First you guess. Don't laugh, this is the most important step. Then you compare the consequences to experience. If it disagrees with experience, the guess is wrong. In that simple statement is the key to science. It doesn't matter how beautiful your guess is or how smart you are or what your name is. If it disagrees with experience, it's wrong. That's all there is to it.

Richard Feynman

Survival Skills

Hello AST 111. In this module well see how we all use scientific thinking and how astronomy was an essential survival skill for antiquity.

Scientific thinking comes naturally to us. We've done it all our lives. We done it since we were a baby.


Credit: pixbay, public domain


Credit: Shaun Fisher, Creative Commons

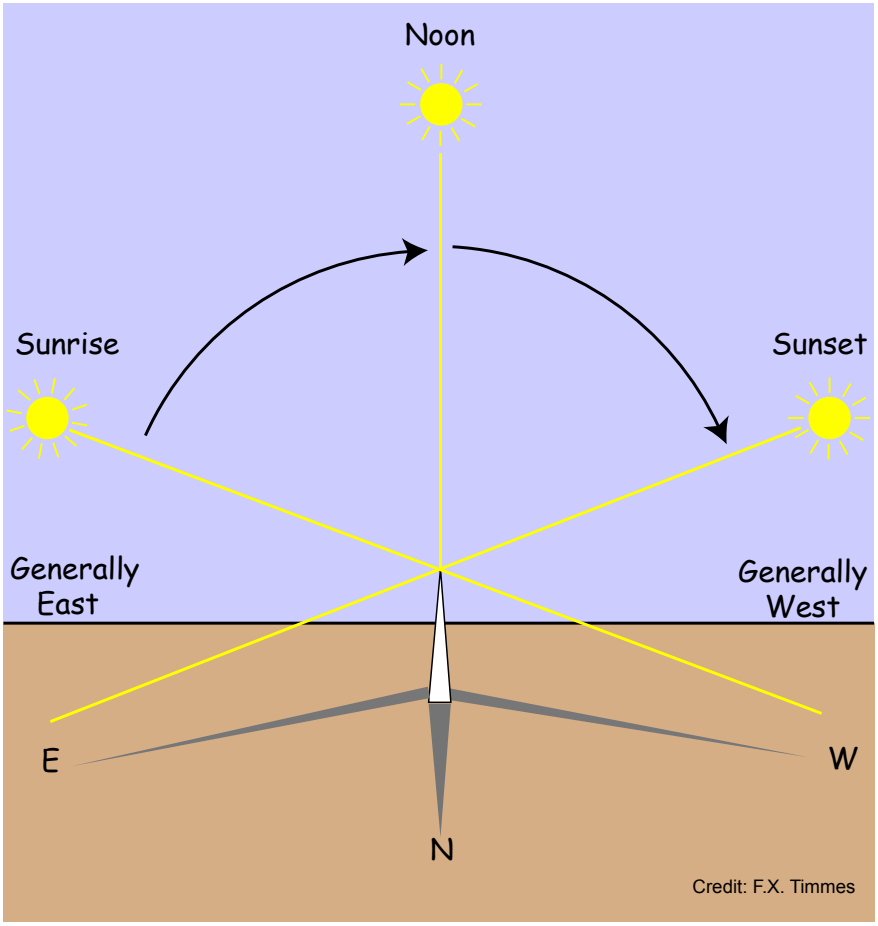
When you're first a baby, you learn very quickly that when you drop an object, it goes to the ground. And you learn to use that fact , to learn how to walk. You also learn the rate at which stuff falls, so when a ball is dropped, you can catch it. You learn scientific thinking very quickly and intuitively.

So then it's really interesting to watch a child's face the very first time that they see have a helium balloon. And they let go of the balloon and it doesn't fall. It goes up. That look of wonderment and puzzlement is priceless — because the rules have been broken. Something is different here. This object didn't fall. It went up to the roof. A whole new set of thinking starts going on, working this new data into their paradigm of what goes up usually comes down.

Scientific thinking relies on the same type of trial and error that we've done ever since we were born, except we do it in a very careful, organized way. But it's something we know intrinsically.

How did astronomy benefit ancient societies? Well, ancient cultures used astronomical observations to do two fundamental things. One is to tell direction-- where are you, where am I, where is something-- and to tell time-- time across the year, time across the month, time across the week. The ability to tell direction and tell time are crucial skills for people who depend on

hunting and agriculture for survival. So astronomy was not a joke. It was not something you do for an intellectual passion. It was practical, crucial survival skills.



So, for example, I'll walk a little bit on how the cardinal directions-- North, East, South, and West-- were defined by the ancients. And it's still with us today. So if you take a stick, and you put it in the ground-- or you use a tree or something like that-- and then the sun will generally rise in the East. And I'll get to a definition of what precisely we mean by East here in a minute.

And you will see that the shadow is long and points generally in a western direction. And the sun will go up, and when it reaches its highest point in the sky, at around noon, the shadow is the shortest. And that, by definition, is North. So this is how North was defined by the ancients-- simply the shortest shadow during the day.

And then as the sun goes on, it goes to sunset. And the shadow moves longer and longer toward the East. Note the direction of that shadow as it goes from West to East.

It's the same shadow direction. That clockwise direction is the reason why clocks rotate the directions they do. Those hands on the clock are simply mimicking the shadows that you would see if you have a stick in the ground and the sun was going around.

So that defined North by day-- shortest shadow. South is just the anti direction. And then at night, North was defined by the star Polaris, the North Star, in the northern hemisphere, because it's a star that does not move. It's very close to the Earth's rotation axis, by chance, but it's there. And so that's how they defined North and South.

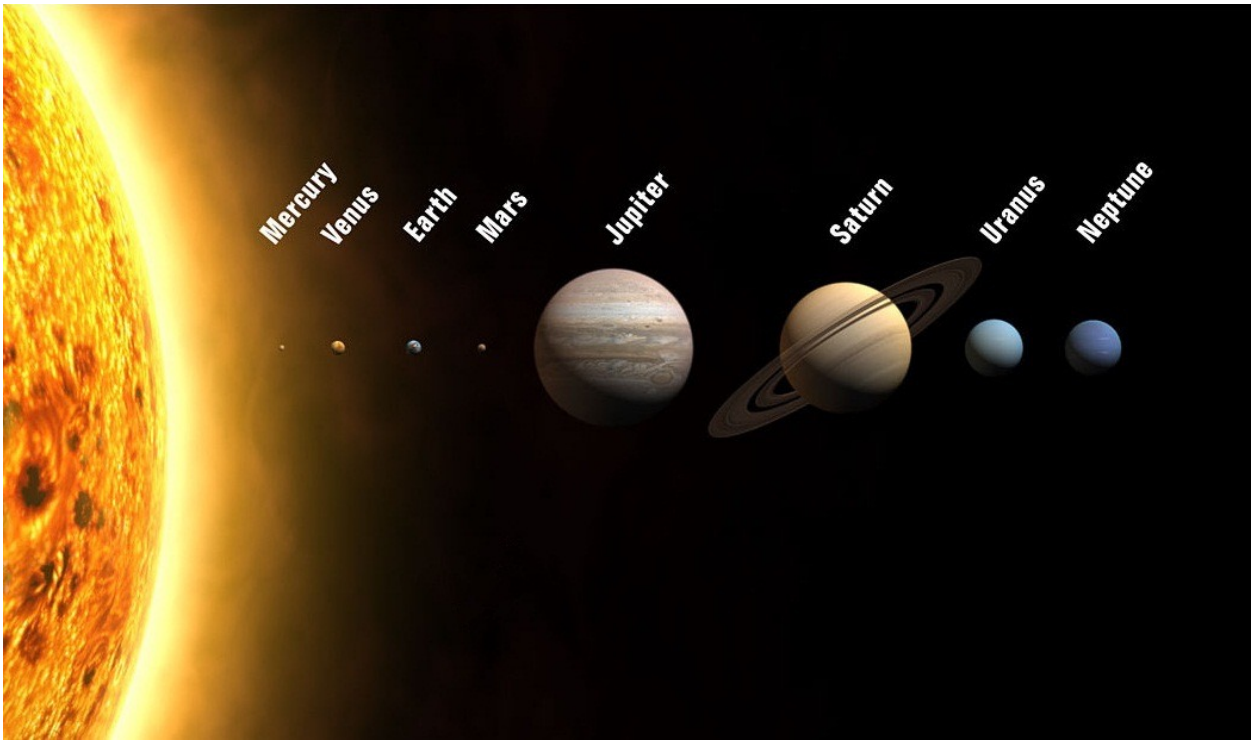
East is defined by sunrise at equinox. So at that point in its orbit-- so halfway through-- when there are 12 hours of day and 12 hours of night, when that sunrise happens, that defines East. And similarly at sunset, that defines the direction West. So our knowledge of the cardinal directions-- North, East, South, and West-- are defined in terms of astronomical events.

So what did ancient civilizations achieve in astronomy? Well, they learned how to tell directions. We just covered that-- North, East South, and West. They learned to tell the time of day from the sun and the moon. They learned to tell the time of the year.

They learned to track cycles of the moon-- origin of the word "month." And they also learned to observe the planets and the stars. And so many of these structures were built to aid these kinds of astronomical observations.

The image above shows famous Stonehenge. A number of the stones at Stonehenge were lined up at various astronomical events-- at equinoxes, at solstices-- when particular stars rose and fell. These were clocks to help them tell the time when it was going around. And there are many of these throughout the world, throughout different cultures as they built these observatories, if you like, to help tell time and direction.

So here's a fun one. How come there are seven days of the week? Why aren't there two days or 14 days in a week? Where did seven come from?



Well, the seven comes the fact that there were only seven known objects that were known to change their position on the celestial sphere. Everything on a celestial sphere was a sticky dot that just stayed there. It never moved. But there were seven objects that were known to move on the celestial sphere.

And those were the Sun, the Moon, Mercury, Venus, and Mars, Jupiter, and Saturn. Seven objects- - seven days of the week. So that's where the seven comes from.

Our particular names for the seven days of the week derive from the Norse-Celtic barbarians when they came in and overthrew Rome:
Sun-day,
Moon-day,
Tiu (Mars)-day,
Woden (Mercury)-day,
Thor (Jupiter)-day,
Freya (Venus)-day,
Saturn-day.

Cool! Thanks. Bye Bye.