

Is the Earth Round or Flat?

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When asked the question today whether or not the world is flat, it is obvious to most people that we are living on a big, blue, marble. Centuries ago, there was much debate without the view from the Apollo Mission to give clear evidence to the contrary. It is easy to imagine why our ancestors may have believed the world was flat when you look off into the horizon or feel yourself walking around. Imagining the view of an ant on top of a watermelon and then looking at how flat a slice of the rind could look is one example to help visualize their perspective and explain how it feels flat when it is actually curved. The saying that hindsight is twenty-twenty makes it interesting to examine the politics, philosophies, and perspectives of the early astronomers that may have viewed the world differently than we do today.

The reason this question piqued my interest is partially due to the recent news coverage of the “Flat Earth Society”. I had never listened closely to beliefs of this group because I thought it was just a name for people who didn’t want to wear masks during the pandemic. A little research revealed that there are actually people who still believe that the Earth is flat and that the government is using NASA to fool everyone. This discovery prompted me to do some research to support why I believe the scientists who came up with the idea that the world is round.

Long ago, a majority of humans believed that the Earth was flat. People relied on the information they had available to them. Some ancient people believed that the flat Earth went on forever. This theory brought up a few questions about common observations. The sun would rise in the east and set in the west every day. How could this

happen if the Earth was flat? Some explanations included a new sun being created each day, a boat that carried the sun back to the east every night, and a chariot with flying horses that carried the sun through the sky. Another unexplainable observation was the fact that the moon and the stars appeared to travel from east to west every night in a predictable pattern. Finally, if the Earth was flat, how deep or thick was it and what was holding it up? In India, many believed that it was held up by elephants standing on a giant turtle swimming in a vast ocean. Today, many of those ideas might seem ridiculous but it is difficult to know what you would have believed if you were living during that time.

Around 500 B.C. in Ancient Greece some philosophers and scientists began to search for explanations to these questions. Pythagorus, a Greek philosopher and mathematician, may have been the first scientist to theorize that the Earth is round. He could see the moon was a sphere and thought that the Earth might be the same shape. Anaximander, another Greek philosopher and the “Father of Cosmology”, also spent some time trying to answer some of these questions. He noticed that the North Star did not move around the sky like other stars and theorized that the sky might be a hollow sphere spinning around the North Star. This satisfied some of his questions better than the magical chariot but he still had more. It seems if you traveled to the edge of the sphere, you could touch the sun. No one had ever been able to do that. Maybe the flat disc of Earth was surrounded by water inside the hollow sky sphere. Maybe the water is held up by a gigantic bowl. Why did people who traveled far north or south see different constellations? Anaximander postulated that the Earth might be a cylinder. There were still unanswered questions with these ideas.

Some years later, more scientists added their thoughts to the debate. One common observation that led scientists to believe that the Earth is actually a sphere was the phenomenon of the lunar eclipse. The shadow of the Earth on the moon was always circular. Around 450 B.C., Philolaus, an Italian philosopher, put together three key pieces of evidence and was finally convinced that the Earth is a sphere. First, ships appear and disappear hull first on the horizon. Second, the change in the view of the stars according to a person's location on Earth meant that the surface must be curved. With the addition of the lunar eclipse observation, Philolaus was sure the Earth must be round. Around 350 B.C., Aristotle helped explain why we don't slip off the edge of the sphere with the theory that everything is pushing down towards the center of the sphere. At this point in time, most educated people believed that the Earth was round.

Another huge development was the estimation of the circumference of Earth. Assuming that the Earth was a sphere, mathematicians were able to postulate the distance around it. About 240 B.C., Erastosthenes was able to use shadows and some surveyors to estimate the circumference of the Earth to be 28,738 miles. The actual circumference at the equator is 24,902 miles but he did a pretty good job with the technology available to him at the time. Several decades later, Posidonius used the same method with different cities of reference but he was off by about 7000 miles. Around 150 A.D., Ptolemy put the results of Posidonius in his book, The Geography. This was used as a trusted source for over a thousand years.

The theory that the Earth is round is often misattributed to Christopher Columbus. When he set out on his journey to the West Indies, most people already believed that the world was round. He was actually trying to take the back way to trade for silk and other

treasures that Europeans wished to have. Columbus used Ptolemy's information about the distance around the Earth and planned his journey thinking he could get there much faster than possible with the ships of the day. Columbus died thinking he had successfully completed the journey he set out for.

Not everyone believed that Columbus had sailed all the way around the world. Decades later, a Portuguese explorer named Ferdinand Magellan led five ships on a voyage around the world. He found a passage between the Atlantic and Pacific Oceans now known as the Straits of Magellan. He died before the journey was complete but after three years, one of his five ships arrived safely back at the starting place with eighteen men aboard. This trip around the world was proof once again that the Earth is a sphere.

The success of our space program has given the most definitive evidence. In 1961, astronauts were able to orbit the Earth and see the spherical shape of the Earth with their own eyes. As technology advances, more and more astronauts have been able to see the same thing. We also get to see photographs from space including daily updates from the Hubble Space Telescope. It is difficult to deny the overwhelming amount of data space travel has provided to answer this question.

Philosophers are important in a society because they ask a lot of questions. Karl Popper believed that scientific knowledge is the best we can do at the moment. His Falsification Principle states that science should be testable and conceivably proven false. Thomas Kuhn is another popular philosopher with strong views on science. According to Horgan (2012), "Kuhn argued that our paradigms keep changing as our culture changes" (p. 1). Kuhn points out that just because modern physics has made it

possible to create nuclear power and CD players does not make Aristotle's physics wrong. Science can adjust as we continue to discover new information.

In conclusion, we will never know all the answers to every question but it is a gift when someone asks why something is true. According to NGSS, the first science and engineering practice is to ask questions and define problems. We are not born understanding that the Earth is round. Asking questions about the world around us is how humans develop ideas. I am thankful for the scientists and philosophers throughout civilization who have shared their thoughts, ideas, and knowledge in order to help me learn about the world. I do believe that the Earth is round but if I am not able to support that thought with evidence, I really should do a better job at asking questions and seeking knowledge. As is seen in the example of Christopher Columbus, even mistakes can be useful. The most important thing is to continue to ask why.

Resources

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