Background for Unicode consideration of Cistercian numerals

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The medieval Cistercian numerals, or 'ciphers' in 19th-century parlance, were developed by the Cistercian monastic order at about the time that Hindu numerals were introduced to northwestern Europe. Digits are based on a horizontal or vertical stave, with the placement of the digit indicating its place (units, tens, hundreds or thousands), and these form compounds on a single stave to indicate more complex numbers. After the Cistercians abandoned the system, marginal use continued until the early 20th century, with the Freemasons and Nazis both briefly flirting with it. Although a horizontal stave was most common while the numerals were in use among the Cistercians, this varied regionally, and the vertical forms came to dominate later. There is historical variation as to which corner of the number represented which digit's place.

The Cistercian system indicated numbers from 1 to 9999. An apparently ancestral system attributed to John of Basingstoke covered numbers 1 to 99 and did not see as much use. (Besides several historical references, it is attested in a single, English Cistercian manuscript.) The Basingstoke numerals are not requested here, but can be seen at the top of Figure 3.

King (1993: 47) summarizes the original use of the system by the Cistercian order:

By the end of the thirteenth century a more useful set of ciphers [than Basingstoke's], originating in Cistercian monasteries in Hainault, had been devised to represent any number up to 9999. There were two main varieties, the first with horizontal stems being the more common, and the second with vertical stems, attested only in Northern France from the fourteenth and fifteenth centuries. (We also have evidence of various other experimental varieties, with different appendages applied in alternative ways, but these were not as successful.) ... Most of the twenty-odd manuscripts in which numeral ciphers of one sort or another occur are of religious content and date from the thirteenth to the fifteenth century. Their provenance spans England to Italy, Normandy to Sweden, a wide geographical distribution reflecting to some extent the expansion of the Cistercian order. In these sources the ciphers are used to represent numbers for foliation, divisions or subdivisions of texts, for numbering marginal notes and items in lists or the lines of a staff in musical notation, referring to columns of text in separate indexes, and writing arguments in Easter tables and year-numbers in dates.

It is not clear that there is any current need for Unicode support. Western Michigan University's Medieval Institute (Cistercian and Monastic Studies) has a digitization project of Cistercian mss, but as of end 2020 they have not expressed any desire for computer encoding of the numerals. This document is therefore background information so that work is not duplicated if a need arises later.

The stem or stave that forms the backbone of all Cistercian numbers does not occur by itself. (That is, there is no zero.) If the bare stem is made available by Unicode, then the (stemless) digit elements can be encoded as combining diacritics, and it would be simplistic for a font to render compound numbers. If there no base stem is provided, then 9963 OT ligatures would need to be included in a font. Because they are perfectly regular, these ligatures could be automatically generated by the typographer, so such an approach would not require much more effort than a non-OT font, nor have much affect on font size.

If OT ligatures are to be used, encoding order needs to be considered. The place values of the four corners of the glyph space vary between manuscripts. If the encoding order is graphical, then it will not always correspond to place value, and if encoding order is numerical, it will not consistently correspond to the form. I suspect that it would be best for Unicode to formalize a thousands-hundreds-tens-units (KHTU) encoding order, and let the font display that input however best reflects a particular tradition.

With horizontal digits, the earliest-attested and most common place-value arrangement is

<u>U Н</u> Т К.

(See Figures 1, 4, 5, 11, 12, 17.) But according to King (2001: 35), two medieval sources change these values, for

<u>U Т</u> К Н.

See Figure 14 for yet a third arrangement in an early modern source,

<u>U Т</u> Н К.

With vertical numbers, the digits are rotated 90 degrees clockwise. Most mss have the equivalent to the earliest horizontal arrangement,

Т|U К|Н.

When speaking German, this is read counter-clockwise from bottom-left (*K*-tausend *H*-hundert *U* und *T*-zig), though that does not appear to have been its motivation.

However, Figure 9 shows a 15th-century source with the hundreds and thousands swapped, for

T | U H | K,

which works if read clockwise in French, and several modern sources follow it (Figs. 16–18). Note that in all of these traditions the units are in the same position. However, in the Masonic revival (Figure 15), the tens and units are also swapped, replicating Basingstoke's original order of units and tens:

U | T H | K

References

David King (1993) 'Rewriting history through instruments: The secrets of a medieval astrolabe from Picardy', in Bennett, Anderson & Ryan, eds, *Making Instruments Count: Essays on Historical Scientific Instruments Presented to Gerard L'Estrange Turner*. University of Michigan.

David King (2001) The Ciphers of the Monks. F. Steiner.

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Figures



Figure 1. King (2001: 34). Schematic horizontal digits and composite numbers. The author presents a triangular digit 5, the form found on an astrolabe where he first encountered the system, but this form has limited distribution. Most sources have a dot instead, or a line shorter than that of 6.



Figure 2. King (2001: 36). Schematic vertical digits and composite numbers. Again, the form of the 5 is not representative.



Figure 3. King (2001: 39). Table of principle attested variants, showing the digits 1 to 9. At top are the possibly ancestral Basingstoke digits (said to have come from Greece, but perhaps 12th-c. English shorthand) and early Cistercian forms. Both are flipped along the stave to form the tens. The middle box is standard Cistercian, which swaps 3-4 and 7-8 of the early forms. (9 is often round, not shown here.) The vertical forms are per Agrippa and as attested on the Picard astrolabe, which differs from Agrippa only in its triangular digit 5. (Some Cistercian-era 'anomalous' variants are not reproduced here.)

The Basingstoke digits are three shapes (upward angle, horizontal line and downward angle) placed at three points on the stave (top, center and bottom). The tens are formed by placing the same on the right side.

The early Cistercian digits form pairs: orthogonal strokes, then those same strokes with a 'hanging' stroke, then dots, then diagonal strokes, then the strokes for 7 and 8 combined to form 9. King proposes that the higher digits of the later Cistercian digits are additive: 7 a conflation of 6 and 1, 8 of 6 and 2, and 9 of 6 and 1 and 2. However, as with the early forms, 9 is still a conflation of 7 and 8, and the evolution may simply be one of the hand. The early Laon mss, for example ('498' seen at right) has a round 9 that is ambiguous between a triangular and a square shape, contrasting with a 7 and 8 that are sharply angular.



Figure 4. King (2001: 97). 'Aqua' in an early-13th-century concordance from Brussels. These early Cistercian forms are found in only one other surviving manuscript. The numbers in the first two lines are 21, 41, 81, 85, 106, 115 and 146, 148, 150, 169, 194, 198, and in the last line 779, 783, 803, 818, 834, 858.

Ad unbern Cucam Fuerur Amm-- Ab urbe condita new alchee you com imrur = ira ab ong the mumber when ad admoni-u uvorume annoz 9 pumrin- & mor Alia ver rufte maroza from cimara munor ly bab

Figure 5. King (2001: 111). Later Cistercian forms with a round 9. Turin mss, Northern France, 14th century. All numbers in the text are written with Cistercian digits. Several are transcribed in the margin here: 4484, 715 and 5199.



Figure 6. King (2001: 134). Angles on the Picard astrolabe, which was recorded as a gift in 1522. At bottom right are 2, 4, 6, 8, 10, 12. The same numbers are repeated in the other quadrants.



Figure 7. King (2001: 137). Decades of degrees on the outer ring of the astrolabe (30, 40, 50, 60), showing the unusual triangular shape of digit 5. Inside is a repeated series of 10, 20, 30, and inside that the decades of days in a month, with 28, 30 or 31 as the third number (visible here are 31 and 10).



Figure 8. King (2001: 155). A mixed alphabetic-Cistercian notation used for foliation in a late 13th-century mss, where the letters range from a to g and the digits from 1 to 6 or 7, as needed for the folio.



Figure 9. King (2001: 157–158). A late-15th-century Norman treatise on arithmetic, using Cistercian and Hindu numbers. The triangular 5 is seen again here.

The author proposed an extension to the Cistercian system for numbers greater than 9999, by wrapping a thousand around the number of thousands. Thus the 10,000 and 11,000 illustrated here resemble a T and a T combined with a J.



Figure 10. King (2001: 193). The digits per Agrippa of Nettesheim. Agrippa's 1510 work was widely read and forms the basis of several later accounts.

fte description, faicte& verifiée à Paris le ==== iour de Mars, l'an de grace, 1==-1.

Figure 11. King (2001: 206). The date of Collange's 1561 translation of Trithemius's *Polygraphiæ*, 15(?) March, 1561.



Figure 12. King (2001: 213). A second account of the convention, per Noviomagus in 1539, of combining with the 1,000 digit to write numbers 10,000 and greater. Here 1000 is joined to itself for 1,000,000.



Figure 13. King (2001: 245). A Cistercian-based code per Porta in 1593. 11 shapes are extended by dots. The forms show how a serif version of the numbers might look.



Figure 14. King (2001: 221). The digits per Costadau in 1717. The swash on digit 6, also found in Bolzanius 1579, is presumably to distinguish it from 5, which had begun to look quite similar. (Cf. for example Figure 11.)

٩,,	P۳	1 3 00	<u> </u>
Цß	μ 60	H 800	H 8000
٦,	Π ₇₀	1 700	1 7000
6	6	600	6000
I 5	5o	500	5000
N 4	¥0	\$00	4000
1 3	50	300	3000
1 =	20	200	2000
٦	10	200	1000

Figure 15. King (2001: 245). Masonic use, ca. 1780, by the Chevaliers de la Rose-Croix of Paris.



Figure 16. King (2001: 224). The digits per Nesselmann in 1842.



Figure 17. King (2001: 225). The digits per Friedlein in 1869. The vertical digits are given as alternative forms. The vertical composites are 5543, 2454, 3970 and 1581.



Figure 18. King (2001: 260). The base digits and the design of the numbers 4321, 2505 and 9876 per W. Blachetta in 1941, with sans-serif forms. The ciphers featured marginally in German nationalist fantasy but did not catch on in Nazi symbolism.