

PRIMARY SOURCE - Required Reading

The primary sources for this week are all forms of star atlas and/or cartography or sky mapping.

Visit this exhibition on the WEB - A history of how the sky has been viewed and mapped

'Thinking outside the Sphere' view the exhibition on line and download the 121 page PDF available from Linda

Hall.<http://www.lindahall.org/online-exhibitions/>

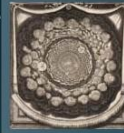
Biographic Index

Exhibit Home Page



- Euler, Leonhard. *Theoria Motuum Planetarum et Cometarum*. Berlin: Haude, 1744.

Introduction: From a Crystalline Sphere to a Plurality of Worlds



- Fine, Oronce. *De Mundi Sphaera*. Paris: Colinaei, 1542.
- Fontenelle, Bernard le Bovier de. *Entretiens sur la Pluralité des Mondes*. Paris: Amaury, 1686.
- Struza, Aegidius. *Astrologia*. Wittenberg: Fincelii, 1659.
- Sacro Bosco, Joannes de. *Sphaera Mundi*. Venice: Scoti, 1482.

Section 1. The Enduring Earth-Centered System



- Aristotle. *[Opera Graeca]*. Venice: Aldus Manutius, 1495.
- Plato. *Timaeus*. Paris: Badius, 1520.
- Ptolemy, Claudius. *Almagest*. Venice: Liechtenstein, 1515.
- Regiomontanus, Joannes. *In Almagest*. Venice: Hamman de Landora, 1496.

Section 2. The Enduring Earth-Centered System



- Apian, Peter. *Cosmographia*. Antwerp: Bontio, 1550.
- Fludd, Robert. *Utriusque Cosmi Maioris Scilicet et Minoris Metaphysica*. Oppenheim: Aere Johan-Theodori de Bry; typis Hieronymi Galleri, 1617.
- Gallucci, Giovanni Paolo. *Theatrum Mundi, et Temporis*. Venice: Somasum, 1588.
- Sacro Bosco, Joannes de. *Sphaera Mundi*. Venice: Scoti, 1490.

Section 3. The Sun Takes Center Stage

Read Aratus' Phaenomena

Available -

<http://www.theoi.com/Text/AratusPhaenomena.html>

Aratus' sky poem become a foundation for western celestial cartography.



Harley MS 647, f 10v, detail. Eridanus
Cicero's translation of Aratus' Phaenomena

PDFs on Moodle

Brady, Bernadette. "Images in the Heavens: A Cultural Landscape " In *The Imagined Sky*, edited by Darrelyn Gunzburg, .

Brady, Bernadette, 'The Horoscope as an 'Imago Mundi': Rethinking the Nature of the Astrologer's Map', in *Astrologies, Plurality and Diversity*, ed. by Nicholas Campion and Liz Greene (University of Wales Trinity Saint David, Lampeter: Sophia Centre Press, 2011), pp. 47-62.

JSTOR Papers - Optional

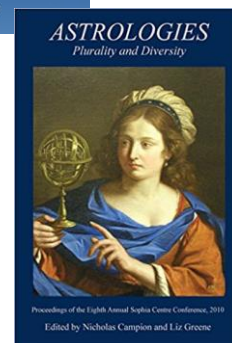
Jacob, Christian. "Towards a Cultural History of Cartography." *Imago Mundi* 48 (1996): 191-198.

Jacob's paper is concerned with the cultural nature of terrestrial maps but the same arguments can be applied to celestial maps.

Schaefer, Bradley. "The Latitude and Epoch for the Formation of the Southern Greek Constellations." *Journal for the History of Astronomy* xxiii (2002): 313 -350.

Unger, Eckhard. "From the Cosmos Picture to the World Map." *Imago Mundi* 2 (1937): 1-7.

Lorimer, H.L. "Stars and Constellations in Homer and Hesiod." *The Annual of the British School at Athens* 46 (19)

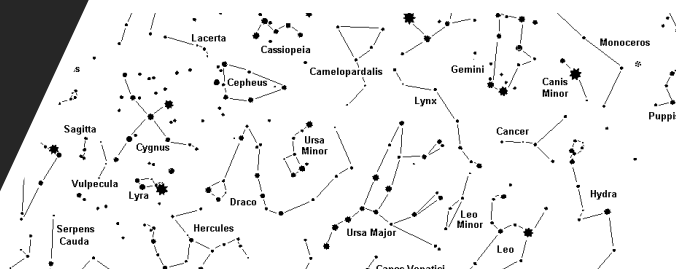


Heavenly Discourses Mapping the Heavens Week 3

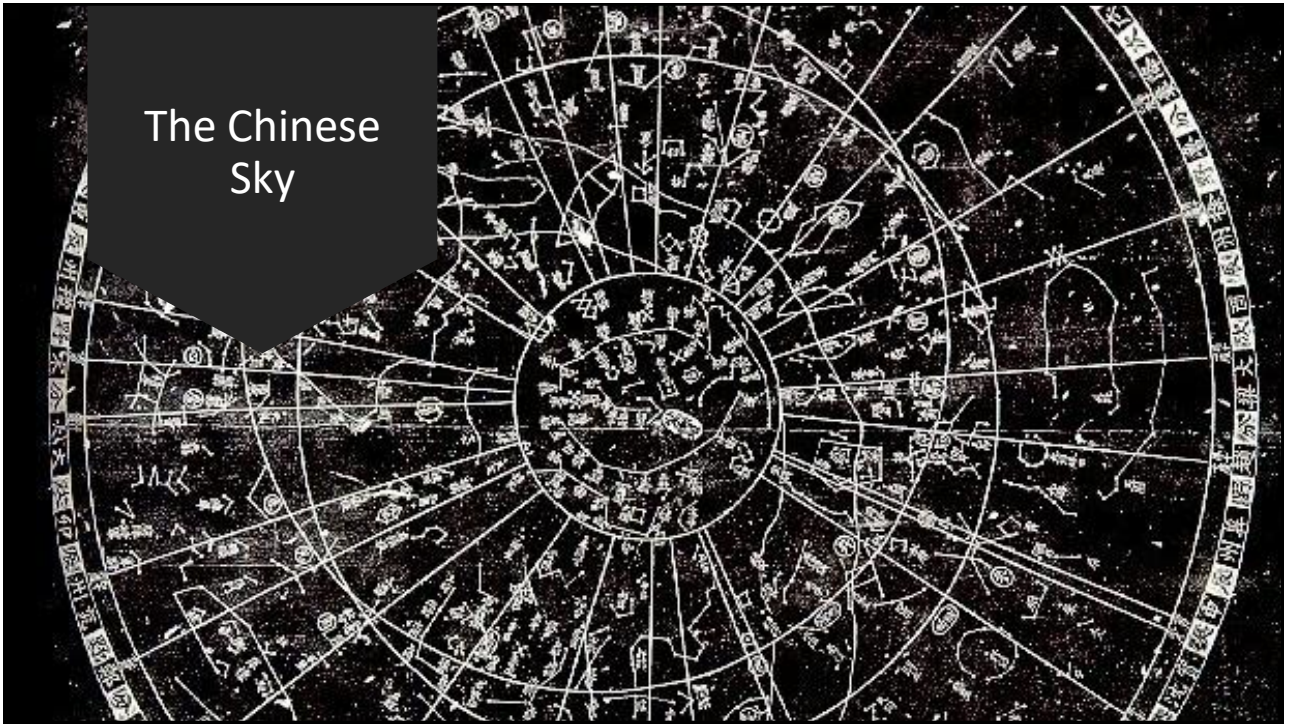
Dr Bernadette Brady
MA in Cultural Astronomy and Astrology
Faculty of Humanities and the Performing Arts
University of Wales Trinity Saint David
Lampeter, Wales.



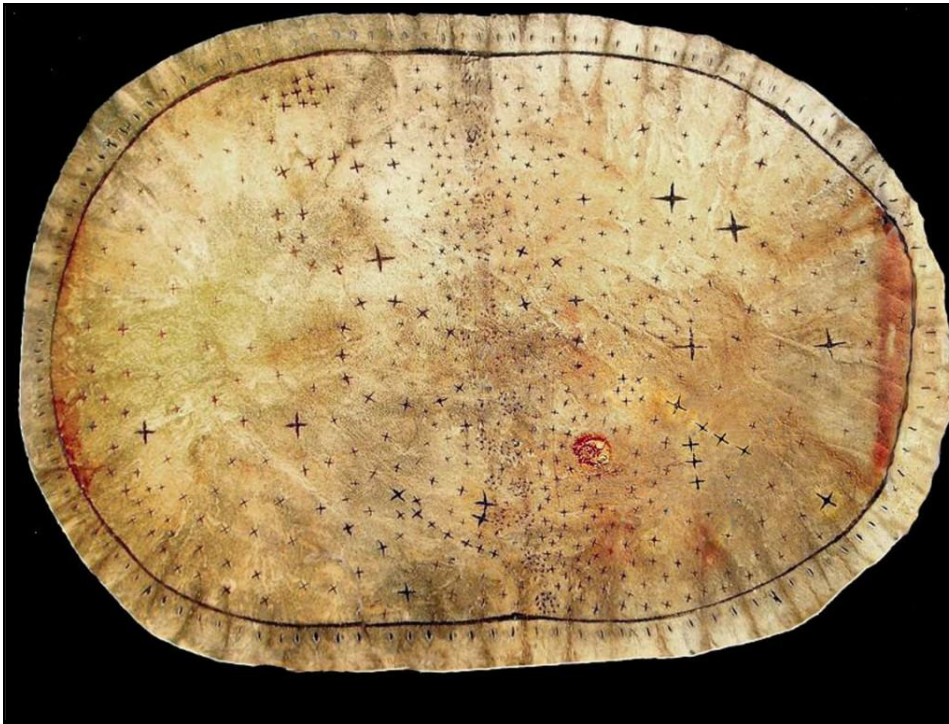
Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David



The Chinese Sky

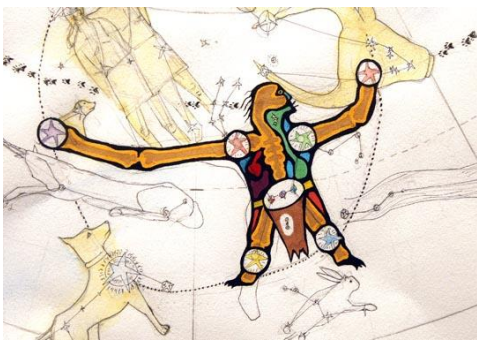


The Fundamentals of the Stars (The Book of Nut) – the order of the cosmos. The passage of the sun and stars throughout the year. (Ramesses VI)



US Native sky map:
Pawnee star chart.

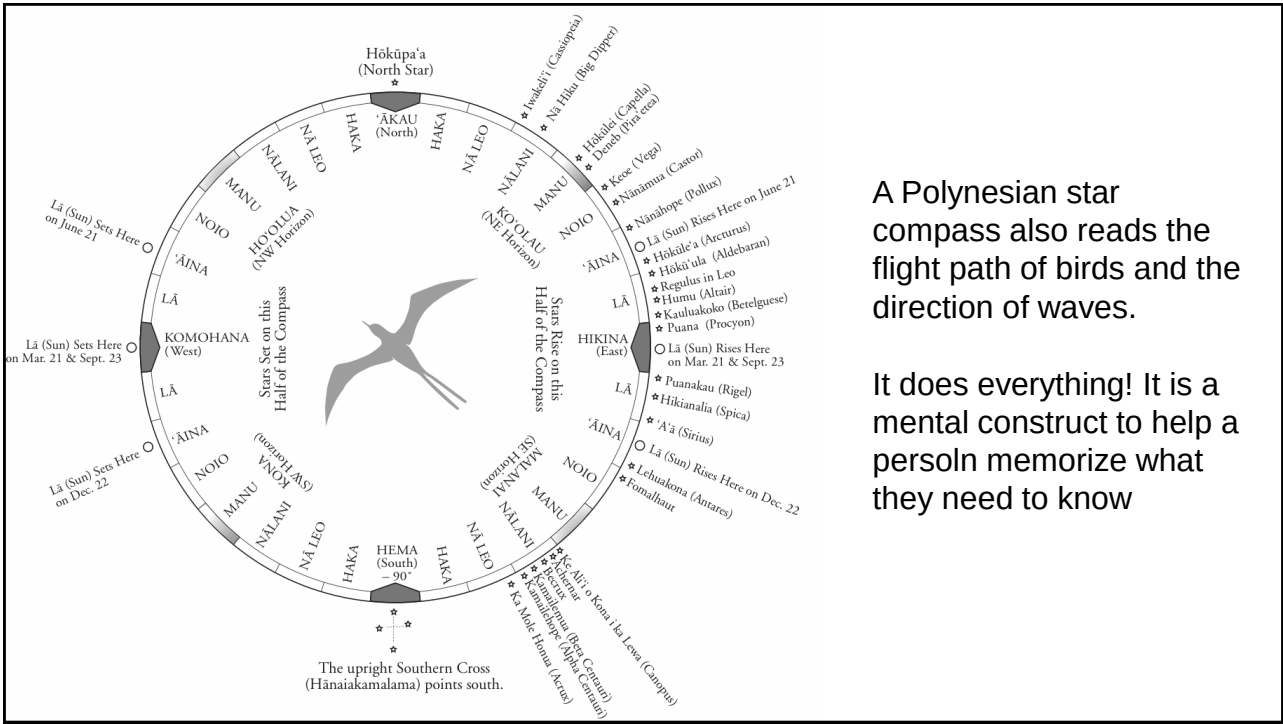
This star chart is of unknown age. The buckskin chart depict some particularly important stars that guided the Skidi Pawnee in their lives.



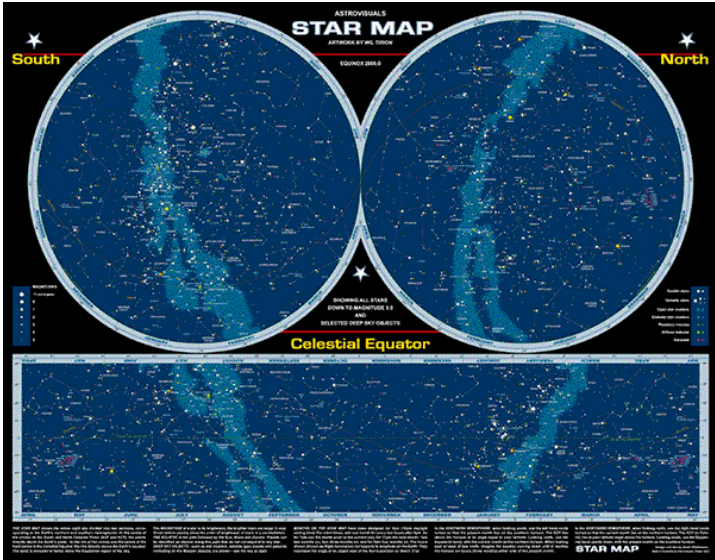
D(L)akota Star
Map and

Ojibwe Sky Star
Map (right)





The Western Sky



The Images in the Sky – Western culture

The constellations as we know them have three sources:

- 1) The Babylonian constellations.
- 2) The Southern Greek constellations.
- 3) The 17th century new constellations.

The history of the mapping of the constellations is the story of humanity's changing relationship with the sky

There appears to be no Egyptian influenced on the shaping of our modern constellations.

Mesopotamian MUL.APIN is most likely the oldest document focused on the constellations. It is dated from the period 1000 BC.

(Hunger, H. & Pingree, D. E. (1999). *Astral sciences in Mesopotamia*, Leiden, Brill. p58).

You can read the MUL.APIN <http://www.mesopotamia.co.uk/astromer/explore/mulapin1.html>

Babylonian
boundary
stones
c.1100 BC



MUL.APIN



On the 1st of Nisannu the **Hired Man** becomes visible.
 On the 20th of Nisannu the **Crook** becomes visible.
 On the 1st of Ayyaru the **Stars** become visible.
 On the 20th of Ayyaru the **Jaw of the Bull** becomes visible.
 On the 10th of Simanu the **True Shepherd of Anu** and the **Great Twins** become visible.
 On the 5th of Du'uzu the **Little Twins** and the **Crab** become visible.
 On the 15th of Du'uzu the **Arrow, the Snake, and the Lion** become visible; 4 minas is a daytime watch, 2 minas is a nighttime watch.
 On the 5th of Abu the **Bow** and the **King** become visible.
 On the 1st of Ululu [. . .]
 On the 10th of Ululu the star of **Eridu** and the **Raven** become visible.
 On the 15th of Ululu **Shu-pa, Enlil**, becomes visible.
 On the 25th of Ululu the **Furrow** becomes visible.cc

Mesopotamian Constellations 18 zodiacal

The way of Anu

Aries – The Hired Man
 Taurus – the Great Bull of Heaven
 Gemini – the Great Twins
 Leo the Lion
 Cancer – the Crab
 Virgo – the Furrow
 Libra – the Scales and a place of the King
 Scorpio – The Scorpion
 Sagittarius - Pabilsag
 Capricorn – the Goat-Fish
 Aquarius – the Great One
 Pisces – The Tails



Orion – The True Shepard of Anu

Auriga – The Crook

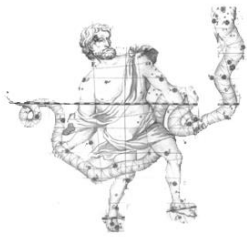
Anunitum (a goddess) – part Pisces
 and part Andromeda

Perseus – the Old Man

Pleiades – the Stars

Great Swallow (part Pisces and part Pegasus)

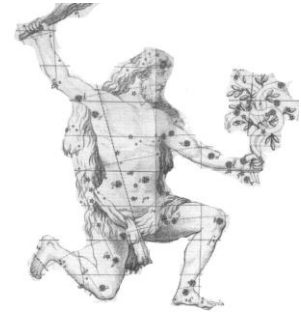
The considered Southern Greek constellations



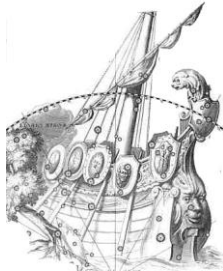
Orphiuchus



Bootes



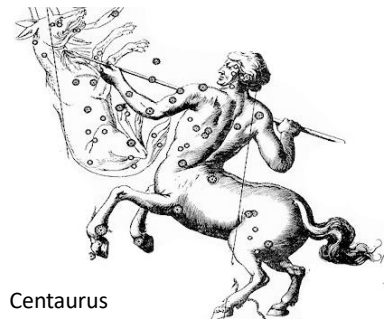
Hercules



Argo



Auriga



Centaurus

Bradley Schaefer

*The Latitude and
Epoch for the
Formation of the
Southern Greek
Constellations
(2002)*

Aratus, *Phaenomena*

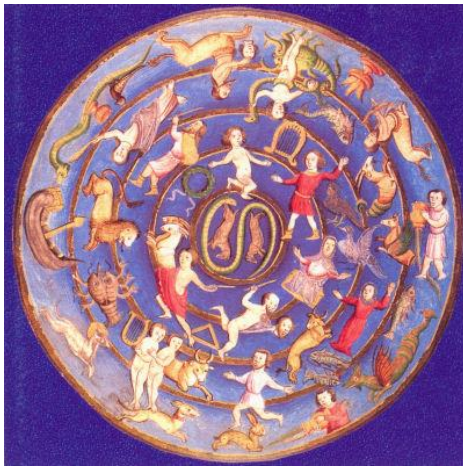
- The epic star map poem *Phaenomena*, written by the Greek poet Aratus of Soli (315–240 BC). Aratus blended the older sky lore with the observational work of Eudoxus of Cnidus (c.408–355 BC). In the poem, however, Aratus makes no distinction between Eudoxus' astronomical observations and the older fragmented sky lore.
- The poem consists of three parts: a description of the constellations, the paranatellonta of these constellations, and a set of weather/sky omens. Between the first and the second, Aratus described the band of stars that constituted the 'great circles': **the Milky Way, the Tropic of Cancer, the Tropic of Capricorn and the Equator**. He then traced each of these star-paths through the constellations.
- Adding to Aratus complex weave of sky, stars and mythic story drawn from antiquity, Aratus threaded his poem with **acrostics**. First noted in Aratus' work by J.M. Jacques (1960), an acrostic poem is one where the first letter of each line spells out a coded message or word. This was used by Aratus to animate the constellations (Jacques, J. M. (1960). 'Sur un acrostiche d'Aratos '. *Revue des &tudes anciennes*, lxii, 48-60.)

Aratus, *Phaenomena* – a voice from the 3rd millennium BC

It is when Aratus described the lines of the tropic of Capricorn, Cancer and the equator through the sky the ancient sky folk lore is revealed. It is evident that part of Aratus' poem is drawing on sky observations from the 3rd millennium BC.

See Zhitomirsky, S. (1999). 'Aratus' "Phaenomena": Dating and Analysing its Primary Source'. *Astronomical & Astrophysical Transactions*, 17, 483-500.

Aratus, *Phaenomena*



Depiction of the classical constellations described in the astronomical poem of Aratus of Soloi and its various Latin editions (miniature from codex Barberianus latinus 76, Biblioteca Apostolica Vaticana, 15th-cent.)

Aratus poem gathers together:

- a) Oral sky history from the Bronze age.
- b) The bended constellations from the Hesiod – 7th century BC.
- c) The observational work of Eudoxus of Cnidus (c.408–355 BC).

It is believed that Aratus' sky then become the model for the original Greek sculptor which was copied in the Farnese Globe. (Schaefer 2005).



Later Aratus work became linked with Hyginus' 'Astronomica'.

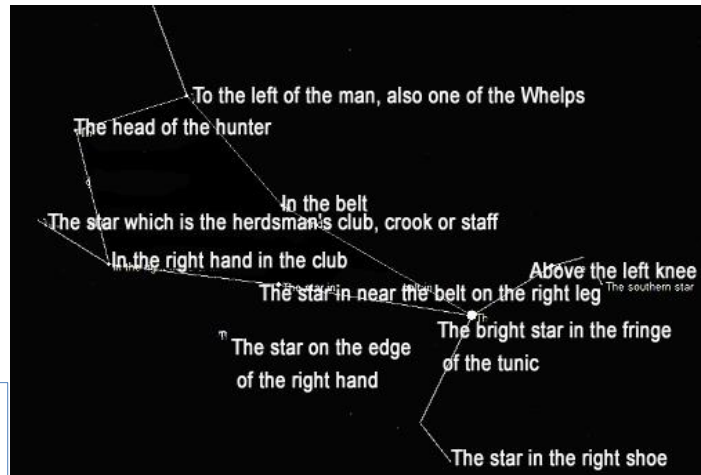
Mapping the Sky

Claudius Ptolemy (c.100-170) noted, borrowed and re-observed 1026 stars in order to help find the rate of precession. Ptolemy used the tradition of the day and described each star in relation to its position within the now **Hellenised images of the constellations**.

Ptolemy located each star as a part of an image. For example, a girdle, a buckle of a belt, the gem in a tiara and so forth. The figure is the stick figure of Bootes showing a few of Ptolemy's named stars via their position in that image.

These fine detailed star-image locations are now known as the **Ptolemaic positions**.

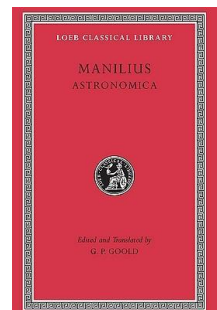
In this period, until the printing press, sky maps were represented in manuscripts, globes and/or ceilings.



Marcus Manilius, poet/astrologer/astronomer, he who lived in the reigns of the Roman emperors Augustus and Tiberius and authored one of the earliest treatise on astrology.

The *Astronomica*, is a didactic poem in five books, begins with an account of celestial phenomena. He renders mathematical tables and diagrams in verse form. His journey to through the spheres is reflective of the Plato's journey of the soul to the stars described in the *Timaeus*.

'Here would another leave the celestial sphere and make his descent through the intervening fires of Saturn, Jupiter, Mars, and the Sun, and you, O Moon, beneath them, whose wandering path follows Venus and Maia's son. But me the heavens entice to hasten on a tour of all the stars in the sky as well, now that I have once dared to mount an aerial car and reached the summit of the dome along its upward slopes. On this side Orion beckons to me, in the mighty sky the mightiest constellation; the heroes' ship that amid the stars sails even now; the Rivers whose winding coils meander far and wide...'



Marcus Manilius, *Astronomica*. trans. G.P.Goold, *Loeb Classical Library* (London: Harvard University Press, 1977). Book 5, p301.

Mapping the Sky

The first known printed sky maps were produced in 1482 by **Erhard Ratdolt** from Augsburg, Germany.

Ratdolt printed Hyginus (64BC-17CE), *Poeticon Astronomicon*, each constellation was a separate image and the stars were not located to any degree of real precision. He printed his constellations using a geocentric orientation.

Ptolemy's list-map (identical to Hyginus) places every star in a specific location *within* every image, using the image itself as the reference point. However, Ratdolt's stars are randomly placed in the images, ignoring Ptolemy's descriptions.



brachio enani. In manu altera. In zona tres. Sub zona quatuor
In viroqz genu vnam. In pedibus aurem binas. Ita omnino est
stellarum numerus. xx.

Perseus huius sinistrâ crus et humerû leuû: cirulus
gñi. ius a reliquo corpore diuidit. Ipse manu dextra
arictiâ circuli tangit: dextro pede caput aurigæ pig-
nere velut currens videt. Idê occidens sagittario e
capricorno exorto inclinat ad caput verius: cû arietē
et tauro rectus exoritur. habet at i viroqz bñero stellâ vñâ. In manu
dextra clare lucente vnam qua falcē tenere dicitur: quo telo Dragonâ



Mapping the Sky – Two views...

There are two ways that the sky can be represented on a printed page:

Internal view: Also known as the **geocentric view**. The constellation figures are depicted as seen from looking up at them in the sky. This is the method commonly adopted in celestial atlases and is most suited for astronomical observations.

External view: the constellation figures are depicted as viewed from the outside. This is the method commonly adopted in **celestial globes**. So the observer is looking down on the image through to the earth.



Albrecht Dürer -
planisphere, 1515.

The sky shifted from
Being a holder of myths
and calendar to a place
of measurement and
exploration

Some thirty-three years after Ratdolt's work, the German artist, engraver and mathematician, **Albrecht Dürer** (1471–1528) produced the **first real astronomical star maps** containing both images and accurate star positions. In producing the first recognised flat map of the heavens, **Dürer also drew on the spirit of Ptolemy's list map by returning to the Aratean or classical images**. However, he maintained the classical globe **or external orientation to his maps**. Note the grid is based on the ecliptic.



Albrecht Dürer -
planisphere, 1515.

Note: Sagittarius aiming
his arrow to the left –
the globe view.

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The move back to the geocentric view.

Note the grid is still based on the ecliptic and the 'pole' is the ecliptical pole. The celestial pole is the tip of the tail of Ursa minor – the Little Bear.

Johannes Honter,
Imagines constellationum Borealiū, 1532.
Geocentric perspective



The geocentric view.

Note: Sagittarius aiming his arrow to the right.

Johannes Honter,
Imagines constellationum Borealiū, 1532.
Geocentric perspective



Giovanni Paolo Gallucci, *Theatrum Mundi et temporis*, 1588. Cassiopeia and Bootes - Geocentric

First Star Atlas

Each image was placed on its own page with a graduated scale so that stars and parts of the images could be considered in RA and declination

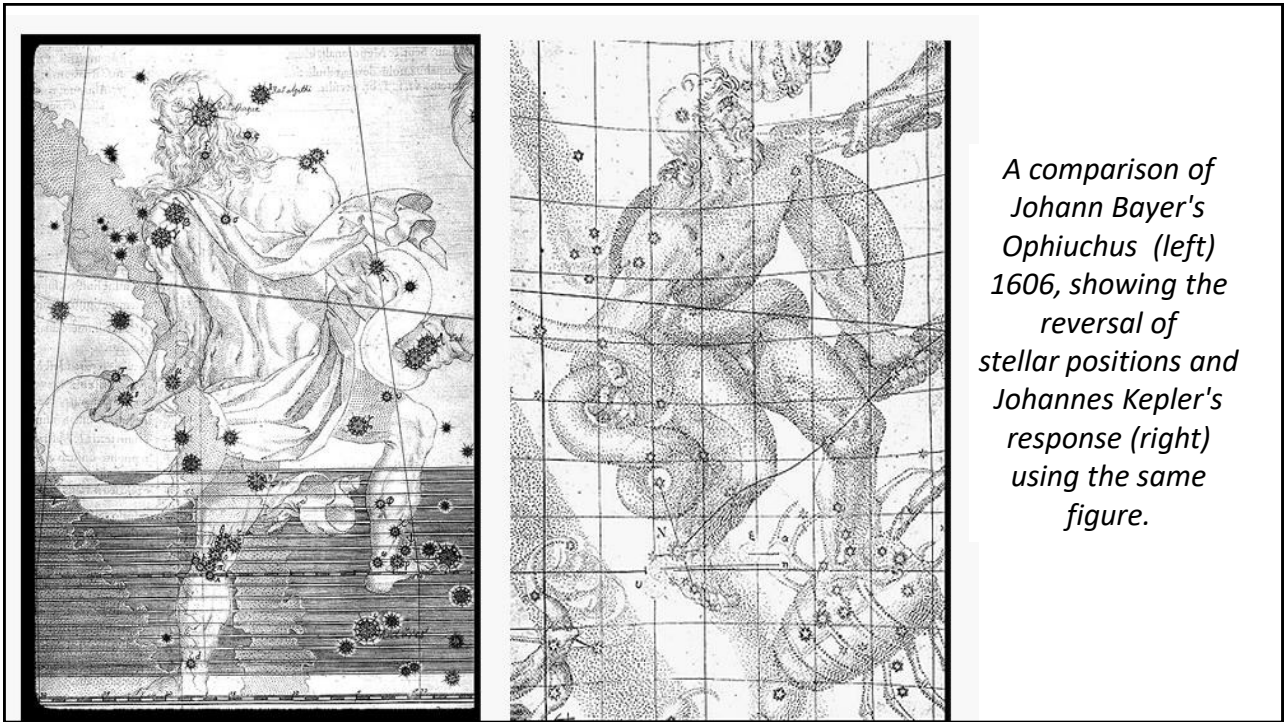


In 1598 Tycho Brahe (1546–1601) completed the most comprehensive and extensive star catalogue since Ptolemy and this laid the foundations for a new generation of cartographers. The most influential of these was **Johann Bayer** (1572-1625).

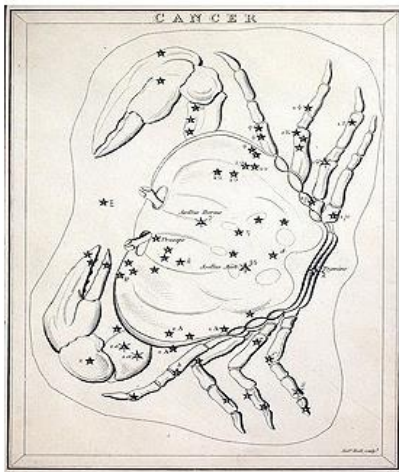
Orion (left) from *Uranometria* 1603, Johann Bayer.

Orion holds his club in his **left hand**, with the star **Betelgeuse** located in his **left shoulder**.

Bayer used a geocentric view of the stars but turned the images around.



The 17 century colonisation of the sky by Christianity.



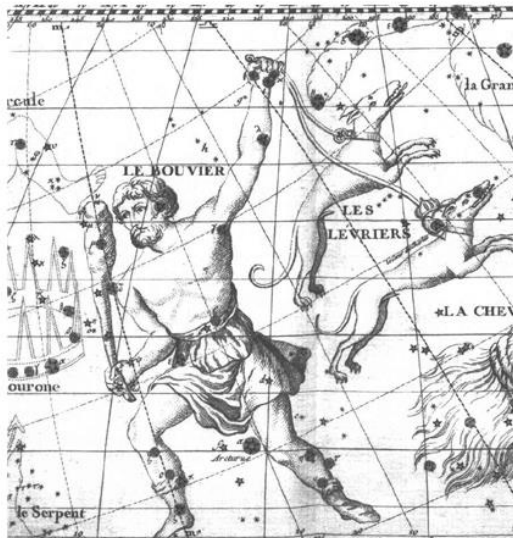
Cancer - Aspen 1825



Schiller's "Scourge of Christ" replaces Cancer.

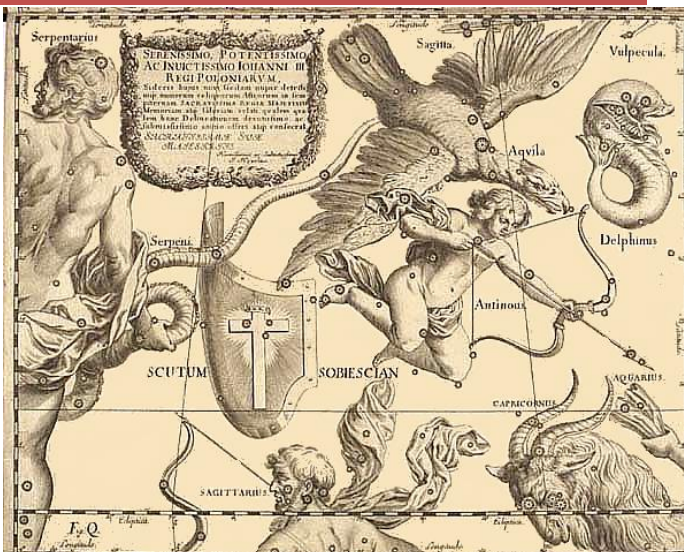
Cancer (left) from Aspen 1825 and Julius Schiller (1627).
Coelum stellatum Christianum Scourge of Christ (Right).

The Christian Sky



Left, Boötes, Flamsteed 1705, and Julius Schiller (1627)
Coelum stellatum Christianum Saint Sylvester (Right).

The Political Sky



Scutum Sobiescianum
(the shield of Sobieski)
Hevelius 1690, created to
commemorate the
victory of the Polish
forces led by King John III
Sobieski in the Battle of
Vienna in 1683.

Later, the name was
shortened to Scutum.

In 1690, Elizabeth, the wife of Johannes Hevelius (1611–1687) published his great *Prodromus Astronomiae* posthumously. In this work Hevelius introduced **ten new constellations** including a political constellation named *Scutum Sobiescianum*, the coat of arms of his patron.

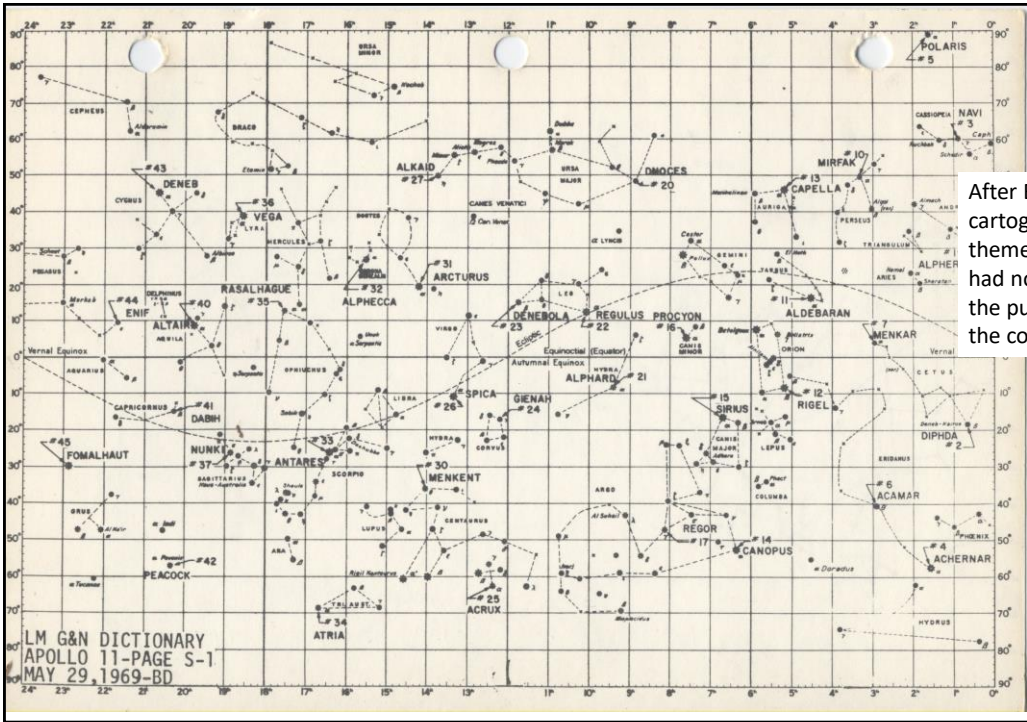


Erhard Weigel (1625–1699), a professor of Astronomy at the University of Jena, Germany, in 1699 produced a celestial globe. Weigel did not use the classical images of Ptolemy but rather the coat of arms of the royal families of Europe.

Erhard Weigel, 1699
a drawing of his celestial globe.



John Flamsteed (1646–1719) slowly compiled a catalogue of stellar observations over a period of forty-three years. Flamsteed held the position of the first Astronomer Royal of England 1675–1719 and he named this catalogue the British Catalogue of Stars. However it wasn't until 1725 that his star catalogue *Atlas coelestis*, having been edited by his wife Margaret, was published posthumously. **Flamsteed's work in *The Atlas coelestis* was partly to correct the reversal of the figures of the constellations in Bayer's work of 1603.** Bayer's work had become popular due to its accurate stellar positions, as well as the quality of its images.

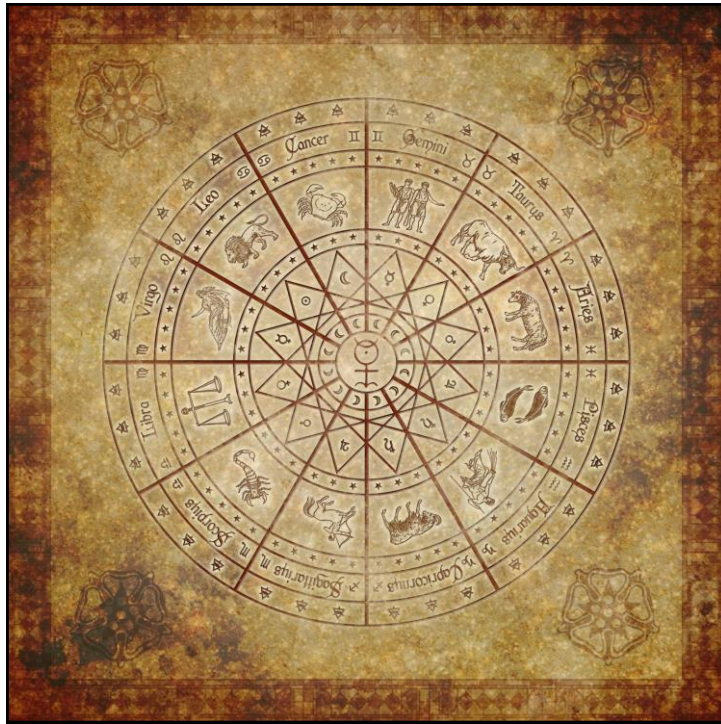


After Bode's atlas celestial cartography split into two themes. Those for astronomers had no images and those for the public, with less data, had the constellation images.

Andromeda	Antlia	Apus	Aquarius	Aquila
	The Air Pump	Bird of Paradise	Water Carrier	The Eagle
Ara	Aries	Auriga	Bootes	Caelum
The Altar	The Ram	The Charioteer	The Herdsman	The Chisel
Camelopardalis	Cancer	Canes Venatici	Canis Major	Canis Minor
The Giraffe	The Crab	Hunting Dogs	The Greater Dog	The Lesser Dog
Capricornus	Carina	Argo	Cassiopeia	Centaurus
The Goat-Fish	The Keel		The Centaur	Cepheus
Cetus	Chamaeleon	Circinus	Columba	Coma Berenices
The Whale		The Drafting Compass	The Dove	Berenice's Hair
Corona Australis	Corona Borealis	Corvus	Crater	Cruce
Southern Crown	Northern Crown	The Crow	The Goblet	Southern Cross
Cygnus	Delphinus	Dorado	Draco	Equuleus
The Swan	The Dolphin	The Goldfish	The Dragon	The Little Horse
Eridanus	Fornax	Gemini	Grus	Hercules
The River	The Furnace	The Twins	The Crane	
Horologium	Hydra	Hydus	Indus	Lacerta
The Pendulum Clock	The Water Serpent	The Lesser Water Snake	The Indian	The Lizard
Leo	Leo Minor	Lepus	Libra	Lupus
The Lion	The Lesser Lion	The Hare	The Scales	The Wolf
Lyms	Lyra	Mensa	Microscopium	Monoceros
	The Lyre	The Table Mountain	The Microscope	The Unicorn
Musca	Norma	Octans	Ophiuchus	Orion
The Fly	The Level	The Octant	Serpent Holder	The Hunter
Pavo	Pegasus	Perseus	Phoenix	Pictor
The Peacock	The Winged Horse		The Phoenix	The Painter's Easel
Pisces	Piscis Austrinus	Puppis	Pyxis	ARGO
The Fish	The Southern Fish	The Stern	The Compass	Reticulum
Sagitta	Sagittarius	Scorpius	Sculptor	Scutum
The Arrow	The Archer	The Scorpion	The Sculptor	The Shield
Serpens	Ophiuchus	Sextans	Telescopium	Triangulum
The Serpent	The Serpent	The Sextant	The Telescope	The Triangle
Triangulum Australe	Tucana	Ursa Major	Ursa Minor	Vela
Southern Triangle	The Toucan	The Great Bear	The Lesser Bear	ARGO
Virgo	Volans	Vulpecula		
The Virgin	The Flying Fish	The Fox		

Ptolmey had listed 48 constellations but with the south sky as well as the use of telescopes another 40 have been added taking the total to 88 constellations.

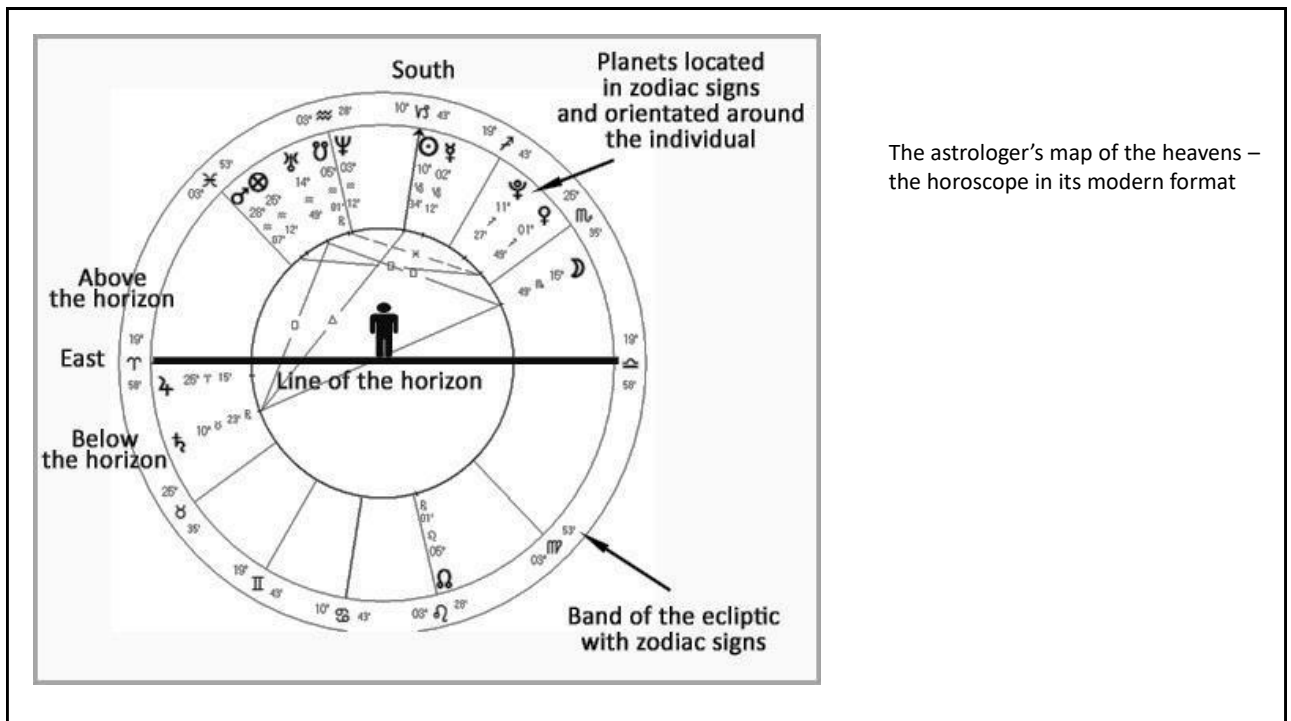
The pink constellations are the non-Ptolemaic constellations



The Astrologer's Map of the Heavens

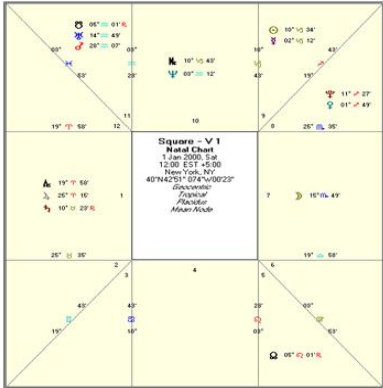
The Horoscope

Seeking to map a
personal relationship to
the cosmic order

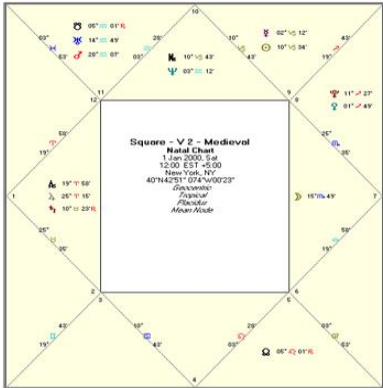


The astrologer's map of the heavens –
the horoscope in its modern format

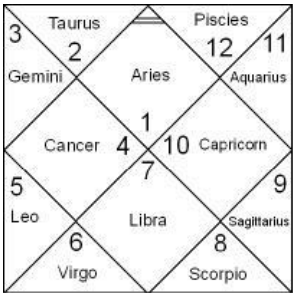
Other formats for horoscopes – square charts



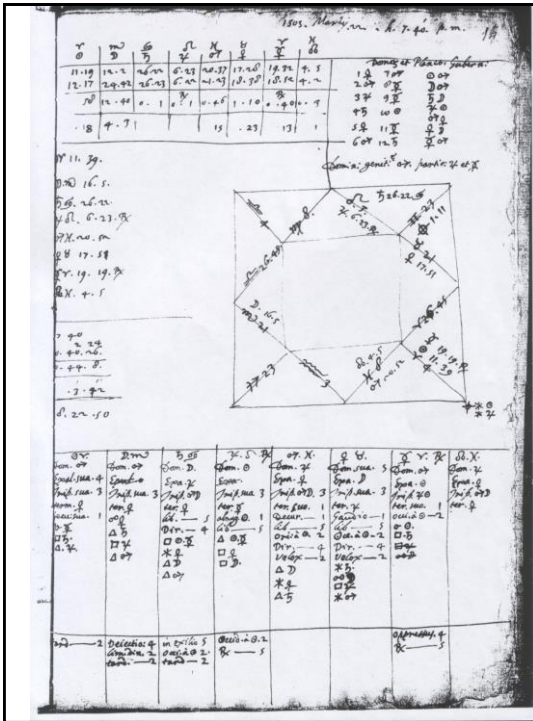
Style used in south India



Medieval European Style



North - Indian Style Chart

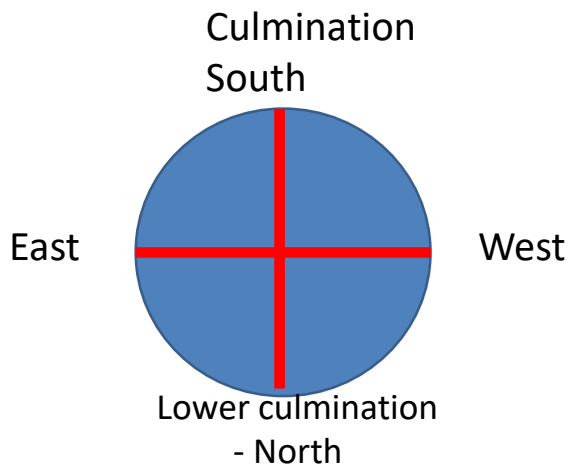


Galileo Galilei (1564-1642)
Astrologica nonnulla.

The chart he drew for his friend Sagredo, using the square style.

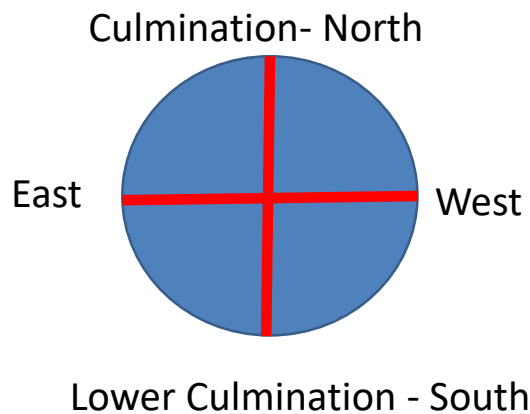
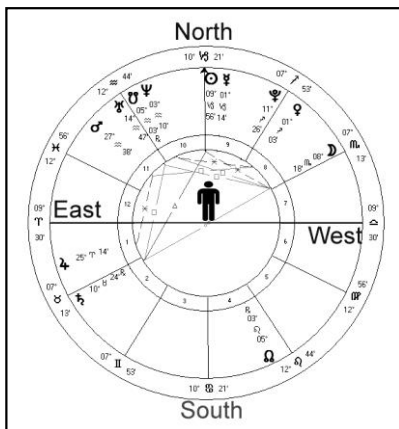
Sagredo
20 June 1571 OS 0.46
Venice.

Horoscopes and Northern hemisphere

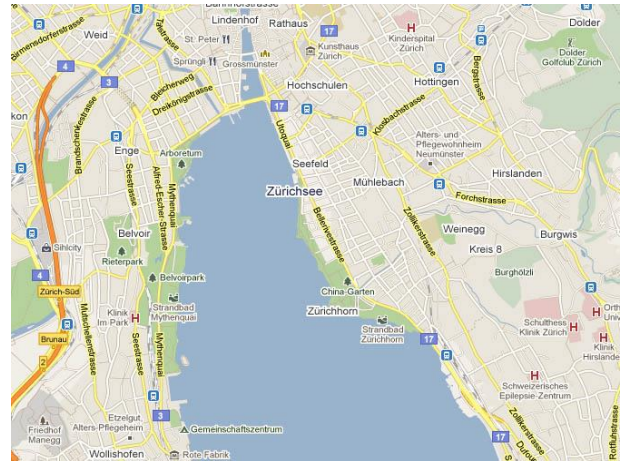
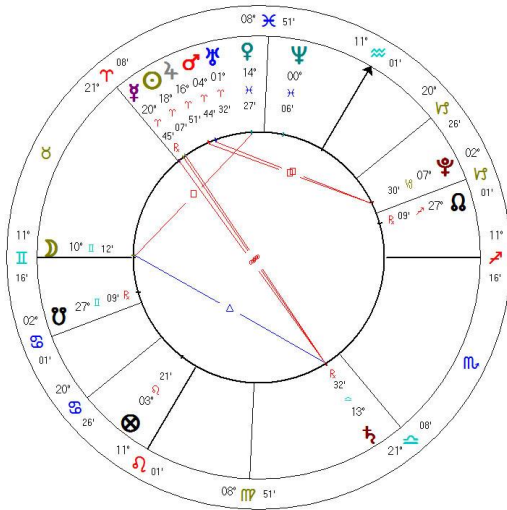


Clockwise – the movement of the Sun from East to West

The horoscope in the southern hemisphere



The symbolic nature of the horoscopes become evident when considering those maps drawn for southern hemisphere. The culmination (north) is still placed above the head but the east is still located on the left. The sky's clockwise movement is maintained.



The horoscope is a symbolic map of the heavens. It seeks to locate the self, not to locate a place.

Conclusion

- Most cultures throughout history have mapped the heavens.
- Not all cultures seek to represent the same information in their maps
- A people's sky map is a reflection about their relationship to the sky.
- As a people change their sky maps they also change their attitude and relationship to the sky.