle was mentioned earlier. Another excavated medieval device which is believed to have been a nocturnal and is currently under study, also shows clear signs of having had a spoke volvelle.17

If they are not the remnants of some form of spoke (so that the disc was originally part of a larger diameter circle), they could perhaps have been a form of cam operating a mechanism or indicator revolving around the disc. The fact that the AM and PM numerals are engraved to be read from the west side of the disc indicates that it had a fixed position relative to the use. This position would have needed to have been set to the compass directions.

A simpler and more likely suggestion is that the ‘lugs’ were used to connect the disc to the end of a short cylinder by interlocking into corresponding cut-outs, thus forming a shallow cylindrical box. This was the method of construc-

![Fig. 6. Map of the region to the south of Norwich.](image)

**Discussion**

It is perhaps coincidental that this device is the third medieval timepiece found in Norfolk by a metal detectorist in the past decade. The other device, a fragment of a quadrant which has been dubbed the ‘Norfolk quadrant’19 was discovered in a similar rural location, also to the south of Norwich and only about 10 km away from the Shotesham field where the horologium was found. A third instrument fragment from Norfolk, a nocturnal, is also under investigation.20 Although none of the devices is firmly dated, the balance of the evidence suggests that the horologium could be older than the quadrant by around a century, though this is subject to revision. Given that the author became aware of them because they were reported on a national database and nothing similar is listed for elsewhere in the country, the question which arises is whether this is pure chance, due to the particular diligence of Norfolk’s metal detectorists, or to some special place of Norwich in the history of horology.

As was described in the earlier paper on the Norfolk quadrant,19 the city of Norwich was second in importance only to London in medieval England and its cathedral was one of the very first to have a clock: it was already being repaired by 1291. Over the period 1322-5, a new astronomical clock

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of considerable complexity was built at great expense (£52 9s 6d), with the clockmaker Master Roger of Stoke (who later worked with Richard of Wallingford on the celebrated St Albans astronomical clock) being a key figure for a period of over two years. Another clockmaker who worked with Roger was a younger man (possibly his son), Laurence of Stoke. Laurence (or someone of the same name) also worked at St Albans, later going on to take orders and become a senior monk: he is described as horologarius when he accompanied a successor of Richard of Wallingford to the papal court in Avignon in 1349. Stoke is a fairly common placename so it is not clear where Roger’s and Laurence’s origins were. One suggestion made by John North as “plausible” is Stoke Holy Cross, around 6 miles south of Norwich. As can be seen in the map of Fig. 6, this is in fact only about 2 miles from the location where the Norfolk horologium was found. It is also apparent that the find site is only a few hundred yards from the long-ruined medieval St Martin’s church. By a curious coincidence(?), the address of the church is Roger’s Lane, Shotesham. It is very tempting to put these facts together and invent a scenario where one of the two local clockmakers visits their home church and loses the horologium: although this is pure speculation, the links between Norfolk and horology do seem to be strong.

The connection between officials of the Church and astronomy is demonstrated by the fact that Richard Courtenay, a chancellor of Oxford University and friend and envoy of Henry V, purchased an astrolabe from the great French maker Jean Fusoris in 1414. Courtenay was made Bishop of Norwich in 1413 until his death in 1415. The direct link to astronomical instruments at Norwich Cathedral is, however, rather tenuous as it is believed that Courtenay never actually visited his seat there. Nevertheless...

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REFERENCES

1. The Portable Antiquities Scheme is administered by the British Museum. The ‘Norfolk Horologium’ is registered as NMS-82940
2. As late as 1436, Andrea Bianco’s mappa mundi showed Jerusalem at the centre and Paradise (East) at the top. A reproduction can be seen in L.A. Brown: The Story of Maps, Dover, New York (1977), p.126-7.
5. See, for example, the degree scale in J. Davis: ‘A medieval Gunter’s quadrant?’, BSS Bull., 23(iii), 2-7 (Sept 2011).
6. See (Brussels MS illus, ref 18). Examples also exist in the British Museum (Inv. no. AN440108) and in the Oxford MHS (Inv. no. 46855).
7. C. Mason, Bristol & Region Archaeological Services, private communication, excavation find at St James’ Priory, Bristol.
11. See Arnaldi op. cit. ref. 8, p. 287.
12. A transcription of, and commentary on, Chaucer’s The Astrolabe is given in R.T. Gunther: Early Science in Oxford – Vol V, Chaucer and Messahalla on the astrolabe, Oxford (1929). A more modern version by James Morrison is online at http://www.chirurgeon.org/files/Chaucer.pdf. “And, as I have seid, 5 of these deegs maken a myle ywe, and 3 milewei maken an houre. And every degre of thys bordure contenith 4 minutes, and every minute 60 secondes.”
17. ‘Norfolk nocturnal’, Portable Antiquities Scheme ref. NMS-D40DC2.
18. An illustrated manuscript c. 1450 (a French translation of Henry Suso’s Horologium Sapientae, now in the Bibliothèque Royale de Belgique, MS. Bruxelles, B.R.IV, f. 13v) shows a number of instruments including a one-handed clock with a 24-hour dial, a quadrant for unequal hours, a shepherd’s dial (chilindre) calibrated in Italian and Babylonian hours, and two portable sundials (one horizontal, the other equinoctial) with polar-pointing gnomons.
20. The third device, a nocturnal, is listed in ref. 17.

For a CV and portrait of the author, see Bulletin 23(ii), p.13 (June 2011).