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Geometer's Angle

## The Geometry of the Zodiac

**Abstract.** The zodiac is widely known as a band of twelve celestial constellations. It also contains a mathematical model for cosmographic depiction, based on observations of the sun, moon, and visible planets as they traverse the celestial ecliptic. Here we consider the zodiac as a timepiece or calendar; how this system of planets and constellations emerges from elementary geometric patterns; and how these patterns inform the symbols of the zodiac and frame our world view.

### *The Zodiac*

The true origin of the zodiac is uncertain. Versions of a wheel composed of twelve celestial constellations have been found throughout the world in Egypt, India, Asia, Greece and Rome, the Americas, and Islam. But the zodiac as we know it, a circle of twelve distinct constellations divided equally into 30° sections, probably dates to the fifth century B.C..<sup>1</sup>

Independent of its function to interpret human behavior, the zodiac likely developed as a vehicle for measuring time, evolving over thousands of years from the practice of timing the sowing of crops and other agricultural events to the rising and setting of familiar star groups. The calendar that developed in fifth century B.C. Greece reflects the zodiac's band of 360°, approximating the number of earth rotations, or days, in the sun's yearly round. The zodiac's twelve 30° sections approximate the number of lunar cycles or months during the same period. The division of the zodiac at the equinoxes and tropics locates the sun's position in the celestial ecliptic at each of the four seasons. Even the days of the week invoke the zodiac's planetary deities [Gleadow 1969, 16-18; Maily Nesle 1981, 22, 33].<sup>2</sup>

#### Definitions:

"**Astrology**" is from the Latin *astrologia*, from the Greek *astrologia* (from *astron* "the stars" + *logia* "versed in tales or stories") which means "knowledge of the stars, astronomy" or "telling of the stars." "**Astronomy**" is from the Latin *astronomia*, from the Greek *astronomia* (from *astron* "the stars" + *nomos* "arranging") which means "star-arranging" [Lewis 1879, Liddell 1940, Simpson 1989].

Astrology is based on the positions of the sun, moon, and planets relative to one another and to the twelve constellations through which they appear to travel. The signs and planets that comprise astrology's symbols are metaphors for archetypal states, spiritual states, psychological states, temporal cycles, and the composition of matter. In this article, we set aside questions of how or whether these planets and constellations influence human behavior, illuminate the past, or predict the future. Our purpose is to consider the traditional western zodiac as a timepiece or calendar, based on natural observations of the sun, moon, and visible planets against the background of constellations that comprise the ecliptic. How does the zodiac emerge from elementary geometric shapes and patterns and how do these patterns inform astrology's symbols?

## *The Tropical Zodiac*

Western astrology recognizes two zodiacs. One is tropical and moving. The other is sidereal and fixed. The sidereal zodiac measures the positions of celestial bodies from a stellar frame of reference, relative to the visible fixed stars. The tropical zodiac reckons the positions of celestial bodies by the seasons and is said to be “moving” because it shifts continuously against the background of fixed stars.

In tropical astrology, the signs of the zodiac are determined by the path of the sun relative to the solstices and equinoxes. The sun’s apparent annual west-to-east path around the ecliptic is inclined about  $23\frac{1}{2}^{\circ}$  to the equator, so that it appears to move north or south in the sky, when viewed from earth. Twice the sun appears to cross the equator: once at the vernal equinox in March on its journey north; and once at the autumnal equinox in September on its journey south. On two other occasions, the sun reaches its northern- and southern-most points on the ecliptic, where it appears to stand still, then turn back in the opposite direction. The circles that locate the sun’s northern- and southern-most points are the Tropics of Cancer and Capricorn. The sun reaches the Tropic of Cancer at the summer solstice in June, on its journey north, and the Tropic of Capricorn at the winter solstice in December, on its journey south.<sup>3</sup>

The vernal equinox never occurs in precisely the same spot from year to year, but rotates around the sky, completing a full circuit about every 25,800 years. Around 125 B.C., the Greek astronomer Hipparchus observed the gradual westerly or “backwards” motion of the vernal point through the constellations, resulting in earlier occurrences of the equinoxes each successive sidereal year. Hipparchus discovered this precession of the equinoxes when the vernal point was in the constellation Aries. Since then,  $0^{\circ}$  Aries, also known as the First Point of Aries, has been the accepted vernal point and the start of the tropical new year [Fenna 2002, Gleadow 1969, 19-20, Thompson 2008].

### **Definitions:**

**Precession of the equinoxes** occurs as the earth rotates about its axis, in response to the gravitational pull of the sun on the earth’s equatorial bulge. The result is that the earth’s axis of rotation describes a small circle in the sky over a period of approximately 25,800 years. Hence, the signs of the zodiac no longer coincide with the constellations for which they were named initially. The tropical zodiac originated when the vernal point was in Aries. Because of precession, this point has since traveled across the constellation Pisces, and will enter Aquarius about the year 2500 [Fenna 2002, Soanes 2003].

The **tropical** or **solar year** is measured relative to the movement of the sun, and is the period between successive vernal equinoxes (approximately 365 days, 5 hours, 48 minutes, and 46 seconds). The slightly longer **sidereal year** is based on the rotation of the earth relative to the fixed stars and constellations (approximately 365 days, 6 hours, 9 minutes, and 1 second) [Fenna 2002].

**Sidereal astrology** measures the positions of celestial bodies by means of the visible fixed stars. “**Sidereal**” is from the Latin *sidereus* (from *sidus* “a group of stars, constellation, heavenly body”), from the Greek *sidêros* (“iron,” also “firmness, steadfastness”) [Lewis 1879, Liddell 1940, Simpson 1989].

**Tropical astrology** measures the positions of celestial bodies from seasonal references known as “**tropics**.” The tropics refer to the two “turning points” of Cancer and Capricorn, the constellations in which the sun, in its apparent journey along the ecliptic, reaches its northern- and southern-most points before turning back in the opposite direction. “Tropic” is via the Latin *tropicus*, which means “belonging to a turn or turning, tropical,” from the Greek *tropikos* (from *tropos* “a turn, direction, course, way”), which means “of the solstice” [Lewis 1879, Liddell 1940, Simpson 1989].

The **Tropics of Cancer** and **Capricorn** are two circles of the celestial sphere, parallel to and approximately 23° 28' north and south of the celestial equator, that touch the ecliptic at its northern- and southernmost parts. The Tropic of Cancer is the northern point of the ecliptic reached by the sun at the summer solstice. The Tropic of Capricorn is the southern point of the ecliptic reached by the sun at the winter solstice [Simpson 1989, Tester 1987, 5-6].

The **celestial equator** is the plane in the celestial sphere that is perpendicular to the earth's axis. Day and night are of equal length when the sun appears in the celestial equator. “Celestial” is from the Latin *caelestis* (from *caelum* “heaven” or “sky”). “Equator” is from the late Latin phrase *circulus aequator diei et noctis* (from *aequare* “to make equal”), which means “the equalizing circle of day and night” [Simpson 1989, Soanes 2003].

The **ecliptic** is the plane in the celestial sphere that represents the apparent yearly orbit of the sun. “Ecliptic” comes via the Latin from the Greek *ekleiptikos* (from *ekleipō* “to leave out, omit, pass over”), which means “caused by an eclipse.” It is so named because solar and lunar eclipses require that both the sun and moon appear in the plane of the ecliptic [Liddell 1940, Simpson 1989, Soanes 2003].

Two **equinoxes** occur each year when the sun crosses the celestial equator and day and night are equal in length: the first day of spring (approximately March 21) and the first day of autumn (approximately September 23). The equinoxes are known as the First Points of Aries and Libra. “Equinox” is from the Old French *equinoxe* and the Latin *aequinoctium* (from *aequi-* “equal” + *noct-*, stem of *nox* “night”) [Ridpath 2003, Simpson 1989].

Two **solstices** occur each year when the sun is furthest north or south of the celestial equator, appears to stand still, then turns back in the opposite direction. In the northern hemisphere, the summer solstice occurs on the longest day of the year, the first day of summer (approximately June 21). The winter solstice occurs on the shortest day of the year, the first day of winter (approximately December 21).<sup>4</sup> The Latin for “solstice” is *solstitium* (from *sol* “sun” + *sistere* “to stand still”), which means “the time when the sun seems to stand still” [Lewis 1879, Nave 2001, Simpson 1989].

### How to Draw a Dodecagon from Three Squares

#### Definition:

The regular **dodecagon** is a plane figure containing twelve equal sides and twelve equal angles. The Greek for “dodecagon” is *dōdekagōnos* (from *dōdekas* “the number twelve” + *gōnia* “corner, angle,” which is related to *gonu* “knee”) [Liddell 1940, Simpson 1989].

To create the zodiac's band of twelve signs, let us draw a regular dodecagon.

- With a compass, draw a circle.
- Draw the horizontal diameter AB through the center of the circle (point O).
- Set the compass at an opening that is slightly smaller than the radius of the circle. Place the compass point at O. Draw arcs that cross the horizontal diameter on the left and right, at points C and D.
- Set the compass at an opening that is slightly larger than before. Place the compass point at C. Draw an arc above and below, as shown.
- With the compass at the same opening, place the compass point at D. Draw an arc above and below, as shown.
- Locate points E and F where the two arcs intersect.
- Draw the line EF through the center of the circle.
- Extend the line EF in both directions to the circumference of the large circle at points G and H.

Lines AB and GH locate the horizontal and vertical diameters of the circle (fig. 1).

- Connect points A, G, B, and H.

The result is a square (fig. 2).

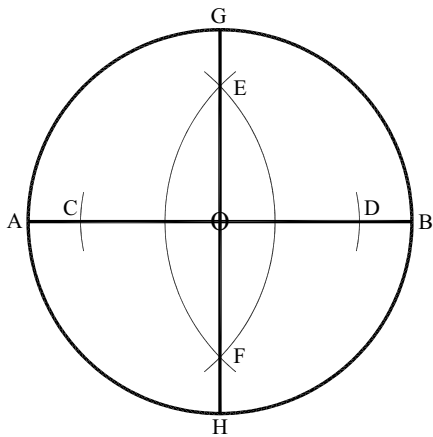


Fig. 1

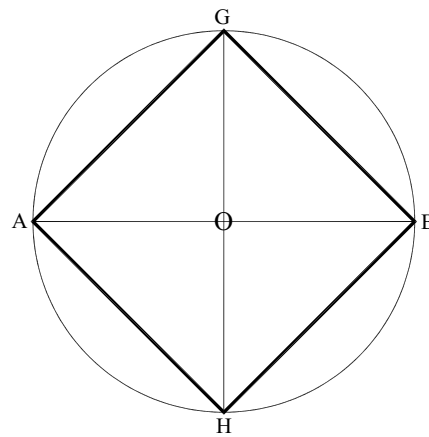


Fig. 2

- Locate point A at the left end of the horizontal diameter (AB).
- Place the compass point at A. Draw a half-circle of radius AO through the center of the circle (point O), as shown.
- Locate point G at the top of the vertical diameter (GH).
- Place the compass point at G. Draw a half-circle of radius GO through the center of the circle (point O), as shown.
- Locate point B at the right end of the horizontal diameter (AB).
- Place the compass point at B. Draw a half-circle of radius BO through the center of the circle (point O), as shown.

- Locate point H at the bottom of the vertical diameter (GH).
- Place the compass point at H. Draw a half-circle of radius HO through the center of the circle (point O), as shown.

The four half-circles are of equal radius and intersect at points I, J, K, and L (fig. 3).

- Locate points M, N, P, Q, R, S, T, and U, where the four half circles intersect the original circle, as shown (fig. 4).
- Connect points N, Q, S, and U.

The result is a square (fig. 5).

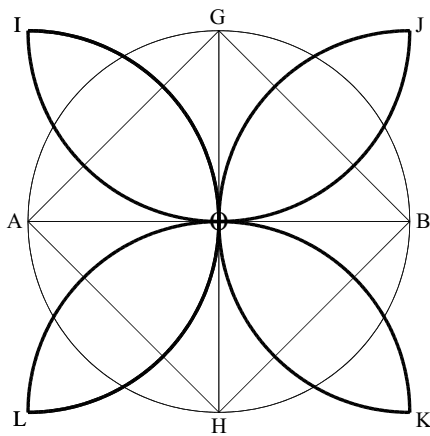


Fig. 3

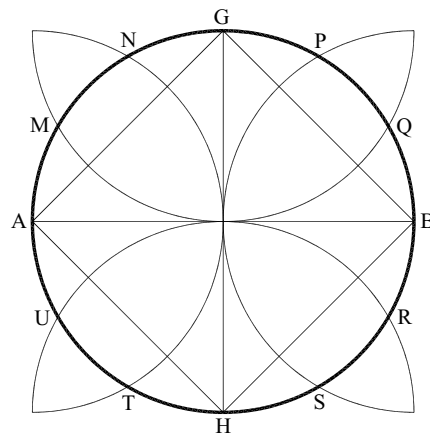


Fig. 4

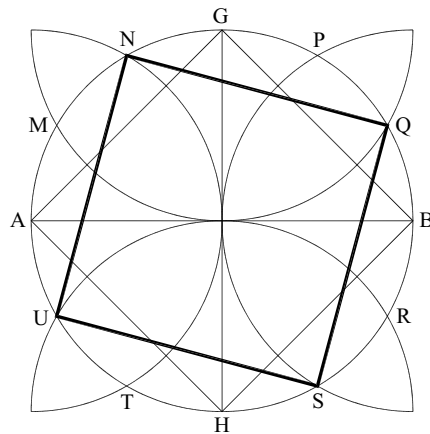


Fig. 5.

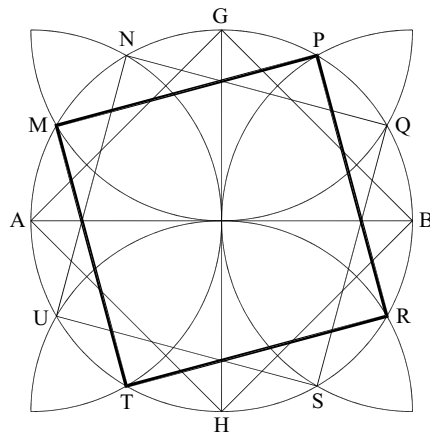


Fig. 6.

- Connect points M, P, R, and T.

The result is a square (fig. 6).

Together, the three squares divide the original circle in twelve equal parts (fig. 7).

- Connect all twelve points (A, M, N, G, P, Q, B, R, S, H, T, and U).

The result is a regular dodecagon composed of three squares (fig. 8).

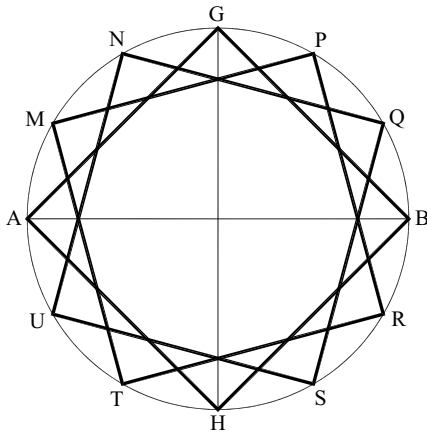


Fig. 7.

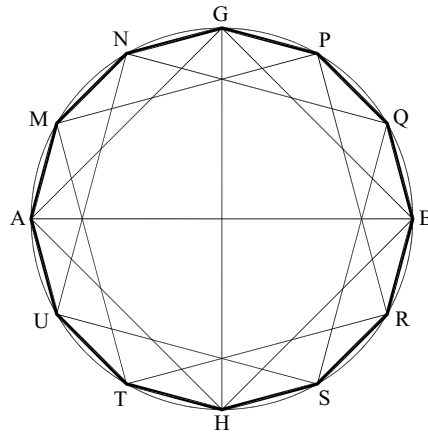


Fig. 8.

### *The Cross of Four Seasons*

In the west, it is customary to begin the zodiac at the vernal equinox on the first day of spring and the new year, when the sun reaches a point of the ecliptic that crosses the celestial equator. In fig. 9, the vernal and autumnal equinoxes, days of equal light and dark, occupy east and west on the horizontal axis. The summer and winter solstices, days of maximum light and maximum dark, occupy north and south on the vertical axis.<sup>5</sup>

These seasonal markers are reflected in the zodiac's primary division into quadrants. At the vernal equinox, the point of the ecliptic rising above the eastern horizon is called the Ascendant or, in Latin, *ascendens*. At the autumnal equinox, the "setting-point" of the ecliptic on the western horizon is called the Descendant or, in Latin, *occasus*. At the winter solstice, the upper point where the meridian intersects the ecliptic, in the south, is called the Midheaven or, in Latin, *Medium Caeli*. At the summer solstice, the lower point where the meridian intersects the ecliptic, in the north, is called the Nadir or, in Latin, *Imum Caeli*.<sup>6</sup>

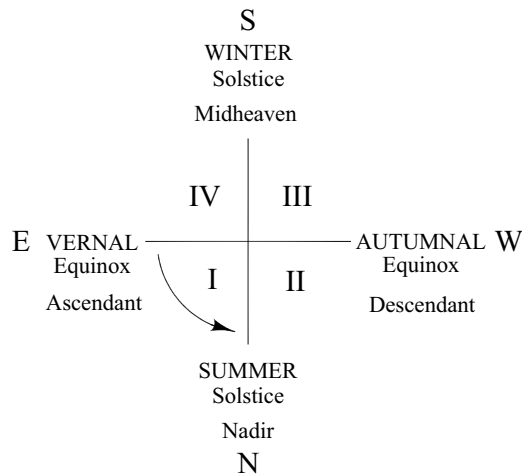


Fig. 9. The Four Seasons

### *Reckoning the Zodiac by the Four Seasons*

Together, the twelve zodiacal signs describe a complete seasonal round. Four “cardinal” signs, laid out in a square, mark the beginning of the seasons at the solstices and equinoxes. Four “fixed” signs, laid out in a square, delineate the middle of the seasons. And four “mutable” signs, laid out in a square, mark the end of the seasons.<sup>7</sup>

#### **Definitions:**

In astronomy, the **zodiac** is a band of the celestial sphere that extends approximately 8 or 9 degrees on either side of the ecliptic and locates the apparent motions of the sun, moon, and principal planets. In astrology, the zodiac is divided in twelve equal parts or “signs,” each bearing the name of a constellation for which it was named originally. “Zodiac” is from the old French *zodiaque*, by way of the Latin *zodiacus* “zodiac,” from the Greek phrase *zodiakos kuklos* (from *zōion* “living being, animal,” “figure, image” or “sign of the zodiac” and *kuklos* “a round” or “a ring”), which means “circle of little animals” [Harper 2001, Liddle 1940, Simpson 1989]. In fact, seven zodiacal signs represent animals (Aries the Ram, Taurus the Bull, Cancer the Crab, Leo the Lion, Scorpio the Scorpion, Capricorn the Goat, and Pisces the Fish); three signs represent human beings (Gemini the Twins, Virgo the Virgin, and Aquarius the Water-bearer); one sign is part animal and part human (Sagittarius the Archer); and one sign is inanimate (Libra the Scales).

Cardinal signs begin the seasons, when times call for initiating movement and activity. Reckoning by the tropical year, the Sun enters the constellation Aries (♈) on the first day of spring and the new year. The Sun enters Cancer (♋) on the first day of summer; Libra (♎) on the first day of autumn; and Capricorn (♏) on the first day of winter. In fig. 10, Aries and Libra are rising and setting on the horizon, in Ascendant and Descendant positions. Cancer and Capricorn are north and south, at the Nadir and Midheaven (fig. 10).

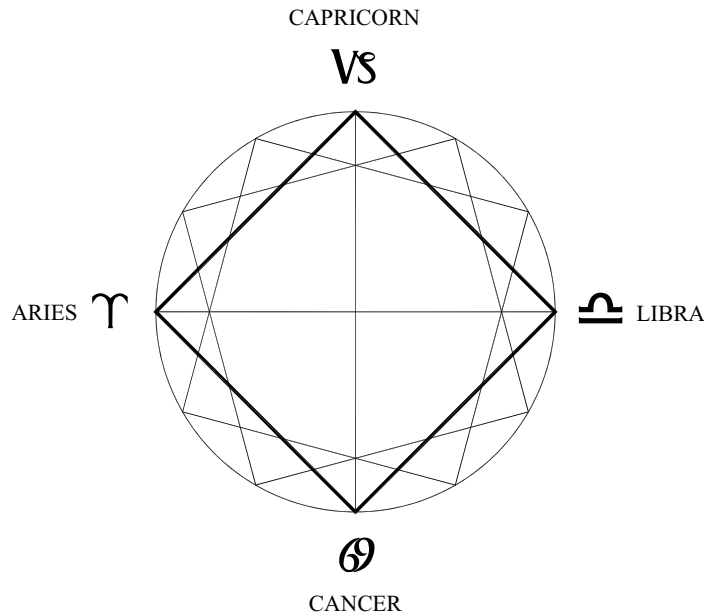


Fig. 10. The Cardinal Signs

**Definitions:**

“**Aries**,” the Latin word for “ram,” is the first sign of the zodiac (♈), which the sun enters at the vernal equinox, about March 21. The constellation Aries (the Ram) is said to represent the ram whose Golden Fleece is sought by Jason and the Argonauts [Lewis 1879, Simpson 1989, Soanes 2003].

“**Cancer**,” the Latin word for “crab” or “tumour,” is the fourth sign of the zodiac (♋), which the sun enters at the summer solstice, about June 21. The constellation Cancer (the Crab) is said to represent a crab that is crushed beneath the foot of Hercules. *Karkinos*, the Greek for the sign of Cancer, means “tumour” or “crab,” so named, according to Galen, for the swollen veins surrounding a malignancy that resemble the limbs of a crab [Lewis 1879, Liddell 1940, Simpson 1989, Soanes 2003].

“**Libra**,” the Latin word for “pound” or “balance,” is the seventh sign of the zodiac (♎), which the sun enters at the autumnal equinox, about September 23. The constellation Libra (the Scales or Balance) is said to represent a pair of scales symbolizing justice [Lewis 1879, Simpson 1989, Soanes 2003].

**Capricorn** (the Goat) is the tenth sign of the zodiac (♏), which the sun enters at the winter solstice, about December 21. The Latin for “Capricorn” is *Capricornus* (from *caper* “goat” + *cornu* “horn”), a literal translation of the Greek *aigokerôs* (from *aix* “goat” + *keras* “animal horn”), which means “goat-horned” [Lewis 1879, Liddell 1889, Liddell 1940, Simpson 1989].



Fixed signs mark the peak of the seasons, when times call for equilibrium and endurance. Reckoning by the tropical year, the sun enters the constellation Taurus (♉) at the peak of spring; Leo (♌) at midsummer; Scorpio (♏) at mid-autumn; and Aquarius (♒) at mid-winter (fig. 11).

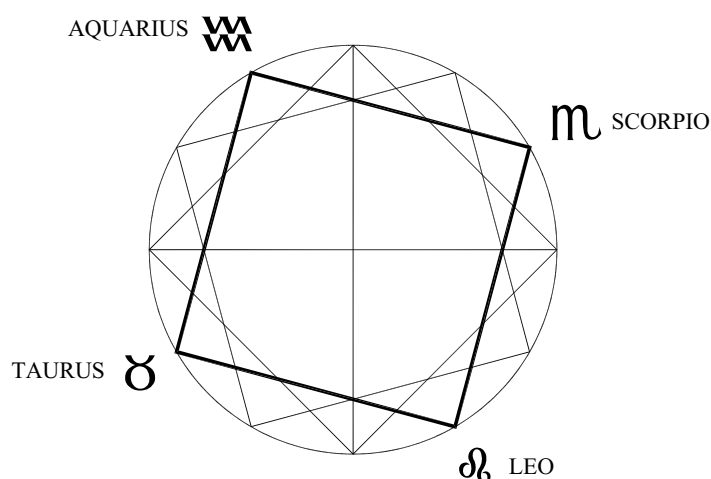


Fig. 11. The Fixed Signs

#### Definitions:

“**Taurus**,” the Latin word for “bull” or “ox,” is the second sign of the zodiac (♉), which the sun enters approximately April 21. The constellation Taurus (the Bull) is said to represent the bull tamed by Jason and contains the star clusters of Hyades, the Pleiades, and the Crab Nebula [Lewis 1879, Simpson 1989, Soanes 2003].

“**Leo**,” the Latin word for “lion,” is the fifth sign of the zodiac (♌), which the sun enters approximately July 21. The constellation Leo (the Lion) is said to represent the lion slain by Hercules and contains the bright stars Regulus and Denebola. The Greek word for “lion” is *leôn* [Lewis 1890, Liddell 1940, Ridpath 2003, Simpson 1989].

“**Scorpio**,” the Latin word for “scorpion,” is the eighth sign of the zodiac (♏), which the sun enters approximately October 23. The constellation Scorpio (the Scorpion) is represented by the scorpion and the eagle, and contains the red giant star Antares, whose red color is sometimes compared to the planet Mars.<sup>8</sup> The Greek word for “scorpion” is *skorpíos* or *skorpiôn* [Lewis 1879, Simpson 1989, Soanes 2003].

“**Aquarius**,” the Latin word for “of water” or “water-carrier,” is the eleventh sign of the zodiac (♒), which the sun enters approximately January 21. The constellation Aquarius (the Water-bearer) is said to represent a man pouring water from a jar [Lewis 1879, Simpson 1989, Soanes 2003].

Mutable signs mark transitions from one season or phase of activity to the next, when times call for flux and change. Reckoning by the tropical year, the sun enters the constellation Gemini (♊) at the end of spring; Virgo (♍) at the end of summer; Sagittarius (♐) at the end of autumn; and Pisces (♓) at the end of winter and the conclusion of the year (fig. 12).

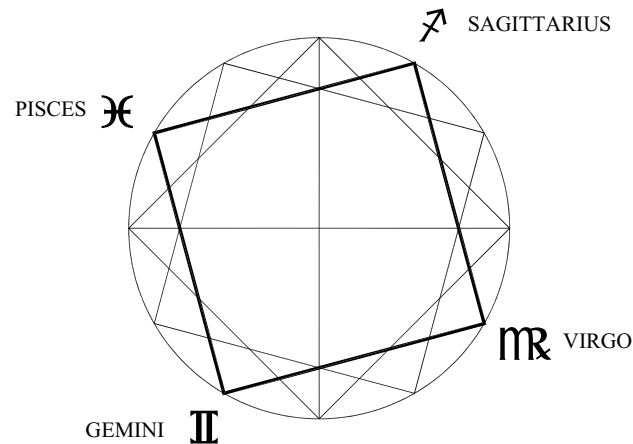


Fig. 12. The Mutable Signs

**Definitions:**

“**Gemini**,” the plural of *geminus*, the Latin word for “born together” or “twin-born,” is the third sign of the zodiac (♊), which the sun enters approximately May 21. The constellation Gemini (the Twins) is said to represent the twins Castor and Pollux, the names of its two brightest stars. The offspring of Leda’s seduction by Zeus, Castor was mortal and Pollux was immortal, but at Pollux’s request shared immortality between them, dividing their time between Hades below the earth and Olympus up above [Lewis 1879, Simpson 1989, Soanes 2003].

“**Virgo**,” the Latin word for “virgin” or “maiden,” is the sixth sign of the zodiac (♍), which the sun enters approximately August 23. The constellation Virgo (the Virgin) is said to represent a maiden or goddess of the harvest and contains the bright star Spica [Lewis 1879, Simpson 1989, Soanes 2003].

“**Sagittarius**,” the Latin word for “archer” or “bowman,” is the ninth sign of the zodiac (♐), which the sun enters approximately November 22. The constellation Sagittarius (the Archer) is said to represent the mythic Centaur with drawn bow [Lewis 1879, Simpson 1989, Soanes 2003].

“**Pisces**,” the plural of *piscis*, the Latin word for “fish,” is the twelfth sign of the zodiac (♓), which the sun enters approximately February 20. The constellation Pisces (the Fish) is said to represent a pair of fish tied together by their tails [Lewis 1879, Simpson 1989, Soanes 2003].

In fig. 13, all twelve signs of the zodiac are arranged as a pattern of squares, according to the four seasons and their phases.

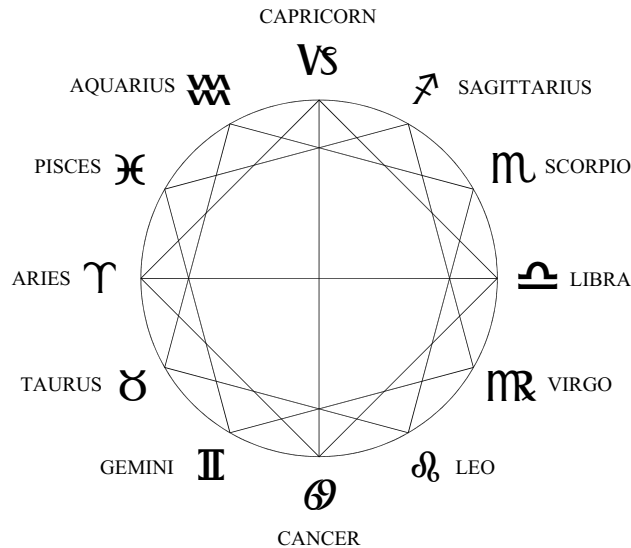


Fig. 13. The Twelve Signs of the Zodiac

### ***The Zodiac and the Human Body***

Between the fourth and third centuries B.C., parts of the human anatomy were linked to individual zodiacal signs. The first sign Aries, which marks the start of the new year, is assigned to the head and brain. Working simultaneously down the body and around the zodiac: Taurus, the second sign, is assigned to the neck and throat; Gemini, the third sign, to the shoulders, arms, and lungs; Cancer, the fourth sign, to the chest, stomach, and breasts; Leo, the fifth sign, to the upper back, spine, and heart; Virgo, the sixth sign, to the abdomen and intestines; Libra, the seventh sign, to the lower back and kidneys; Scorpio, the eighth sign, to the pelvis, genitals, and anus; Sagittarius, the ninth sign, to the thighs, hips, and flesh; Capricorn, the tenth sign, to the bones, joints, knees, and skin; and Aquarius, the eleventh sign, to the calves, ankles, and circulatory system.

The last sign Pisces concludes the year and is assigned to the feet and lymphatic system. Underlying this association of the human anatomy with the stars is the notion that man or humanity can be a measure of the universe, containing within itself all that is required to understand the nature and structure of the whole. In this sense, the macrocosm of the universe and the human microcosm are one [Jones 1969, 199, Maily Nesle 1981, 131-186, Tester 1987, 23].

### **How to Draw a Dodecagon from Four Triangles**

Let us create the twelve signs of the zodiac from a regular dodecagon composed of four triangles.

- With a compass, draw a circle and its horizontal and vertical diameters (AB and GH). (Repeat fig. 1.)
- Locate point B at the right end of the horizontal diameter (AB).
- Place the compass point at B. Draw an arc of radius BO that intersects the circle at points S and P.
- Connect points A, P, and S.

The result is an equilateral triangle (fig. 14).

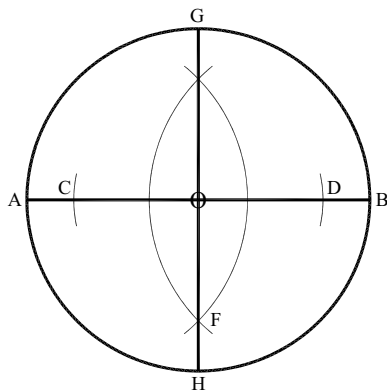


Fig. 1

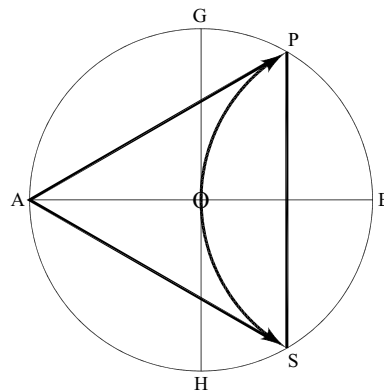


Fig. 14

- Locate point H at the bottom of the vertical diameter (GH).
- Place the compass point at H. Draw an arc of radius HO that intersects the circle at points U and R.
- Connect points G, R, and U.

The result is an equilateral triangle, as shown (fig. 15).

- Locate point A at the left end of the horizontal diameter (AB).
- Place the compass point at A. Draw an arc of radius AO that intersects the circle at points N and T.
- Connect points B, T, and N.

The result is an equilateral triangle, as shown (fig. 16).

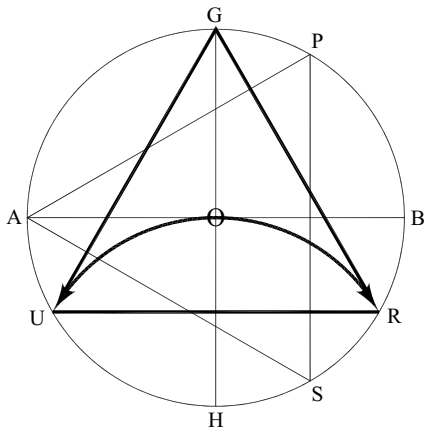


Fig. 15

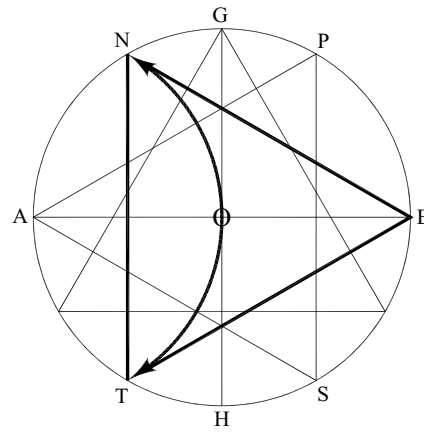


Fig. 16

- Locate point G at the top of the vertical diameter (GH).
- Place the compass point at G. Draw an arc of radius GO that intersects the circle at points Q and M.
- Connect points H, M, and Q.

The result is an equilateral triangle, as shown (fig. 17).

Together, the four triangles divide the original circle in twelve equal parts (fig. 18).

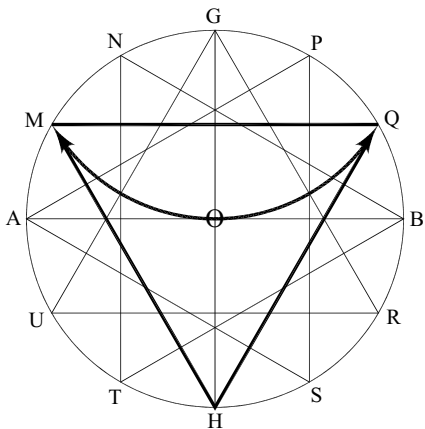


Fig. 17

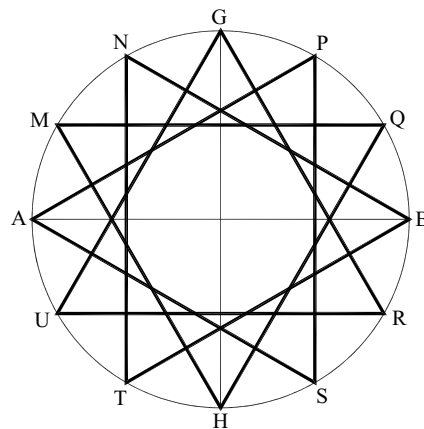


Fig. 18

- Connect all twelve points (A, M, N, G, P, Q, B, R, S, H, T, and U).

The result is a regular dodecagon composed of four triangles (fig. 19).

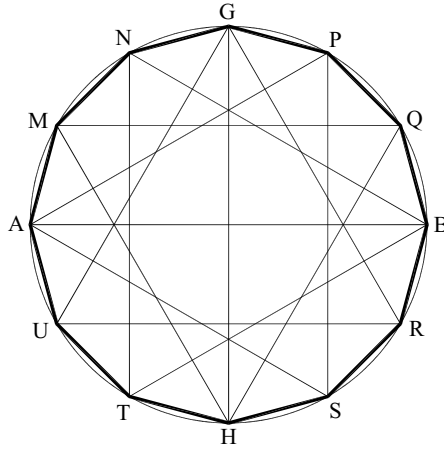


Fig. 19

### *The Cross of Four Elements*

In one respect, the zodiac depicts the seasons as they unfold through cardinal, fixed, and mutable phases, in a twelvefold arrangement composed of three squares. In another, the zodiac emerges from a pattern of triangles that diagrams the material composition of the universe, according to the four-element theory attributed to Empedocles, the Greek philosopher and physician (c. 490 – c. 430 B.C.).

Empedocles' elements decrease in density from fire through air and water to earth, and can be characterized further by the qualities of expansion and contraction, or hot and cold, and solution and fixation, or moist and dry. Pairs of elements that share no quality, such as fire and water, or air and earth, are contrary. Pairs of elements that share one quality are compatible. Fire and air share the quality of hot; air and water share the quality of moist; water and earth share the quality of cold; and earth and fire share the quality of dry (fig. 20).

Fire is hot and dry and produces a choleric temperament. Air is hot and moist and produces a sanguine temperament. Water is cold and moist and produces a phlegmatic temperament. Earth is cold and dry and produces a melancholic temperament.<sup>9</sup>

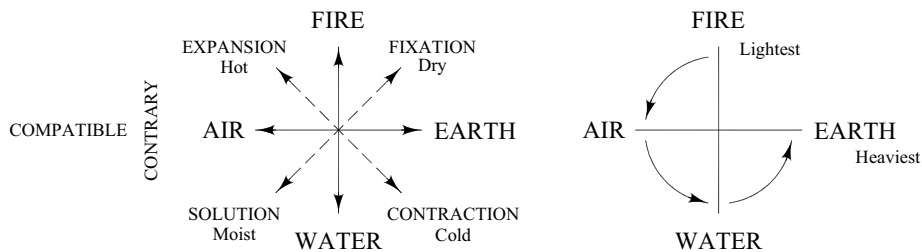


Fig. 20. The Four Elements

In human terms, fire is comparable to spirit, air to intellect, water to emotion, and earth to the physical senses. Fire is associated with energy, vitality, intuition and creativity, and in human terms is the state of pure “being” driven by power and self-expression. Air is associated with expansion, renewal, mobility and growth, and in human terms is the state of “thinking” or “knowing,” driven by thirst for knowledge. Water is associated with feeling, instinct, memory and the unconscious, and in human terms is the state of “understanding,” driven by desire for emotional contact. Earth is associated with solidarity, concentration and perseverance, and in human terms is the state of “doing,” grounded in practicality and common sense and driven by need for security and stability (fig. 21).

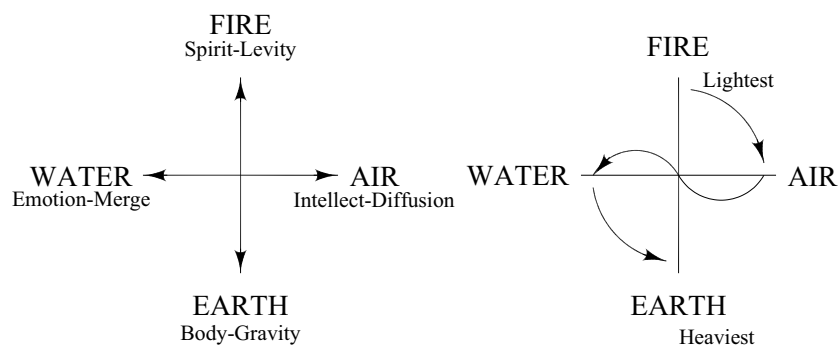


Fig. 21. The Four Elements in Human Terms

### *Reckoning the Zodiac by the Four Elements*

Each element characterizes three zodiacal signs whose positions divide the zodiac circle precisely in thirds, forming an equilateral triangle. In astrology, trine relationships or “aspects” are considered benign and favorable, constituting a natural harmony that unifies and connects one sign, or planet within the sign, to another. Taken together, the four trines of fire, earth, air, and water comprise the twelve signs of the zodiac.<sup>10</sup>

#### **Definitions:**

**Aspects** delineate the relative positions of planetary bodies, as viewed from earth. In addition to the **trine aspect**, where celestial bodies are separated at 120° intervals around the zodiac circle, astrology recognizes, among others, the **conjunction** (0° separation), the **sextile** (60° separation), the **square** (90° separation), and the **opposition** (180° separation). “Trine” is from the Latin *trinus* (from *tres* “three”), which means “three each” [Lewis 1879, Simpson 1989].

#### **The Twelve Houses**

In addition to the apparent positions of the sun, moon and visible planets, relative to one another and to the twelve signs of the zodiac circle, some systems recognize a second circle of twelve “houses” that divide the ecliptic evenly in thirty degree sections. Typically, the Ascendant marks the beginning or “cusp” of the First House. The Descendant marks the cusp of the Seventh House. The Midheaven marks the cusp of the Tenth House and the Nadir marks the cusp of the Fourth House.<sup>11</sup> Each house governs a specific area or

sphere of life where planetary energies are focused. Houses run parallel to zodiacal signs and depict how archetypes and qualities play out concretely in affairs here on earth.

### The Trine of Fire

#### Definition:

**Fire**, the element associated with spirit, radiates upward with the force of levity. The Greek for “fire” is *pur*, which means “fire, light, heat of the sun,” “summer solstice,” “flame,” “lightening,” and “funeral-fire.” The Latin for “fire” is *ignis*, from the Greek *aiglê*, which means “the light of the sun, radiance,” and *aglaos*, which means “splendid, shining, bright, beautiful” [Lewis 1879, Liddell 1940, Simpson 1989].

The cardinal sign Aries (♈), the fixed sign Leo (♌), and the mutable sign Sagittarius (♐) comprise the trine of zodiacal signs characterized by the element fire (fig. 22). In human terms, fire signs, and their corresponding First, Fifth, and Ninth Houses, trace the development of the ego through modes of self-expression.

The process begins with the emergence of the individual in the first sign of Aries, symbolized by the Hero, where the catalytic energy of fire is expressed in the will to lead, to initiate, and to be. Aries’ ruling planet Mars brings courage, passion, assertiveness, and decisiveness to the process of making one’s mark in the world.<sup>12</sup> Aries is analogous to the First House of Self, encompassing the individual’s ego, personality, appearance, and physical body.

The next fire sign in the zodiac is Leo, symbolized by the Creator, where the creative and procreative energies of fire are expressed. Leo’s ruling planet is the Sun, who, as the Father Creator, enhances emotional modes of expression. Leo is analogous to the Fifth House of Creativity, encompassing creation, procreation, the arts, and one’s own children.

The last fire sign is Sagittarius, symbolized by the Philosopher, where fire is expressed in the spiritual quest for meaning and where self-expression is directed to values and philosophy. Sagittarius is ruled by the planet Jupiter, who brings optimism and idealism to the capacity for prophetic and visionary thought and a curiosity about distant cultures and lands. Sagittarius is analogous to the Ninth House of Travel and Philosophy, encompassing religion, philosophy, and long-distance journeys.

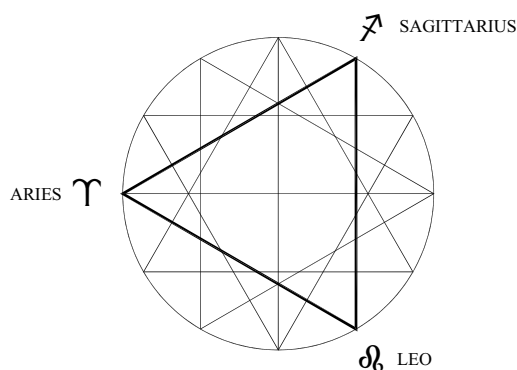


Fig. 22. The Fire Trine



## The Trine of Earth

### Definition:

**Earth**, the element associated with the physical body and the ground of common sense, is pulled downward by force of gravity. “Earth” is from the Greek *eraze* which means “to earth, to the ground” [Liddell 1940].

The fixed sign Taurus (♉), the mutable sign Virgo (♍), and the cardinal sign Capricorn (♑) comprise the trine of zodiacal signs characterized by the element earth (fig. 23). Earth signs, and their corresponding Second, Sixth, and Tenth Houses, describe how resources are manifest.

The process begins with Taurus, the second sign of the zodiac, symbolized by the Earth Mother and governing personal resources and material security. Also associated with sensuous earth and beauty, Taurus is ruled by the planet Venus, expressed in earth as erotic instinct and magnetism. Taurus is analogous to the Second House of Possessions, encompassing money and acquisitions.

The next earth sign in the zodiac is Virgo, symbolized by the Virgin, where resources are applied in the service of work. Virgo is ruled by the planet Mercury, expressed in earth as verbal facility, the capacity for organization, and pragmatic, critical thought. Virgo is analogous to the Sixth House of Work, encompassing health, the physical body, and selfless work and service.

The last earth sign is Capricorn, symbolized by the Professional, where resources are directed in service to the world. Capricorn is ruled by the planet Saturn who as the World Father brings responsibility and perseverance to the way we present ourselves to society and secure our place in the world. Capricorn is analogous to the Tenth House of Profession, encompassing worldly responsibility, professional work, and social status.

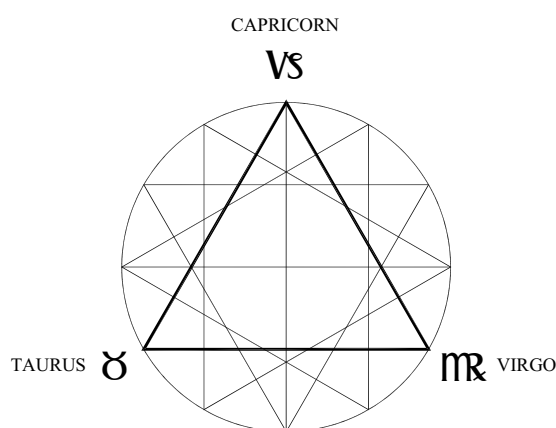


Fig. 23. The Earth Trine

## The Trine of Air

### Definition:

**Air**, the element associated with intellect and breath, diffuses outward, giving voice to thought. “Air” is from the Latin *aer*, which means “the air, atmosphere, sky,” and from the Greek *aēr*, which means “the lower air, the air,” related to *aēmi*, which means “to breath hard, blow” [Lewis 1879, Liddell 1940, Simpson 1989].

The mutable sign Gemini (♊), the cardinal sign Libra (♎), and the fixed sign Aquarius (♒) comprise the trine of zodiacal signs characterized by the element air (fig.24). Air signs, and their corresponding Third, Seventh, and Eleventh Houses, trace the growth of social and interpersonal relationships.

The process begins with Gemini, the third sign of the zodiac, which is symbolized by Brother-Sister Twins and includes relationships with siblings, neighbors, and peers. Gemini is ruled by Mercury who as the Messenger facilitates short distance travel and brings mental and verbal acuity to writing and teaching skills. Gemini is analogous to the Third House of Communication, encompassing brothers and sisters, neighbors, commerce, and short distance commutes.

The next air sign in the zodiac is Libra, which is symbolized by the Mediator and ruled by the planet Venus. Libra is the seventh sign of the zodiac and the first to express a conscious awareness of others. In Libra the romance of Venus is idealized, bringing cooperation and diplomacy to relationships, and harmony and feminine beauty to creativity and the arts. Libra is analogous to the Seventh House of the Other, encompassing marriage, equal partnerships, open enemies, and the public.

The last air sign is Aquarius, which is symbolized by the Humanitarian and includes social institutions and groups. Aquarius is ruled by Saturn, who, as the Father Teacher, brings material restriction and human interconnection to impersonal, worldly, and synthetic processes of thought. Aquarius is analogous to the Eleventh House of Friends, encompassing collective groups and institutions, ideals, and other people’s children.

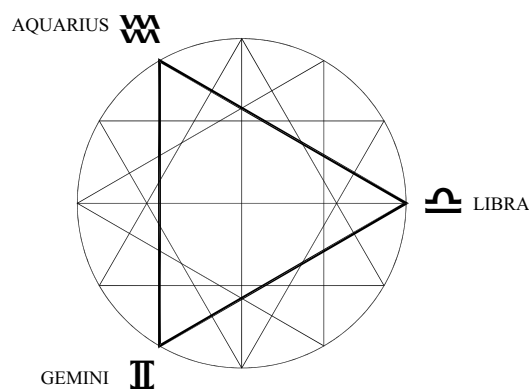


Fig. 24. The Air Trine

## The Trine of Water

### Definition:

**Water** flows inward, merges, and, like our tears, conveys feeling and emotion. “Water” is from the Latin *unda*, which means “a wave, billow,” and is related to the Greek *hudôr*, which means “water” [Lewis 1879, Liddell 1940, Simpson 1989].

The cardinal sign Cancer (♋), the fixed sign Scorpio (♏), and the mutable sign Pisces (♓) are characterized by the element water (fig. 25). Water signs, and their corresponding Fourth, Eighth, and Twelfth Houses, delineate pathways of the unconscious.

The process begins with Cancer, the fourth sign of the zodiac, symbolized by the Mother and governing unconscious personal connections to our family, racial, and collective roots. Cancer is ruled by the Moon, who brings instinct and nurturing to dependencies between mother and child. Cancer is analogous to the Fourth House of Home and Family, encompassing community, heritage, ancestry, and childhood.

The next water sign in the zodiac is Scorpio, symbolized by the Transformer, where unconscious forces of the psyche penetrate the dark waters of mystery, death, and transformation. Scorpio is ruled by the planet Mars, who supplies fortitude to endure pain and force to penetrate the depths. Scorpio is analogous to the Eighth House of Sex, Death, and Rebirth, encompassing the underworld, transformation, sexual motivation, and other people’s money.

The last water sign, and the sign that concludes the year, is Pisces, symbolized by the Mystic, where the ego surrenders to the transpersonal universe and the collective unconscious. Pisces is ruled by the planet Jupiter, who brings expansion and optimism to the capacity for empathy and compassion. Pisces is analogous to the Twelfth House of Self-Sacrifice, encompassing mystery, karma, endings, solitude, and secret enemies.

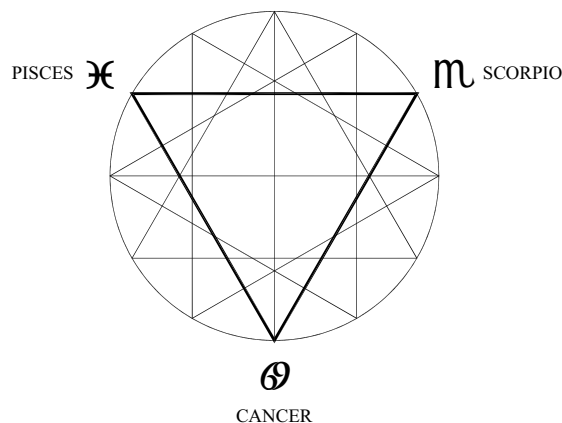


Fig. 25. The Water Trine

In fig. 26, all twelve signs of the zodiac are arranged as a pattern of triangles. In accord with the four elements, fig. 27 summarizes their essential qualities and analogous human traits.

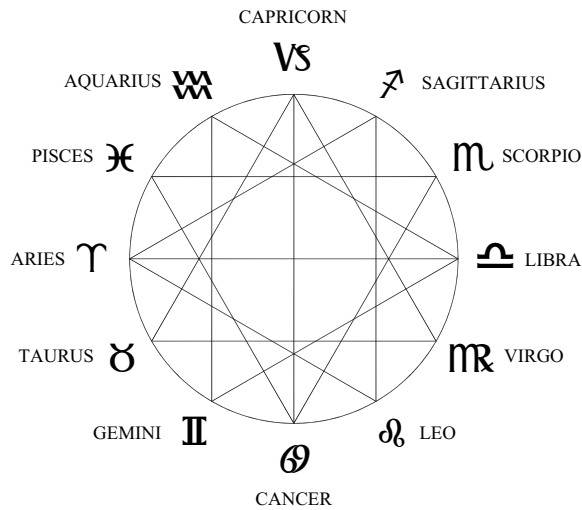


Fig. 26. The Twelve Signs of the Zodiac

**THE FOUR ELEMENTS**

ELEMENT	FIRE	AIR	WATER	EARTH
<b>MOTION</b>	Levity Flows upward	Diffusion Flows outward	Merge Flows inward	Gravity Flows downward
<b>HUMAN REALM</b>	Spirit - Heart Intuition	Intellect - Mind Thought	Emotion - Psyche Feeling	Physical body Sense
	"I am" "I believe"	"I know" "I think"	"I understand" "I feel"	"I do" "I make"
	Leadership	Cooperation	Empathy	Follow-through
<b>HUMOUR</b>	Choler	Blood	Phlegm	Melancholy
<b>QUALITY</b>	Hot and Dry	Hot and Moist	Cold and Moist	Cold and Dry
<b>CARDINAL</b>	Aries	Libra	Cancer	Capricorn
<b>FIXED</b>	Leo	Aquarius	Scorpio	Taurus
<b>MUTABLE</b>	Sagittarius	Gemini	Pisces	Virgo

Fig. 27

**COMPLEMENTARY OPPOSITIONS**

INNER SIGNS AND HOUSES		OUTER SIGNS AND HOUSES	
<b>I. ARIES</b>	Self - Personality	<b>VII. LIBRA</b>	Other - Partnership
<b>II. TAURUS</b>	Our own money, energy, resources	<b>VIII. SCORPIO</b>	Others' money energy, resources
<b>III. GEMINI</b>	Brothers Sisters Short local travel Information	<b>IX. SAGITTARIUS</b>	Groups Institutions Distant journeys Knowledge
<b>IV. CANCER</b>	Personal home Mother Household	<b>X. CAPRICORN</b>	Home in the world Father Profession
<b>V. LEO</b>	Our own children Love we express Personal love	<b>XI. AQUARIUS</b>	Others' children Love we receive Impersonal love
<b>VI. VIRGO</b>	Service to work Physical body	<b>XII. PISCES</b>	Self-sacrifice Universal realm

Fig. 28

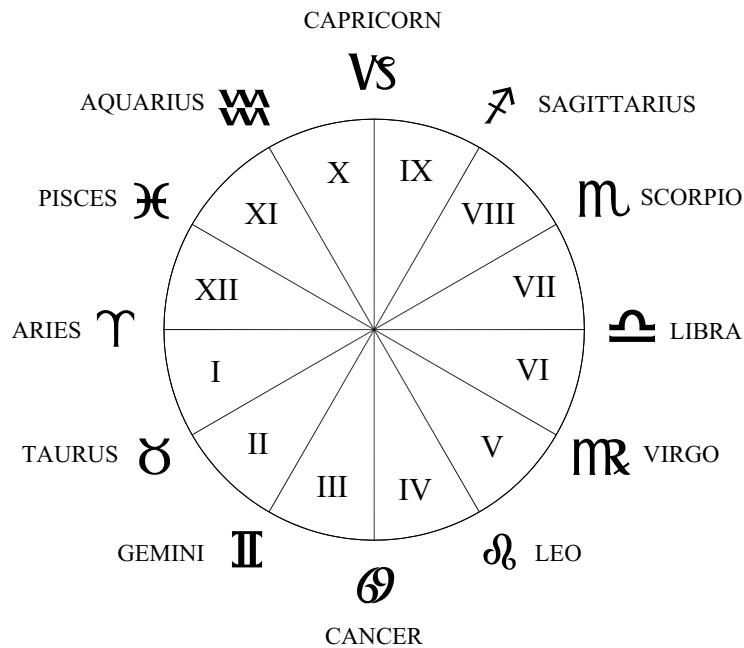


Fig. 29. The Twelve Signs of the Zodiac and Their Houses

### *Complementary Oppositions*

In addition to square and trine relationships, the meaning of the zodiac is conveyed through a geometry of oppositions. When two signs or houses oppose one another, dividing the circle of the zodiac in half and forming a 180° aspect, their values and areas of concern are complementary. The first six houses and signs of the zodiac, from Aries through Virgo, appear below the horizon and address our individual connection to inner, personal worlds. The last six houses and signs, from Libra through Pisces, appear above the horizon and address our complementary social connection to outer, impersonal worlds (fig. 28).

In fig. 29, all twelve signs and houses of the zodiac are arranged in a pattern of complementary oppositions.

### *Conclusion*

“By these same triangles, astrologers calculate the harmonies of the stars of the twelve heavenly signs...” [Vitruvius 1999: V, 6, 1].

According to Vitruvius, Roman theatres of his day followed astrology’s twelve-fold arrangement of triangles, while those of the Greeks followed a similar arrangement composed of three squares [Vitruvius 1999: 68-70, 247-248]. Astrology’s zodiac has much to tell about who we are and the world we inhabit, in the symbolic content of individual signs, and in the way signs relate geometrically. When viewed chronologically, the signs from Aries to Pisces represent the human anatomy, from head to foot.

As a composite of square relationships, they depict the phases of a seasonal round. Trine relationships inform the elemental composition of matter. Oppositions delineate pathways of human conduct through inner and outer worlds. Whether the zodiac reflects credible descriptions of the world and human behavior, or has the capacity to influence events, is not for us to say. What is clear is that the expression of meaning through rich layers of geometric pattern invokes a world view of interdependent elements that is holistic and vibrant.

### *Notes*

1. The use of the ecliptic as a celestial reference and the subsequent zodiac of twelve signs as we know it are believed to be of Babylonian origin, but inherited from the Greeks. As early as the second millennium B.C. there are references to the moon transiting constellations whose names include possibly eight of the twelve constellations now known as the zodiac. Neugebauer believes that Babylonian astronomy’s “prehistory” (1800 B.C. to 400 B.C.) includes a great circle for calculating solar and planetary motion consisting of twelve 30° sections. But the principal development of astrology is Hellenistic. There is no evidence of a complete zodiac of twelve constellations from Aries to Pisces, in ancient Greece, until the fifth century B.C. [Neugebauer 1969, 102-103, 170-171; Thompson 2008]. See [Thompson 2008] for a detailed summary of the origin of the zodiac, which includes three major developments: twelve unequal constellations along the ecliptic; twelve constellations of equal 30° sections along the ecliptic; and twelve tropical signs divided in equal 30° sections.
2. Possibly, the division of circles into 360 degrees to approximate the number of earth rotations each year appeared independently in Babylon, Egypt, and China. Three hundred and sixty earth rotations fall short of a true solar year by just over five days. Twelve lunar periods of 29.5 days each, or 354 days, fall short of a true solar year by eleven days [Gleadow 1969, 16-18].
3. [Tester 1987, 6.] See illustration [Fletcher 2005a, 143].

4. In the southern hemisphere, these are reversed.
5. The directions of south-above, north-below, and east and west on the left and right, respectively, are in the manner of maps of the sixteenth century [Heninger 1977, 140-141]. Perhaps this arrangement expresses the notion of an ideal reality of which our common experience is a mirror reflection. Each season of the year corresponds to a quarter period within a twenty-four hour day. See [Fletcher 2005b, 40].
6. See [Jones 1969, 24-25, Tester 1987, 25]. The meridian is the north-south line intersecting the horizon, where a great circle on the celestial sphere passes through the celestial poles and the observer's zenith and nadir, and which the sun crosses at noon and at midnight [Simpson 1989]. When applied to human behavior, the quadrants delineate realms we inhabit and how we relate to them. On the left or eastern half, behavior is inner-directed and self-initiated. On the right or western half, behavior is outer-directed and initiated by others. Above the horizon, awareness is conscious, impersonal, and objective. Below the horizon, awareness is unconscious, personal, and subjective. Thus, in Quadrant I, which begins at the Ascendant, behavior is self-directed in unconscious, personal, and subjective ways. In Quadrant II, which begins at the Nadir, behavior is directed to others in unconscious, personal, and subjective ways. In Quadrant III, which begins at the Descendant, behavior is directed to others in conscious, impersonal, and objective ways. In Quadrant IV, which begins at the Midheaven, behavior is self-directed in conscious, impersonal, and objective ways. These general traits form the basis of specific characteristics associated with each zodiacal sign [Bresciani 1985].
7. The interpretations that follow are from [Bresciani 1985, Jones 1969, Maily Nesle 1981].
8. In Western astrology, Aries and Scorpio are "ruled" by the planet Mars.
9. In ancient and medieval physiology, four bodily fluids (choler or yellow bile, melancholy or black bile, blood, and phlegm) are said to determine one's physical and mental disposition. This four-humour theory is attributed to the Greek physician Hippocrates (c.460-377 B.C.). The association of the elements with qualities of hot, dry, moist, and cold is attributed to Aristotle [Blakemore 2001].
10. The interpretations that follow are from [Bresciani 1985, Jones 1969, Maily Nesle 1981].
11. When casting a specific chart, the First House is tied to the sign of the zodiac that is "rising" on the eastern horizon at the time and place in question. Systems that divide the ecliptic into 30° zodiac signs and comparable 30° houses are known as "equal house" systems.
12. In astrology, a planet that "rules" a particular sign of the zodiac is said to have its domicile there, in its most powerful position of influence.

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Rachel Fletcher is a theatre designer and geometer living in Massachusetts, with degrees from Hofstra University, SUNY Albany and Humboldt State University. She is the creator/curator of two museum exhibits on geometry, “Infinite Measure” and “Design by Nature”. She is the co-curator of the exhibit “Harmony by Design: The Golden Mean” and author of the exhibit catalog. In conjunction with these exhibits, which have traveled to Chicago, Washington, and New York, she teaches geometry and proportion to design practitioners. She is an adjunct professor at the New York School of Interior Design. Her essays have appeared in numerous books and journals, including *Design Spirit*, *Parabola*, and *The Power of Place*. She is the founding director of the Housatonic River Walk in Great Barrington, Massachusetts, and is currently directing the creation of an African American Heritage Trail in the Upper Housatonic Valley of Connecticut and Massachusetts.