
Images in the Heavens: A Cultural Landscape

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Abstract

The constellation images with their historically persistent nature and adaptability fulfil many contemporary definitions of culture. From the earliest Elamite seals of the fourth millennium to the list-maps in the first century CE through Ptolemy's *Almagest*, the constellation images became established in Western cultures. With the invention of printing and the age of the great star atlases from the sixteenth to the nineteenth centuries, the constellation images continued to display cultural resistance by cartographers to Gothicise, Christianise, politicise or simply remove them. This resilience has shown that the constellation images are in fact a living gallery of human history with images ranging from the Palaeolithic to the modern world. Furthermore, with their acceptance across a diversity of people and nations, the constellation images today have come to represent a form of world culture, in that they constitute a culture of humanity that is not linked by tribes, clans, nations, religions, or languages.

Keywords

Cosmology, culture, constellational imagery, sky, history of astronomy, cultural astronomy, celestial cartography

This paper investigates a story. It is a story that is remarkable in its resistance to change, yet at the same time receptive to the creative desires of humanity. Its roots lie potentially in the Palaeolithic period, yet it has carried its themes in an unbroken line from the Bronze Age to the twenty-first century. It is the story of the images humanity has placed in

the sky, images embedded with human lifestyle, society, and even the gods. The history of this story shows that these sky images display a persistence through time, as well as evoke an almost universality of acceptance. Such a wide acceptance challenges the unspoken but assumed argument that the constellation images are an irrelevant historical relic. I contend instead that these images represent a cultural phenomenon that has transcended national and religious identities, at least within the West.

The notion of culture has diverse definitions. Raymond Williams (1958: 82) in the 1950s suggested that culture is both ordinary—how an individual is taught to act, behave, and respond—as well as creative. His premise was that culture is at once traditional, in the handing down of customs from one generation to the next, yet at the same time flexible and open to change, allowing for human creativity. A more contemporary approach to the question of culture is that of John Bodley (1999), who argued that culture is a shared social phenomenon that is learned, passes from one generation to the next, and involves the assignment of arbitrary symbolic meanings. For Bodley, culture is an observable phenomenon, and hence he recognised the importance of images and icons as carriers of a people's cultural information.

In contrast to Williams and Bodley, Terry Eagleton focused on how culture is created rather than how it is carried. He suggests that culture is the outcome of the human will encountering the determinism of nature. He sees the word 'agriculture' as an example of such a merging and points out how customs, ritual, and family knowledge emerge out of the human will pitted against or in union with the landscape (Eagleton 2000: 2). In his view of culture, he keeps his eyes firmly on the ground. Nevertheless, within Eagleton's earth-based definition, it is possible to consider the sky. For the sky is also part of nature; it also exhibits a persistent and unrelenting fixedness, and the human will has always engaged and negotiated with the 'heavenly gods'. Eagleton also argues that culture borrows from the determinism of nature, and through its traditions and history it imposes pressure on its human carriers for its continual existence: 'Culture is what we can change, but the stuff to be altered has its own autonomous existence, which then lends it something of the recalcitrance of nature' (2000: 4). For Eagleton, a culture, once established by the blending of humanity with nature, is hard to remove.

Within Eagleton's definition, therefore, the determinism of nature, earth, and sky is a vital ingredient for the formation of culture. He sees it like the 'other parent' in union with the 'parent' of human imagination. Within Bodley's definition, cultures, once formed, produce images and symbols that, Williams would suggest, exist in a diversity of expressions

from the revered to the mundane. My aim is to show how the sky and its images exhibit the features of Williams's, Bodley's, and Eagleton's definitions of culture—a culture that has emerged from the blend of humanity with the fixedness of the sky and one which displays an autonomous existence stubbornly resisting change. At the same time, it is a culture that through human creativity has scattered its images across time into diverse objects, ranging from precious manuscripts and ceilings, to mouse mats and coffee cups.

Images in the Sky

This journey in exploring sky images as a unique culture begins with some of humanity's earliest art. The bull leaps out at the viewer from the walls of the Lascaux cave (fig. 1), dated from 17,000 BCE. With its long horns and seven dots it appears to be the sky bull of Taurus marked with the seven stars of the Pleiades. This image may, however, simply be the statement, 'We saw seven bulls'. Of greater interest is that scholars like Michael Rappenglueck (Whitehead 2000) suggest that it is Taurus. The desire for it to be Taurus is a desire to pull those forgotten artists and forgotten people with their forgotten culture closer to us, to be united across time by a common sky, all belonging to a common culture. Another piece of evidence for this desire comes from a much later period.

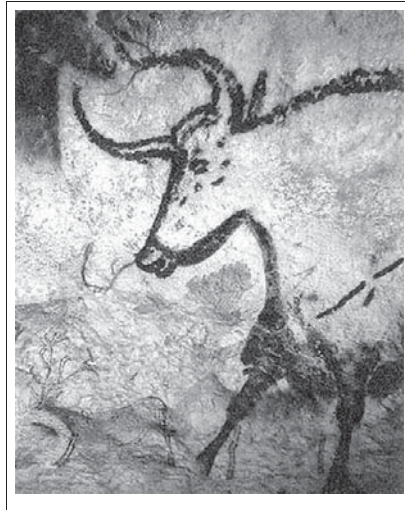


Figure 1. The bull, Lascaux Cave, France, c. 17,000 BCE.
Photo: Prof. Saxx, Wikimedia Commons.

This is the discovery of what may be a celestial bear within the traditions of the native people of North America. A Pawnee sky map dated earlier than the arrival of the white settlers in the sixteenth century apparently shows a constellation of a bear using the same stars as Ursa Major (Hagar 1900: 92; Buckstaff 1927: 282; also see Frazier 1979). This has been explained either as a coincidence that the Pawnees independently saw the stars of Ursa Major as a bear or that this constellation was a part of the oral tradition carried across the late Pleistocene period by the first humans into the northern parts of the Americas conservatively established around 15,000 BCE (Goebel, Waters, and O'Rourke 2008: 1497).

Although not as speculative as the motivation of our Palaeolithic ancestors or the star maps of the Pawnee people, the debates on the origins of the constellation images are still diverse. Archaeoastronomers A. Crommellin in 1923 and later John Rogers (1998), S. Zhitomirsky (1999: 495), and Bradley Schaefer (2002: 316) argued that the Southern Greek constellations were established in a series of groups, ranging from the third millennium to the first millennium BCE. These constellations are the four giants of the heavens, Ophiuchus, Bootes, Auriga, and Hercules, as well as the southern vessel of the Argo and the constellation Centaurus. There was also a Mesopotamian contribution. Nick Kanas (2007: 28) argued that by the third millennium BCE the names of the constellations of the Bull, the Lion, and the Scorpion were recorded in Sumerian text. Jeffery Cooley (2013: 58-64), in his summary of Babylonian and Assyrian celestial text, noted that by the Middle Assyrian period (sixteenth to tenth century BCE), 36 bright stars were listed within constellations. B.L. Van der Waerden (1949: 13-14) contended that most of these Middle Assyrian constellations appear to correspond with our current view of the sky. These include eighteen constellations that describe the path of the moon. These were listed by Francesca Rochberg (2004: 127) as the Hired One (Aries), Great Bull of Heaven, the Twins, the Crab, the Lion, the Farrow (Virgo), the Scales (Libra), the Scorpion, Pabilsag (Sagittarius), the Goat Fish, the Great One (Aquarius), the Tails (Pisces), the Swallows (another part of Pisces), the Stars (the Pleiades), the True Shepherd of Anu (Orion), the Old Man (Perseus), and the Crook (Auriga), although she also commented that the drawn images may not have been used until the middle of the first millennium BCE. However, the images were well established as descriptive text in the *Enuma Anu Enlil*, a text which originated in the last third of the third millennium BCE and expanded in the second millennium BCE (Hunger and Pingree 1999: 6-7). The text of the *Enuma Anu Enlil* is a collection of celestial omens, and it used the sky images as a way of locating a planet in the heavens. As Reiner put it, for example: 'If Jupiter

reaches the navel of the Scorpion, in the land of Elam the market [price] of one kor of barley will be reduced to one bushel', that is, by four-fifths (Reiner 1999: 27).

Separate from these arguments regarding the history of the constellation images, the image of the bull and the lion is an ancient motif, and it makes up what Willy Hartner (1965: 1) has labelled a symplegma: an intertwining of two different objects which make up a symbol. He suggested that an Elamite seal from the fourth millennium BCE is that of a symplegma of the constellations of the Lion and the Bull. Despite other seals of other combative animals appearing within the corpus of Elamite seals, he further concluded that this particular symplegma represented a calendar event, as it described the naked eye astronomy of the spring night skies for that period (Hartner 1965: 15). At those latitudes for the fourth millennium BCE, the February sunsets would reveal the constellation of the Lion culminating as the Bull set in the west. Thus the setting of the Bull in the evening marked its death, with the new incoming season having as its icon the culminating Lion. Regardless of whether Hartner's assessment of the seal is correct, this symplegma of possible sky/animal blended imagery is also reflected in later Mesopotamian art, as shown in a relief from Persepolis dated c. 550 BCE (fig. 2).



Figure 2. A later depiction of the Lion/Bull symplegma, Persepolis c. 550 BCE.
Photo: Anatoly Terentiev, Wikimedia Commons.

Clearer examples of descriptive sky images appear later in Homer's *Odyssey* and *Iliad* and Hesiod's *Shield of Heracles*, works placed into text around the eighth century BCE (Lorimer 1951: 86-87). In these texts the constellations appear to be well established with personalised names. In *The Odyssey* Book V, Homer describes Odysseus's method of navigating his vessel across the ocean for eighteen days, a possible reference to the eighteen constellations of the moon:

There he sat and never closed his eyes in sleep, but kept them on the Pleiades or watched Bootes slowly set, or the Great Bear, nicknamed the Wain, which always wheels round in the same place and looks across at Orion the Hunter with a wary eye (Homer 1986: 95).

In Hesiod's *Shield of Heracles*, which is more cosmological than astronomical, there is, however, a description of the constellation Perseus:

There, too, was the son of rich-haired Danae, the horseman Perseus: his feet did not touch the shield and yet were not far from it... On his feet he had winged sandals, and his black-sheathed sword was slung across his shoulders by a cross-belt of bronze. He was flying swift as thought. The head of a dreadful monster, the Gorgon, covered the broad of his back, and a bag of silver—a marvel to see (Hesiod 1914: II.216-25).

Coming after Homer and Hesiod was the work of Eudoxus of Cnidus (406–355 BCE), who wrote a 'handbook' for the globe—a work now lost but considered to be part of the source material for the *Farnese Globe*, a second-century Roman copy of a Hellenistic globe which displayed most of the now-considered classical constellations (Estey 1943: 114). This notion of the sky images carrying the knowledge of the celestial sphere or globe was also evident in the third-century BCE sky poem, *The Phaenomena*, by Aratus (315–240 BCE). Aratus was a student of Zeno, the founder of the Stoic school of philosophy. Aratus placed into text a description of the sky images and their relationship to each other, and he used these images to define the great circles of the celestial sphere:

Between the Tropics a Belt, peers of the grey Milky Way, undergirds the earth and with imaginary line bisects the sphere. In it the days are equal to the nights both at the waning of the summer and the waxing of the spring. The sign appointed for it is the Ram and the knees of the Bull—the Ram being borne lengthwise through it, but of the Bull just the visible bend of the knees (Aratus 1989: L.511-15).

Due to the effects of precession, the great circles of the celestial sphere gradually move against the backdrop of the stars. Therefore, a description of how any circle passed through a particular celestial image is valid only for a certain period of some hundred or so years. In this way Aratus's poetic descriptions of the constellation imagery woven into celestial geometry allows the different parts of his poem to be dated.

Aratus wrote his poem in the third century BCE, but he did not use direct observation. Instead he used a collection of visual astronomy data, some of which can be dated by the use of precession to 2000 BCE $\pm$ 300 years (Zhitomirsky 1999: 498; Roy 1984; Crommellin 1923). The implications of Aratus's poem are twofold: first, it indicates that some images of the Greek constellations were in use from the second millennium BCE, and second, in this early period these images were already used to carry

knowledge of the celestial sphere (Brady 2013). Today the celestial coordinates of right ascension and declination define the equator, tropics, or the location of a star. In the first millennium BCE, however, it was the actual constellation images that defined the sky geometry. A star like Antares, for example, was located by looking for the red star in the heart or middle of the Scorpion (Ptolemy 1915: 39). The Tropic of Capricorn was defined by a line which ran through the 'Water-Bearer's feet and the Monster's tail' (Aratus 2010: 525-26). Thus, by this period, the constellations' images had moved from mythic/divine creatures to carriers of astronomical data and were displaying what Eagleton (2000: 4) would suggest was their 'own autonomous existence'.

Consequently, in 323 BCE when Alexander the Great's half-brother, Philip III Arrhidaeus, became Pharaoh of Egypt, the Greek culture resisted the adoption of the rich sky imagery of the Egyptians. The Dendera Zodiac (fig. 3) displays this phenomenon. Located in the temple of Hathor at Dendera and, according to R.A. Parker, dated within the Hellenistic period of around 50 BCE, it shows evidence of how the Greek constellation images colonised the Egyptian sky (Parker 1974: 63). The Dendera Zodiac is a stone star map that has twelve zodiac signs, as well as other mythological or divine figures representing constellations. There is much we can recognise in this sky map from 2000 years ago—the zodiac, for example. As Parker has argued, however, there is much here that is alien from our vantage point because the Egyptian sky components failed to be adopted into the Greek constellations that were already, by this time, saturated with useful navigational and celestial sphere information.



Figure 3. Photograph of the Dendera Zodiac, originally part of the ceiling in the temple of Hathor at Dendera about 50 BCE. This image is a true sky map showing a mixture of Greek/Mesopotamian images as well as Egyptian, Musée du Louvre.

Image: Sebi, Wikimedia Commons.

Indeed, there is more that is familiar for the twenty-first-century viewer on a Babylonian border stone from 1500 BCE than on the great astronomical ceiling of Senmut, created in the same period by an Egyptian architect (figs. 4, 5). While Senmut's ceiling is considered to be the oldest known astronomical display in the world, as Donald Etz (1997: 143) has pointed out, it raises little interest amongst historians of astronomy. This lack of Egyptian sky components in our contemporary images suggests that the blended Mesopotamian and early Southern Greek imagery had, before they encountered the Egyptian constellations, become culturally robust by being embedded with astronomical knowledge.



Figure 4. Section of a boundary stone showing the Hydra, Leo, and the Scorpion. Image: Trustees of the British Museum.

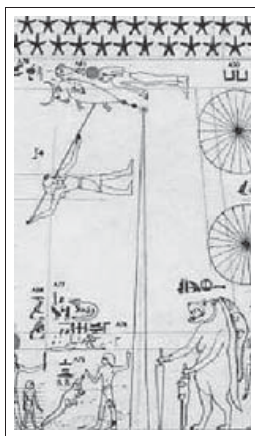


Figure 5. Section of the ceiling from the tomb of Senmut, 2nd millennium BCE. Image: Wikimedia Commons.

By the second century BCE, the astronomer Hipparchus (190–120 BCE) had compiled the first known star catalogue, which is believed to be one of Claudius Ptolemy's (90–c.168) prime sources (North 2008: 98–99). Ptolemy was concerned with the positions of stars and noted, borrowed,

and re-observed 1026 stars in order to help find the rate of precession.¹ Ptolemy used the tradition of the day and described each star in relation to its position within the now Hellenised images of the constellations. In doing so, far more than Aratus some 400 years earlier, he embedded fine image detail into his text. Each star was located and defined as part of, for example, a girdle, a buckle of a belt, the gem in a tiara, and so forth (Ptolemy 1998: 341-400). Figure 6 is an image of the stick figure of Bootes showing a few of Ptolemy's named stars via their position in that image. These finely detailed star-image locations are now known as the Ptolemaic positions. As Ptolemy's *Almagest* became a revered work from the classical period right through to the seventeenth century, the images themselves were protected by their astronomical usefulness and their association with his name. Indeed, as I shall discuss presently, only once in the last 2000 years were Ptolemy's star positions challenged, and that was in 1603 by Johann Bayer. Bayer's mirror-imaging of Ptolemy's positions, however, in which the right hand became the left, were dismissed and overthrown by his contemporary, Johannes Kepler, and again later in the eighteenth century by John Flamsteed.

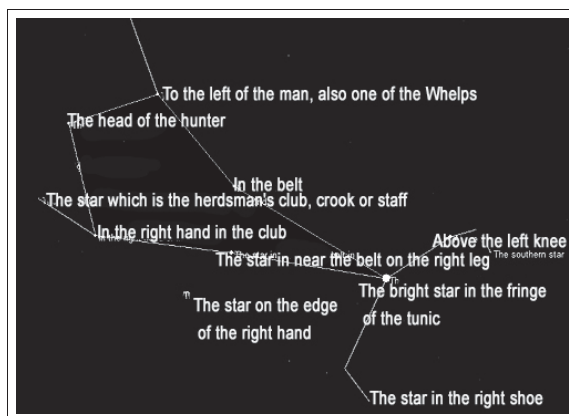


Figure 6. Bootes with some of Ptolemy's star's positions, named within the image so as to locate each star in its unique position in the sky. Image: Bernadette Brady.

Meanwhile, the sky images, from possibly as early as the fourth millennium BCE or, more conservatively, as late as the first millennium BCE, maintained their form and visual astronomy data until the end of the classical era. From this post-Ptolemaic period until the invention of the printing press, the images moved into medieval manuscript, frescos,

1. Ptolemy actually listed 1028 stars but two of these were duplicates.

and Islamic globes (Rogers 1998: 82). This was principally through illustrations based on Aratus's *Phaenomena*, in the case of Islamic works, or Cicero's Latin version of Aratus in the West (Beer 1967: 183). Often linked with Aratus's work was the *Poetica Astronomica* of Gaius Julius Hyginus (64 BCE–17 CE), a work that focused on the ethno-astronomical data of the mythology of the constellations as described by Ptolemy rather than naked eye astronomy (Whitfield 1995: 33; Condos 1997). Throughout the medieval era the constellation images fuelled by the work of Aratus and Hyginus underwent stylistic changes, yet they still maintained their association with Ptolemy's star/image descriptions.

Printed Maps

It was not until the invention of the printing press that the constellation images were seriously challenged. The first known printed sky maps were produced in 1482 by Erhard Ratdolt from Augsburg, Germany. Ratdolt was considered to be one of the masters of early printing, and he developed the techniques that gave the world the first book faceplate (Redgrave 1894: 6–7). As he developed printing skills far superior to others of his profession, he sought publications worthy of his talent. He produced two books that were both Latin versions of classical works. These books were the first printed edition of Euclid's geometry that, to the amazement of other printers, included the diagrams as part of the printed text, and the *Poeticon Astronomicon* by Hyginus (Ratdolt 1482), complete with images. With both these works Ratdolt was more concerned with the images and the typeface than with the accuracy of the printed word (Heath 1920). In his printing of the *Poeticon Astronomicon*, each constellation was a separate image and the stars were not precisely located.² He printed his constellations using a geocentric orientation, the view of the stars as seen from the earth, with the exception of the constellation Aquarius. His publications went through many editions and reached a large readership. From Ratdolt's and his readers' point of view, the important information was the image's link with the mythology, rather than their accuracy as star locators.

Ratdolt took his sky images from different, now unknown medieval manuscripts. In his selection he drew on the style of images used by Michael Scotus (1175–1232) who, in his *Liber de signis*, had moved away from the classical or Aratean style and produced Gothic and Romanesque

2. Ptolemy's list-map places every star in a specific location *within* every image, using the image itself as the reference point. Ratdolt's stars were, however, randomly placed in the images, ignoring Ptolemy's descriptions.

images (Ackermann 2001). Ratdolt's Water Carrier (fig. 7) is thus dressed in medieval clothing and pours his water into a dish, whereas Ptolemy describes him pouring water into the mouth of a great fish. The noble warrior king Orion (fig. 8) is shown as a medieval nobleman in full battle armour, and the skin of a lion, which Ptolemy hangs from Orion's left arm, has been turned into a shield. Ratdolt may have tampered with Ptolemy's images to follow the medieval tendency for Gothic images. For a widely based readership, however, he removed the stars from their list maps and provided them as images on the printed page, freeing these sky images from the confines of frescos and rare manuscripts.

Astronomers tended to consider Ratdolt's contribution to the world of celestial cartography as minor. Nevertheless, his mass production of sky images had an impact on cartography, because list-maps of the sky, such as had been produced by Ptolemy, were no longer thought to be adequate. If cartographers wanted their work to be widely accepted, they were now dependent on both the continual improvement of stellar plotting as well as on their ability to depict the imagery of the sky. Indeed, for over 300 years after Ratdolt, up to and including the *Uranographia* of Johann Bode (1747–1826), the role of the artist within celestial cartography was valued. If the images of the constellations are a culture in their own right, then by being instrumental in their mass production, Ratdolt is one of its significant contributors.



Figure 7. Erhard Ratdolt's Aquarius, in Hyginus, *Poeticon Astronomicum*, published by Erhard Ratdolt, 1482. Digitised book in public domain.



Figure 8. Erhardt Ratdolt's Orion, in Hyginus, *Poeticon Astronomicum*, published by Erhard Ratdolt, 1482. Digitised book in public domain.

Some 33 years later, in 1515, the German artist, engraver, and mathematician, Albrecht Dürer (1471–1528), produced the first real astronomical star maps containing both images and accurate star positions. Rather than a globe, he produced flat maps showing a large portion of the sky in two polar projections: one containing eighteen northern constellations (fig. 9) and the twelve zodiac constellations; and the other containing fifteen southern constellations. 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, in which the images were oriented as if they were placed on a celestial globe such that one looked down onto the constellation from above, rather than the geocentric view of looking up to the constellations from the earth.

Dürer worked with Conradus Heinfagel (c. 1470–1530), a mathematician from Nuremberg, and so was able to include coordinates and scales with his celestial images. This meant that, for the first time, astronomers did not require the constellation image in order to locate a star. Antares was no longer found by looking to the heart of the Scorpion but could be located by Dürer's coordinate system. Up to the time of Dürer's work, cartographers were expected to be both mathematician and artist or mathematicians who worked with artists. Dürer, however, freed astronomy from the need for artistry; yet the cultural momentum of the constellation images was such that the link between art and mathematics was maintained for another 400 years. Although Dürer's maps had little impact at the time on the public, his development of a flat map laid the foundation for future cartographers, and he provided the now classical visual interpretation of Ptolemy's text-based images (Holden 1890: 20).

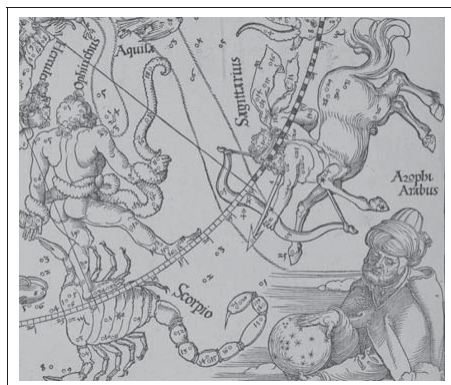


Figure 9. Section of the northern planisphere by Albrecht Dürer. Celestial Map of the Northern Sky, showing Scorpio, Ophiuchus and Sagittarius, 1515 Woodcut. Image: Trustees of the British Museum.

Dürer's or Heinfagel's choice of the globe-view for the orientations of the constellations did not, however, settle the question. If the bull of the Lascaux cave is a representation of a sky image, then it is drawn from the geocentric perspective, since drawing a sky image by looking up from earth is the natural view. In 1532 Johannes Honter (1498–1549), known as the Luther of Transylvania, produced *Imagines Constellationum Borealiū* and *Imagines Constellationum Australiū*. These two star maps were published as part of the collected works of Claudius Ptolemy (Ptolemy 1541). Honter was influenced by Dürer's and Heinfagel's mathematics, yet he returned to Ratdolt's geocentric perspective (Warner 1979: 123). In the early sixteenth century there had been a resurgence of the Ptolemaic and Aristotelian geocentric models of the solar system (Heninger 1977: 53). Honter's decision to create his celestial maps from the geocentric perspective, therefore, may have been a reflection of this new enthusiasm for Ptolemy, conveniently in rapport with the new Lutheran doctrine of simplicity and reality—to wit, the stars viewed as they appear to everyman and everywoman. Additionally, Honter rejected the classical images and changed some of the figures into northern Europeans dressed in heavy clothes and with thick beards. His work proved popular and went through many editions, making a lasting impact. Unlike Dürer and Heinfagel, whose mathematics and new idea of scale and coordinate system made their work useful for actually locating the stars in the sky, Honter's maps were mathematically flawed, the coordinate system being a full 30° out of alignment. Nevertheless, and perhaps surprisingly, this mathematical fault did not detract from the work's popularity. As Kanas has claimed, people wanted the maps for their constellation images (2007: 142).

It was some 50 years after Honter that the first accurate geocentric sky maps were produced. Giovanni Paolo Gallucci (1538–1621) was a mathematician and astrologer who lived in Venice in the mid-to-latter part of the sixteenth century. In 1588 he produced *Theatrum Mundi, et Temporis*, an astrological handbook that contained tables and diagrams for explaining celestial mechanics, as well as a set of star maps. In this work Gallucci presented all 48 of Ptolemy's constellations using the accuracy of Copernicus's new star catalogue. Gallucci (1614: 91) also used his knowledge of perspective and geometry and linked a trapezoidal projection to a stellar coordinate system so that the location of the stars could be read from the margins in both celestial latitude and longitude. It was Gallucci, therefore, who produced the first useful celestial atlas; it was geocentric in its orientation and accurate in its positioning of stars. In this seeming burst of freedom and creativity, Gallucci produced truly remarkable images for his atlas. He depicted the

classical constellations in a style that appears modern. In this respect he was at the same time handing on the classical images to future generations while also exhibiting his own creativity. His images depict Bootes the Hunter as an ancient hunter-gatherer, barefoot, and wearing only a loin cloth or short tunic, while his Cassiopeia foreshadows Picasso's pink period, showing an uninhibited and relaxed classical woman reclining on her throne (fig. 10).

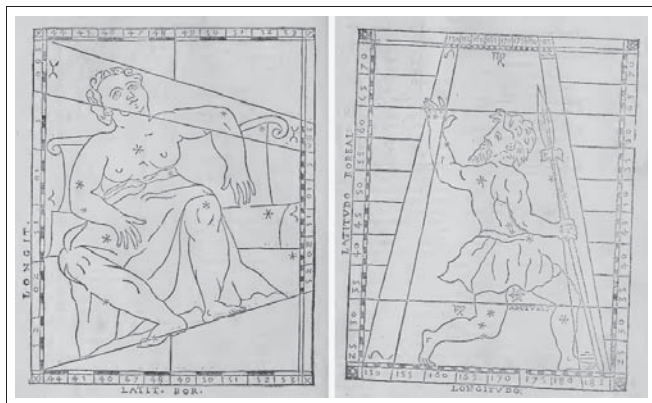


Figure 10. Gallucci's *Theatrum Mundi, et Temporis*, 1614, Bootes (right) and Cassiopeia (left). Images: Gallucci, Giovanni Paolo, *Theatrum Mundi, et Temporis*, Granada: Sebastian Muñoz, 1614. Digitised book in public domain.

By this stage, the long history of the expression of star images had seen many style changes yet nevertheless had remained consistent with regard to their subject matter of hunters, warriors, mythical creatures, animals, scales, crowns, and insects. These images were also now represented in two ways: the globe-view and the earth-view. By the late sixteenth century, however, another factor came into play. In 1598 Tycho Brahe (1546–1601) completed the most comprehensive and extensive star catalogue since Ptolemy and thus laid the foundations for a new generation of cartographers. The most influential of these was Johann Bayer (1572–1625). In 1603 he produced the *Uranometria*, which was regarded as the best scientific celestial cartography endeavour of its day. Bayer's work not only contained the 48 Ptolemaic constellations, it also included twelve new southern constellations and thus began the effort to name the southern sky (Bayer 1603). The *Uranometria* contained 51 star charts and was a true atlas, as each page had a grid coordinate system, enabling a star's position to be read in relationship to the sky as well as to other constellations. In addition, Bayer developed the system first used 51 years earlier by Alessandro Piccolomini (1508–1578), who labelled the

stars in order of brightness within a constellation using alphabetical letters (Piccolomini 1552). Piccolomini chose Latin, but Bayer employed the less Catholic Greek letters. His maps were accurate and followed the geocentric orientation established and made acceptable by Ratdolt and Honter. These maps were popular with non-astronomers because of their beauty, but Bayer turned all of his figures outwards to face the outer solar system. Although Ptolemy had described the star Betelgeuse as 'the right shoulder of Orion', Bayer's warrior Orion now became left-handed (fig. 11). Bayer's desire to allow his figures to look outward rather than down upon the human race outweighed the cultural pressure to maintain Ptolemy's traditional star positions. For reasons known only to himself, Bayer was willing to sacrifice one of the cartographer's ancient traditions in order to achieve this reversal.



Figure 11. Orion from Johann Bayer's *Uranometria* 1603. In this image Orion holds his club in his left hand. Image: Wikimedia Commons.

Johannes Kepler (1571–1630) disagreed with Bayer's reversal of Ptolemy's image-based star positions. In 1606 in Prague, Kepler published a single constellation figure, *De Stella Nova in Pede Serpentinae*, which showed a new star (fig. 12). This star had appeared in Ophiuchus at the same time as a triple conjunction of the planets Mars, Jupiter, and Saturn. His figure is clearly Bayer's Ophiuchus from 1603, but it now turned around to restore Ptolemy's star positions. Bayer produced a beautiful and accurate celestial atlas, yet no other cartographer followed his example, even though his work was considered of great importance astronomically. His system for defining the order of magnitude of the stars within a constellation by the Greek alphabet is universally accepted and carries his name but not his reversed images.

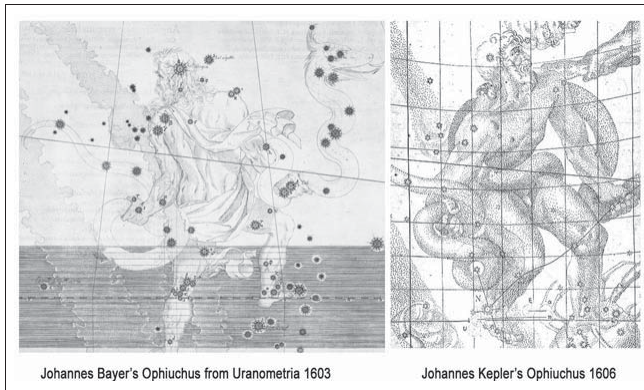


Figure 12. A comparison of Johann Bayer's Ophiuchus from *Uranometria*. Image courtesy of Barry Lawrence (Ruderman Antique Maps—RareMaps.com) showing the reversal of stellar positions and Johannes Kepler's response in 1606. Kepler's image: Wikimedia Commons.

In this period Julius Schiller (1580–1627) produced a celestial atlas that attempted to replace all the classical constellations with Christian images. After help from Bayer, in 1627 he published the *Coelum Stellatum Christianum* (Schiller 1627) representing the celestial hemispheres as the two parts of the Bible. The constellations of the northern hemisphere focused on the New Testament, while the Old Testament was embodied in the southern hemisphere images. Aquarius became Abraham and Isaac, Aries became Christ's Manger, Cancer turned into the Scourge of Christ, and Bootes became Saint Sylvester. In 1661, Andreas Cellarius (1596–1665) produced a new edition of Schiller's Christian constellations. Published in Amsterdam as *Harmonia Macrocosmica*, Cellarius improved the artistry of the original images and, indeed, made the concept of a Christian sky more popular by abolishing all the 'pagan' images (Cellarius 1661). This was to be the first serious attempt in the history of constellations from the Sumerian text of 3000 BCE to the then-present day to replace all the constellation images, and it was unsuccessful. Due to Cellarius's 'apostolic fever', other astronomers did not accept his images (Ashworth 1981: 60).

Politics brought another challenge to the expression of the sky's images. In 1690, Elizabeth, the wife of Johannes Hevelius (1611–1687) posthumously published his great *Prodromus Astronomiae*. In this work Hevelius introduced ten new constellations including a political one named *Scutum Sobiescianum* (Hevelius 1690), which was the coat-of-arms of his patron (Ashworth 1981: 60). When this coat-of-arms was later renamed *Scutum*, the Shield, it lost its political overtone. The starry sky

was now, however, moving into the arena of political propaganda and this continued into the late seventeenth and early eighteenth centuries, during which a variety of celestial atlases and globes were produced. One notable example was by Erhard Weigel (1625–1699), a professor of astronomy at the University of Jena, Germany, who in 1699 produced a celestial globe that was an optical planetarium.³ Weigel did not draw on the classical images of Ptolemy but rather the coats-of-arms of the royal families of Europe. In Weigel's sky the all-conquering and all-powerful warrior Orion, whom the Egyptians considered their pharaoh, became the double-headed Austrian Eagle (Franklin Institute). His imagery was designed either to flatter the European courts or to make a statement—perhaps true, perhaps propaganda—about the prevailing European balance of power. Like the Christian constellations of Schiller and Cellarius 150 years earlier, however, as Jürgen Hamel (2010: 34) concluded, Weigel's cartographic work was more agitprop than astronomy.

At this time the question of longitude was one that occupied the minds of British astronomers. To help this endeavour, John Flamsteed (1646–1719) slowly compiled a catalogue of stellar observations over a period of 43 years (Kanas 2007: 172). Flamsteed held the position of the first Astronomer Royal of England 1675–1719 and named this catalogue the British Catalogue of Stars (Flamsteed 1729). But it was not until 1725 that his star catalogue *Atlas Coelestis*, having been edited by his wife Margaret, was published posthumously. Flamsteed published *Atlas Coelestis* in part 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. Flamsteed considered this work to represent a major flaw in celestial cartography. Thus he went to considerable trouble to find an artist capable of drawing the images to his satisfaction, eventually finding Sir James Thornhill, the man who had created murals in many of Christopher Wren's great buildings, including St Paul's Cathedral (Whitfield 1995: 100). Flamsteed wanted to restore Ptolemy's star positions and re-establish the classical geocentric imagery—with the figures looking down on humanity—and to ensure that all his measurements were perfect. His perfectionism delayed the publishing of his observations and star catalogue, which frustrated Isaac Newton (1642–1726) and Edmund Halley (1656–1742),

3. The globe was constructed in a manner that allowed a lamp to be placed in a hollow centre. The light from this lamp shone through an embossed copper sphere, which used holes to represent the stars. The observer looked into the globe through one of four large holes, and could see stars in their correct positions as points of light. Weigel also produced a globe large enough to enable a person to walk inside.

who needed Flamsteed's star catalogue for their own work in trying to calculate longitude. They pressured Flamsteed to release his work; Flamsteed's response was recorded in a letter he wrote in 1705 quoted by Deborah Warner (1979: 82): 'Sir I. Newton would have the great catalog printed without the maps. I cannot consent to so sneaking a proposition.' Newton and Halley prevailed, however, as Flamsteed sent them a preliminary manuscript of his catalogue and some of his observations under the condition that only his observations were to be published. Despite this request, Newton and Halley printed 400 copies of Flamsteed's complete catalogue without crediting its author. Flamsteed tracked down and destroyed some 300 copies (Kanas 2007: 173). Apart from Flamsteed's desire to protect his work, his prolonged reluctance to release his catalogue was due in part to the huge effort that went into preparing the images; this suggested that he considered the role of the classical images of the constellations to be of equal value to the star locations themselves.

By the early nineteenth century, accurate and complete celestial maps were becoming very dense as new stars and nebulae were discovered through the use of the telescope. With all this new visual information competing for space on the cartographer's map, the question of the need for the constellation images was reconsidered. By the dawn of the nineteenth century, Johann Bode (1747–1826) in Berlin was completing what came to be known as the last great star atlas, the *Uranographia* of 1801. Bode was a self-taught astronomer and became the director of the Berlin Academy of Science, a position he held for over 40 years (Hockey 2007: 141). He produced the *Uranographia* by using Ptolemy's star-image positions and the classical geocentric orientation (Bode 1801). He used the work of Bayer, Hevelius, and Flamsteed for the new constellations and stars. His atlas contained 99 constellations, with at least five asterisms or subgroups. Ptolemy's work had contained 1026 stars; Bode's masterpiece contained over 17,000 stars and 2500 nebulae. From this point forward, according to Kanas (2007: 183–84), professional star atlases for astronomers were stripped of images. Yet some of the images in Bode's *Uranographia*—images such as the Bull, the Lion, the Snake, as well as more complex images such as Pabilsag the fearful warrior of the Babylonian zodiac—had and continued to maintain a visual integrity for over 5500 years. Pabilsag, from an eighth-century neo-Babylonian boundary stone, for example, demonstrates the remarkable constancy in image with contemporary renditions of the constellation Sagittarius (fig. 13).



Figure 13. Pabilsag from eighth-century neo-Babylonian boundary stone (image courtesy of the British Museum) and a contemporary image of Sagittarius. Starlight celestial software (permission given).

By the early twentieth century, astronomers' maps, stripped of their artistry and mythology, were visually barren to the uninitiated or uneducated. In 1922 astronomers decided officially to organise the constellations of sky, and the International Astronomical Union divided the celestial sphere into 88 constellations, which included all of the classical constellations along with 44 new constellations. By 1930 the boundaries between the constellations were being defined in terms of right ascension and declination (Davenhall and Leggett 1997). Just as the Greeks had difficulty in standardising the location of the seasonal zodiac signs amongst the stars, however, such astronomical boundaries need to be altered periodically, as precession skews the constellation images against the mathematical grids.

With astronomy no longer perpetuating the images of the constellations in the artwork of the great celestial atlases, the images have moved into popular culture. In the early twenty-first century there is a profusion of zodiacal images, from jewellery to clothing to body tattoos. Heaven's objects are used for the naming of confectionary, such as the Milky Way chocolate bar, while constellation names are appropriated in an endless list for casinos, cinemas, insurance companies, shipping lines, newspapers, navigational devices, and even 'Taurus' pistols. As Williams, cited earlier, stated, culture is both ordinary and creative. The zodiac sign coffee cup in the office is deeply ordinary and at the same time a creative use of a largely universally recognised constellation image for the identification of one's cup. Despite the starry images having lost their utility in astronomy, their robustness in everyday life is widespread.

By acknowledging the age of many of the stellar images, the sky can be viewed as a cultural gallery. Our Palaeolithic ancestors potentially placed some of the images we have today in the sky, such as perhaps the

bull in the Lascaux cave. As Richard Allen has shown, a constellation like Bootes, seen as a herdsman and the hunter, was ancient by the time of Homer, and may be an artefact from our Neolithic ancestors (1963: 93). The constellations of Orion, the Pharaoh of the Egyptians and the ancient Greek warrior, and Auriga the Charioteer, thought to be a shepherd and remodelled by the Greeks (Jobes and Jobes 1964: 126), are also voices from the Bronze Age. Constellations such as Telescopium and Horologium, for their parts, which were added to our sky in the eighteenth century, are artefacts of early modernity (fig. 14). In contemporary times there are the deep-space imagery, galaxies, and nebulae that humanity continues to name, such as the Horse Head nebula, the Sombrero, and the Eye of God.

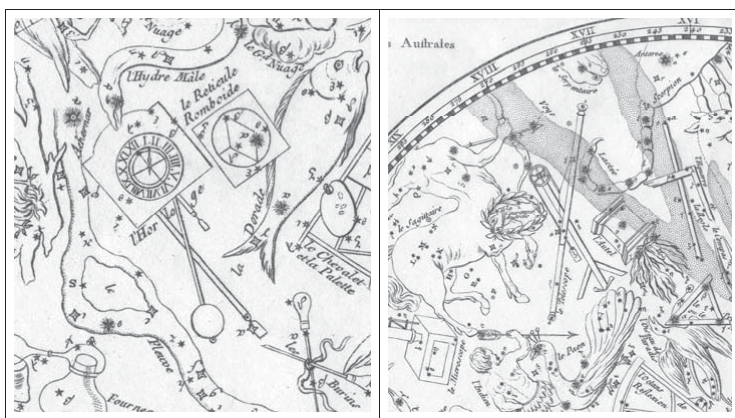


Figure 14. Nicolas Lacaille (1713–1762) images from *Atlas Celeste*, Telescopium (right) and Horologium (left). Images: courtesy of Ian Ridpath.

Conclusion

The heavens have always been a palate for human imagination. It would seem that their story emerged when the images from Mesopotamia blended with the giants of the southern Greek constellations. These images then became linked with the scientific thinking of the Greeks who used them to carry information of star locations and the celestial sphere. Empowered and protected with this knowledge, they resisted merging with the Egyptian view of the heavens, and 2000 years later, having gained authority by virtue of their antiquity, they survived the efforts of Christianity to repaint the heavens and repelled the political propaganda of the eighteenth century. As they lost their usefulness in terms of astronomy, they nevertheless maintained a place within the

world of amateur sky viewing, enhanced in the twenty-first century by applications on hand-held telephones and other devices. Their images and names have thus continued to gain vitality in popular culture. Instead of becoming a relic or being placed in a museum of disused scientific notions, these ancient images of the sky have grown in cultural importance yet further with the discovery and naming of the southern skies and the advent of deep-space photography.

This discussion of the perpetuation of images from antiquity to the present day may seem obvious, but the robustness of these images is suggestive of similarities between diverse cultures. In reconsidering the arguments of Bodley (humanity's tendency to generate symbols created culture), Williams (culture is diverse in its everyday representations), Eagleton (culture is created wherever humanity encounters the 'recalcitrance of nature'), and Hartner (the idea of a symplegma), I contend that a culture is formed by the symplegma of humanity with the sky.

When the 'nature' component of a culture-forming symplegma is a landscape, then the resulting culture is territorial, tribal, political, or nation building, and 'owned' by a particular human group. On the other hand, when the 'nature' component of the symplegma is a shared night sky that knows no national boundaries, then its human observers create a culture that transcends such borders. To reiterate, when viewed in this manner the constellation images emerge out of a symplegma of humanity and the sky. They gain their mythology and stories from the imagination of their human parent and their divine immortal nature from their sky parent. They constitute a culture of humanity that is not bound by tribe, clan, nation, religions, or language.

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