

Does time exist?

What does science tell us about time?

Physicists consider the interactions between all matter and energy. That means they look at things as big as the universe and as microscopic as the atoms that hold our world together! Whether you look at the big stuff or the small stuff will change the way you consider time. Watch this great TED-Ed video about the nature of time. After watching the video, consider the following questions.

 **TED-Ed video: Does Time Exist?**
WATCH: youtu.be/R3tbVHlsKhs

1. Is time an illusion? Where do you stand on the issue?
What example can you use to support your reasoning?
2. If you could go back in time, what time period would you choose?
Why? What would you do?



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 **Check out Time and Navigation**
WEBSITE: airandspace.si.edu/exhibitions/time-and-navigation

Time and Navigation

"Explore how revolutions in timekeeping over the years have influenced how we find our way."

- Smithsonian National Air and Space Museum



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 **Check out PBS Space Time video**
WATCH: youtu.be/YNEBhwimJWs

Want to take a deeper look at the difference between general relativity (the physics of the very big) and quantum mechanics (the physics of the very small)?



How can we use the rotation of the earth to track time?

Make a simple sun dial with simple materials at home

Have you ever noticed your own shadow? Of course you have! Have you considered why it changes in length or position? It has to do with the location of the sun in the sky. As the Earth rotates, the sun appears to move overhead - in reality, we are the ones who are moving! Your shadow "moves" because the sun's position is changing.

The same concept can be used to explain how a sun dial works. A sun dial is one of the oldest known instruments used to tell time. It uses a pointer, called a gnomon, to cast a shadow on a dial - like the dial you are familiar with on an analog watch. As the sun rises, moves across the sky, and sets, the shadow created by the pointer will rotate around the dial in such a way that you can tell time.

You'll want to get up early and will need to check on your sun dial every hour throughout the day. The more daylight hours you can track, the better!

Gather the following materials:

- Pen, pencil, and/or markers
- Ruler or straight edge
- Paper plate or cardboard circle
- Straw, or chopstick, or straight narrow stick
- Ruler
- Few small stones or coins
- Adult helper
- Large open space and a sunny day!

Make the structure that you will use to measure time

- Take a paper plate, or cut a plate sized circle out of cardboard (ask for help with cutting!)
- Use a pen or pencil to (carefully!) poke a small hole in the center of the circle or plate
- Place the straw, chopstick, or stick so it stands upright in the hole you created in the circle or plate (secure it with glue, putty, or tape if necessary)

Wait for a sunny day and place your sun dial outside in a large open space early in the day

Record the location of the shadow every hour over the course of the day

- You can use stones and coins to mark the location of the shadow along the edge of the circle or plate
- You can also mark the location of the shadow using pen, pencil or a marker
- Don't forget to note the hour at which you mark the location

Bring your sun dial inside at the end of the day

- Draw a line from the center of the circle or plate through the location of each shadow marking to the edge of the circle
- Take a look at the sun dial and consider the following questions:

1. **Did the shadow created by the pointer move throughout the day? Why? Or why not?**
2. **Is there a pattern to the changes you noted? What can you conclude from that?**
3. **What else changed about the shadow over the course of the day? Why do you think that may be?**

Students! Answering our questions? Using our strategies? Share them with us at discovery@worldstrides.com.