SPACE awareness

JOURNEY OF IDEAS:
INTRODUCTION CHAPTER 5

MEET FOUR ISLAMIC SCHOLARS OF THE ISLAMIC GOLDEN AGES

5.1 THE ASTRONOMER AL-SUFI WHO BUILT A BRIDGE BETWEEN GREEK AND ISLAMIC ASTRONOMY

Al-Sufi (903 – 986 CE) was a famous Persian astronomer who was influenced by the Greek astronomer Hipparchus from Rhodes and Ptolemy from Alexandria (see Chapter 3). The names of many prominent stars in our night sky are Arabic and can be traced back to Al-Sufi's work. Examples are Aldebaran, Betelgeuse, Algol, and Rigel. Ali-Sufi's full name was Abu 'l-Hussain 'Abd al-Rahman ibn Umar ibn Sahl al-Sufi al-Razi and he is known in the west as Azophi. He was born in Rey, Persia (today´s Iran), in the late 9th century. Like other Muslim men of science, he studied and wrote in Arabic. He carried out astronomical observations from the magnificent Persian city of Isfahan (now in Iran), where he became the Royal Astronomer to the Emir Adud al-Dawla, a man who ruled over large parts of today´s Iraq and Iran.

Figure 1. Al-Sufi (Credits: Provot)

Adud al-Dawla understood the importance of science. After he became Emir, he sponsored a large number of scientific projects. In 960 he ordered the construction of a great dam between Shiraz and Estakhr. The dam irrigated about 300 villages and became known as Band-e Amir (the port of the Amir). On his orders, an observatory was built in Isfahan. It was at this observatory that Al-Sufi worked on mapping the night sky, just as Hipparchus and Ptolemy did 800 years before him. He painstakingly measured the positions and brightness of large numbers of stars as accurately as possible.

Al-Sufi devoted decades of his life to mapping the sky and comparing it to Hipparchus' discoveries (see chapter 3): (a) He noticed that the constellations seemed to shift very slowly on the sky along the years. By measuring the positions of the constellations during spring and by comparing his measurements with those obtained by the Babylonian thousands of years before, he concluded that the sphere of the sky shifted very slowly. In reality it is the Earth's axis that 'rotates' (or precesses) like a spinning top. Because it takes 26.000 years for the Earth's axis to completely recess around, this effect is too slow to be noticed within a few years. (b) In 135 BCE Hipparchus reported the appearance of a "new star" in the sky, (We now think that this star was actually a supernova – a dying star undergoing an enormous explosion.) This was a huge surprise since it had been thought that the sky was eternal, perfect and unchangeable. Afterwards Hipparchus kept observing the sky in case another surprising new star appeared!

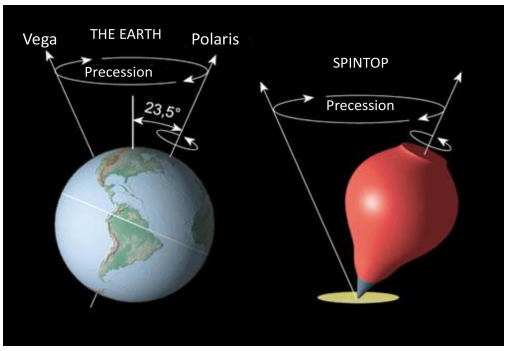

Figure 2. Earth precession (Credits: Earth and Planetary Magnetism Group Zurich)

About 200 years before Hipparchus, the philosopher Aristotle had realised the importance of making accurate descriptions of natural objects. His description and classification of plants laid the groundwork for the science of botany. A similar approach was adopted in astronomy: A first step in exploring the sky and the universe was to make a catalogue of all objects in the sky. The second step consisted of comparing these objects with one another and trying to deduce if there were any connections between them. [It is intriguing that during the 1800s, many centuries later, Darwin adopted the same research method, by listing and classifying plants and animals. Studying their similarities and differences led him to develop the theory of evolution].

Al-Sufi´s first task was to bring together Arab and Greek constellations. In doing so he linked Greek and Islamic astronomy with each other and made himself and his Islamic culture legitimate heirs of the Greek tradition. His work of unifying the constellations was not easy, because the Arabs used different patterns and stars than the Greek to represent their constellations (see activity 'Star Gazing in Baghdad'). In the end he decided to adopt the Greek constellations (patterns of stars) and use the Arabic names for most of the stars. In a few cases, where the names were "multicultural" and widely known, he kept the Greek star names. For some of the stars other Arabic names were introduced throughout the following centuries, but most star names used today are in fact the names used in Al-Sufi's original list.

In about 964 CE Al-Sufi summarised his observations in a work with the title "The Book of Fixed Stars ". Based on his own observations he gave a detailed description of the 48 Ptolemaic constellations taken from an Arabic translation of

Ptolemy's Almagest. He observed and described the stars, their positions, their magnitudes and for the first time introduced the colours of the stars.

Despite the many legends associated with the constellations, Al-Sufi was not interested in Greek or Arabic mythology. He used the figures of the constellations merely as a gigantic "reference system" in the sky relative to which the positions of the stars could be measured.

While observing stars in the Andromeda constellation Al-Sufi made the earliest recorded observation of the Andromeda nebula, describing it as a "small cloud". We now know that the Andromeda nebula is not a gas cloud but rather a galaxy – a giant family of thousands of millions of stars like our own Milky Way. Al-Sufi mentions it as lying before the mouth of a Big Fish, an Arabic constellation that was placed over of Andromeda (see picture at the right). The Andromeda galaxy is the nearest galaxy to our own Milky Way and can be seen with naked eyes during autumn in the northern hemisphere.

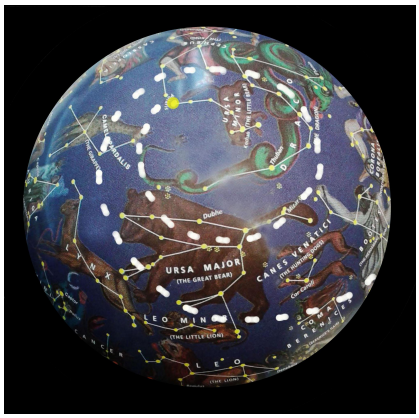

Figure 3. Al-Sufis method of mapping the sky (Credits: Scorza)

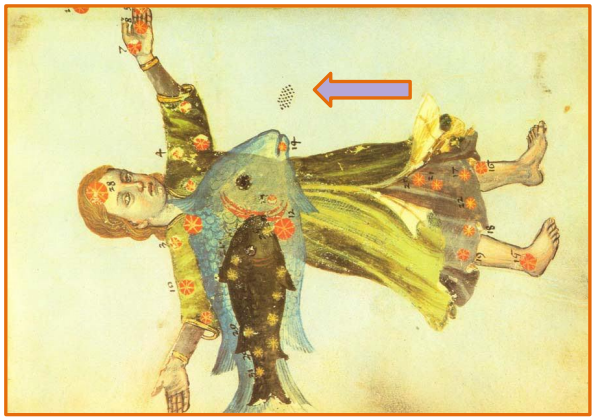

Figure 4. Left: Modern depiction of the Andromeda galaxy as represented by Al-Sufi in his Book of the Constellations (small dots in front of the mouth of the fish). **Right:** Image of the Andromeda galaxy (credits: ESO).

Using the constellations as a reference system, Al-Sufi found another cloud-like object, the Large Magellanic Cloud (LMC). We now know that the LMC is also a galaxy – a small satellite galaxy that orbits our Milky Way. He probably made this observation from Yemen, because the LMC was too far south to be seen from Isfahan. The LMC was not observed by Europeans until Magellan made his voyage to South America in the 16th century!

Al-Sufi also followed the practice of Hipparchus and Ptolemy in also using a globe to represent the night sky. The Greek had imagined the sky as a sphere, with the Earth in its centre. The stars were imagined to be fixed, while the planets and the Sun moved along orbits around the Earth fixed as concentric spheres. In his "Book on the Fixed Stars" Al-Sufi introduced the idea of representing the constellations as we see them directly in the sky from our observing location on the Earth (left picture below) and as we see them when looking upon a sky globe, "from outside the celestial sphere".

Al-Sufi´s Legacy:

Just like Al-Sufi, present-day astronomers often survey the sky and observe how various stars and galaxies change in position and brightness. Since Galileo first observed the sky with a telescope in the 17th century, astronomers have built larger and larger telescopes and were able to observe deeper and deeper into space. During the last half century, they have even launched telescopes into space. Mapping the sky from space avoids interference due to the Earth's atmosphere that causes stars to twinkle. ESA's GAIA satellite is such a space telescope that is measuring the positions, brightness and distances of more than one billion stars! If Al-Sufi were alive today he would surely be amazed and delighted to see how the work that he begun is being continued by astronomers of present day!

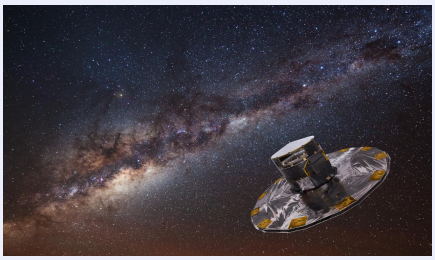

Figure 5. GAIA satellite (credit: ESA)

5.2 MARIAM AL-ASTROLABIYA: THE WOMAN FROM ALEPPO THAT BUILT ASTROLABES

Figure 5. Astrolabe of the 14th Century. Credits: Museum of the history of science, Oxford)

One of the main ideas that arose in Alexandria and Rhodes among the ancient astronomers was to measure the sky as accurately as possible. There were many reasons for this: Hipparchus (2th Century BCE) had noticed that the constellations seemed to shift very slowly across the sky as the year progressed (we know now today that the apparent shift of the constellations is due to the movement of the Earth around the Sun, see activity "Build your own Astrolabe"). To measure time, it was important to predict the time of the sunrise and sunset and to estimate the length of the days.
Another issue was to find the planets in the sky and to follow their movements. All these activities required accurate measurements of the objects on the night sky. For this purpose, astronomers like Hipparchus designed and developed instruments. One of these instruments was the astrolabe (in ancient Greek ἀστρολάβος) which means "the one that catches the heavenly bodies".

Later on, in the 4th Century BCE, a female astronomer called Hypatia of Alexandria (ca. 370—415 BCE), designed and built her own astrolabes as well as other astronomical instruments. 600 hundred years after Hypatia, the Arab astronomers adapted the Greek astrolabe for their own use, improving it by introducing new functions and by making even more accurate measurements. Among them was a woman called Mariam Al-Ijliya who lived during the 10th century in Aleppo (today´s Syria) that became known for her astrolabes. Her father was an apprentice to a famous astrolabe maker in Baghdad. Mariam was so interested in exploring the night sky that she became her father's student. She developed such a large variety of hand-crafted intricate and innovative designs of astrolabes that she was employed by the ruler of Aleppo, Sayf Al Dawla over the period from 944 CE to 967 CE. Like Hypatia in Alexandria, she was honoured because of her work. This is her story!

The story of Mariam Al-Ijliya (This story is fictional and was created by Raje Saidi, Morocco)

Once upon a time in the tenth century in Aleppo (a city in Syria), the little girl Mariam was born to be a genius, not only in her time but also by today's standards. She had a caring mother, who raised her children with love and altruism. Her father was a modest craftsman, making a living from his handmade craft to make his family rich of joy.

Unlike her elder sisters, Mariam didn't enjoy staying at home and doing chores around the house. She was a smart girl at school and enjoyed learning a lot. Since she was two years old, her loving father took her to the school every morning on his way to work. Her elder sister Najma was the one who brought her back home after she finished school.

One day, Mariam left school, but she didn't find Najma waiting for her. Instead, her father was standing outside with a sad face. Mariam felt worried.
"Father, is something wrong happening at home? Is Najma alright?" said Mariam. "Oh darling, everything is alright. I finished work early today so that we can go home together" said her father, forcing a smile on his face. Mariam knew her father hid some bad news. Her heart was beating fast.

"Father, tell me what's wrong?" she asked. This time, he could act no more and he bent over and told her "You are a smart girl. Let's go home. We can't talk here."

On their way home, Mariam felt as if they were walking for a whole day. The road seemed very long and a horrible silence overwhelmed her. No one of them was talking. Her mind couldn't stop thinking of what might have happened. She thought of her mother who maybe was very sick. Then she thought of her cat that could have been injured. At last she thought her father needed to change his work and he would ask them to move to another city like what happened to some of their neighbors. Finally, she set her mind and busied herself by counting numbers. As she was good at math, she counted and counted many thousands of seconds until finally they arrived at home.

Figure 6.: Mariam Al-Ijliya Astrolabiya (credits: Provot)

"So, tell me now" she asked her father. "I am sorry to tell you, my daughter, that the school will close. We have been told so this morning.", said her father.

Mariam remained speechless for a while. Mariam loved her school. She enjoyed being with her friends and teachers. Even when she was sick, she didn't miss school. Not knowing what to say she had tears on her eyes. Her father held her tight and whispered words to comfort her in her sadness. He knew the news was going to be tremendously harsh for her. Mariam was an exceptional girl. She showed great passion for learning since she was very little. She learnt fast and had a strong sense of observation. He noticed her talent and prayed for her to be successful in her life.

"Life sometimes feels unfair, but who knows what good may come out of it", her father said. "But I have a nice idea which I am sure you will like. Starting tomorrow, I rely on you to help me making astrolabes", added her father. "Ah, the clock that you recently brought back from Baghdad?" Mariam asked, while wiping her tears. "Yes, and I promise you will enjoy working with your new boss, Mr. Al-'Ijli " said her father smiling.

Al-'Ijli was the name of Mariam's father. He was known in the Aleppo craftsman trade for reproducing astrolabes. Widely used by Muslim astronomers, the astrobabe was an important instrument used to predict the position of the Sun, the Moon, the planets and the stars. It was also used to determine prayer timings with the movement of the Sun, the Qibla, the prayer direction towards Mecca, as well as the fasting days during the month of Ramadan.

Days went by and Mariam proved to be a good student. She grew older and learned all about building astrolabes. With time, she became much more skilled and she worked on new designs of astrolabes. At the age of twenty-three, she was the only woman in the city to do such work. She became known and people all over the country talked about her.

One day, as she was busy designing a new astrolabe, a soldier stepped into her store. She was surprised to see him and felt worried. A flashback came quickly to her mind. She recalled the time when she unexpectedly saw her father standing at the school gate when she was little. It was the unforgettable moment when she learnt that she would never go back to school, a school where she grew up along with her friends having fun and spending pleasant moments. Those precious moments were a memory of an enjoyable past. She felt her heart beating and without hesitation she said:

"Go back to your place if it is for bad, step forward and tell me if it is for good." The soldier moved a step forward and said: "Madam, I am a messenger from his highness the Caliph". Mariam was relieved a bit, but still felt doubtful. What would the Caliph want from her? She was a modest citizen working peacefully on developing a useful tool for the scholars in her country.

"Madam, I have a message to deliver to you. Here it is". The soldier handed her a letter and left.

Left alone perplexed, Mariam held the letter. She hesitated to open it. She was not ready for an unexpected change in her life. What if she had to move again from a place where she was living comfortably to an unknown destination? What would it be for?

"Mariam, I am back", she heard her father say, while entering the store. "You can go home now, to have lunch. I can take over now." he added. Not saying a word, Mariam was standing as if frozen. Then she handed the letter to her father. He saw the fear in her eyes, opened his mouth, but no words came out. He was worried too. "Please read it", said Mariam.

Mariam´s father read the message sent in the name of the Caliph out loud. Before finishing, he threw the letter and hugged his daughter. He was crying tears of happiness. To her surprise, she was appointed member of the council of scholars. Mariam and her father were extremely happy. That was a fantastic surprise! Henceforth, Mariam became actively involved in her new endeavor. She was mastering her job. Not only she continued reproducing astrolabes but also developed more sophisticated models. Mariam´s passion for her craft was so strong that she reached an honorable position within her society.

Mariam had the benefit to have a father who helped her make the best of situations and supported her in her passion for learning. She finished school from home, with his help. She made an opportunity for learning out of her life circumstances. She made an important contribution to improve technology in her time. With her contributions, the field of navigation advanced significantly. Mariam al-Ijliya, also known as "Al Astrolabiya", remains a role model until today.

5.3. THE SCIENTIST IBN AL-HAYTHAM DEVELOPS A THEORY OF LIGHT

Al Hassan Ibn Al-Haytham, known in the West as "Alhazen", was a well-known Muslim scientist, mathematician and philosopher of the 10th Century AD. He made significant contributions to the advancement in fields like optics, astronomy and mathematics during the Islamic Golden ages. He is acknowledged most for his work on the nature of light and (human) vision, as well as on laying the foundations of the current scientific method, by testing all his hypotheses experimentally.

Figure 33. Al-Haytham (Credits: Provot).

Ibn Al-Haytham was born around 965 in Basra, in an Arab family. Being a young man, he moved to Cairo (today's Egypt), which was then ruled by the Caliph al-Hakim under the Fatimid dynasty. The Caliph was a patron of sciences, and had great interest in astronomy and engineering. Inspired by the city of Baghdad, the Caliph had founded a second House of Wisdom in Cairo (see chapter 4).

Soon after his arrival in Cairo, the young scientist Al-Haytham proposed to the Caliph a hydraulic project to improve the regulation of the flooding of the Nile. However, after years of measurements and calculations, he arrived to the conclusion that it wouldn't be possible to construct a dam. Some people say that, fearing the anger of the Caliph, Al-Haytham feigned madness and the Caliph ordered house arrest. During this time, and until the death of the Caliph in 1021 Al-Haytham devoted himself to the study of optics, astronomy, geometry and natural philosophy at his home. Ironically at the exact location at the Nile which Al-Haytham favored for building his dam, the Aswan Dam was built in 1902!

Ibn Al-Haytham contributions to optics

Throughout history there have been several theories about how the human vision works, as well as theories about the nature of light. One of the first ideas related to the human vision was formulated by the Greek philosopher Empedocles (5th Century BCE). He reasoned that the Greek goddess Aphrodite had lit a fire in the human eye, and vision was possible because light rays from this fire emanated from the eye illuminating objects around us. This idea was further supported later on in Alexandria by Euclid (3th century BCE) and Ptolemy (2th Century AD). Both believed that the eyes act both as emitters and receivers of some kind of rays which travel from the eyes to objects and then bounce back from these objects to the eyes. Euclid even made a mathematical description of this process (the so-called "lines of sight theory"). Ibn Al-Haytham read about these early ideas during his studies in Basra and in the famous Bayt al-Hikma (House of Wisdom) in Baghdad. He also knew, from the translations into Arabic, what the Greek philosopher Aristoteles (3th Century BCE in Athens) thought about this topic: that light existed independently of the human eye and radiates from the objects into the eye via a medium.

Going beyond the speculative practice of the first natural philosophers, Al-Haytham tried a completely new approach by analysing the structure of the eye and figuring out how it works. He recognised the importance of the lens in the eye and refuted by means of rational and scientific observations the "lines of sight theory": if the latter were correct, we should also be able to see the objects around us during night time. Also, he observed that when looking directly at very bright objects, like the Sun, for a prolonged period of time, eyes can be harmed and/or damaged. He concluded that light has an effect on the eyes and not the opposite, thus vision would only be possible when light rays are emitted from a luminous object or are reflected from the object before it entered the eye. He was also the first to establish a theory of light independently of our vision, laying the foundation of the science of optics. He explained how our eyes work through the use of a dark chamber (camera obscura) as a model of vision and through the dissection of the eye. He concluded that the eye is an optical instrument and light is an independent physical entity of visual sensation.

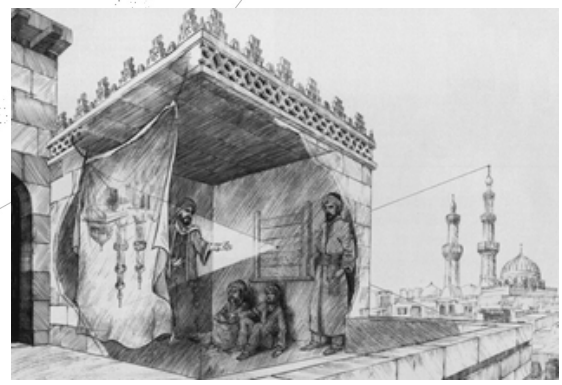

Figure 8. The Camera Obscura invented by Ibn al-Haytham (Credits: 1001 Inventions)

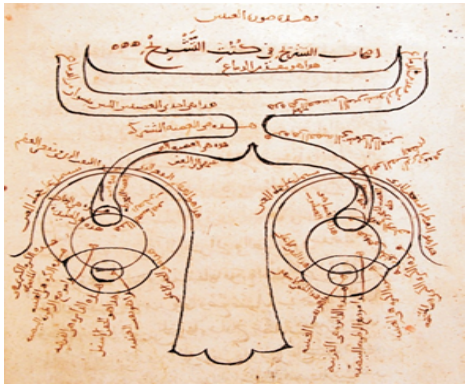

Figure 9. Diagram of the eyes and related nerves, (Book of Optics, Ibn al-Haytham)

Furthermore, Al-Haytham formulated the laws of reflection and refraction and developed a physical theory in which he visualised light as made out of tiny balls thrown against an obstacle and described it geometrically (a corpuscular approach of light at his time!). He worked on spherical and parabolic mirrors, spherical aberration, the magnifying power of lenses and atmospheric refraction. He also discussed the density of the atmosphere, and correctly explained the refraction of light in the atmosphere by arguing that twilight is caused by refraction of solar radiation from beneath the horizon. Al-Haytham also calculated the height of the atmosphere by observing sunsets.

Ibn Al-Haytham published his work on optics and human vision in the famous seven volume treatise "Kitab al-Manazir" (Book of Optics) which was translated into Latin in the late 13th century ("De Aspectibus or Perspectiva"). This work was very influential during the Middle Ages and it is considered as the first comprehensive treatment of optics. Ibn Al-Haytham was honoured in medieval Europe as 'Ptolemaeus Secundus': Ptolemy the Second. The Biographic Dictionary of Scientists says that the work of Ibn Al-Haytham was unmatched until the times of Johannes Kepler 600 years later.

Today, many authors consider that the ideas of Ibn Al-Haytham influenced European scholars including those of the European Renaissance: Roger Bacon, Johannes Kepler, Galileo Galilei, Christiaan Huygens, Isaac Newton, Michelangelo, Leonardo Da Vinci, and others. A famous quote of Al-Haytham is the following:

"If learning the truth is the scientist's goal...then he must make himself the enemy of all he reads."

5.4 FATIMA AL-FIHRI: THE WOMAN WHO FOUNDED THE FIRST UNIVERSITY OF THE WORLD

One of the important contributions of the Islamic culture to the rest of the world was their interest in communicating knowledge. While in the ancient world knowledge was reserved to a small group (usually priests), during the Islamic Golden Ages and especially in Baghdad, knowledge was offered to a larger number of scholars (see chapter 3 "The long way to Baghdad"). Many of these scholars belonged to other cultures and were invited during the Abassid dynasty to translate many books into Arabic in the House of Wisdom. This was the case with Chinese, Indian, Persian and western scholars.

Figure 10. Fatima Al-Fihri (Credits Provot)

Another step in communicating knowledge was made in Morocco by a woman called Fatima Al-Fihri, who, in the year 859 AD, founded the first university of the world in honor of her father. Al-Fihri was the daughter of a wealthy merchant and had been educated by her father. The family was part of a large migration to Fez from the town of Al-Qayrawan (Kairouan, today in Tunisia), and so the town lent its name to the university founded by Fatima.

The Qarawiyyin university is the oldest university in existence that is still being used as such and the first degree awarding educational institution in the world according to UNESCO. This university became one of the leading spiritual and educational centers of the historic Muslim world.

Figure 11. The Qayrawan University, Fes, Morocco (Credits: Al Huffpost)

During centuries the university was under the rule of the Governor of Morocco and only the sultan could appoint teachers. However, the students were allowed to choose their teachers and curricula! Many famous scientists from the Islamic world and some European scientists studied at this university. In the West, the most famous alumnus is probably Pope Sylvester II, who in Europe introduced Arab numbers, culture and sciences including mathematics and astronomy. Therefore, the Qarawiyyin University played a significant role in the mediation of culture and knowledge between Muslims and Europeans. In the fourteenth century alone, 8,000 students from Tunisia, Algeria, Morocco, and Egypt were trained in Fez.

The story of Fatima Muhammad Al-Fihri by Raja Saidi (Fictional)

Once upon a time, there was a little girl named Fatima who was living prosperously with her family in Kairouan, a city in present-day Tunisia. Her father was a rich merchant but also a generously loving father who educated his girl in Islamic religion and exemplary virtues.
Fatima was a joyful little girl playing around and growing little by little. She had an older sister whose name was Mariam and who was always helping their mother at home, as well as taking care of little Fatima.

One day, her mother passed away and only her father was left to bring comfort to her in these times of sadness. And so she was very close to him. She was a smart child asking many questions about the world around her.

"Father, today I heard some new merchant talking about a place called Baghdad. What is it?" she once asked her father after they finished a good day of hard work in the marketplace. Her father answered: "Baghdad is a nice city in Iraq known for a big library called "The House of Wisdom". Scholars from different parts of the world go there to share and learn all human sciences". "Can I go to there, father?" Fatima asked. Her father smiled and felt happy about the curiosity of his daughter. "It is a very long trip to go there and you are still young," he answered. "Let's study here and I promise to be a good teacher to you." He added. "I wish I can go to such place when I grow older!" Fatima whispered. The following night, Fatima had a dream of studying in a big famous school. She imagined herself surrounded by books, reading all the time, and playing a role of a teacher as well.

In the following years, the joyful girl spent great moments with her father. She was passionately learning and discovering and she enjoyed her little world. On his side, her father did spare no effort to broaden her mind and helped her develop great intellectual talents.
Suddenly, the city became a dangerous place because of political incidents. The city was filled with soldiers and the citizens were scared. It was a war threatening their life. Fatima's father was very worried for his daughters and decided to move far away looking for a safer place to protect his little family. Quickly, they gathered what was necessary for a long trip and joined other traveling families too. They travelled toward the west because it was safer. The days were long, riding camels and crossing different places while the nights were pleasant for Fatima as she enjoyed gazing at the starry sky.
At some point in the middle of the desert, as she laid down next to her father getting reading for sleep during a peaceful night, she was gazing at the sky and said to her father:
"Father, I see images in the sky." "Look! There, and there too, as if the stars are drawing pictures." Her father replied: "Indeed, I see a spoon over there too". He pointed to a group of stars. "It's like a spoon; they call it the "Big Dipper". It is composed of seven stars and sometimes it appears upside down or backwards depending on where we are. Now, let's imagine drawing a line between the two stars at its end and extend it four times; we reach another bright star, which is called Polaris. Polaris helps us find the North." explained her father. "Can you see it?" he asked. "Yes, father" she replied. Fatima then fell asleep with a smile on her face.

Finally, the family landed in Fez, a city in Morocco. At that time, the city was under the reign of the king Idriss II. Fatima's father touched the ground and took some of its earth in his hand and smelled it. "Earth is our home." He sighed.

A new home was then built there and a new journey began for Al Fihri's. The father invested in trade again and became much wealthier. Fatima continued to show a thirst for knowledge and was known for her exceptional curiosity. She became an honorable woman and got married and had children.

In a time to come, her father was sick. Fatima and Mariam were worried about his health. They brought the best doctors in the city to take care of him. Unfortunately, his illness was very severe and his health went from bad to worse until finally he passed away. The loss of their beloved father was very painful. Fatima and her sister Mariam fell into a deep sorrow. However, they also felt happiness and gratitude for the time they lived together. So, to honour their father and to keep his memory alive, they spent their inherited large wealth to service their community.

Oh Father, my shining star
From my eye, you are now far
For my heart, alive you are
For your love, I remain a beggar
Forever, I spend on you my dinar

Hence, because of their immense love for their father, the two sisters decided to honour his memory following Muslim practice. Mariam founded the Al-Andalus mosque. Fatima on her side, decided to build Al Qarawiyyin, a big mosque and school in 859 AD. Fatima's big dream for education came true by building a place of knowledge dissemination.
Indeed, Al Qarawiyyin was not only a place for religious teaching, but also many subjects were taught such as medicine, mathematics, astronomy, chemistry, history, geography, and even music. Hence Al Qarawiyyin University came to the world and became an important destination for education which attracted scholars and students from all over the world and of all faiths. The university was a bridge of cultural and academic exchange between the Islamic world and the Western world.
Today, Al Qarawiyyin University is the oldest university in the world still in operation. The 9th century witnessed the emergence of an educational jewel of international reputation thanks to the generosity and the intelligence of a young refugee who escaped war and became a devoted woman. Fatima or "The Mother of the Children" as the community called her passed away in 878 AD, leaving behind a priceless treasure.

Arabic. For this purpose, al-Mansur founded a palace library which later evolved into the House of Wisdom, which became a major intellectual center during the Islamic Golden Age. Al-Mansur invited delegations of scholars from India and other places to come to Baghdad to share their knowledge of mathematics and astronomy. Many foreign works were translated into Arabic from Greek, Chinese, Sanskrit, Persian and Syriac.

This resource was developed by Space Awareness. Space Awareness is funded by the European Commission's Horizon 2020 Programme under grant agreement n° 638653.