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Oronce Fine was a French polymath of the highest order.[1] Born in the late 15th century, he led a true Renaissance in mathematics, astronomy, horology, and cartography. His dozens of publications include much on innovative sundials, quadrants, etc. Despite this, only two instruments by him have been recorded, a navicula sundial and portions of a sophisticated planetary clock. A third one has just come to light, that a quadrant sundial of 1518. Although unsigned, the attribution is certain, based on design, numeral and letter shapes, and notably the tangible provenance to Fine's supporter and benefactor. Here we present the instrument and the evidence.

The quadrant is constructed of a fine large slab of yellowish elephant ivory, measuring 137 mm and 126 mm along the sides, and with a thickness varying from 5.0 to 5.5 mm. There are a notch probably for plumb bob storage, two notches for sight vanes, a swivelling brass suspension for plumb line, and a swivelling index arm of whitish ivory. The decor consists of an engraved gilt sun face on the front, plus a system of engraved compass arcs on the reverse. The rulings, notations, etc. are hand-engraved throughout, with red, blue, black, burgundy and gold infill. Various numerals are engraved, others stamped.

Fig. 2. One of numerous explanatory labels on the quadrant, this one specifying that it has been designed for use at latitude 48° 30′.

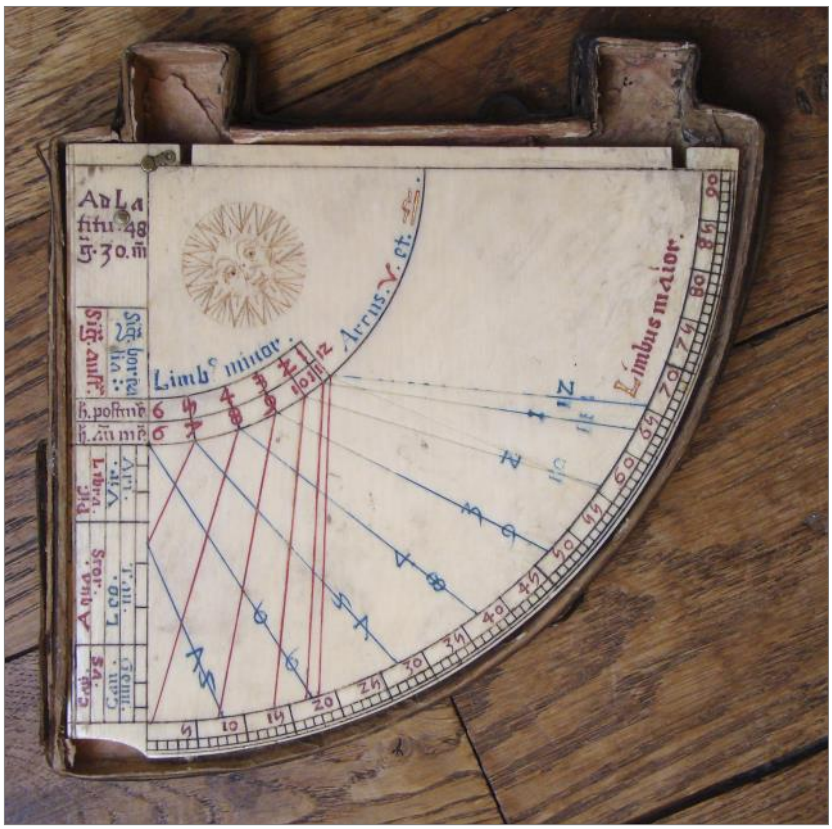

Fig. 1. The recently discovered horary quadrant by Oronce Fine, 1518.

The Front – Altitude and Horary Quadrant

The front (Fig. 1) is labelled "Ad Latitu. 48g, 30m" (thus designed for 48° 30′ latitude – see Fig. 2), and bears a 90° altitude quadrant centred on the apex with plumb support and divided every degree counter-clockwise, labelled every 5° noting the very distinctive 'zig-zag' shape for the numeral '5,' as well as the 'z' shape for the numeral '2.' An horary quadrant, for time telling, is laid out between the arcs of "Limb′ minor" and "Limbus maior." All the hour lines are straight (see discussion below), with one group colour-coded all in blue (for summer, and running from 5 am until 7 pm), the other in red (folded back for use in the six months of winter, the hours from 6 am to noon labelled "h an me," those back from noon to 6 pm labelled "h post me" for "hours post-meridian").

In use a cord with plumb weight and sliding bead would hang from the quadrant's apex. The bead would be positioned at a height corresponding to the time of year, the quadrant would be held up with the sights aligned with the

sun, the cord would hang vertically, and the position of the bead on the hour lines would indicate the time. For setting the bead at the correct date, there is engraved along the left edge a Zodiacal scale, again colour-coded, all the engraving in blue again for summer, labelled "Sig. borealia" and divided every ten degrees through the Zodiacal houses of "Ari, Tau, Gemi, Can, Leo, Vir." Red is applied to the winter, labelled "Sig. aust." and incorporating the houses "Libra, Scor, Sa, Cap, Aqua, Pic." The top end of the Zodiacal scales, i.e., for the dates of the equinoxes, is labelled "Arcus" followed by the signs for Aries and Libra. And here we note another of the maker's very distinctive letter forms, the lower case 'c' which invariably lacks its lower edge, being formed more like an 'r.' And speaking of idiosyncrasies, a mistaken summer hour line originally was drawn down from 12 noon to about 56°, intersecting the 10 am/2 pm line. If we measure on the quadrant the sun's altitude at noon at the equinoxes, we find the design latitude as about 48° 20′, very close to that intended.

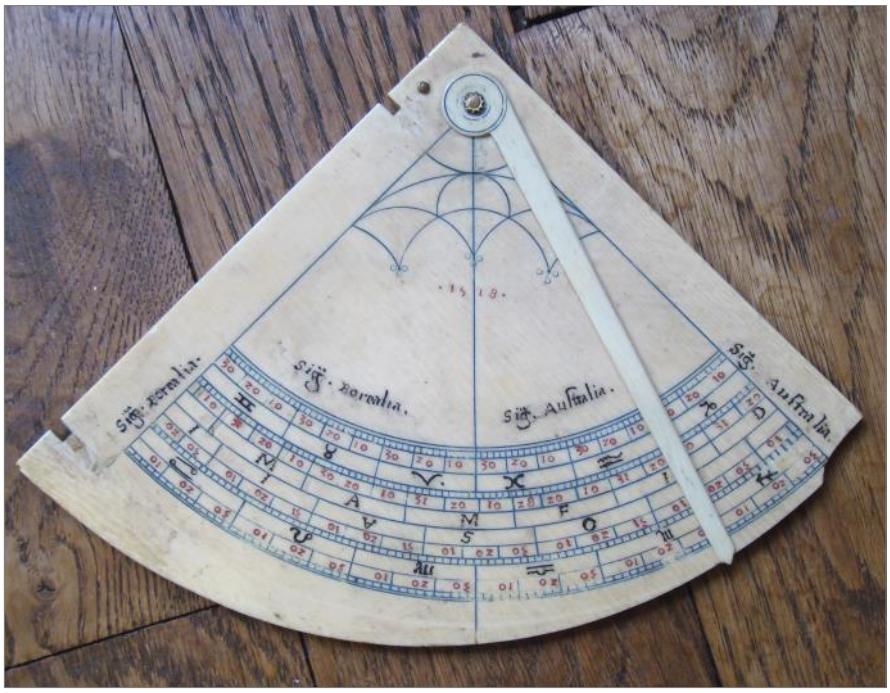

Fig. 3. The reverse, with its high-resolution scales for converting back-and-forth between calendar date and the sun's position in the Zodiac, using the index arm for precision. Note that the vernal equinox is on 11 March.

The Back – Calendar Conversion

The reverse (Fig. 3) is again hand-engraved, but with numerals punched, noting distinctive 1, 2, 3, and 5 shapes. Here the colour infills differentiate the lines and arcs (blue), the numerals (red), and the words and letters and Zodiacal symbols (black). There are four calibrated quadrantal arcs, centred on an apex (different from that on the front side) to which is mounted a rotating straight index arm made of thin ivory and decorated with simple circles with blue infill. The two central bands give the calendar date throughout the year, with divisions every two days, and respecting the correct 30-, 31-, and 28-day months. Months are identified by their capital letters, noting stylistically that all vertical lines in these letters are crossed in the centre. An inscribed centre line gives the equinoxes as 11 March and 13.5 September. We note that in 1518 (as dated – see Fig. 4) the equinox occurred on 11 March at about noon, in the Julian calendar. (The Gregorian calendar would not be introduced for another 60+ years.) The left half of the layout is for summer, marked twice "Sig. Borealia," the right half winter "Sig. Australia." The outer two bands give the Zodiacal houses, each with 30 degrees and divided every two degrees. Thus we have precision conversion between calendar date and sun's position in the Zodiac, necessary for setting the bead position on the front side. The condition of the quadrant is fine, lacking of course the two sight vanes (which were probably very simple bold vanes pierced with holes, to be compared with the single surviving vane on the astrolabe-quadrant in Rouen[2]) and the plumb bob. The ivory surface is somewhat scraped, and some coloured infill was possibly repainted at some time. Overall the instrument presents beautifully, and is in extraordinary condition for its age.

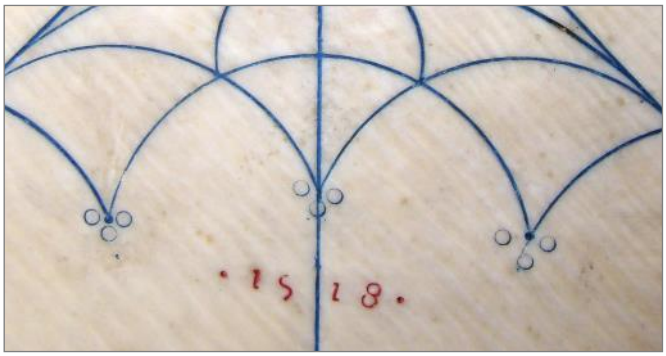

Fig. 4. Symmetrical decorative arcs, and the date of fabrication (1518).

The Case

The wonderful case (Figs 5, 6, 7) is made of wood covered in thick hard blackened brown shaped calfskin, lined with rose-coloured paper, and fitted with brass attachments. The leather is fully hand-chiselled, with wonderful floral (with appearance of lilies, acanthus, and climbing plant) and geometric designs and with a cut and struck blazon in polychromed patterns. The latter, after forming, was apparently fully gilt and then covered in places with azure, red and silver (some of which pigment has faded). The workmanship on the case cover is remarkable for the period, with a great finesse of execution, and with original and elegant asymmetrical floral decor. It stands out compared with the perfect symmetry of even the most sumptuous French Renaissance book bindings. The style

Fig. 5. The hand-carved leather case, with its elegant asymmetric floral patterns and bearing the gilt and polychromed blazon of Michel Boudet, Fine's protector and supporter.

Fig. 6. The case bottom, hand-incised with a triangular / rectangular latticework.

evokes that of the Italian Renaissance, suggesting the possibility that the master craftsman of the case cover was of Italian origin, installed in Paris. The case extensions for the missing sight vanes are a bit puzzling; they are curiously quite large, and wide in the plane of the quadrant, and not well centred on the vane attachment notches. Were the sights of an unusual design, or was there a bit of miscommunication between Fine and the case maker, or did perhaps the latter work from one of Fine's published two-dimensional drawings where the sight vanes are always shown flat in the plane of the quadrant, rather than in a three-dimensional view? Case closure is by a hook on the circular edge, with two eyes on the straight opposing edges for lacing a cord to carry. It may be compared with the case on the earlier astrolabe-quadrant in Rouen, and that on a

Fig. 7. Details showing the case-work extension for a sight vane, plus one of the original brass eyes for cord to bind and carry the instrument.

medieval horary quadrant recently recorded.[3] The condition is fine noting minor losses and some warping. It is an extraordinary survival with the quadrant.

Technical Design

So here we have an early quadrant, clearly designed for time-telling, as announced by the bold gilt sunface, and made for the specific latitude 48° 30′. Notre Dame in Paris is at 48° 51′, and in Fine's *Protomathesis*, wherein many complex dials are fully detailed, we note that the fixed-latitude quadrants are all specified for latitude 48° 40′. If we take the quadrant's stated latitude literally, it is designed for use on an East–West line passing 39 km south of Notre Dame in Paris. Interestingly, and unlike many quadrants, this one is engraved with numerous cryptic 'instructions', identifying the various arcs and tables. It is an early horary quadrant, calibrated for equal hours (as opposed to unequal hours, popular a century before), and with the date lines folded back for half the year to give greater resolution. The present quadrant shows the sophistication of having changed the spacing of the Zodiacal dates to give mathematically straight, rather than curved, hour lines. Cowham[4] discusses the various types of, and evolution of, the horary quadrant. The earliest similar straight-line form which Cowham reports is the 1558 design of Gebhart von Baeinen (recorded by Zinner[5] as being in the Vienna Kunsthistorisches Museum). And we find an illustration of the form in Fine's works[6] (Fig. 8). By comparison Fine's other quadrants, and of course the later Gunter's quadrants, always have curved hour lines.

The survival and recent appearance of the present Renaissance quadrant is noteworthy. Horary quadrants are illustrated in various 16th-century books, but we find a remarkably similar one hiding in the most famous 1533 painting by Hans Holbein the Younger, *Les Ambassadeurs* (Figs 9 & 10). The material of the quadrant would appear to be the same, and the layout is again the uncommon design with straight hour lines.

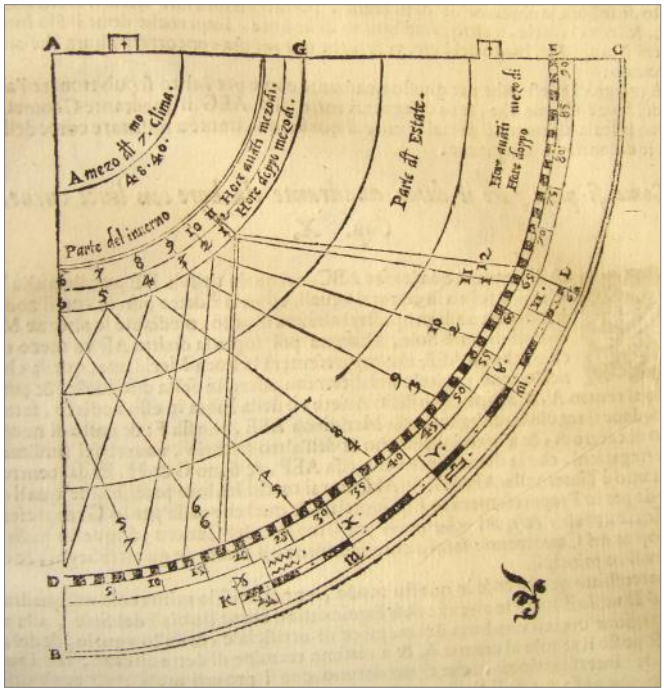

Fig. 8. Illustration from Oronce Fine's Works, showing a quadrant much like the present, where the Zodiacal scale has been expanded and contracted to give all hour lines as straight lines.

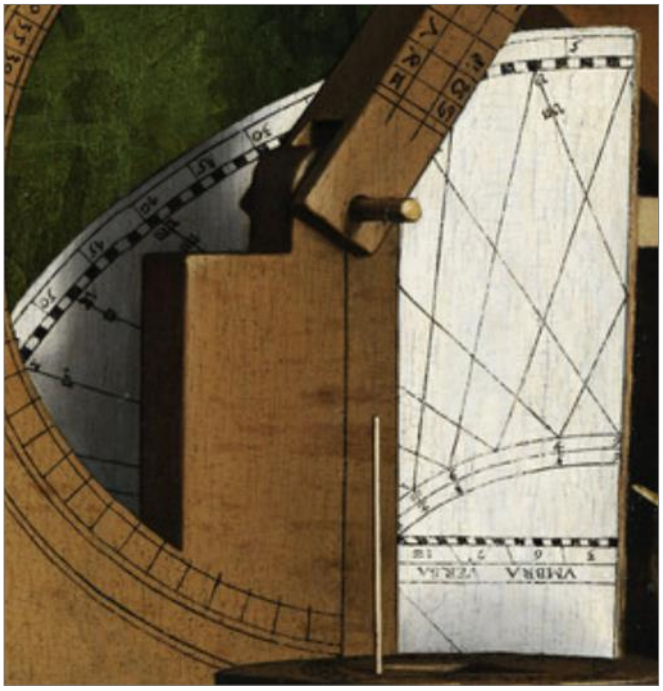

Fig. 10. Detail of the horary quadrant in Les Ambassadeurs, remarkably similar to the present quadrant, of the same uncommon form with straight equal-hour lines.

Fig. 9. The 1533 painting Les Ambassadeurs, by Hans Holbein the Younger, now in the National Gallery in London.

The Maker

The undeniable maker is Oronce Fine, born in Briançon in 1494, educated in Paris at the Collège de Navarre, going on to receive a degree in medicine in 1522, becoming famous as a mathematician and cartographer. Fine arrived in Paris, fatherless, c.1510, and entered studies which led to a master's degree in 1516. By 1518 he was teaching at two institutions in Paris and had published editions of several scholarly books including Sacrobosco's *De sphaera*. A prolific author and engraver, Fine is also known as a fine craftsman of instruments; surviving are a signed ivory 'navicula' sundial dated 1524, and Fine's work on an extraordinary 15th-century planetary clock modified by him c.1553 and held in the Bibliothèque Sainte-Geneviève in Paris, exhibited in 1971[7] and recently studied in detail.[8] His ivory navicula is in the Museo Poldi Pezzoli[9] in Milan, discussed and illustrated by Eagleton.[10] Studying the numerals on that dial, we find again the same distinctive punched 1, 2, and 3 shapes, as well as the 5, although its 's' shape now (six years later, and after Fine's imprisonment c.1523/4[11]) less dramatically rotated (Figs 11 & 12). And we see the same terminal symbol representing the "us" of Opus, as for the "us" of Limbus on the quadrant.

The Benefactor

With the quadrant's case we find a remarkable further connection with Fine. The blazon is that of Michel Boudet, who served as évêque (Bishop) of Langres (in eastern France) from 1512 until his death in 1529. He held numerous distinguished royal appointments under Kings Louis XII and François I. Boudet's coat of arms is preserved in the 16th-century stained glass in the church at Monliot-et-Courcelles west of Langres (Fig. 13), as well as on several surviving seal imprints. The device on the case matches this, complete with the quarters of fleur-de-lys, roses, etc., and it is surmounted by the bishop's crozier. The Fine family inhabited the Dauphiné in the vicinity of Briançon, in southeastern France, for centuries.[12]

Despite Oronce's genius and successes in astronomy and mathematics, for which he received acclaim throughout his life, he never achieved financial security, and in fact often

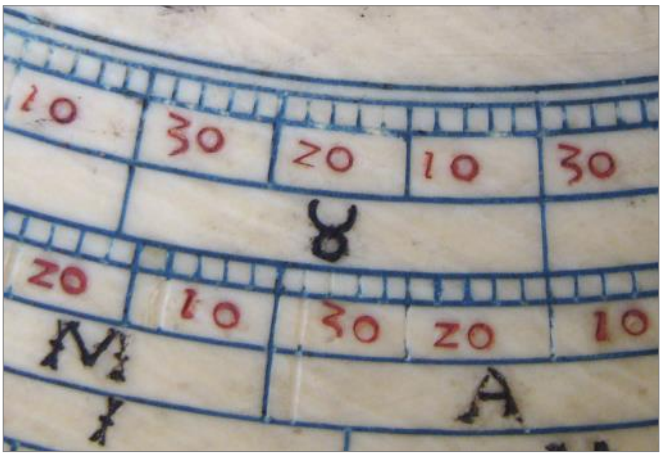

Fig. 11. Details of numeral shapes on the present 1518 quadrant.

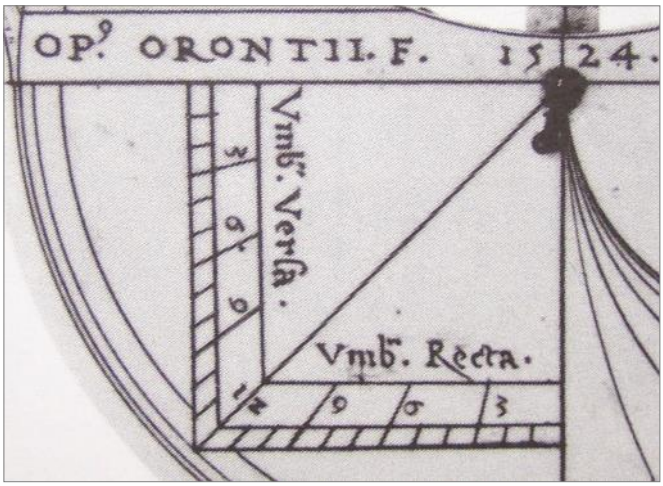

Fig. 12. Detail of the 1524 ivory navicula sundial, the one other recorded sundial by Oronce Fine. Note the fine similarities of the punched 1, 2, and 3 shapes in the shadow square, to the same numerals in Fig. 11.

suffered. Adolphe Rochas[13] writes of Fine's difficulties (here translated):

"*Except for a bishop of Langres, Michel Boudet, who had been his protector from the beginning of his studies, the great lords whom he implored remained deaf to his prayers: in exchange for the base flatteries to which poverty made him descend, he received only letters of thanks or sterile praise: often even the generosities of his Patrons were limited to a gift of paper, wax and parchment, thus abandoned to his own…*"

Thus Boudet supported and mentored Fine in his early years.

Further evidence is found in two dedications Fine published in works he edited, the first in 1517 in Bassolis' *Opera in quattuor Sententiarum libros* where his praises of Boudet include a poem and his armorial. The second appears in the encyclopedic 1523 *Margarita Philosophica*,[14] where Fine expresses his thanks and declares his indebtedness to Boudet for all his benefits, and describes him as one of his most faithful friends. Fine explains that this edition was

Fig. 13. The 16th-century coat of arms of Bishop Boudet, Oronce Fine's protector, in the church at Monliot-et-Courcelles southeast of Paris. It is to be compared with that on the case (Fig. 5).

requested by Boudet himself. Thus we have clear evidence of the strong intellectual and supportive bond between the two.

The conclusion is clear. At age 24 Oronce Fine, working in Paris, created this quadrant for his protector and supporter the Bishop of Langres.

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REFERENCES and NOTES

1. A. Marr (ed.): *The Worlds of Oronce Fine -- Mathematics, Instruments and Print in Renaissance France* (2009).
2. A. Anthiaume and J. Sottas: *L'astrolabe-quadrant du Musée des antiquités de Rouen,* pp. 157-161 (1910).
3. E. Dekker: 'An Unrecorded Medieval Astronomical Quadrant from c. 1300', *Annals of Science* 52, pp. 1-47 (1995).
4. M. Cowham: *A Study of the Quadrant* (2014).
5. E. Zinner: *Astronomische Instrumente des 11 bis 18 jahrhunderts*, Beck, Munich (1956).
6. *Opere di Orontio Fineo del Delfinato*, this the posthumous translation by Bartoli of Fine's Works, p. 503, G. Hertz, Venice (1670).
7. *Science et Astrologie au XVIe Siècle -- Oronce Fine et son Horloge Planétaire*, pp. 13-14 (1971).
8. K. Gaulke, M. Korey and S. Gessner: 'Clocks as Astronomical Models' in A. Turner (ed.) *A General History of Horology*, Oxford University Press (2022).
9. Museo Poldi Pezzoli: *Orologi Oreficerie* (1981).
10. C. Eagleton: *Monks, Manuscripts and Sundials – The Navicula in Medieval England,* Figs 29A & B (2010).

11. R. Ross: *Studies on Oronce Fine, 1494-1555*, being an extensive (468 pp) Ph.D. thesis submitted to Columbia University, N.Y. (1971).
12. A. Albert: *Biographie Bibliographie du Briançonnais canton de Briançon* (1895).
13. A. Rochas: *Biographie du Dauphiné*, Vol. 1, pp. 384-393 (1856), who writes:
"*Excepté un évêque de Langres, Michel Boudet, qui avait été son protecteur dès le commencement de ses études, les grands seigneurs qu'il implora restèrent sourds a ses prières: en échange des basses flatteries où la misère le faisait desendre, il ne recevait que des lettres de remerciements où de stériles louanges: souvent même les libéralités de ses Mécènes se bornaient à un cadeau, de papier, de cire et de parchemin, ainsi abandonné à ses propres...*".
14. *Nouveau Sistême de Bibliographie Alfabétique,* 2nd ed., pp. 179-182 (1822).

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