

# The San Zeno Wheel: A wooden volvelle and monastic timekeeping in fifteenth-century Verona

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The San Zeno Wheel (Figs 1 and 2, hereon referred to as 'the Wheel') is a virtually unstudied and unique fifteenth-century horological device. With thanks to a grant from the Scientific Instrument Society, I consulted the Wheel in the Map and Atlas Museum of La Jolla (San Diego) in July 2016. As well as forming the beginning of research that was published in the *Journal of the Warburg and Courtauld Institutes* in 2018, the trip allowed me to take the necessary photographs to make an interactive, three-dimensional model of the Wheel, now available online: [www.cabinet.ox.ac.uk/san-zeno-wheel-verona-c-1450](http://www.cabinet.ox.ac.uk/san-zeno-wheel-verona-c-1450).<sup>1</sup>

Despite the significance of the object to the history of science and horology, it was until recently remarkably little known, with just one article published a little over a century ago devoted to it.<sup>2</sup> Its lack of study can be attributed to its physical inaccessibility, as it was held in a private collection from the late eighteenth to the early twenty-first century. After leaving the collection it was described by provenance experts with the help of the late art historian, Caterina Gemma Brenzoni.<sup>3</sup> Readers may recognise the Wheel from its recent display in the exhibition 'Now and Forever: The Art of Medieval Time' at the Morgan Library (New York).

The research resulting from the SIS grant demonstrates the Wheel's potentially far-reaching implications for the history of horology and our current understanding of medieval timekeeping. The first half of the resulting article considers how the Wheel's features correspond to contemporary manuscript volvelles and to the liturgical calendars of larger horological devices. This includes the earliest astronomical clocks—in Strasbourg, Gdańsk, Padua, and Wells—with particular focus on the small number of surviving monumental calendar disks, namely that of St Mary's Church in Gdańsk, Poland (Fig. 3, constructed by Hans Düringer between 1464–70).

The second half, and the final section of this summary, investigates the role of the Wheel within the timekeeping practices of the Basilica of San Zeno and how it was used by the Benedictine community. Through its consideration alongside a mechanical clock present at the complex in the fifteenth century, I show how the Basilica of San Zeno provides a unique case study regarding the ways in which multiple time systems were synchronised in the reckoning of the liturgy following the introduction of mechanical clocks into ecclesiastical spaces.



Fig. 1 *The San Zeno Wheel: front. California, San Diego, Map and Atlas Museum of La Jolla. Photograph courtesy of the Museum.*

## The San Zeno Wheel

The Wheel is a large volvelle consisting of three movable disks that turn on a central axis. The disks are made of pine covered in vellum, giving the impression of a huge manuscript sheet. The diameter of the base disk is 1280 mm, indicating that it was designed to be used by multiple viewers at a time. The only known documentation on the Wheel from its construction until the twenty-first century was written by the antiquarian, Giovanni Battista Giuseppe Biancolini (1697–1780). In 1757, he recorded how a 'curious calendar is tucked into the wall of the loggia which leads from the dormitory of San Zeno monastery to the choir and the sacristy of the church...placed there about 1455 for use of the monks of San Zeno'.<sup>4</sup> The entry goes on to describe the saints included in the calendar, proving that Biancolini was looking at the same object and confirming that the Wheel was in the basilica of San Zeno in 1757. For most if not all of the time since the late eighteenth century it was owned by the Veronese Cartolari family.<sup>5</sup>

The saints' days featured in the calendar in-

dicate that it was made to correspond to the liturgy in the Basilica of San Zeno.<sup>6</sup> It is not clear whence the date of 1455 was derived, though stylistic analysis, the saints' feasts in the calendar, and the construction of another horological device in the basilica support an early to mid-fifteenth-century date for its making. The content of the Wheel is typical to other medieval volvelles from the late fourteenth century and beyond: a calendar with a movable disk for calculating the movement of the Moon in relation to that of the Sun.<sup>7</sup> The disks are independent as the solar and lunar cycles move at a different pace. By aligning them, the user can calculate the date of Easter.

Proceeding from the outer margin towards the centre, the outermost set of information constitutes a fixed saints' calendar: the date, dominical letters, and saints' days with their liturgical gradings. Inside is information for computing the dates of the movable feasts, including the golden number and a sequence of fifty-nine letters next to the potential dates of Easter, which were probably used with a separate table to ascertain its date for each year.<sup>8</sup>



Fig. 2 The San Zeno Wheel: detail showing the content. Map and Atlas Museum of La Jolla Map Museum. Photograph courtesy of the author.

Within the liturgical calendar are sets of astronomical data. From the outermost inwards are the degrees of each sign of the zodiac and the sidereal months (the time it takes for the Moon to orbit the Earth). The following six columns concern the timing of each day and are essential to understanding the time systems in place in the basilica. This system is

described below. Further towards the centre are miniatures of the signs of the zodiac. Each has two vellum labels pasted onto it (some are missing), upon which are written the name of the sign and the word *Bonum*, *Indifferens* or *Malum*, possibly indicating the appropriateness of that time for bloodletting.<sup>9</sup>

The second wooden disk concerns the age of the Moon. Under a scale divided into ‘L’ (*lune*), ‘H’ (*horae*), ‘M’ (*minutae*) and ‘E’ (*etas*), the age of the Moon is given (in Arabic numerals) alternately below L and E (*etas lune*). The hours and minutes rise from 0:0 to 12:0, and back to 0:0 in increments of 8 minutes. It is unclear exactly how this system works and deserves its own study. On the uppermost disk is a painted starry sky with a circular hole showing the phase of the Moon, which, by partially revealing the appropriate shape on the disk below, waxes and wanes as it is rotated.

### Monastic Timekeeping at the Basilica of San Zeno

To understand how the Wheel originally functioned, it must be contextualised within the fifteenth-century timekeeping practices of the San Zeno Basilica. The Wheel’s scale and content indicates that it was not a device intended for the use of the laity in the basilica, but instead for the monastic community in the restricted areas of the complex. The method of daily timekeeping the Wheel provides supports the argument that it would have been used by the Benedictine monks. The six columns of Arabic numerals inside the liturgical calendar of the Wheel are dedicated to the duration of daylight and darkness (in hours and minutes) for each day. The columns split each day into four segments by stating the duration of the half night<sup>10</sup>, full night<sup>11</sup>, and full night plus half day in hours and minutes.<sup>12</sup> This system did not solely depend on a numerical measurement of the time, but also on the distance from sunrise and sunset as the feasts of the liturgical day commenced at sunset of the modern calendar day preceding the date of the feast. The Wheel thus has the potential to function in correspondence with a device that counted the hours, while fulfilling its monastic role: to calculate the daily liturgical routine.

Key to understanding the Wheel’s original function is the presence of another horological instrument in the basilica that seems to have been made during the same period as the Wheel, around the mid-fifteenth century. The clock’s face survives as a square wall painting (Fig. 4) on the left side of the apse and high above the ground. With a ring of painted numbers 1 to 24 in both Arabic and Roman lettering is a small black circle which, according to a small cavity found in the wall during its conservation, probably held a mecha-



Fig. 3 Gdańsk, St Mary’s church, liturgical calendar of the astronomical clock (1464–70). Photograph CC BY-SA 3.0.

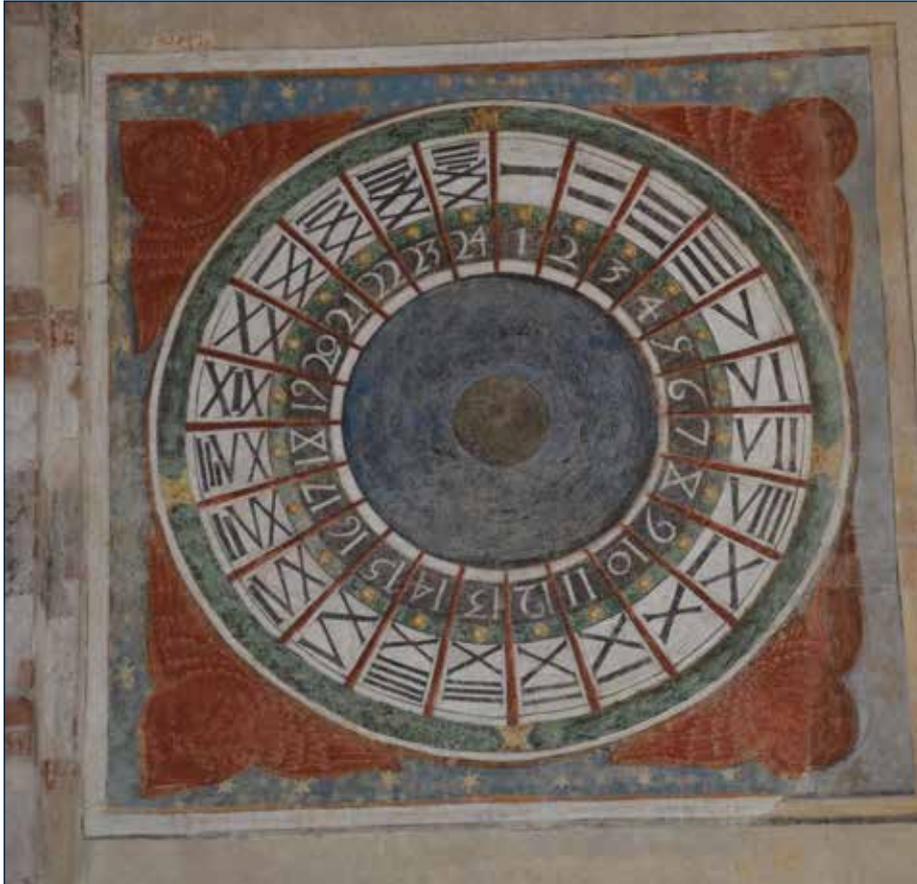


Fig. 4 Verona, basilica of San Zeno, painted clock on the wall of the choir. Photograph courtesy of the author.

nism with a hand indicating the time of day.<sup>13</sup>

The Wheel's method for daily reckoning suggests that while it may not have been in the same physical space as the mechanical clock, this does not discount the possibility that they worked together. In fact, this way of reckoning demonstrates that the equal and unequal hours were not inevitably opposed but could be synchronised. Whereas mechanical clocks would have been helpful in quantifying the time of day, the Wheel would have been used to calculate more accurately the times of the liturgical day.

The San Zeno case study provides new evidence towards the argument, most recently asserted by Gerhard Dohrn-van Rossum, that the transition between modes of timekeeping was not so sudden, and that ecclesiastical time co-existed with the new fixed hours in the period following the proliferation of the mechanical clock.<sup>14</sup> What remains is to return to fourteenth- and fifteenth-century time-keeping instruments made for ecclesiastical spaces, and to interrogate what they can tell us about the modification—and in some cases, synchronisation—of old and new systems of time.

## Notes and References

1. The outcome of this research has been

published as, 'Synchronising the Hours: A fifteenth-century wooden volvelle from the Basilica of San Zeno, Verona,' in the *Journal of the Warburg and Courtauld Institutes*, **81** (2018), pp. 35–69. I would like to thank Captain Richard Cloward for his warm welcome to the La Jolla Museum and for allowing me to take these pictures. For more on the process of creating the 3D model, see S. Griffin, 'The San Zeno Wheel in 3D: Using Cabinet as A DPhil student,' *Blog of the Oxford Internet Institute*, [www.oii.ox.ac.uk/blog/san-zeno-wheel/](http://www.oii.ox.ac.uk/blog/san-zeno-wheel/). I would also like to thank Jamie Cameron for his help with making the model.

2. Antonio Avena and Guido Valerio Callegari, 'Un calendario ecclesiastico veronese del secolo XV', *Madonna Verona*, **11** (I) (1917), pp. 1–33.

3. Caterina Gemma Brenzoni, *Ricerche inedite d'archivio e lettura storico artistica della decorazione dell'abside della basilica di San Zeno* (Verona, 2016), pp. 117–19; Peter Kidd, 'A unique late Medieval/early Renaissance volvelle astronomical calendar', in Daniel Crouch, Elena Napoleone and Nick Trimming, eds, *Daniel Crouch Rare Books: Catalogue VI* (London, 2014), pp. 12–25.

4. Translation from Kidd, 'A unique late Medieval/early Renaissance volvelle', pp. 22–23. Original text: 'Curioso Calendario si sta ran-

nicchiato nella parete della Loggia che dal Dormitorio del Monistero Zenoniano conduce al Coro e alla Sagristia di quella Chiesa... e vi fu posto del 1455. per uso degl'istessi Monaci di San Zenone...' in Giovanni Battista Giuseppe Biancolini, *Dei vescovi e governatori di Verona* (Verona, 1757), p. 22.

5. Avena and Callegari, 'Un calendario ecclesiastico', pp. 23–24.

6. These are listed with their dates in Kidd, 'A unique late Medieval/early Renaissance volvelle', p. 22. Avena noted that the entry for Lucipino is added in a later hand. Avena and Callegari, 'Un calendario ecclesiastico', p. 28.

7. For a more detailed description of the Wheel's content, see: [www.cabinet.ox.ac.uk/san-zeno-wheel-verona-c-1450/](http://www.cabinet.ox.ac.uk/san-zeno-wheel-verona-c-1450/). This description of the calendar's data is indebted to earlier accounts (see nos 2 and 3). For an introduction to lunar volvelles, primarily in printed books, see Nick Kanas, *Star Maps: History, Artistry and Cartography*, (New York: Springer, 2012), pp. 234–41.

8. For an explanation of this sequence see Philipp Nothhaft, *Scandalous Error: Calendar Reform and Calendrical Astronomy in Medieval Europe* (Oxford: Oxford University Press, 2018), pp. 54–55.

9. Kidd, 'A unique late Medieval/early Renaissance volvelle', p. 20.

10. Time from dusk till midnight. This varies from the maximum number of hours of darkness during the Winter solstice (7 hours 45 minutes on December 13–16), to the minimum number of hours on the Summer Solstice (4 hours 15 minutes on June 13–18).

11. Time from dusk till dawn, and therefore the double of the previous columns: 15 hours 30 minutes on December 13–16, to a minimum of 8 hours 30 minutes on June 13–18.

12. Time from dusk till noon, therefore the previous 2 columns combined. Maximum 19 hours 45 minutes on December 13–16, to a minimum of 16 hours 15 minutes on June 13–18.

13. For the date and restoration of the clock wall painting, see Flavio Pachera, 'Il restauro dell'abside', in Marco Ciatti and Paola Marini, eds, *Andrea Mantegna. La Pala di San Zeno: studio e conservazione* (Florence: Edifir Edizioni, 2009), pp. 65–74, pp. 70–71.

14. Gerhard Dohrn-van Rossum, *History of the Hour: Clocks and Modern Temporal Orders*, tr. Thomas Dunlap (Chicago: Chicago University Press, 1996), p. 113.

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