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techkeen · Sep 23, 2020 · 6 min read

A Brief History of Units of Measure

Updated: 15 hours ago

Good morning. Don't we look marvelous today?

Over the past few years, I have grown to really love this one Youtuber. Maybe you have heard of him, his name is Mehdi Sadaghdar aka ElectroBOOM! If you have not yet watched any of his videos, I would *strongly* suggest you look up his YouTube channel. Not only are his videos greatly informative, but he is seriously a natural entertainer. His humour reminds me of the YouTube we had a decade ago. I could go on all day about him. Mehdi's work is so great that I know people watching him with little more knowledge than how to plug in a cord.
Give ElectroBOOM! a chance, you might learn a thing or two.

I currently live in China, which means I do live behind 'The Great Firewall'. The Firewall blocks YouTube, so I have to look around BiliBili and other video apps. I found ElectroBOOM!. Fantastique!

Link to the series: YT
Link to the episode: YT
(URLs will be posted when I visit outside of China)

The following Timeline is based on the Second Episode in the ElectroBOOM! 101 series. I did rearrange the order a little.

William Gilbert (1544-1603) studied the effect of the 'attracting force' by rubbing amber on

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Halley (1656-1742) discovered and published [out of his own pocket] Newton's *Philosophiae Naturalis Principa Mathematica*.

- This book included Newton's Laws of Motion. The second of which, '*The sum of all forces on an object is equal to its mass times acceleration*', so Force = Mass X Acceleration.
- The Newton (N), the unit of force, was named after this Newton (1643-1727).

Benjamin Franklin (1706-1790) proposed and *allegedly performed* the kite experiment in 1752. The experiment was supposed *to demonstrate a link between* lightning *and electricity*. Now we know that it was likely an *ambient electrical charge* that his kite picked up from the storm.

- In an attempt to recreate his experiment, George Wilhelm Richmann (1711-1753) died when struct by Ball Lightning.
- According to *The Franklin Institute*, Thomas-François Dalibard had demonstrated an *'electrical nature of* lightning*'* just one month *prior* in Northern France.

Charles-Augustin de Coulomb (1736-1806) is best known for discovering Coulomb's Law, which states *electric force between two static charges* is proportional to the product of their charges divided by the square of their distance*, F = KE ((q1 +q2)/r^2) . It tells us that between two conductive objects, opposites attract.

- Think like with magnets how positive (N, North) sides push apart, and negative (S, South) sides repulse each other.
- ElectroBOOM! said it's like Coulomb said, "obviously there is something flowing in a conductive medium like a fluid. Let's just call that Electric Charge (q)."

* charges must be spherical, non-overlapping, and stationary.

James Watt (1736-1819) invented the *Steam Engine*. In order *to compare the strength of his steam engines with the equivalent of horses*, the Horsepower ((delta) Δh) was created. Every horsepower is basically *the amount of weight the typical horse can pull up times 1 meter per second*. ~75kg is the metric horsepower. Later in life, the Watt (W) was named after him for his work in ___, which James Joule had been studying.

Have you noticed?

Well, Gilbert died 103 years before Franklin was born; Franklin was born 100 years before Coulomb died; Coulomb and Watt were born the same year. Also, Franklin died 99 years before Joule.

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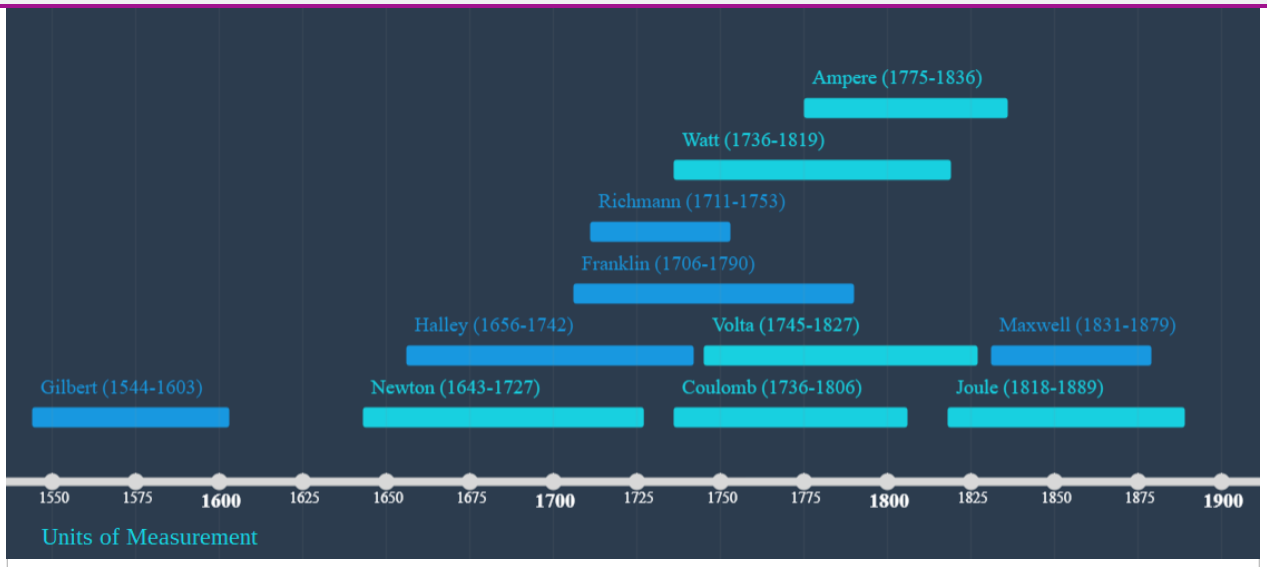

Timeline comparing when they lived.

André-Marie Ampère (1775-1836) was one of the founders of Electromagnetism. He is known for inventing the *solenoid* and *the telegraph*. Ampère noticed *Magnetic Force*; if *electricity is passed between two adjacent wires, they impose force on each other.* The Amp, or Ampere, (I) was named after him for his research on Current (I).

James [Prescott] Joule (1818-1889) was an English Physicist, Mathematician, and brewer. He, like James Watt, studied engines, electricity, and heat. He was one-half of the discoverers of the *Joule-Thomson Effect* [Joule Kelvin Effect] of Thermodynamics, where "*The change in temperature that accompanies expansion of a gas without production of work or transfer of heat.*" (Britannica, Joule-Thomson Effect).

The Joule Joule realised that *the work on an object would be equal to the force applied to it*. Which is represented as F = MA or [M * A]. Work, the energy spent by that force to move a mass by a given distance, is represented as W = F * l . 'l' is the distance the object travels under force. Power is the work *divided by* the amount of time the energy was being spent; P = F * l / t. This tells us that *if the same amount of energy is spent in less time then it has a greater punch*, as is represented by Watts.

Explanation of Current (I)

ElectroBOOM!'s Mehdi gave a great explanation of Current (I), which I will paraphrase in jot form:

- Imagine a water hose. You could measure the flow based on the amount of mass (m) passing a specific point in the hose per second. If you had 1kg/s (kilogram per second), 2 kg/s flowing through would be faster.
- This is the same for electric current (I), except here mass (m) or volume (v) don't make a difference. The mass or volume of electric current doesn't make electricity flow faster.
    - +Electricity can move with tiny electrons or large ion particles through solids, liquids, or gases.

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- +Electric Charge is what matters. 1 coulomb (q) is the amount of charge that 1 amp of current (I) can carry every second.
- We didn't know it was electrons traveling through the wire, so they called one side positive and the other negative. q+ -> q- but actually e+ <- e- (electrons)

Alessandro Giuseppe Antonio Anastasio Volta (1745-1827) Let's just say *Volta*. Volta *invented the first battery*. The *Voltaic Pile* was a source of electrical energy. If you connected a circuit across it, it would *provide the energy that would push the current through the circuit.* The Volt (V) aka "*electrical potential*" is named in his honour.

NOTE THAT ELECTRICAL POTENTIAL (V) IS NOT THE SAME AS POTENTIAL ENERGY.

Explanation of Voltage (V)

ElectroBOOM! explains; I'll paraphrase:
- If I hold a mass (m) above a surface, the force (F) applied to it is equal to its mass (m) times the gravitational acceleration of Earth (g). [F = m * g]
- If I let go of it from a height (h), it releases energy equal to the force (F) times the distance (d or mgh [m * g * h]). [W = F * h = m * g * h]
+But if I don't let go, this mass has the potential to release that much energy.
- Similarly, if we have 2 charged balls like Coulomb's experiment, we know how much force is between them using Coulomb's Law. Knowing their distance (d), we know that the total electrical potential energy that they would release if let go. [insert complicated formula] or to make it easier [W = Ke ((q1 * q2)/r)] a
+The total energy doesn't affect the current (I). Holding 1kg of water at a certain height, and holding the entire ocean at that same height. If all of the water has to go through the same pipe [which can have 1kg max at once], the water would have gone down the pipe 1kg at a time.
++ The current (I) would be dependent on the gravitational acceleration (g) and the height (h) that the 1kg of water has to go down through. Basically, Specific Energy is *the total potential energy (mgh [m * g * h]) divided by the mass (m, but now just gh [g * h]).*

[W = mgh ; W/m = gh]

+This too is the same in electronics. The current (I) is not dependent on the total energy, but on the available energy per unit of charge
[Joules (J) per Coulomb (q) or J/q]

The unit of this, the Volt (V) aka "electrical potential", goes to Volta. The voltage difference between any 2 points in space is the difference between their electrical potentials.

Newton	N	force (F)	Sir Isaac Newton
Joule	J	energy	James P. Joule
Watts	W	power	James Watt

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Volts	V	potential	Alessandro GAA Volta

Power VS Energy

Power the rate of delivery of energy; work performed per unit of time.
The joule per second. 1 Watt of power is used when 1 joule of work is done in one second.

Energy the work performed over a period of time.

1 Watt = 1 joule / 1 second

Voltage Vs Current

Voltage (V) is the amount of energy available to move 1 Coulomb (q) of charge, expressed in Joules (J).
+ may make it easier to understand if I say, "Electrical potential is the amount of energy avail..., so remember that Voltage is that electric potential(V)."

Current (I) is the amount of charge (Coulomb; q) passing in 1 second (time; t), expressed in Coulombs (q).
+amount of Coulombs (q) passing through in 1 second (t).

Voltage (V) = (Work (energy)) / (I (charge))

Current (I) = (q (charge)) / (t (time or seconds))

When the voltage (V) value of one point is higher than the other point and there is a conductive path between them, the positive current (I+) runs from the higher voltage to the lower.

James Clerk Maxwell (1831-1879) wrapped everything from Halley to Volta in math.

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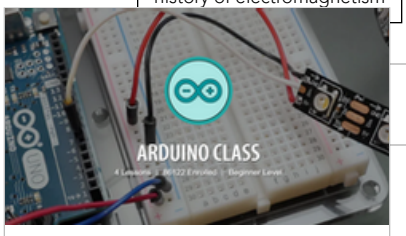

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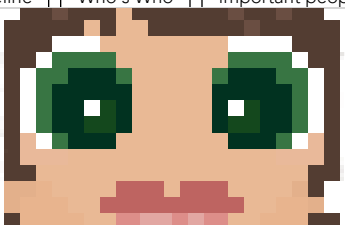

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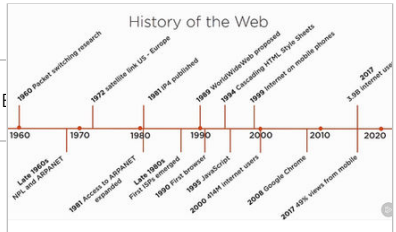

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