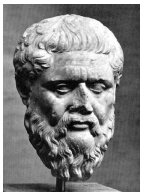
Mathematics, Time and the Heavens

One of the great goals of natural scientists has been to discover and describe invariance and patterns in nature using mathematics. Another has been to find quantitative ways to deal with variability and randomness. The first goal leads to determinism, the second leads to quantification of probabilities and chance. Sometimes scientists find reliable quantitative laws for predicting future and retrodicting past behavior of physical systems, at least with some acceptable degree of accuracy. Sometimes they find useful quantified probabilities for this purpose.

Development of mathematical thought was accelerated by observations of celestial objects. Investigators have found that many ancient peoples in many parts of the world had quite sophisticated mathematical understanding of celestial phenomena. In the last 3 centuries B.C. Babylonians developed mathematical methods which are favorably comparable in quality to additional methods developed later by Greeks. Development of mathematics went hand-in-hand with development of astronomy. In contrast with capricious gods of nature, visions arose of the divine manifesting itself in ways based on apparently unvarying paths of the sun, moon, planets and stars.



Such thoughts are discussed in Plato's *Epinomis* (translated by Raymond Klibansky in *Philebus and Epinomis*, 1956). Plato asks how we are to get wisdom. He runs through a number of domains of knowledge in farming, the useful and fine arts, sciences of war, medicine and transportation, and says that none of them constitute wholly reliable wisdom. Then he asks what single science there is which, if it were taken away from mankind or never had made its appearance, people would be thoughtless and foolish creatures. His answer is mathematics. Plato says that our knowledge of mathematics comes to us from Ouranos, the god of the heavens. Call him Ouranos, Cosmos, or whatever you please, Plato says, Ouranos is the source of all good things, such as the seasons and our food. Mathematics, says Plato, is the greatest gift of all, if people will only accept it, and let their minds range over the heavens. Plato, who lived 427–347 B.C., was of course speaking of Greek mathematics of his own time.

Similar thoughts are found in the dialogue *Timaeus* by Plato. As translated by Francis Cornford in *Plato's Cosmology* (1937), Plato says: "Sight, then, in my judgment is the cause of the highest benefits to us in that no word of our present discourse about the universe could ever have been spoken, had we never seen stars, Sun, and sky. But as it is, the sight of day and night, of months and the revolving years, of equinox and solstice, has caused the invention of number and bestowed on us the notion of time and the study of the nature of the world; whence have derived all philosophy, than which no greater boon has ever come or shall come to mortal man as a gift from heaven."

In the cosmological myth in the *Timaeus*, Plato speaks of the Demiurge, the Creator. Plato says (Cornford's translation) that the Demiurge "took thought to make, as it were, a moving likeness of eternity; and, at the same time that he

ordered the Heaven, he made, of eternity that abides in unity, an everlasting likeness moving according to number – that to which we have given the name Time. A little later in the dialogue, Plato says: "Time came into being together with the Heaven, in order that, as they were brought into being together, so they may be dissolved together, if ever their dissolution should come to pass."

Notions about the nature of time are intricately involved with notions about celestial objects. Presumably animals other than humans are not conscious of time passing the way humans are. For humans, consciousness of time brings consciousness of aging and death. This incites countermeasures, such as: a paradise lost in the past; a heaven and hell to go to; an end of time; a better or worse world to come on earth; attempts to preserve the present whatever its blemishes might be. Briefly stated, consciousness of time is a prime factor in the formation of religions.

One can conceive of time being measured linearly or cyclically. In biblical prophecy, the future is beheld, proclaimed, believed in. Prophets looked forward and backward in a kind of linear time bounded by creation and consummation. Isaiah says in the Bible (*Isaiah,* 43.18, Revised Standard Version).: "Remember not the former things, nor consider the things of old. Behold, I am doing a new thing." And later (60.19-20): "The sun shall be no more your light by day, nor for brightness shall the moon give light to you by night; but the Lord will be your everlasting light, and your God will be your glory. Your sun shall no more go down, nor your moon withdraw itself; for the Lord will be your everlasting light, and your days of mourning shall be ended. Your people shall all be righteous; they shall possess the land for ever, the shoot of my planting, the work of my hands, that I might be glorified. The least one shall become a clan, and the smallest one a mighty nation; I am the Lord; in its time I will hasten it.". This implies that periodic movements of celestial objects will cease, and time will flow only forward, as if along a line, and that time will approach a consummation and cease.

Ancient Jews put the beginning of the world on October 7, 3761 B.C., as measured by the Gregorian Christian calendar. Cosmologists today put the date of creation earlier, say at around 15 thousand million years ago, give or take 5 million years or so. The time intervals are different, but the principle is the same. On the other hand, some cosmologists have proposed that although our universe is now expanding, it will eventually start contracting, and that when it has fully contracted there will be another big bang, and so on and on forever and ever.

Proposals that our universe has been and will continue to recur forever are known as doctrines of Eternal Return. This concept was prevalent in ancient in India, and found in ancient Egypt and Persia. More recently, it was taken up by Friedrich Nietzsche (1844-1900). In *Thus Spoke Zarathustra*, Nietzsche wrote: "Behold, we know what you teach: that all things recur eternally, and we ourselves too; and that we have already existed an eternal number of times, and all things with us. You teach that there is a great year of becoming, a monster of a great year; which must, like an hourglass, turn over again and again so that it may run down and run out again; and all these years are alike in what is greatest as in what is smallest; and we ourselves are alike in every great year, in what is greatest as in what is smallest."

Some writers of books about history of astrology choose to start from astral beliefs and kinds of worship which didn't make use of mathematical methods like those developed by Babylonians and classical Greeks. They might even begin with prehistoric times. Others begin with Babylonians of the last three centuries B.C. in view of ways mathematics is used by astrologers nowadays. These commonly say that astrology began with these Babylonians, and that there was a notable development of astrology in the Hellenistic period. The Hellenist period is often taken to have started with the death of Alexander the Great in 323 B.C., and to have ended in the takeover of Egypt by Romans under Octavian in 31 B.C. However, in view of how Romans were affected by developments in this Hellenistic era, it is common to find that people who lived after 31 B.C. are said to be "Hellenistic". Sometimes this designation is used for people who lived before 312 A.D. when Constantine the Great converted to Christianity and subsequently ordered tolerance of Christianity throughout the Roman empire.