Empires and exact sciences in pre-modern Eurasia

Pre-modern Asia’s diverse intellectual traditions shared a scientific enterprise in the development of mathematical astronomy and astrology. Inspired by the prospect of foretelling the future, and by the mathematical beauty of heavenly motions, scholars in the dominant cultures of Asia and Europe constructed a remarkably complex system of calculation, observation and prediction that became the springboard for modern physical science.

But by then Mesopotamia was under the control of the Persian and Macedonian empires, who took little interest in celestial warnings from Babylonian deities. So the astronomers turned to forecasting the future for individual patrons rather than for the state. They appear to have invented the concept of the horoscope, a prediction of the fate of an individual based on the positions of the stars and planets at the moment of his or her birth. The allure of such glimpses into the future launched the disciplines of mathematical astronomy and astrology on their far-flung wanderings through the subsequent millennia.

Dissemination of exact sciences

Greek scholars encountered Babylonian astronomy and celestial omens in Ptolemaic Egypt in the second half of the first millennium BCE. They superimposed the spherical cosmology of their own philosophical systems onto some of the Babylonian astrophysical schemes for mathematically predicting astronomical phenomena. This combination developed over the next few centuries into the famous system of nested celestial spheres, revolving around a stationary spheric earth, that we know as “Ptolemaic” astronomy.

The geometrised Ptolemaic universe served as the model for probably the most important scientific instrument of pre-modern times, the plane astrolabe (see sidebar). Greek science also adopted Babylonian ‘prot-horoscopes’ and expanded them into a full-blown system of horoscopic astrology.

In the flourishing trade of the Roman empire in the early first millennium CE, the Hellenistic exact sciences spread eastward to India, where they developed into the astrology and spherical astronomy of the classical Sanskrit tradition. These Indian sciences then rippled outward to enrich the astral knowledge of cultures in pre-Islamic Iran, China and Southeast Asia.

The complex multi-cultural layering of such knowledge is illustrated in Figure 1, which shows the iconography of the zodiacal signs Virgo and Pisces as represented in a mandala in the Takihata temple in Kyoto. Here we see Japanese versions of Chinese versions of Indian versions of the signs of the celestial zodiac adapted by Greeks from its original Babylonian form. (Note that in the process the single maiden representing the sign Virgo has become two, and the two fish representing Pisces have become one.)

The rise and expansion of Islam in the 7th century continued the development and transmission of the exact sciences. In addition to many influences from India and Sassanian Iran (such as the decimal place-value numerals and various mathematical, astronomical and astrological methods), science in the Islamic world incorporated the Hellenistic Greek theories of ancient authors such as Euclid, Archimedes and Ptolemy. Embodied mostly in Arabic and Persian texts, these new syntheses of mathematical, astronomical and astrological knowledge were quickly diffused eastward to India, Central Asia, China, Byzantium and the Latin West. There they came into contact with different traditions of the exact-sciences tradition, sometimes stimulating efforts by scientists to compare, assess and reconcile their variants.

Figure 2 shows an example of one of these second millennium cross-cultural transmissions: an Arabic manuscript, written in India, explains the cosmology of nested heavenly spheres derived ultimately from Greek philosophy. In the western world, such interactions between variant traditions helped form the Renaissance science that eventually replaced the Ptolemaic systems of astronomy and astrology with the heliocentric cosmos of early modern astronomers like Copernicus, Kepler and Newton.

**Bibliography**


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