SPACE
awareness

JOURNEY OF IDEAS:
INTRODUCTION CHAPTER 2

THE BIRTH OF THE ASTRONOMICAL IDEAS

THE BIRTH OF THE ASTRONOMICAL IDEAS: ASTRONOMY FOR RELIGIOUS AND PRACTICAL PURPOSES

Since the dawn of history our ancestors observed the sky that led to the discovery of the periodicity of sky phenomena. They noticed that the Sun rose and set periodically. The Moon changed its shape, and the shapes repeated. Groups of stars were visible sometimes and disappeared to become visible again at a later time. The Sumerians, who lived in Mesopotamia, assigned gods to the planets and observed their motions in the sky. Like in other polytheistic cultures, the Sumerians projected their gods onto the sky, making them responsible for all earthy events including weather, earthquakes, rain, birth and death.
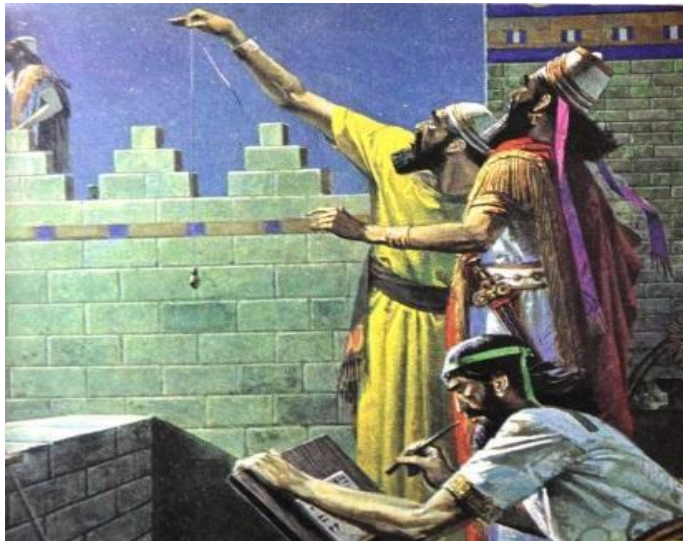

Fig. 1 Babylonian astronomers (Credits: http://www.fhshh.com)

In 2500 BCE, priests in Babylon (Iraq at present) and Egypt continued with the Sumerian tradition and recorded their observations. Later on they started to make use of the observed regularity in the sky to measure time and to make calendars. Astronomical observations were used for fixing the time of religious festivals, for the time of prayer, for letting farmers know when to plant crops, for helping sailors to navigate their ships and find the way back home, and even for the time to collect taxes. Thus, for many centuries in different cultures astronomy and mathematics were used as a practical tool linked not only to religion but also to daily life[1].

The Babylonians not only observed the periodicity of sky phenomena but they recorded their observations on clay tables. Recording played an important role because it later allowed them to analyse records of ancient observations, which in turn made it possible to predict future astronomical events. They also used arithmetical procedures to compute the time and place of significant astronomical events (e.g. the appearance and visibility of planets in the sky).
The Babylonians used the sexagesimal system (base 60) which was developed earlier by the Sumerians. They divided the duration of the day into 24 hours, each hour into 60 minutes, and each minute into 60 seconds. We still use these units of time today! Also the modern practice of dividing a circle into 360 degrees began with the Sumerians and Babylonians.

Fig.2 The yearly Nile inundation (Credits: Wikipedia)

During the same time as the Babylonian observations, the Egyptian astronomers discovered and measured the length of the year. Because in Egypt people´s life depended so strongly on their crops, predicting the flood of the Nile became very important. Every time that the Nile flood took place, the Egyptian astronomers observed that the star Sirius was exactly East in the sky, just before sunrise. Sirius is the brightest star in the Northern Hemisphere and it belongs to the constellation of the Big dog (Canis Majoris).

Ancient Egyptians believed that the Nile flooded every year because of Isis´ tears of sorrow for her dead husband, the deity Osiris. Isis was identified in the sky with the star Sirius. Both phenomena are however not causally related (the appearance of Sirius on the East sky was not the cause of the Nile flood) but closely observing the sky and Sirius' position helped to predict the flood and to be prepared for it. A feast was introduced around this event that took place around the 15th of August. From that date each year Sirius could be seen during 182 nights in the night sky. After that, Sirius disappeared again for 183 days from the night sky. Exactly after 365 days after the Nile flood it appeared again at the East before sunrise! By counting how much days passed from one appearance of Sirius to the next one they defined the length of the year: roughly 365 days.   The Egyptian year was subsequently divided into the three seasons of Akhet (Inundation), Peret (Growth), and Shemu (Harvest).
Once cities became larger and people started to do different types of work, measuring time became very important because of the different events which had to be organised. Measuring time marks the beginning of big civilisations!

THE SEXAGESIMAL SYSTEM AND ITS LEGACY TODAY

The sexagesimal numeral system has as base the number 60. It was developed by the ancient Sumerians in 3000 BCE and was widely used by the Babylonians over the course of centuries. We still use it today for measuring time, angles and geographic coordinates!

The sexagesimal system has huge advantages: the number 60 has twelve factors: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, and 60, of which 2, 3, and 5 are prime numbers (prime numbers only have two divisors: 1 and itself). You can imagine that with so many factors, many fractions involving sexagesimal numbers can be simplified!

The sexagesimal system used in Babylon did not use 60 different symbols for its digits. Instead, the cuneiform digits of the Sumerians and Babylonians used ten as a sub-base:

𒁹 1	𒌋𒁹 11	𒎙𒁹 21	𒌍𒁹 31	𒐏𒁹 41	𒐐𒁹 51
𒈫 2	𒌋𒈫 12	𒎙𒈫 22	𒌍𒈫 32	𒐏𒈫 42	𒐐𒈫 52
𒐈 3	𒌋𒐈 13	𒎙𒐈 23	𒌍𒐈 33	𒐏𒐈 43	𒐐𒐈 53
𒐉 4	𒌋𒐉 14	𒎙𒐉 24	𒌍𒐉 34	𒐏𒐉 44	𒐐𒐉 54
𒐊 5	𒌋𒐊 15	𒎙𒐊 25	𒌍𒐊 35	𒐏𒐊 45	𒐐𒐊 55
𒐋 6	𒌋𒐋 16	𒎙𒐋 26	𒌍𒐋 36	𒐏𒐋 46	𒐐𒐋 56
𒐌 7	𒌋𒐌 17	𒎙𒐌 27	𒌍𒐌 37	𒐏𒐌 47	𒐐𒐌 57
𒐍 8	𒌋𒐍 18	𒎙𒐍 28	𒌍𒐍 38	𒐏𒐍 48	𒐐𒐍 58
𒐎 9	𒌋𒐎 19	𒎙𒐎 29	𒌍𒐎 39	𒐏𒐎 49	𒐐𒐎 59
𒌋 10	𒎙 20	𒌍 30	𒐏 40	𒐐 50	

Fig. 3 The sexagesimal system as used in Babylon with cuneiform symbols (Credits: Josell7 (https://commons.wikimedia.org/wiki/File:Babylonian_numerals.svg), https://creativecommons.org/licenses/by-sa/4.0/legalcode*)*

The 𒁹 symbol means 1 or 60, the 𒌋 symbol means 10. This allows for different combinations:

𒈫 = 2   or   𒐕𒁹 = 60+1 = 61   or   𒁹 𒁹 = 60+60 = 120

𒁹𒌋 = 60+10 = 70   𒁹𒁹𒌋 = 60 + 60 + 10 = 130

In Babylon, The selection of the right combination was done depending on the context. For instance, a market merchant selling a "few" fruits, "many" fruits or "a large amount" of fruits used one of the combinations to perform an addition and fix a price. To avoid confusion, we will only use the first and most simple combination during our activities.

LITERATURE CHAPTER 2

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