Tours of the Libraries of Reichenau and St. Gall

Reckoning Time at Reichenau and St Gall (Computistics)

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Computus along with the psalms, tironian notes, chant, and grammar constituted the five core disciplines Charlemagne wanted priests to know. That computus featured so prominently in his *General Instruction (Admonitio Generalis)* of 789 [**see St Gall cod. 733 (e-codices)**] speaks eloquently to Charlemagne's (or his advisors') understanding of what constituted essential learning in the Carolingian age. In more modern times, however, computus along with tironian notes have slipped from view when compared to other elements of the program. The books on the library shelves of Reichenau and St Gall demonstrate that those communities fully appreciated the importance of computus to priestly formation and Carolingian learning.

What is computus?

While seemingly of modern derivation, Latin *computus* emerged in the early Middle Ages as a useful term for a variety of applications. Its root is *computare*, to calculate or to reckon. Computus initially referred to any kind of mathematical operation, such as calculating how many of the smallest units of time there are in a minute, hour, day, week, month, year, or more [**Cod. Aug. 167, ff. 8v-9r**]. Since these operations were critical to fixing the date of Easter in the Christian calendar, the meaning of computus expanded by the time of Bede and the Carolingians to include time reckoning, calendar studies, and associated astronomical phenomena. A computus could also be a book that contained this information, such as **Saint-Gall 250**, a book that, with its many different texts, charts, and diagrams, might first seem a hodge-podge. But, what unites its **astronomical diagrams**, **computistical excerpts**, the ***Astronomica* of Hyginus** (c. 64 BCE-17 CE), the **Latin Aratus** of the first century BCE, **Bede's eighth-century CE computistical works**, and the "modern" **martyrology of Wandalbert of Prüm** (c. 813-870) are their shared reference to calendrical time in all its manifestations.

Calendar studies were important to medieval Christians not only to know the date, but especially to know liturgically holy days. The very Creation was measured in days in Genesis, which told that God established the stars and planets to delineate the seasons, the days, and the years (Gn 1,14). And since the Creator entered time through the incarnation and changed the course of sacred history through his passion and resurrection, the proper observance of these moments in time made mere calendar days significant sacred days. Given the multiplicity of calendrical systems available in the early medieval centuries, determining appropriate holy days was also a matter of controversy. The calendars most important to early medieval Christians, the Jewish lunar calendar and the Roman solar calendar, were inherently at odds. While the Roman calendar provided the general context for thinking about and organizing time, [**Cod. Aug. 167, ff. 16v-17v**; and **Csg 250, pp. 93-103**] the lunar calendar was still needed to date Christ's resurrection and other events that depended on knowing the date of Easter.

Fixing the lunar date of Easter on the solar calendar proved to be particularly vexing. The biblical account of the event reports only that it took place during the Jewish Passover holy days. Passover falls on the fourteenth day of Nisan, the first month in the Jewish calendar when the first full moon of spring occurs. Depending on when this moon occurred made Easter a moveable feast that could occur anywhere between March 22 and April 25.

The creation of "Easter tables," which reconcile the lunar and solar calendars to provide a handy reference to all future Easters, did not entirely solve the problem since some of the tables were based on different calendar principles with the result that Easter might be fixed on different dates. Bede (*Ecclesiastical History of the English People* 3,5) reported that Queen Eanflæd followed the Roman formula while her husband, King Oswiu, followed Irish practice for determining Easter. One year the two dates were almost a month apart. Oswiu was celebrating Easter festivities while Eanflæd and her court were still observing Lent.

Dionysius Exiguus, a Greek monk who had settled in Rome sometime in the late 490s, harmonized the lunar and solar calendars over a 19-year cycle. His cycle depended both on astronomical observation and accurate arithmetic. For example, a solar year equals $365\frac{1}{4}$ days, but 12 lunar months of $29\frac{1}{2}$ days each come only to 354 days, 11 days too few. After three solar years, therefore, the lunar calendar will be off by 33 days. In order to keep the two calendars synchronous, an additional month of 30 days was inserted in the lunar calendar after years 3, 6, 8, 11, 14, 17, and 19 in the cycle. These months made up for the "lost" days which were called lunar epacts. But the inserted months still left 3 lunar days unaccounted for after lunar year 3. The computist had to remember these 3 lunar epacts and add them to the next year's 11 days, the following year's 11, and the following year's 11 days at which point 36 lunar epacts would have accumulated. An inserted month would account for 30 of those 36, leaving 6 days that would have to be carried forward in the cycle. The computist would also need to remember to include an extra day in both cycles every four years to account for the quarter day in each solar year. Over the course of the 19-year cycle the lunar and solar calendars would coincide almost perfectly. *Almost perfectly*, since the lunar cycle ends up one day longer. That day, the *saltus lunae*, was skipped over so that the next 19-year cycle could begin with the sun and moon in harmony.

Dionysius created tables and explanations for how to use five 19-year cycles that covered the 95 years from A.D. 532 to 626. His most important contribution ultimately was that A.D., *annus domini*. [**Cod. Aug. 167, f. 14r**] Dionysius's tables were the first to record the years from the date of Christ's birth rather than from the indictions of Roman emperor Diocletian (285-305), the "impious persecutor" of Christians. Bede's major computistical works, *On the Nature of Things* (*De natura rerum*) of 701, *On Times* (*De temporibus*) of 703, and *The Reckoning of Time* (*De temporum ratione*) of 725, disseminated and popularized this new dating scheme. His books, especially the magisterial *The Reckoning of Time*, became the standard books on the subject in the Carolingian age. But they did not suppress creative thinking and teaching on the computus. Bede's works stimulated a rich glossing tradition as teachers such as Hrabanus Maurus [**Csg 902 (e-codices)**], Walahfrid Strabo [**Csg 878 (e-codices)**], Heiric of Auxerre, Martin Hiberniensis, Helperic of Auxerre and generations of anonymous masters, explained and developed Bede's doctrines for their students.

Computistical texts and images at Reichenau and Saint-Gall

Csg 915 is not one of the monuments of Carolingian computistical science. This codex houses a wide variety of texts useful for monastic life and governance. But, between its covers the monks also added computistical material, including a table of months according to the Romans, Hebrews, Greeks, and Egyptians. And, as if to prove how modern they were, they added Charlemagne's renaming of the months which they must have got from Einhard's account. [**Csg 915, p. 241**]. The almost casual inclusion of computistical material in a collection central to monastic observance suggests how important computus was to monks.

Reichenau and Saint-Gall both owned copies of Bede's computistical works, especially the definitive *The Reckoning of Time*, which survives today in some 245 copies, an impressive number for a technical work of the eighth century. And in almost 200 pages in its modern edition, Bede's text provided detailed instructions in 71 chapters for understanding and calculating time from its smallest division, the indivisible atom, to its largest, the Ages of the World. Reichenau's copy of Bede's works was copied in northeastern France, perhaps near Soissons, by Irish scribes. The "Karlsruhe Bede" [**Cod. Aug. 167**] stands as one of the most important Bede collections on account of its many contemporary glosses which reveal masters teaching and interpreting their text. In addition to *On the Nature of Things* [**Cod. Aug. 167, f. 18r**], *On Times* [**Cod. Aug. 167, f. 21r**], and *The Reckoning of Time* [**Cod. Aug. 167, f. 23v**], the masters who owned this book also benefited from ancillary texts that could prove useful in instruction. Letters to and from Pope Leo I authoritatively documenting the Roman calculation of Easter as *the* prescribed method provided ecclesiastical support for the science of Bede and the Carolingian age [**Cod. Aug. 167, fols. 47v-49r**]. Texts attributed to Columbanus, Augustine, and Jerome in Csg 250 [pp. **112**, **436**, and **439**] lent additional authority to computistical doctrine.

Computus manuals invariably also come with anonymous, often brief texts that explain specific rules for finding computistical information *Si uis scire* ("If you would like to know" how to find this or that) they invariably begin. [**Cod. Aug. 167, f. 9v**; **Cod. Aug. 229, fol. 57v-61v**]. These verbal directions to apply rules to determine data points readily available on Dionysius's paschal tables that, as augmented by Bede, stretched from 532 CE to 1063 CE might seem superfluous. But books of computus with elaborate Easter tables were not available to every priest, so priests had to know how to calculate dates for themselves. Besides, they had little use for tables that stretched back into the remote past and forward into the distant future. What undoubtedly worked for most of them were small digests of important dates in years relevant to them copied into personal books along with other texts useful for pastoral work. Csg 682, a compact pocket-sized book bears just such an abbreviated guide to essential calendar information [**Csg 682, pp. 1-6**] for the years 816-844.

Books of computus linked texts and images that augmented and clarified the doctrines of the texts. The Easter Tables are genuine monuments of draftsmanship and precision that brought clarity to complex material. Images enabled readers to comprehend astronomical doctrine visually and to more effectively transmit science to their students. The diagram preserved on **Csg 250, p. 2** presents in a rectangular zodiacal grid Pliny's answer to the question of why the observed planets (Venus, Mars, Sun, Jupiter, Saturn, Mercury, Moon) change their sizes and colors as they move from north to south by plotting the movements of the planets along the grid. The codex also offers a rendering of Pliny's explanation of the planetary apsides, the farthest and nearest points of each planet from the Earth, where the planets appeared to move more slowly or more quickly around the fixed Earth. Here [**Csg 250, p. 23**], look closely to find the pinpricks at the center of each planet's own circle. Just below the depiction of the planetary apsides, the globe of the Earth divided into its five climatic zones from the artic to antartic was rendered in black ink. The superimposed image in orange links the terrestrial zones to their corresponding celestial ones. This image was inspired by Macrobius's spherical cosmology with its inherent symmetry between and the northern and southern hemispheres and its implicit potential for human life below the torrid equatorial zone. Another image **[Csg 250, p. 640**] invited its viewer to contemplate a manuscript page while imaginatively assuming a vantage point in space that would permit observation of the sun, moon, and Earth during the course of a lunar month in order to understand how the phases of the moon occurred. Martianus Capella's teaching that Mercury and Venus circle the Sun was well-known in the Carolingian age and illustrated in the Karlsruhe Bede [**Cod. Aug. 167, f. 16r**]. The upper drawing presents Capella's understanding of the orbits of all the planets around the Earth, while the lower drawing provides greater clarity by highlighting the orbits of Mercury and Venus around the Sun as all three circle the Earth.

Images were indispensable to fully appreciate Aratus's discussion of the zodiacal signs and constellations in his *De astrologia* [Csg, 250, pp. **462**, **472**, **474**-508, **512**, **515**, **518**, **521**] and to detect the signs in the night sky. These carefully-wrought and imaginative line drawings suggest just how much ancient cosmology interested Carolingian monks. As if to rein in pernicious fascination with ancient divinities, one writer offered a Christian twist to his age's fascination with ancient cosmology [Csg 250, pp. **532**-538] when he reminded his readers that God created the heavenly bodies to provide light and to divide the day from the night and to mark the seasons. The zodiacal signs and constellations imbued with human characteristics are only delusional figments produced by the imaginations of philosophers and mathematicians. He then offered a Christian interpretation of the major signs (while reserving the right to call them by their traditional classical names!) grounded in the Bible. The all-powerful Sun stands for Christ, who described himself as "the light of the world." Ancient science understood in a Christian light equipped monks to understand time in its "eternal stability and stable eternity" (Bede, *On the Reckoning of Time* 61 [trans. Wallis, p. 249]).

Further Reading

- John J. Contreni. "Counting, Calendars, and Cosmology: Numeracy in the Early Middle Ages." In *Learning and Culture in Carolingian Europe: Letters, Numbers, Exegesis, and Manuscripts*, Variorum Collected Studies Series (Farnham: Ashgate, 2011), ch. III.
- Bruce S. Eastwood. *Ordering the Heavens: Roman Astronomy and Cosmology in the Carolingian Renaissance*. Leiden and Boston: Brill, 2007.
- Calvin B. Kendall and Faith Wallis. Bede "*On the Nature of Things*" and "*On Times*". Translated Texts for Historians 56. Liverpool: Liverpool University Press, 2010.
- Faith Wallis. *Bede: "The Reckoning of Time"*. Translated Texts for Historians 29. Liverpool: Liverpool University Press, 1999.