

NOW:

TIME

Jeff Feddersen, NYU / ITP



We begin by looking up at the sky. The configuration of our solar system - on a planet that rotates just so, with a transparent atmosphere, and orbits just so, with a moon, and other planets inside and outside our orbit - creates a unique pattern of phenomena in the sky. The moon changes monthly; the sun yearly; the “fixed stars” of the firmament form an intricate design; each dark clear night is a partial window into this design, and the parts we can see change throughout the year. Against this firmament the wandering stars - the planets - move, sometimes forward, sometimes backwards. People throughout time, in every place, have looked up at this show and tried to work out how it works, made up stories about it. Animals understand these patterns, and our earliest, earliest pre-human ancestors, before the cave paintings at Lascaux and before language, before fire, would have understood them as well. Our very cells resonate with these movements.



(That alone is beautiful and interesting, perhaps, but maybe not enough to warrant a class here.)

So I want to tell the story of a dingy looking lump of brass and rotted wood that was uncovered from a shipwreck. [Story of Antikythera here +100BC, 1900AD, 1970s, now]. Eventually X-ray technology would be able to see inside, and what was revealed was dozens of gears. Some gears were inscribed with clues as to their function. While researchers are still figuring out small details of exactly how this mechanism worked, it's definitely understood to be mathematical model of the solar system implemented in mechanical gears.

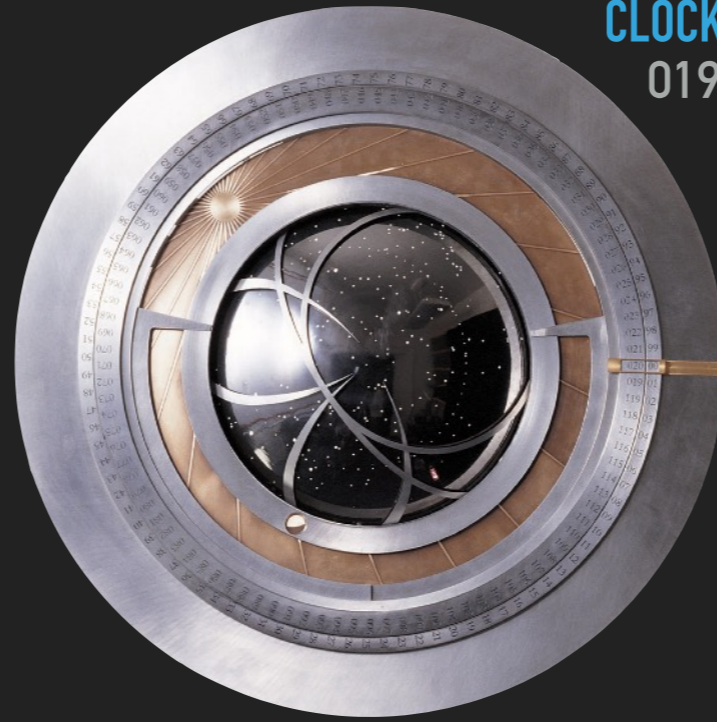
ANTIKYTHERA MECHANISM

~100BCE



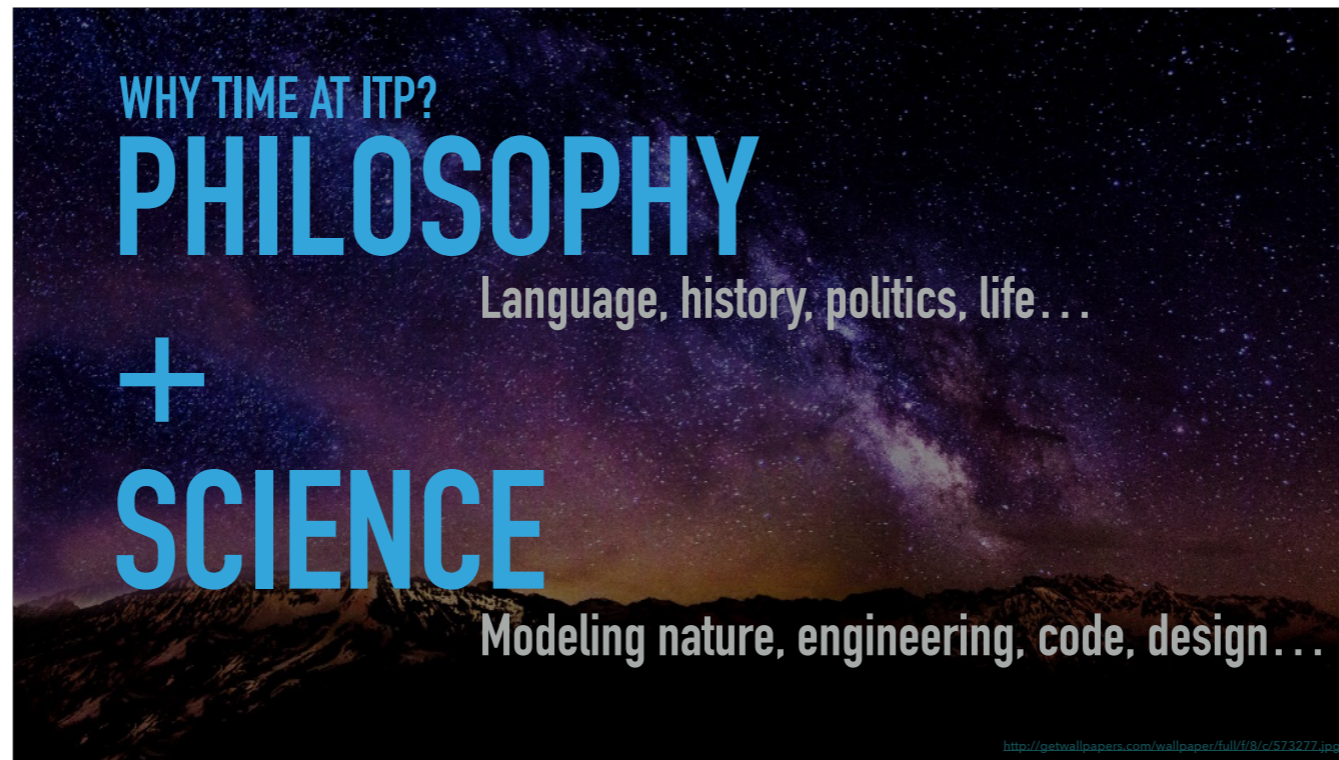
BACK

CLOCK of the LONG NOW
01997, ONGOING



<http://longnow.org/clock/>

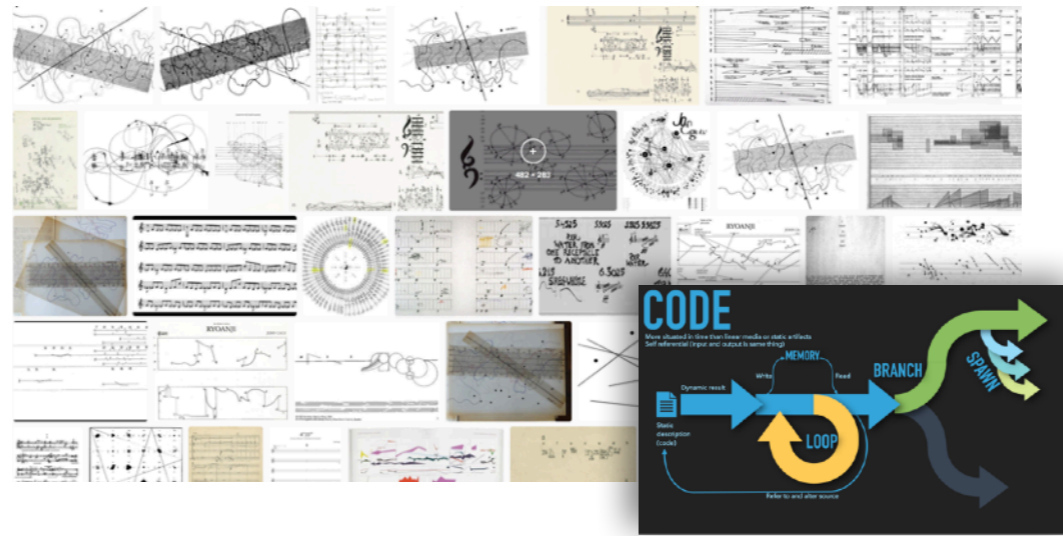




We start where humanity started - skygazing, working out the puzzle of why the sun, moon, stars and planets move the way they do. A sense of time pervades our language and thought - most common word in English. History - both the act of looking back in time, and looking at how time has been thought about in the past. Politics - time affects humans and is subject to human conflict. Example: it's September, aka 7th month... Life deeply embedded in time, very personal.

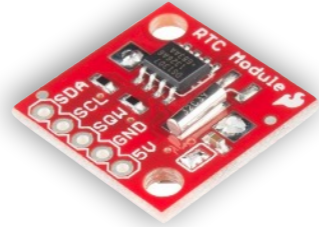
Science - modeling nature. Looking at the sky and finding the patterns. Making tools to track those patterns. Code is the medium most situated in time. Design - clocks are cool.

Graphical music scores guide musical activity in time



Code executes in time in unique ways
(slide from upcoming "Existing in Time")

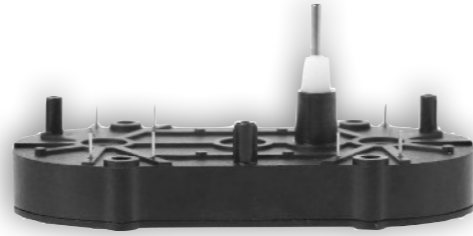
Working with code makes our projects exist IN TIME even more than other media, e.g. a painting (more or less static) or music. No good illustration of computer code executing in time but draw parallel to



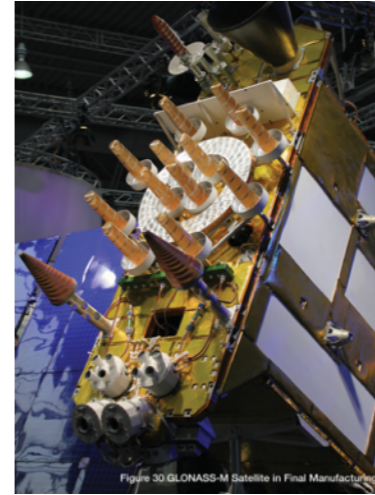
Sparkfun RTC Breakout boards



Mechanical watch movement



VID-28 Bi-axial stepper motor



Russian GLONASS satellite with atomic clock



ACTIVITY: HUMAN PLANETARIUM

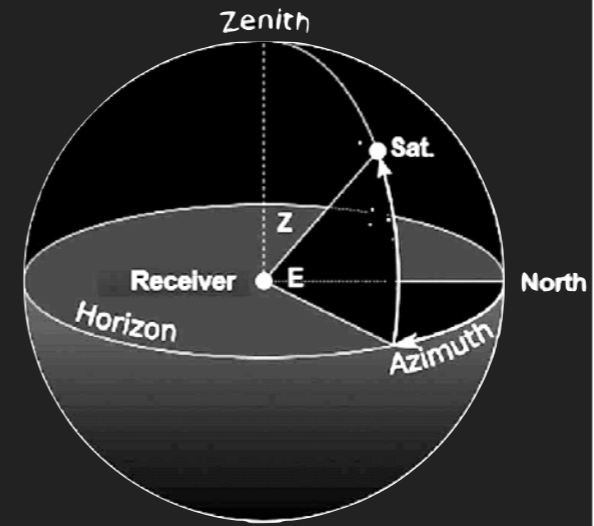
Teams formed and assigned an object in the sky.

Locate your object in the sky.

Use Stellarium, Suncalc and Mooncalc, etc. Make sure to set location to 370 Jay Street, and time to 1PM EDT today. Find coordinates as Azimuth and Altitude or Elevation (as opposed to Right Ascension and Declination). Use compass and level apps to find direction towards sky object. Set compass to use true (not magnetic) north. Use anything (paper + tape, your arm, anything) as pointers.

Create a pointer to your object.

Get creative



https://www.researchgate.net/figure/Satellite-Azimuth-and-elevation-angle_fig1_334197029

The image shows a screenshot of the Stellarium Web interface in a browser window. The browser's address bar shows 'stellarium-web.org'. The interface includes a left sidebar with 'View Settings' and 'Planets Tonight' options. A central panel displays the 'Venus' object with its properties: Magnitude: -3.81, Distance: 1.46 AU, Radius: 6051.89 Km, RA/Dec: 09h 52m 29.0s +13° 59' 55.7", Az/Alt: 207° 42' 31.6" +60° 46' 12.2", Phase: 97%, and Visibility: Rise: 05:16, Set: 18:56. A text box below this panel states: 'Venus is the second planet from the Sun and is named after the Roman goddess of love and beauty. As the brightest natural object in Earth's night sky after the Moon, Venus can...'. The main view shows a starry sky with the Sun, Venus, and the Moon. A red line representing the ecliptic is visible. A search bar at the top right says 'Find your object'. The bottom status bar shows 'NEAR NEW YORK' and the time '13:00:13' on '2022-06-01'. Annotations with blue lines point to various settings: 'Turn on Ecliptic in View Settings' points to the ecliptic line; 'Set location' points to the 'NEAR NEW YORK' text; 'Turn off atmosphere and ground' points to the atmosphere and ground icons in the bottom toolbar; and 'Set to current time' points to the time and date display.

Turn on Ecliptic in View Settings

Set location

Turn off atmosphere and ground

Set to current time

Find your object

Use Azimuth and Altitude (Elevation)

Property	Value
Magnitude	-3.81
Distance	1.46 AU
Radius	6051.89 Km
RA/Dec	09h 52m 29.0s +13° 59' 55.7"
Az/Alt	207° 42' 31.6" +60° 46' 12.2"
Phase	97%
Visibility	Rise: 05:16 Set: 18:56

Venus is the second planet from the Sun and is named after the Roman goddess of love and beauty. As the brightest natural object in Earth's night sky after the Moon, Venus can...

NEAR NEW YORK

13:00:13
2022-06-01



Heidi Neilson's [Moon Arrow](#) always points at the moon (sometimes it's behind the Earth).



GNOMON

gnomon (n.)

"vertical shaft that tells time by the shadow it casts" ... from Latin *gnomon*, from Greek *gnōmōn* "indicator (of a sundial), carpenter's rule" ... "one that discerns or examines, interpreter, expert," from *gignōskein* "to come to know," **from Proto-Indo-European root *gno- "to know."**

<https://www.etymonline.com/word/gnomon>

In other words: we gain knowledge of the world by studying the movement of shadows. Reminded of Plato's cave - the "reality" we see is like a shadow on a cave wall, cast by some unseen deeper reality.

ARJUNA

"As rivers flow into the ocean, all the warriors of this world are passing into your fiery jaws; all creatures rush to their destruction like moths to a flame. You lap the worlds into your burning mouths and swallow them... **Tell me who you are, O Lord of terrible form.** I bow before you; have mercy! I want to know who you are, you who existed before all creation. Your nature and workings confound me."

KRISHNA

"I AM TIME, destroyer of all."

BHAGAVAD GITA

TAOSI GNOMON

Xiangfen 襄汾, Shanxi Province

2300 - 1900 BCE

Oldest gnomon, oldest observatory



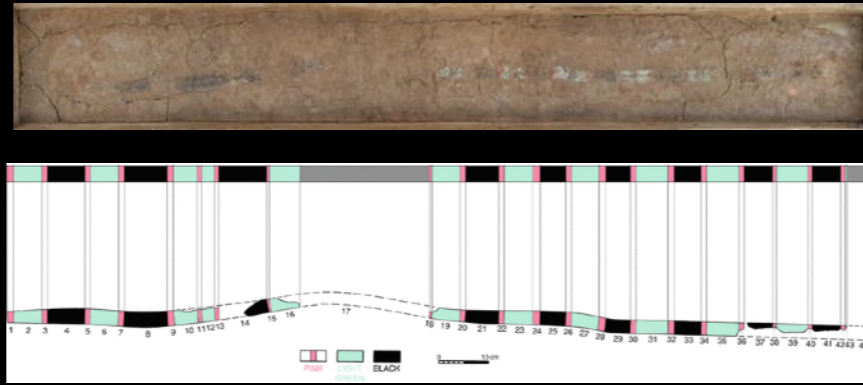
[Handbook of Archaeoastronomy and Ethnoastronomy](#)

Pronounce ~"Tao Su"

~1.7m stick. Pigments in the dirt where this was discovered indicated it was painted with colored stripes

TAOSI GNOMON

Xiangfen 襄汾, Shanxi Province
23rd - 19th century BCE
Oldest gnomon, oldest observatory



[Handbook of Archaeoastronomy and Ethnoastronomy](#)

TAOSI GNOMON

Xiangfen 襄汾, Shanxi Province

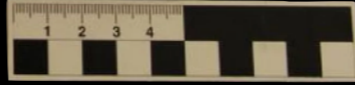
2300 - 1900 BCE

Oldest gnomon, oldest observatory



[Handbook of Archaeoastronomy and Ethnoastronomy](#)

universitat Basel, Ägyptologie



EGYPTIAN SUNDIAL

13th century BCE
"temporary hours"



livescience.com

BYZANTINE SUNDIAL 6TH CENTURY CE



<http://hist.science.online.fr/>



JANTAR MANTAR, JAIPUR

goibibo.com

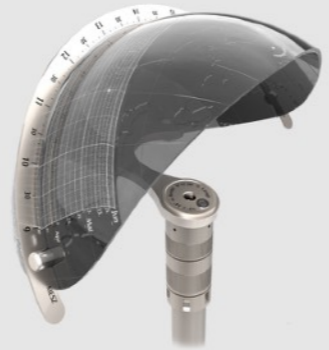


JANTAR MANTAR, JAIPUR

wikipedia

HELIOS Subsolaris

lichtpunktgenau



SOLAR RING

100 year success story



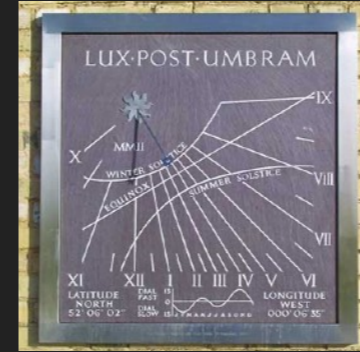
<https://www.helios-sonnenuhren.de/en/helios-subsolaris>
<https://www.helios-sonnenuhren.de/en/helios-solar-ring>

HORIZONTAL



sundialsoc.org.uk

VERTICAL



<https://www.davidharber.co.uk/>

EQUITORIAL



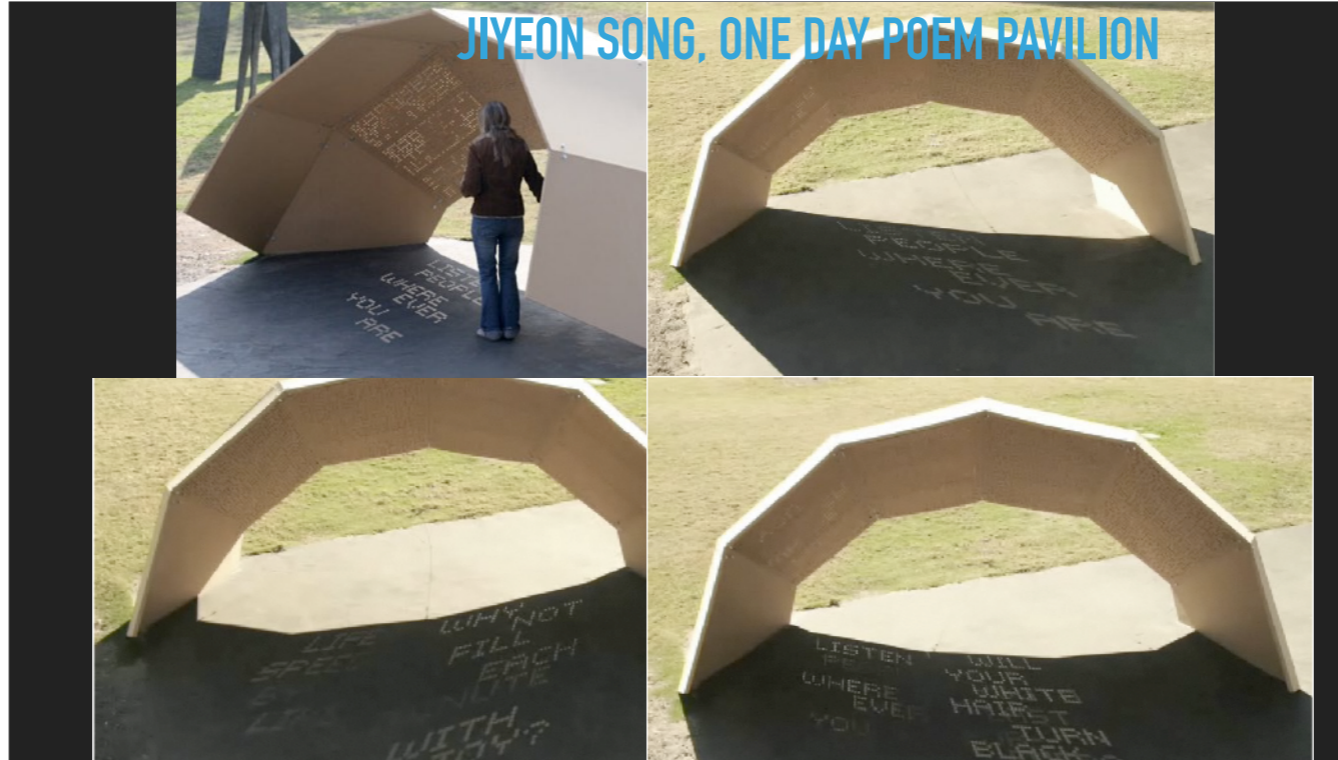
[ebay.com](https://www.ebay.com)

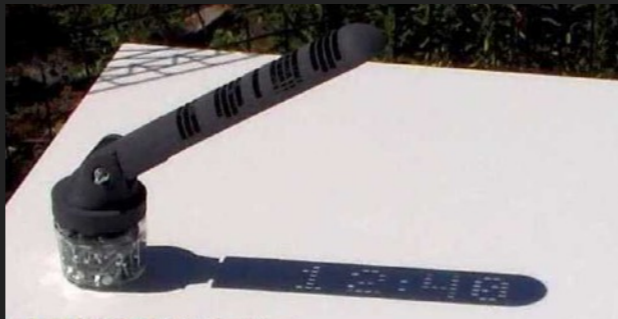
CONCAVE



[Jang Yeong-sil Science Garden](https://www.jangyeongsil.com)

JIYEON SONG, ONE DAY POEM PAVILION





DIGITAL

<https://www.thingiverse.com/thing:1068443>

EVERY CITY IS A SUNDIAL



https://www.youtube.com/watch?v=_E3lqHq2tNU



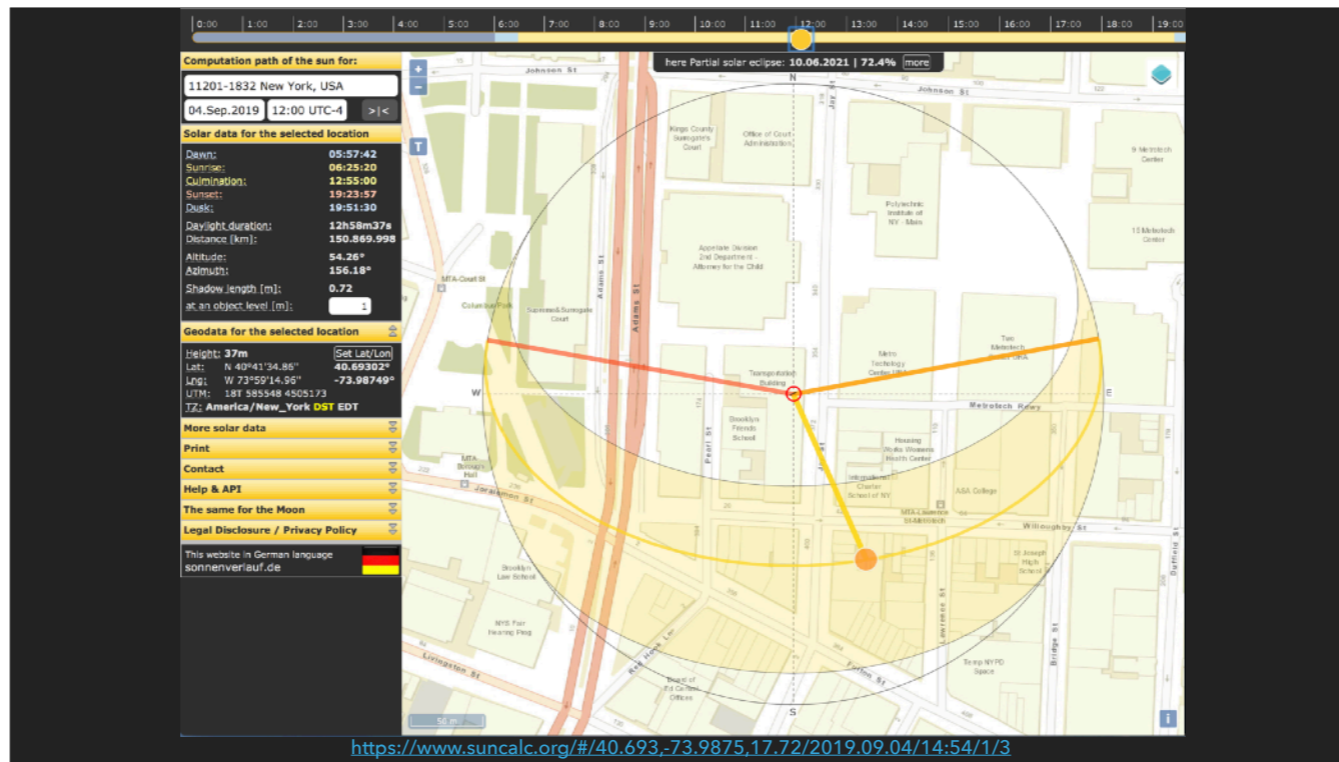
MANHATTAN HENGE

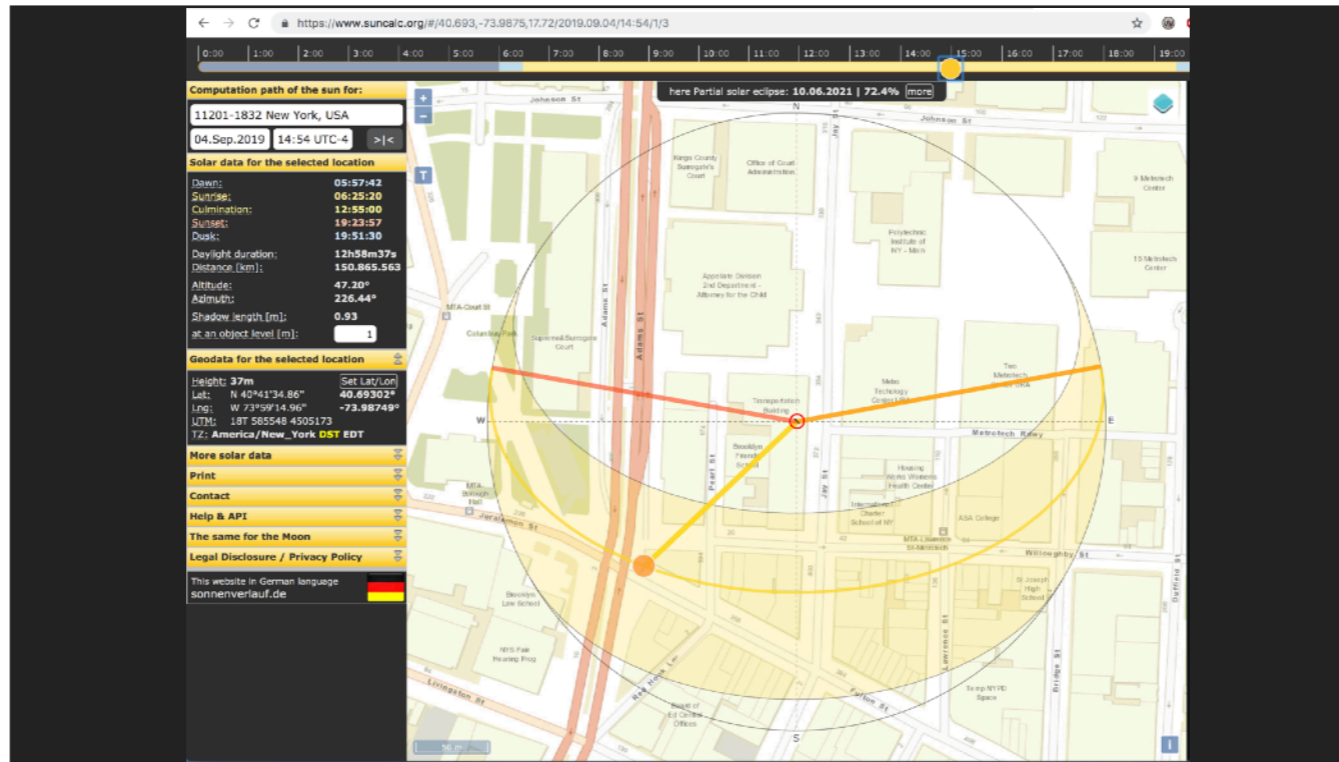
EVERY WINDOW...



EVERY WINDOW...



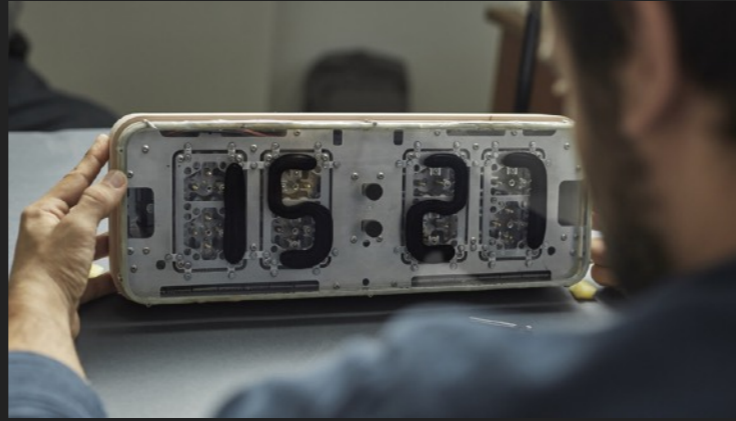




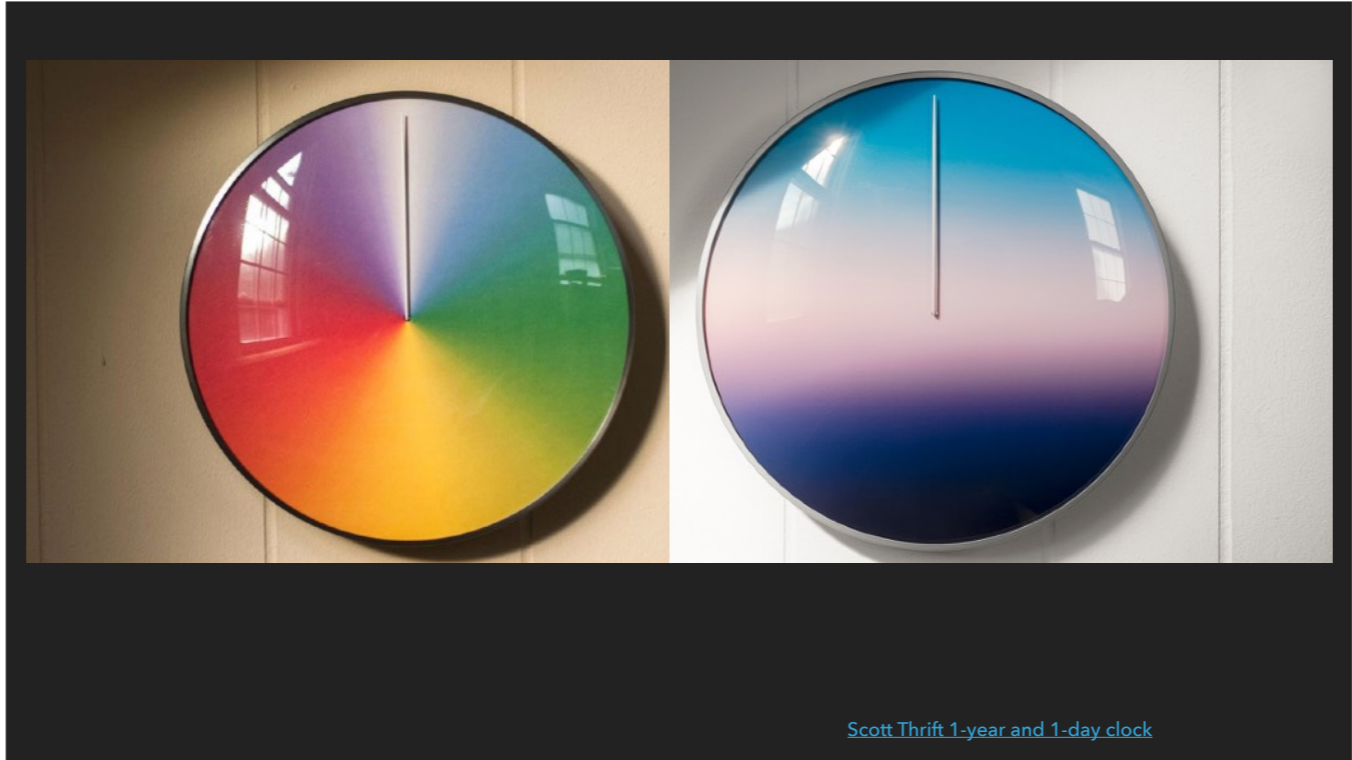
Clocks are cool



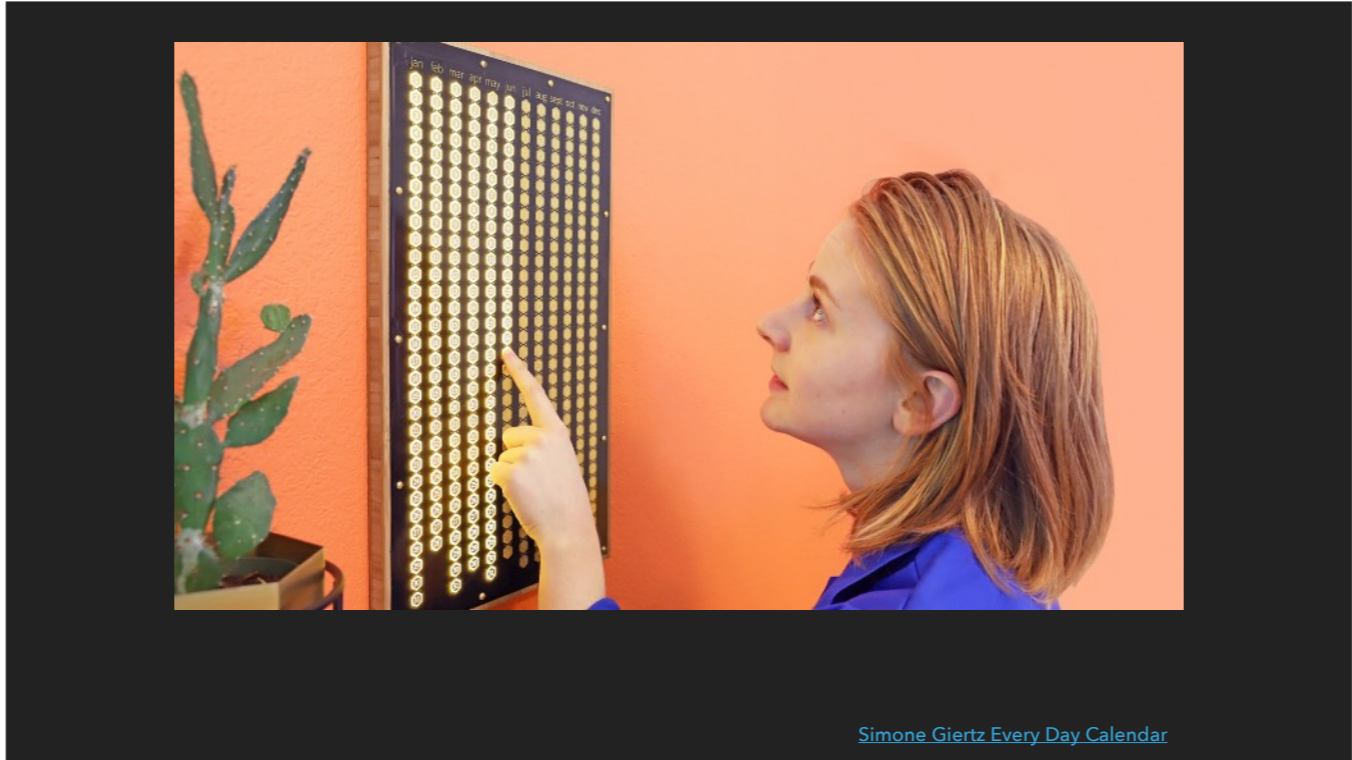
Strausberg Astronomical Clock [Atlas Obscura](#)



[Ferrofluid Clock](#)



[Scott Thrift 1-year and 1-day clock](#)



[Simone Giertz Every Day Calendar](#)

So so much more, some here, some for you to find and share...

<https://www.fddrsn.net/teaching/time/gallery/>

