

How Did Ideas Spread Among Scientists and Mathematicians?

The progress of science was slow during the European Middle Ages. A number of factors contributed to the lack of focus on science and mathematics:

- Religion put the focus on the afterlife; scientific questioning was discouraged.
- Europe was still steeped in superstition; most people believed in astrology, magic, and witchcraft.
- Wealthy patrons were more interested in sponsoring the arts, so there was little money left over for people interested in scientific discovery.
- European universities focused on classical liberal arts education; little attention was given to the study of science and mathematics.

Progress in science and mathematics had continued in the works of Jewish, Islamic, and isolated European scholars. Growing humanist ideas led European thinkers to build, expand on, and share knowledge that earlier scholars had developed.

During the Renaissance, European scientists began to look at the world using reasoning and observation. They asked questions and were interested in searching for the natural causes of events rather than accepting that the causes were supernatural powers. The Renaissance was not a time of many scientific advances, but scientific curiosity led many more scholars to begin recording their observations of the natural world. This accumulation of knowledge led to the ages of scientific discovery in later centuries. There were, however, some notable scientists and mathematicians in Renaissance Europe.

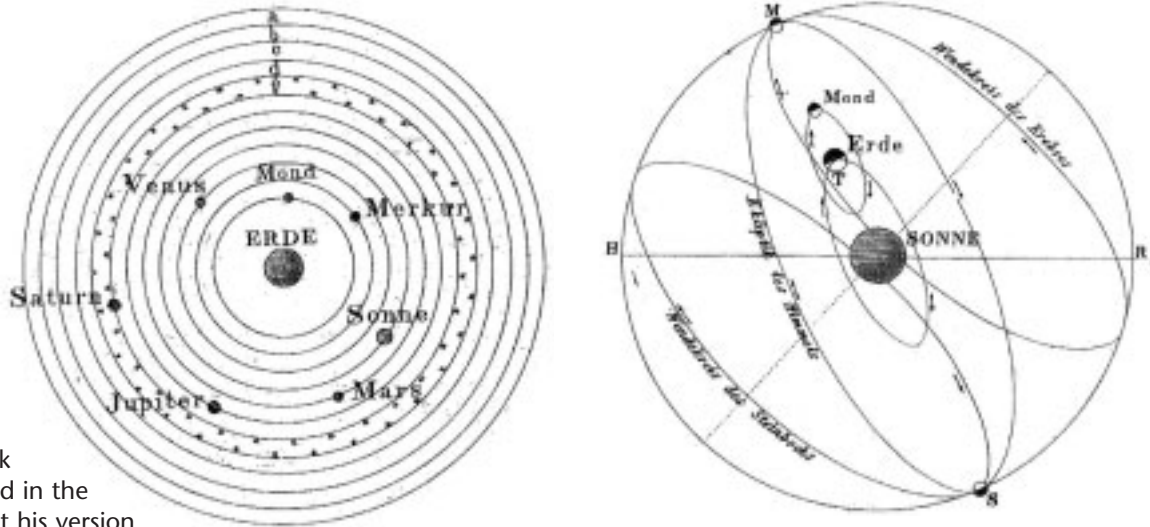
Nicolaus Copernicus

Nicolaus Copernicus (1473–1543), a Polish mathematician and astronomer, used mathematics and careful observations to develop a different theory about the universe. Until the late Renaissance, most Europeans believed the Ptolemaic view of the universe: Earth was the centre of the universe and the other planets and the sun revolved around the Earth. Copernicus's observations and calculations proved that the Earth and the other planets revolved around the sun. Copernicus also proved that the Earth rotated on its axis once a day. Copernicus's

*Astronomer Copernicus:
Conversations with God,*
Jan Matejko, 1873.

Some historians believe that Copernicus kept his findings secret to avoid conflict with the Roman Catholic Church's view that God made Earth the centre of the universe. His findings were not published until shortly before his death and were banned by the Roman Catholic Church.





Competing Worldviews

Ptolemy, a Greek astronomer, lived in the 2nd century, but his version of the universe (left) was part of the Christian worldview until the late Renaissance. The Earth was the centre of the universe. Some illustrations had this wording around the outer rings: Heaven, realm, and dwelling place of God and of all the elect. Why do you think some people would be so upset about accepting the Copernican solar system (shown on the right)? Locate the Earth (Erde) and the sun (Sonne) in both systems. What was the impact of this shifting worldview?

Islamic scholars such as Ibn Yunis, al-Tusi, al-Urdi, and Ibn al-Shatir laid the groundwork for many developments in astronomy. Ibn Yunis (950–1009) was an Islamic scholar working in Cairo, Egypt. He created large astronomical tables based on hundreds of years of recorded observations. He also invented the pendulum. Nasir al-Din al-Tusi (1201–1274) was a Persian scientist who wrote books detailing accurate planetary movements and the positions of stars. Such knowledge had an influence on the works of European scientists such as Copernicus.

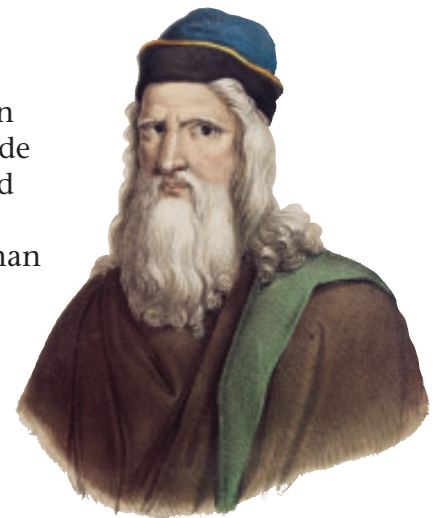
heresy: an opinion against the beliefs of a given religion

views were condemned as **heresy** by the Roman Catholic Church of the time. It was almost 100 years after his death before his theory of the universe began to be accepted by the rest of the European world.

Leonardo da Vinci

Da Vinci made a number of scientific advancements. He began dissecting human cadavers once the pope allowed it and made detailed drawings and notes that were used by physicians, as well as artists, who used the knowledge to paint more realistic human figures.

He recorded plans for numerous inventions such as parachutes, tanks, and submarines.



I wonder ... why would some people in the Church have been opposed to the dissection of cadavers?

I wonder ... are there groups today who oppose dissection? I wonder why they might.

François Viète

The French mathematician François Viète (1540–1603) wrote books on trigonometry and geometry. His work was built on the ideas of Islamic scholars. Among other mathematical advances, he provided solutions to doubling a cube and trisecting an angle, all useful in engineering and architecture.

Other advances were made in mathematics that were used in trade, business, banking, calculations for ship navigation, and astronomical mathematics used for mapping.

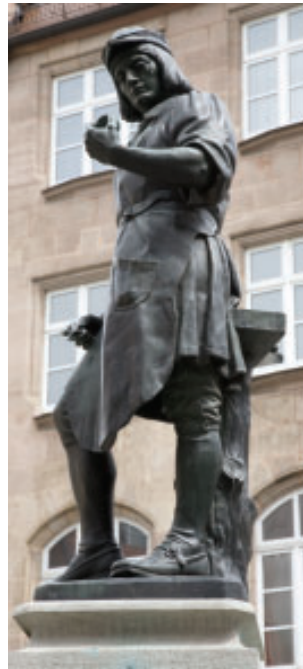


François Viète,
Alexandre Saverien, 1766

Changing Views of Time

A significant advancement in technology during the Renaissance was the invention of the mechanical clock. Before the early 1500s, time was measured by sundials, hourglasses, or weight-driven clocks. Most people lived their days according to the rising and setting of the sun and by church bells calling to prayer. About 1500, Peter Henlein, a German locksmith, invented the spring-powered clock that let inventors make smaller clocks and watches.

It was now possible, because of this invention, to keep accurate track of smaller pieces of time. People began to see time as small segments that could be measured and counted.



Peter Henlein, fountain,
Nuremberg, Germany.
Peter Henlein invented the
first spring-driven watch.

I wonder ... how did the ability to keep track of smaller and smaller segments of time change the way people lived their days?

REFLECT AND RESPOND

1. A discovery or invention often depends on previous knowledge discovered by others. Explain how Copernicus's proof that the Earth revolves around the sun depended on previous knowledge. Choose a recent discovery or invention. Explore the previous knowledge that was necessary to make this discovery or invention.
2. Currently, many humans believe they may be the only intelligent life in the universe. How would the discovery of intelligent life in another solar system cause people on Earth to experience a shift in worldview?

Create a dialogue between two people — a person who accepts a recent announcement that intelligent life exists in another solar system and one who refuses to believe it. How might this compare to the shift from the Ptolemaic view to the Copernican view of the universe?

3. How has the invention of precise clocks and watches changed the way people define and relate to time? Relate comments you have heard people make about time. What are some beliefs and values about time in our modern worldview?