

*The 'Woodhenge' of Coevorden: The Palisade*                      *H.J. Hollander*                      3

Artist Paul de Kort has built this double ring of wooden posts on an artificial hill near the new Ossehaar residential area. The shadows of certain posts falling on the central stump, together defining the 'Ossehaar Axis', mark four dates; two at sunrise and two at sunset. These dates divide the year in four quarters, although not exactly according to the usual calendar. These dates could in future be used for local events.

A 'palisade' was originally the name for a row of poles or stakes, such as the Romans used to defend their military camps.

*Canonical and temporal hours, and St Benedict*                      *F.W. Maes*                      4

Many churches have mediaeval canonical sundials, which indicate the canonical hours according to the Rule of St. Benedict. They usually consist of a horizontal gnomon and a semicircle, divided in equal sectors, on a south wall. Fig 1 shows examples. Many must have disappeared over the centuries; others were modified to some extent.

This articles addresses two questions: I. What exactly are canonical hours, what is their relation to equal (local time) hours? And II. how important is the 'blind' period before sunrise and after sunset for their intended use?

I. Fig 2 compares a 12-sector canonical dial (dashed lines) with an equal-hours sundial for local apparent time. Of course, noon, or 12 hours LAT, always coincides with 6 hours canonical. On the summer solstice, 13 hours LAT is almost exactly 7 hours canonical, but on the equinox it is closer to 7,5; and on the winter equinox, it is 9 hours canonical: three canonical hours after noon. More examples are given.

Canonical hours are defined with respect to the horizontal through the gnomon; this plane defines 0 and 12 hours: at sunrise, it is 0 hours canonical. Every rotation about the gnomon through a further 15 degrees defines the next canonical hour. Because the angle is measured on the vertical east-west plane,

some authors call the canonical hours: 'vertical hours'.

The canonical hour angle  $u$  depends on solar altitude  $h$  and azimuth  $Z$ , where  $\tan(u) = -\tan(h) / \sin(Z)$ .

Fig 3 shows the relation between equal and canonical hours for different latitudes. Morning hours are shown; afternoon hours are the mirror image. Note that south dials between the tropics remain dark during part of the year – up to half a year on the equator.

The lower, 0 hours line coincides with sunset. The top line for noon is always 6 hours canonical. Canonical hours differ in length even during the same day.

Fig 3 also indicates when the sun is due east. Before that instant, the dial face is in shadow; this is the blind period. If the sundial were a thin slab with the gnomon protruding on both sides, however, the canonical hours under the 'east' line could be read on the north face of the dial.

During winter, and especially in the higher latitudes, the canonical hours around noon get rather short compare to one equal hour. In summer, on the other hand, the early and late canonical hours become quite long.

The Rule of St Benedict of Nursia is his adaptation of Psalm 119, and proscribes Matins (in the middle of the night), and [Lauds (at dawn),] Prime, Terce, Sext, None, Vespers and Compline (during the day). Some canonical dials mark the third, sixth and ninth hour using a transverse line, a star, or a T, S (or M for Meridiem) and N. This worked for dials with 12, 8 or 4 sectors.

Schaldach hypothesized that the 11 or 13 sectors, sometimes seen, are really just the very wide hour lines (excluding or including the outermost lines) of a 12-sector sundial.

II. Fig 4 shows canonical vs. equal hours on the summer solstice, for different latitudes, and indicates the 'blind' periods from sunrise until 0 canonical (and again from 12 canonical to sunset). They are shortest – about 7 equal hours total – on latitudes around 45 degrees. Still, that includes the times of Prime, Vespers and Compline; and around 30 degrees latitudes, of Terce and None as well. We may assume that other time indicators were available. They could be set to sundial time when available.

Laymen were presumably less affected by canonical time keeping, being expected only to attend Lauds and Vespers.

Fig 5 illustrates the relation between canonical and temporal (antique) hours for 52 degrees latitude. As expected, 0, 6 and 12 hours coincide. Around noon, the canonical hours are much shorter than temporal hours, this being compensated for in the early and late hours.

Fig 6 gives the general case for several latitudes. Note that all temporal hours on a given day are equal to each other. Canonical hours vary greatly in length also when expressed in temporal hours, especially during winter in the higher latitudes, when the first canonical hour lasts two temporal hours, while the sixth lasts only one half temporal hour. On the other hand, during summer and on lower latitudes, canonical hours almost equal temporal hours.

The replacement of the antique, temporal hours by canonical hours meant that in North Iceland, Lauds and Vespers moved to up to one temporal hour earlier, and Terce en None an hour and a half.

In closing, the author wonders: A horizontal dial with upright gnomon would be even simpler than the vertical canonical dial, and would have no 'blind' periods. Are there any records of one having been used for serious timekeeping?

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With an explanation of the constants used. Interference by the Moon and by the planets is accounted for.

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The contribution of Bob Franken in last instalment of the Bulletin was a translation, with subsequent editing, of the text by Massimo Goretti that we publish today. Bob had offered to do this work after Massimo had suggested that his (Massimo's) article might be of interest to the Dutch readers. Bob also made new drawings, as the ones available at the time were not suitable. The Bulletin editors supplied the layout of the equations appearing in Bob's text. In today's addendum, Massimo thanks Bob for all this work.

However, it is a pity that his name, as that of the original author, did not appear above the text. This was largely due to a misunderstanding: Bob wanted to present the text merely as an (admittedly edited) translation, and not as an *introduction and discussion*; and he assumed that Goretti's name would be over it. Bob would undoubtedly have protested against seeing his own name in the header in the final pages, but he never saw the final proof (he could not open the PDF).

Of course, eventually, all this is the editor's fault; and we apologize for any misunderstanding. On the bright side, we can virtually guarantee it will not happen again.

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