

Myths of Mesoamerican Cultures Reflect a Knowledge and Practice of Astronomy

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This interdisciplinary unit will focus on two myths from ancient Mesoamerica, and the role that naked-eye astronomy and calendrics played in the overall development of mythology in this region of the world.

Purpose

The purpose of this unit is to enhance the students' understanding of the cosmovision held by the ancient people of Mesoamerica, especially that of the Maya and the Aztec. Their cosmovision, the way they saw the world, is revealed through their myths which were recorded in books known as codices. The various surviving codices reveal that these people were avid watchers of the night sky. Based on years of meticulous observations, they discovered a repeating pattern in the movements of the stars, planets, sun and moon. These predictable patterns suggested that nature was ordered. It became the ultimate preoccupation of these people to understand this order and to incorporate it into the structure of their civilizations. Another aim of this unit is to introduce students to basic concepts in astronomy and calendrics so that they may gain an appreciation for how much these "ancient" people knew about the universe.

Narrative

The Purpose of Myths

All cultures have a mythology, a collection of stories that tells how the world was created, who or what did the creating, how long it took, how various creatures and objects came into being, and what role or function each plays in the overall scheme of things. They also give clues to how one is suppose to behave, and what is the proper relationship between things. The Maya and the Aztec were no different in this regard, though it did take the world some time to discover the richness of their stories. Our understanding of them is not complete. New discoveries are continually being made that add a new dimension to who these people were. Their descendants are alive today telling the stories of how they came to be. And a number of them still practice skywatching and keeping track of time the way their forefathers did. So this knowledge is not dead; this way of knowing is still valid for a group of people.

Two Orders of Mythology

Myths on one level are stories about gods and goddesses, about animals with human-like qualities, or about creatures with supernatural abilities who interact with humans and participate in the creation, maintenance and even destruction of life. This is the most common understanding of the word myth. Yet, there is another definition of this word as proposed by Joseph Campbell in his book, The Power of Myth. Actually, there are two very distinct orders of mythology, according to him. There is the nature-oriented mythology and the socially-oriented mythology. The first is one in which we are part of a whole, the whole of nature, a natural creature. The second defines each of us as a member of a particular group.

Each culture has its own unique mythological tradition, rituals, ceremonies and prayers. These two orders interact in the sense that "they integrate the individual into his society and the society into the field of nature. It unites the field of nature with my nature. It's a harmonizing force." (Campbell p. 55) Elsewhere he states that, yes, myths are stories about gods, but a god "is a personification of a motivating power or a value system that functions in human life and in the universe-- *the powers of your own body and of nature*. The myths are metaphorical of spiritual potentiality in the human being, and *the same powers that animate our life animate the life of the world*." (Campbell p.22, *italics mine*.)

From Campbell's perspective then, the function of the myth is to "relate you to your nature and to the natural world, of which you are a part." (Campbell p. 22) You have a place, and not necessarily a "special" place, in the order of things and must be brought into awareness of this fact. Perhaps another way to state this would be to say that there is a natural order and harmony to nature, and what the individual or group must do is fit in. (Note that many groups did, and still do, perceive themselves to be something special; hence all the tribal names in which they call themselves "The People," "Us," "human beings," or similar words.) Campbell also points out that there is a desire to be in accord with the grand symphony that is this world, to be in concert with its rhythms, to minimize chaos, and to maintain order and stability.

It is generally believed by most archaeologists that the ancient people of Mexico and Central America were attempting to place themselves in harmony with nature through careful astronomical observations and by noting the great cycles of movement made by celestial bodies. Based on these cycles, astronomer-priests made calculations which then determined the dates for performing particular rituals, conducting specific ceremonies, reciting special prayers, retelling sacred stories, inaugurating the new king, and when to go to war. Their daily activities were determined by knowing what time it was in a religious, or ceremonial sense, so as to be doing the right thing to ensure that the gods, or the various forces of nature, would continue to look down on them favorably and keep the world going.

Advanced Civilization of the Mesoamerica

The people of ancient Mexico and Central America had a highly advanced civilization as revealed by their art, sculpture, architecture, written records, and their calendric documents which revealed that "mathematics and astronomy were among their intellectual hallmarks." (Nelson p.10) Collectively these people are known as the Mesoamericans, but each is known by a unique name. In basic chronological order, they are known as the Olmecs, the Pre-classic Maya, the Zapotec, the Classic Maya, the Toltecs, the Mixtec, and the Aztec. Their kingdoms spanned approximately one thousand seven hundred years and were on par with civilizations of the Old World. The Classic period of Olmecs chronologically coincides with the Golden Age of Greece, while that of Pre-Classic Maya (also known as the Protoclassic period) and Classic Maya corresponds with the reign and the glory of the Roman Empire, up through the rule of Charlemagne. At a later date, the Aztecs were conquering surrounding tribes while in the Old World the Crusades were coming to an end and Constantinople was in decline. (See Table 1.)

The region these people occupied was roughly from what is now southern Mexico and the Yucatan, all of Belize, Guatemala, El Salvador, western and southern Honduras, and along the Pacific side of Central America down to present day Costa Rica. Though they were speaking a

number of languages, which were often not even related, and though they did have distinct cultures, they did hold some cultural traits in common. These included hieroglyphic writing, screenfold books, masonry ballcourts with rings, an interest and knowledge of astronomy and mathematics, three calendars: a 260 day religious one, a 365 day vague year, and the Long Count calendar, and a common pantheon of gods, goddesses, and monsters. In some cases these gods names were the same, while in others cases distinct names were given to the same god. To confuse matters even more a number of gods have multiple names and attributes. For example, the Aztec god, Quetzalcoatl is a snake, bird, inventor of civilization, and a god of water and the southwind. These creatures all have a Nahuatl name and are aspects of Quetzalcoatl, most of the time. Yet he is best known as the "plumed serpent", a creator god. In another important manifestation he is the wind Ehecatl, and appears as the breath in living things. But in the Maya mythology, Quetzalcoatl is known by the name Kukulcan or as Gucumatz. (it should be noted that Gucumatz is a more recent addition to the pantheon of Mayan gods. He is more important in Postclassic Maya myth and legends dating from 900-1521 A.D.).

The Importance of Nature

The mythology of Mesoamerica is intimately entwined with the natural world. "Mayan myth derives to a large degree from sky observations." (Jenkins, 1994) There are gods or a god for: the four cardinal directions, for lightening, thunder, fire, sky, water, corn, darkness, daylight, earthquakes, stars, planets, the sun and the moon, etc. They were an agricultural people; therefore events related to planting and harvesting were of supreme importance. These gods made the people's very existence possible, and the people believed they owed a debt to their gods, who demanded worship, prayer, and sacrifice. As far as they were concerned the continuation of life was not a guarantee; it was a negotiated contract, in essence. If they performed the correct ceremonies at the correct time, then order and harmony were maintained. This increased the chance that things would continue moving in their normal paths, maintain their specific functions, and the world would appear less chaotic, less unpredictable. If the proper ceremonies and rituals were not performed at the proper time, then the world might be destroyed. As noted by Ralph Nelson, "In its full-blown form, Mesoamerican religion was directed toward insuring the continuation of the world." Therefore, they had to devise a system for keeping track of time, hence the development of calendars.

The Mesoamericans became preoccupied with creating and maintaining two distinct calendars, one of 260 days (the tzolkin) and the other of 365 days (vague year calendar), which told them when to carry out particular rituals. In addition there was the Long Count calendar which has been running day after day in a linear fashion since the beginning of this present World Age, since August 12, 3114 B.C., according to the Maya. Not only did they keep detailed records of time, but they also kept detailed records of lunar and solar eclipse cycles, the cyclic phases of the moon, the synodic period of the planet Venus, the apparent movements of their constellations, the occurrences of comets and asteroid showers, the precession of the equinoxes, and the summer and winter solstices. It is of importance to note that the creation and destruction myths are often related to calendrical and astronomical events. In other words, astronomy and mathematics played a significant role in the development of these cultures' cosmovisions.

Calendrics in Mesoamerican Creation Myths

Obviously, the calendar and astronomy played a central role in the ancient Americans' daily lives. Indeed for the ancient Mesoamericans a "vital cause-effect relationship existed between the events of daily life and motion of the heavens." (Aveni p. 40) The calendars and astronomical observations guided them with respect to the planting and harvesting of crops, the designing and construction of buildings, the conducting of ceremonial dances, storytelling and rituals, and it figured in their creation myths and provided the basis for divination. "In Mesoamerican thought, the calendar concerned the definition and ordering of space as well as time." (Taube p. 13) According to some archaeoastronomers the calendars represent the Mayas' attempt to demonstrate the union of space and time, while the writings of the priests point to a single goal: "... to establish an order to human existence by bringing the naturally occurring astronomical cycles into accord with the 260-day calendar." (Aveni p. 203) For an in-depth explanation of this idea see chapter IV. of Aveni's *Skywatchers of Ancient Mexico*. This is reminiscent of the physicist Stephen Hawking's, and other physicists, quest for a unified field theory. The Maya priest-astronomers used celestial events to glorify astrology, and to ensure that certain political "appointments" would be accepted by the people. For example, the priests used their knowledge of astronomical events to "predict" that a lunar or solar eclipse would occur upon the ascension of king so-and-so to the throne and that this would be proof of his legitimacy as ruler.

The most important calendar was the *Tzol kin*, the ritual calendar composed of 260 days. Each month had twenty days, each carrying the name of a specific god. And each day bore a number from one to thirteen. The thirteen numbers were assigned consecutively to the twenty days. Thirteen times twenty equals 260. The vague-year calendar of 365 days was composed of eighteen twenty-day months with five final days. Eighteen times twenty plus five equals 365. "The 365 vague year calendar ran concurrently with the 260-day calendar, with each vague year being named by a specific 260-day date. Due to the permutations of these two cycles, a particular named vague year, such as 2 Reed, would not recur until the completion of fifty-two vague years." (Taube p. 13) In other words, the two calendars ran simultaneously. Envision the two calendars as two wheels, side by side, with their cogs intermeshing-- much like the gears in a watch. The important idea concerning these two calendars is that though they have the same day names, there is only one day in which the day name is exactly the same on both calendars. This phenomenon occurs only once in 52 years and represents the end of one cycle of time. It was called the *Xuihmolpilli*, the binding or bundling of years. In order to celebrate this event a New Fire ceremony was conducted wherein all the fireplaces in the country were extinguished and lit anew from the sacred flame. This sacred flame was lit by the attending high priests in the chest cavity of a sacrificial victim. In this manner it was a blessed flame. Furthermore, all the statues regarded as gods were cast into the water, and all the hearth stones were tossed out of people's homes. Everyone was involved in sweeping out the trash from his home, (i.e., throwing out the old and ushering in a new beginning?). A true sense of renewal was felt. In one website account, the ASTRO list version of "Orion in Mesoamerica," the hearth stones are associated with the stars Rigel, Saiph and Alnitak in the constellation of Orion.

Regardless of the sense of renewal that was felt, this was still an especially worrisome time as the forces of creation and chaos could surface again to do battle. The end of a 52 year cycle might signify an ideal time for the sun god to break his agreement with humans to rise every day. "The Aztecs were especially doubtful, and put out all the fires at the end of the 52 year

cycle (when the two wheels of the calendar meshed to repeat an identical day), a seemingly logical time for the gods to break the contract of life." (Nelson p. 17) This very notion is found in the Aztec myth concerning the creation of the fifth sun, Nahui Ollin, which is recounted below.

Common Elements Found in Mesoamerican Calendars

It is enlightening to talk about the general construction of Mesoamerican calendars as they reveal some information concerning how the ancient Americans viewed their universe. It will be helpful to refer to the drawings in Aveni's book, *Skywatchers of Ancient Mexico*, on page 155. The calendars in his book are from various codices. First thing to notice about most of these calendars is the partition of them into four quadrants depicting the four regions of the world, or the cardinal directions of east, north, west and south. These four directions are considered four of the sun's houses. The zenith position (straight up, 90 degrees overhead) was considered the fifth house. Some calendars look very much like a Maltese Cross.

The four regions often occupy a particular spot on the calendar and have colors associated with them. In general, east (top) is red, north (left) is yellow, west (bottom) is blue and south (right) is green. Notice the cardinal directions are shifted by 90 degrees counterclockwise. Just as in naked-eye observation, as the sun rises in the east it "sees" (sun's-eye view) north to its right, south to its left and west directly in front of it, where it goes to "die" each night. It travels in a counterclockwise motion on the calendar, just as it travels in an eastward (counterclockwise) direction with respect to the background stars, assuming a geocentric model. In some cases each region or quadrant contains a representative: tree or plant, bird, god or gods, associated days, and a body part or ritual subject. Note that each bird in Fig. 57 b contains the emblem for a particular god who is a year bearer, and that each body part has been assigned a direction in space. This calls to mind the Christian idea of the human body being a temple unto the Lord--that the temple of worship, a church, is constructed using the human body as the template.

In many of the calendars there are intercardinal lines (think of them as lines marking the positions of NE, SE, NW, SW) extending to the outer edge of the calendar representing "the migration of the sun god *kin* to his northern and southern extremities along the horizon." (Aveni.156) What is being depicted here are the extreme north and south positions of the sun along the horizon. In other words, this is showing the summer solstice sunrise and sunset points as well as the winter solstice sunrise and sunset points.

Astronomical Occurrences as the Basis for Creation Myths

Mayan manuscripts and codices contain illustrations of various celestial bodies and astronomical events deemed important in maintaining the balance and perpetuation of the universe. For example, they performed observations with regards to the rising and setting of the sun (*Tonatiuh*) and moon (*Meztli*) as well as the phases of the moon. Their calendars incorporate the notion of summer and winter solstice sunrise and sunset as mentioned above. Various codices contain extensive lunar observations. They even calculated the lunar synodic period (how many days from one full moon to the next, or one thin crescent moon to the next, not as easy as it sounds) to be 29.53086 days, whereas the modern day calculation is 29.53059 days. This represents an error of about 23 seconds! Though they were interested in the moon, as attested by a number of stories involving the moon and various creatures, especially the rabbit

(The *Rabbit in the Moon*), they were more concerned with the sun and the planet Venus. The notion that the sun might not rise if the proper prayers, sacrifices and rituals were neglected preoccupied the minds of these people.

Both the Aztecs and Maya recorded the planet Venus, *Citlalpol's*, periods of greatest brilliancy and lesser brilliancy along with its appearance as "morning star" and "evening star," which has to do with the synodic periods of Venus. At Inferior Conjunction when Venus passes between the Earth and the Sun, it cannot be seen from the Earth. It "disappears" for 8 days during this time. After inferior conjunction Venus can be spotted rising in the east before dawn. This is called helical rising, and it is at this time that Venus is known as the "morning star." Venus will reach its greatest western elongation (in retrograde motion), reaching the maximum angular distance, 47 degrees, from the sun soon after its first helical rising. This is one of its two periods of greatest brilliancy in the sky. After that it remains visible in the morning sky for approximately another 263 days. Then it enters its period of superior conjunction when it is on the opposite side of the sun. In other words, the sun is between the earth and Venus; therefore, Venus can't be seen and "disappears" for about 8 weeks due to the glare of the sun. Next, Venus emerges from behind the sun, but now its on the "eastern" side of the sun and is visible just after sunset. It is now known as the "evening star." It remains visible as the evening star for approximately 263 days. This is its second period of greatest brilliancy, when it is at its greatest eastern elongation point (again in retrograde motion). Then it arrives at inferior conjunction again and repeats the pattern. As Venus never strays too far from the sun as either the morning or evening star, it's considered to be one of the "guardians of the sun" by the ancient Mesoamericans. A number of archaeoastronomers now believe that the theme of death and resurrection is symbolically based on the interactions of these two bodies, Venus and the sun. The study of a number of stelae reveals that the Maya and Aztec also timed some of their wars according to the periods of Venus.

Be aware that different authors give conflicting accounts as to what role Venus as "morning star" and "evening star" plays in the cosmology of Mesoamerica. In one Mayan account Venus and Mercury are known as the "guardians of the sun," as stated above. Yet, in an Aztec account Venus is "*Tlahuizcalpantecuhtli*, Lord of Dawn, who battled the rising sun at the first dawning at Teotihuacan." (Taube p.15) Both the Aztec and the Maya venerated this planet, but for different reasons. The Aztecs worshipped the Venus god, *Quetzalcoatl*, whose job was similar to that of the hero twins-- defeating darkness. Whereas the Maya feared the Venus god, *Kukulcan*, whose "reappearance in different quarters after a prolonged absence carried various evil connotations for the people of Yucatan." (Aveni p.26)

In addition, solar and lunar eclipses were recorded along with the appearance of comets and meteorites. Comets were known as "the stars that smoke," *Citlalimpopoca*, and usually portend the death of a noble. Whereas the meteor was known as the "shooting star", *Citlaltlamina*. In a number of books these four celestial phenomena usually were considered bad omens. A number of constellations were also observed by the Aztec and Maya. Though the stars would be the same as those observed today, their constellations, in general, would be different than those recognized by Western astronomers today. Some that are recognized today and by the ancient Mesoamericans include, but are not limited to, the following: the Pleiades, Orion's Belt and Sword, the Big Dipper, the Little Dipper, Gemini (?), Castor and Pollux in Gemini, Scorpio, Taurus, Polaris, Rigel, Sirius, Betelgeuse, and the Southern Cross. Obviously, they also

recognized ecliptic, the path the sun takes across the sky and which is where most of these constellations lie either in or near.

The Milky Way was much venerated by the Maya. It was called a number of things: the World Tree, the Crossroads, or the Wakah Chan. Wakah can mean "six" or "erect," while Chan or K'an can mean "four," "serpent" or "sky". The Milky Way consists of many star clouds and was believed to be the birth place of all life by the Maya. The Milky Way was the Tree of Life. But in the center of the Milky Way lies the "dark rift"- a black ridge caused by so much interstellar dust which blots out the light of stars within it and behind it. This dark rift was known to the Maya as *Xibalba Be*, the Road to the Underworld. It was sometimes called "the Black Road." It figures prominently in the *Popul Vuh* story of "How the Hero Twins Defeated Darkness." Where the World Tree (the Milky Way) meets the ecliptic, near the constellation of Sagittarius, was given special attention by the Maya. [The World Tree lies near the road to Xibalba and it is the tree in which One Hunahpo's decapitated head is hung. Is the *Popol Vuh* a mythological description for an astronomical process in which the winter solstice sun (One Hunahpo) "will conjunct the crossing point of [the] Milky Way and ecliptic in Sagittarius" (Jenkins 1994) on December 21, 2012 A.D., the date when the great cycle, of approximately 5125 years, of the Mayan Long Count calendar ends?]

The Right Perspective: A Geocentric Model of the Universe & Naked-Eye Observation

Naked-eye observations led to the development of a basic knowledge of astronomy by the inhabitants of ancient Mesoamerica. This knowledge has been passed down to the descendants of the Aztec and Maya. In fact a number of Maya, in particular, still employ the traditional way of marking time and determining when to plant and harvest. If we want to understand and more fully appreciate just how much the Maya and the Aztec knew about the universe, then we need to place ourselves in their shoes. What this means is that we need to make observations in a manner consistent with how they would have done it.

First, we have to place earth at the center of the solar system with all the other visible planets, the sun and moon orbiting the earth. This is known as the geocentric model, as opposed to the heliocentric model. (See fig. 1. courtesy of Zeilik and John Wiley & Sons) This was the model they followed. Here the sun's daily movement across the sky from east to west establishes day and night. But with respect to the background stars, the sun travels from west to east (eastward) through the twelve constellations of the zodiac. Remember that the constellations that make up the zodiac for us are not the same ones used by them. Configurations of constellations are culture specific.

Second, the motions of planets Mercury, Venus, Mars, Jupiter and Saturn were recorded. These planets exhibit three types of motion. Daily they rise in the east and set in the west with respect to the horizon. But they travel in an eastward (counterclockwise) direction with respect to the background stars, which are traveling in a westward (clockwise) direction. Thirdly, they occasionally appear to reverse direction and travel in a westward (clockwise) direction, just like the background stars. This third type of motion is called retrograde motion. The ancient Mesoamericans were aware of these motions, and some of their stories of cosmogony seem to hinge on them.

One planet's motion was of particular interest. Venus was of special importance as it was

known as both the "morning star" and "evening star." It stayed relatively close to the sun's path on the ecliptic, never straying too far. Sometimes it would rise in the east as much as three hours before the sun. This is when it was called the "morning star". At other times it would appear for a short time after sunset. This is when it was called the "evening star." (Zeilik points out that Venus would begin its retrograde motion after its greatest eastern elongation, its greatest distance east of the sun.) At other times it would disappear from the night sky completely. This phenomena is related to the synodic period of Venus. (Refer back to the above section describing in more detail the synodic period of Venus.)

Myth #1: The Interaction of Venus and the Sun as the Basis for the Theme of Death and Resurrection

The fact that Venus does stay rather close to the sun could have provided the inspiration for a rather gruesome event in the myth concerning the creation of the fifth sun, *Nahui Ollin*. Briefly, this is what happens. The earth, the people, and the food and drink have been created but there is no sun to shine in this newly generated world. So, the gods get together in darkness, which typically represents chaos, to discuss who should be the next sun. A very arrogant god named *Tecuciztecatl* quickly volunteers for the job. But the gods select the humble and diseased god *Nanahuatzin*, who had split a gigantic rock (another story in the mythology of creation) to get maize for the humans so they would not starve. There was a competition between them to see who would get the honor. The final requirement was for each to jump into the sacrificial fire. The gods stipulated that *Tecuciztecatl* go first, but he chickened out. Then they called upon *Nanahuatzin* who did not hesitate. Seeing the bravery which *Nanahuatzin* demonstrated, *Tecuciztecatl* was not to be outdone. He quickly followed suit. But it was too late. The choice had been made. The other gods looked all around attempting to guess where *Nanahuatzin* would rise. Some correctly guessed the east. "No longer sickly and humble, *Nanahuatzin* returns rising as *Tonatiuh*, the fiery sun god whose rays shoot out in all directions." (Taube p.42) But soon after, here comes *Tecuciztecatl* rising in the east just as brightly as *Tonatiuh*. This spells trouble as the world will be too bright now. Therefore, "one of the gods runs out and throws a rabbit in the face of *Tecuciztecatl*. Thus wounded, the face of the moon is dimmer than the sun, and during full moons, the rabbit can be seen seated in the face of the moon." (Taube p. 42; for a drawing of this see Aveni p. 68) Just as this problem gets resolved, *Tonatiuh* decides not to move unless the other gods sacrifice themselves to him. As you can imagine, the gods become infuriated with *Tonatiuh*'s new found arrogance. So, the god *Tlahuizcalpantecuhtli*, Lord of Dawn, god of the morning star (alias Venus) decides to shoot an arrow at the sun, but he misses. Now the sun shoots one back piercing *Tlahuizcalpantecuhtli* through the head (the gruesome event!). "At this moment, the Lord of the Dawn is transformed into the god of stone and coldness, *Itztlacoliuhqui*, and for this reason it is always cold at the time of dawn." (Taube p. 44)

Thirdly, the Aztec and the Maya both had manuscripts depicting and predicting solar and lunar eclipses. Eclipses have to do with the alignment of the earth, moon and sun relative to one another. In either a solar or lunar eclipse "the sun or moon becomes darkened, its shape changing and its lit area reducing in size as if it were going through phases within a short time." (Davidson p.54) The moon must be full moon phase for a lunar eclipse to occur. The alignment is one in which the earth is perfectly situated between the sun and the moon thereby blocking the sun's light from reflecting off the moon. What the observer notices is that the moon has

become a "dimmed disc in a clear sky, where only shortly before it had shone brilliantly." (Davidson p.54) (For a helpful visual aid see Zeilik fig. 1. 1 5, p. 1 6.) In a solar eclipse the moon is in new moon phase, meaning that the moon is situated between the sun and the earth in such a manner that the moon temporarily blocks out the sun's light completely. As the moon is much smaller than the earth, only a small portion of the earth's surface receives no sunlight for several minutes. (See Zeilik p. 15.) In both cases the important point to remember, in regards to ancient Mesoamerican observers, is that the sun and moon were not manifesting a normal pattern of behavior. And when strange occurrences took place, it could signify the beginning of the end.

It is hard for the western mind to perhaps grasp just how influential the celestial bodies were in the daily lives of the people of these cultures. These objects were considered to be gods and goddesses in many instances, at least by the masses. Yet in some myths the celestial bodies are considered to be just ruled by gods and goddesses. It would not be far-fetched to state that for the Mesoamericans, and other agricultural people, nature was the primary source for contemplation. Its cycles lay at the foundation of their cosmology, "Where seasons come and go, and life follows death." (Nelson p. 13)

Aspects of nature suggest an underlying unity-- in some way everything is connected to everything else. Therefore, man is just a part of nature, and not at the center of nature. He takes his place alongside the plants, animals, stars, planets, moon and sun. Everything has an essence, "all existence is alive and conscious." (Nelson p. 13) And what is important is the relationship between 'the "inner souls" of a person and the "inner souls" of objects.' (Nelson p.15) And in this sense man lives in a sanctified universe. The sun is god; the moon is god. They provide sustenance and illumination for the body and soul. This then is their duty, so to speak. If they do not rise, life does not arise. And mankind must do his duty as well. For the Mesoamericans this meant human sacrifices had to be carried out in order to appease the sun god, Tonatiuh; otherwise, he may decide not to rise. "As above, so below" is a maxim for them. Just as recounted in the story above, Tonatiuh demanded that the other gods sacrifice their lives, otherwise he would not move, so too did the people require that humans sacrifice their lives in imitation of the divine act. It was necessary for the continuation of the world.

Myth #2: The Popul Vuh as a Mythological Description of an Astronomical Process

The *Popul Vuh* is the Mayan story of creation. In it are the explanations for how the universe came into existence, what constitutes the various levels of existence-- sort of a geography of the world, explanations for a variety of natural phenomena, a history of the world, how people came into existence, and stories which convey messages of a more personal nature, such as how greed and arrogance threatens the order of things. Some of these messages appear to be in direct conflict with certain violent practices these cultures engaged in. Perhaps it's a matter of perspective. Whereas the respecting of the individual's life is a traditional Western value, death as one of life's forces was respected and valued in ancient Mesoamerican cultures. There was even the idea that when a person was sacrificed, he did not die but only just disappeared. This is reminiscent of the synodic path of Venus wherein it disappears for a while only to resurface later. This idea of regeneration/ resurrection is one of the major themes in the story of how the hero twins vanquish *Xibalba*, the place of darkness, chaos and destruction, and death.

Briefly, here is the general story: One set of twins Hun Hunahpu and his brother Vucub Hunahpu like to play ball at the masonry ballcourt. This causes much noise and upsets the Gods of Death, Hun-Came and Vucub-Came, who then send some owls to command the twins to make their appearance in Xibalba as they want to play ball with them. Hun Hunahpu and Vucub Hunahpu show up on the appointed day. Of course, the Lords of the Underworld have no intention of playing ball. They quickly set up some tests for these twins to complete successfully. If they are not successful, they will be sacrificed. Needless to say, they fail the tests. Hun Hunahpu's head is placed in a barren tree and the tree immediately becomes filled with calabash gourds. This is a miracle. Hun Hunahpu's head becomes one of the fruits.

Xquic (Blood Moon), the daughter of one of the minor Lords of the Underworld, hears about this special tree and decides to go see it for herself. She wonders out loud if she should pick one of the fruits (sound familiar?). Just then Hun Hunahpu's head speaks and tells her the fruit is no good, they're just a bunch of skulls. This does not dismay her, and she still asks for one. Thereby he spits into her hand impregnating her. He tells her that saliva and spit are "the sons of kings, and when they die they keep their substance." (Nelson p. 55) She returns home with the twins, Hunahpu and Xbalanque, in her belly. This is how they were conceived. Her dad, Gathered Blood, realizes that she is pregnant and demands to know who the father is. She says, "I have no child father; I haven't yet known the face of a man." (Nelson p. 55) Her dad explodes in a fit of rage and commands the owls to take his daughter away, kill her, and return with her deceitful heart in a bowl.

Xquic convinces the owls that what happened to her is a miracle and that soon "The time will come when I defeat the Lords of Death." (Nelson p.56) The owls decide to take pity on her and let her escape to the upper world. They return with a bowl of coagulated sap from a tree oozing red sap. It satisfies her father. She then goes to her mother-in-law's house who refuses to acknowledge her as family. Xquic is put through a trial which she successfully completes, and only then does Xmucame receive her as a daughter. The twins are born and grow up to be hunters and ball players. Soon they raise the ire of the Lords of the Underworld and are commanded to appear in Xibalba. They too are put through the same series of tests as their father, but they are successful where he failed. This makes the Lords angry, so they challenge the twins to a game of ball. They play several games, but each ended in a tie. The boys knew they were to die regardless of who won the game. But they state to the Lords, "You think that our own death is a stranger to us?" (Nelson p. 82) And with that pronouncement they embrace one another and jump into the pit of fire.

Prior to dying they requested that their bones be dumped into the river. Five days after their death, two old men came to Xibalba performing exotic dances and miraculous feats. [Once again the theme of death and resurrection.] They were even able to slice up dogs, other creatures, and even themselves and be resurrected. Naturally, Hun-Came and Vucub-Came wanted their turn. So, Hunahpu and Xbalanque, disguised as old men, obliged the Lords of Death except they did not bring them back to life.

This is the story of how the Lords of Death were defeated by the second set of twins, which is actually Hun Hunahpu (One Hunahpu), their father's resurrection so to speak. The two sons then ascended into the sky as light. "One was given the sun, the other took the moon. The arch of heaven and the face of the earth were lighted." (Nelson p.86)

A New Take on the Astronomical Significance of the "Hero Twins Defeat of Darkness" in the *Popol Vuh*

A recently published book by John Major Jenkins, *Maya Cosmogony 2012*, gives a rather interesting astronomical interpretation of the Hero Twins myth. In this account the Hero Twin myth "encodes a rare alignment in precession." (Jenkins p. 163.) Jenkins bases his ideas on the work of Dennis Tedlock, who did a translation of the *Popol Vuh* (1985), and is a Maya-trained daykeeper. According to Tedlock Xquic, Blood Moon, "is the waning post-full moon, the sliver-shaped moon that rises in the east just before sunrise. ...One Hunahpu (the calendric day 1 Ahau) represents Venus, and Seven Hunahpu represents Jupiter. ...As a calendric year-bearer associated with the seasonal quarters, the resurrected One Hunahpu represents the December solstice sun, and his rebirth was only possible through the efforts of his sons, the Hero Twins." (Jenkins p. 156) Recall in this story that the first set of twins die in Xibalba at the hands of the Lords of Death. One Hunahpu gets decapitated and his head is hung from a barren tree, which miraculously bears fruit once One Hunahpu's skull was placed in it. Then along comes Blood Moon, Xquic, to see about this tree for herself and so on. Based upon Tedlock's interpretation of the *Popol Vuh*, the skull belongs to both brothers. They speak through it with one mind. The skull represents the conjunction of these two bright planets, Venus and Jupiter. The tree in which the skull hangs is "by the road, (the ecliptic). This astronomical configuration suggests a cross formed by the Milky Way and the ecliptic." (Jenkins p.156) Therefore, this meeting between the skull, Venus-Jupiter conjuncting, and the waning post-full moon in the Milky Way's dark-rift is no less than an account of a Venus-Jupiter-moon syzygy (a triple conjunction) which is to occur in the future. Hence the development of the Mayans' Long Count calendar.

Jenkins goes beyond this idea, in a web-article entitled, "Thesis (From The Center of Mayan Time, c 19994," to argue that the primary event in the *Popol Vuh* is the encoding of a rare astronomical alignment that is caused by precession. This alignment will occur when the winter solstice sun (One Hunahpu First Father) conjuncts the crossing point of the ecliptic and the Milky Way (the Tree of Life, First Mother). Specifically, the crossing point is where the "dark rift"(the Road to Xibalba, the birth canal of First Mother) is located in the Milky Way. This rare alignment is to occur on December 12, 2012 A.D. according to the calculations of the Maya. This date is also the end-date of this great cycle of the Mayan Long Count calendar. Stated another way, a precession-caused rare alignment, in which the December solstice sun (specifically the December 21, 2012 A.D. winter solstice) will move into conjunction with the great bulge (the pregnant Xquic) of the Milky Way near Sagittarius, heralds the end of one World Age and the birth of the next.

This story, in mythological terms, is about the union of First Mother and First Father, or actually, the birth of First Father *from* First Mother. The winter solstice sun passes through the birth canal of the Milky Way and ushers in the beginning of a new great cycle of time, a resetting of the great celestial star-clock of precession. Jenkins speculates that this union may announce an "unprecedented shift in the nature of human consciousness and civilization." (Jenkins, 1994.) Metaphorically, the winter solstice sun represents the beginning of the return journey to the life-giving warmth of summer. It marked the time when earth/ life's energy had been slowed down and was at its lowest. But now the embers of a new life are stirring and will burst forth born anew. Life had "died" and was being "resurrected"-- the origins of the

resurrection concept in Christianity? Note that many world religions share the winter solstice time as a period of holiness honored by ceremonies and festivals.

Astronomically, the winter solstice sun represents the turning point in the sun's migration south of the equator. It has reached its southernmost extreme distance from the equator, or if you like, its farthest point south along the horizon before heading back north. The winter solstice is the day of least sunlight, the shortest day of the year, but marks the beginning of increasing daylight and warmth. Nature will soon begin to wake up from her sleep and life will renew itself.

For agriculturally-based people, historically the year has been divided into four seasons. These included the two solstices and the two equinoxes which could be thought of as the four "directional pillars" that support the year. These four times of the year were, and still are, considered important as they indicate seasonal changes which obviously had a direct impact on the lives of an agricultural society. In the case of the Maya, an agricultural people, the seasonal markers were avidly watched and duly recorded. They prepared almanacs recording past and recent solar and lunar eclipses, the phases of the moon, the periods of Venus and Mars, the movements of various other planets, and conjunctions of celestial bodies. These tables have proven to be highly accurate. This alone is proof of the detailed knowledge that the ancient skywatchers of Mesoamerica had concerning astronomy. But the fact that these tables also made future predictions concerning the aforementioned celestial events is even more astounding. That these people would be seemingly concerned with future astronomical events raises some interesting questions. The most obvious one is why would they want to know this kind of detailed knowledge? Is their end date for a great cycle in this World Age of no significance? Are their almanacs only proof of their agriculturally-based interest in the seasons? Were they just a superstitious people who felt compelled to align their buildings, streets, and homes to be in accord with some theory concerning planetary influence on their lives? Were the ancient Americans a people living in fear and ignorance who simply lacked the intellectual understanding of how nature really works, which we now possess?

Personally, I do not have a sufficient knowledge of astronomy by which to evaluate Jenkin and Tedlock's interpretation of the Hero Twins myth. Nevertheless, it does provide food for thought. But if the astronomical events they predict will occur in the coming years, based on their analysis of the Mayan astronomical records, do occur ... what then? Is this proof that the Maya were on to something? Did they have some type of foresight that a major shift in human consciousness or civilization was to occur? Or is this just a fantastical interpretation of some knuckle-headed, pseudo-Mayanists who believe that ancient Mesoamerican priest-astronomers knew more than just naked-eye astronomy?

Regardless of one's personal opinion on this particular interpretation of the meaning of the Popol Vuh, there is plenty of evidence demonstrating just how aware the ancient Mesoamericans were of the universe, and how much they knew about astronomy.

STUDENT LESSON PLANS:

1. Before any formal discussion on astronomy have the students draw a picture/ model illustrating their understanding of how the solar system is structured.
2. Next have them briefly explain what causes night and day, what causes the seasons and how

long it takes for the earth to circle the sun once.

3. Hold a discussion on what types of astronomical observations are possible without the aid of a telescope. Take notes on the following items:

- * drawing of a geocentric model of the universe (Zelik p.24)

- * drawings illustrating the various motions of the moon, sun and planets based on a geocentric model, and with respect to the horizon, the background stars, and the periodic retrograde motion of the planets.

- * a drawing and discussion of the synodical motion of Venus as an explanation for why it was considered both a morning and evening star (Aveni p. 84)

- * drawing the various phases of the moon so that they may identify Xquic, as the waning post-full moon. In addition, I would like for them to attempt drawing a rabbit on the face of the moon based on Aveni's drawing.

- * draw pictures illustrating a total solar and a total lunar eclipse (journal entry here!)

4. Xerox a class set of Taube's version of the *Popol Vuh*. (Discussion of general storyline and how to pronounce names before the actual reading of it is necessary.) Read the story and discuss what is interesting and familiar about it, what is weird or confusing, and what questions are still on the mind.

5. Introduce Jenkin's and Tedlock's ideas as to what is being depicted astronomically in this myth. This might be too overwhelming for an eighth grade class.

6. Some possible writing exercises might include the following:

- * You are a person living back in the times of the ancient Maya and you are about to experience your first total solar eclipse. Everyone has been talking about it. Tell us about how you are feeling right at this moment.

- * Plot a constellation on a picture of an animal which has historically been associated with that constellation from any cultural tradition, (i.e., Greek, Roman, Chinese, etc.). Then write a story about an escapade involving your "animal constellation."

For extra credit or for the enriched class-- have two animal constellations involved in a dialogue. Use proper dialogue techniques.

- * Using a Venn diagram compare and contrast the opening scene of the Popol Vuh with any other creation story. Next write a four to five paragraph essay in which you delineate how the two stories are similar and how they are different.

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[http:// www.en.com/users/cygnus/mayastro.htm](http://www.en.com/users/cygnus/mayastro.htm)-- info. on imp. of Venus, Milky Way, ecliptic, constell. of Orion; Maya civilization; Dresden Codex; stories.

<http://hermetic.nofadz.com/>-- Maya calendars: Long Count, Tzol kin (260 day), and Haab (365 day).

<http://www.astro.uva.nl/>-- Very brief explanations of the importance of some celestial bodies to ancient Mesoamericans.

<http://www.FAMSI.org>-- full of links to a number of topics on Mesoamerica.

<http://www.halfmoon.org>-- gives info. on how to write your name in Mayan glyphs