

The history of clocks essay sample

[History](#)



In this poster we are going to show you the history and the development of the clock through time and how it has impacted society. We will also show how electricity has affected the development and effectiveness of clocks.

Sun clock:

One of the first clocks on record is the sun clock. Sun clocks basically work on the principle that the position of a stationary object's shadow will be in the same place at a certain time of day. The ancient people could put a scale on the shadow of an object like the obelisk in such a way that at dawn it is at one end and at dusk it is at the other. So that the people can have an estimate of how much daylight there is left. Also they could set a point to show when it is the middle of the day because at the middle of the day the sun will be highest in the sky so the shadow will be at its shortest. When the shadow is at its shortest they can put a mark at where it was on the scale. In some places they even made sun clocks that account for the different seasons because in different seasons the sun comes up and goes down at different times of day.

The sun clock was very useful to the ancient people because it helped the people of the ancient world to plan better for the rest of the day, which made the economy more effective. There are some problems with sun clocks. For example they only work if it is daytime and the sun is not obstructed by anything, like a cloud. If one did not account for the change of season then the clock would only be accurate in the season that it was made. The main problem was that it was not very accurate. It was just about enough accurate to estimate time to within plus or minus 1 hour during daytime.

Water clock:

Another one of the early types of clocks is the water clock. It is defined by any time keeping device that has a regulated flow of water in or out of a container. The change in depth of the water in the container can be measured to calculate the amount of time passed. In 250 BC there was a mathematician called Ctesibius who invented a clock, which was named clepsydra (water thief), it was much more accurate than the normal water clocks of the time and it was the most accurate clock up until the 17th century, when a physicist called Christiaan Huygens showed how to use the swing of a pendulum to regulate the clock. Also in the 11th century Su Song, a Chinese mathematician, made an even more accurate water clock, which he used for astronomy.

The water clock was first used in the ancient times for applying water to crops for a more uniform spread of water. The water clock was also used in Rome to limit the length of speeches and by astronomers to record the time of a certain astronomical events.

The water clock was quite accurate, but because it is very hard to regulate the flow of water extremely accurately, it will display the wrong time after a few months. Also, in changing climate water would have different densities, which could affect the accuracy, and if you live in a climate that gets very cold in winter then the water would be too cold to exist in a liquid state.

Sand clock:

The sand clock (hourglass) is used to measure a certain amount of time. It works by having sand or any type of powder in a glass cylinder, which is closed at both ends, and is very thin in the middle and wide at each end. When the sand clock is put vertically all the powder flows from one end to the other and it is designed for this to take a certain amount of time.

A clock like this is limited to only a certain amount of time and one has to flip it every time all the sand is at one of the ends. It is useful for working shifts for example on a ship there always has to be some one on the look out but people need to sleep as well so every one just does one hour of look out at night and they can use an hour glass to do this.

Fire clocks:

Fire clocks include the candle clock and the incense clock, which both work on the rate of the burning of a substance. In the candle clock it is paraffin or in older times bees wax and in the incense clock it is the incense. The candle clock is basically a candle next to a scale or with a scale painted on to it so as it burns the height of the candle decreases with a constant speed, which then can be used to measure time. The incense clock had a stick of incense suspended horizontally above a gong and along it at intervals there were weights hung on it so that when the incense had burned past the place where the weight was hung the weight would fall on to the gong alerting people that an hour had past. The incense clock was first found in China and Japan and it was common in houses and in temples. They are quite accurate and they can work at any time of day in any temperature unlike the water clock and the sun clock.

Mechanical clocks:

Mechanical clocks were the start of really accurate clocks. The first ones were first used in the medieval times where they made an arrangement of gears that were attached to a heavy weight which turned them slowly but they were not that accurate. Soon a man called Peter Henlein started using spring-powered clocks, which used springs instead of gravity to turn the gears. These clocks became popular among the rich because they were very small and could easily fit on a mantel or a shelf. In the year 1582 an Italian scientist called Galileo as a teenager had noticed the swing of the chandeliers in the church and he used his pulse to measure that their time period was there same whether their swing was small or not and started to experiment with swinging weights. He found that the pendulum was an accurate way of marking of exact intervals of time.

After this the pendulum became the number one mechanism used in clocks for setting an accurate time interval. This system was not perfect because the pendulum swings in an arc of a circle and when this happens the swing of the pendulum varies slightly. For the swing to keep an accurate time it had to swing in a shape called a cycloid. The Dutch astronomer Christian Huygens first devised a successful pendulum clock in 1656. He used a shorter pendulum that swung several times a second. It had an error of less than one minute a day plus or minus 10 seconds. In 1670 the English William Clement used a pendulum of one yard, which had a time period of one second. He also put it in a glass cabinet to reduce the affect of air currents. This clock was more accurate than any clock before it and it became known as the grandfather's clock. This was the first clock that was sufficiently

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accurate enough to have a minute hand because it was accurate enough to measure time to the second. In 1721 it was improved to one second a day and it continued to develop until it had an accuracy of a hundredth of a second per day and it became the standard for most astronomical observations.

The chronometer is a type of mechanical clock but it is a very special one because it was a clock that would stay accurate while on a boat out at sea. The pendulum clock was good on land but once it was put on a ship and sailed out to sea the pendulum swung in any direction and was very inaccurate. The reason why a clock that could work on the sea was so important was because of navigation. In navigation of the globe there are two units used for your location: latitude and longitude. Latitude is very easy to find using the stars and a sextant, but the only way to find longitude was if you knew the difference between your own time and that of Greenwich Mean Time (GMT). So with a clock that displays GMT and using the sun you can work out how many hours you are ahead or behind GMT and each hour is equivalent to 15 degrees of longitude.

In 1714 the British government saw this as a matter of great importance because it was very hard to trade with countries across oceans if you could not navigate across the oceans. They offered a longitude prize for the person who could figure out how to find longitude and there was a reward ranging from £10,000 to £20,000, which is several million pounds in modern terms. In 1761 James Harrison had finished making the first working chronometer.

The mechanical clock is a very accurate and useful clock that helped society in a lot of ways. For example the chronometer helps with naval navigation, which was very important in exploration and trade. There are very few problems with the mechanical clocks because they are so accurate, but they are quite expensive and hard to make.

Electrical clocks:

Most electronic clocks are based on the same principles as the mechanical clocks. The only difference is that an electrical motor now does some of the tasks that are done by gravity or a spring, for example the winding up of the weight or the spring would now be done with an electrical motor. The most common type of modern clocks are quartz watch, which work on the principle called the piezoelectric effect where a piece of quartz (SiO_2) bends if it gets affected by an electric current and if you bend it, it will produce an electric current. In a quartz watch there is a piece of quartz in the shape of a tiny tuning fork. There is also a battery, a silicon chip and the display. The battery sends an electric current to the silicon chip, which sends it to the quartz, which like the pendulum vibrates at a constant speed, which sends an electric current which is sent back to the chip at regular intervals and this chip then uses this to change the image on the screen at a correct rate.

The electric clocks are in very common use nowadays, mainly because they are even more accurate than the mechanical clocks. Also because they are so much cheaper to mass-produce and electricity is not affected by the motion of a ship, it makes chronometers much easier to make and these clocks have allowed humans to become much more time efficient, which is

one of the most important aspects in developing and adapting to the ever changing universe. There are also problems for example when quartz clocks are mass-produced they are normally made out of plastic which is very hard to recycle and if people do not dispose of them correctly they can be an environmental problem because plastic takes very long to decompose so it can damage the environment.

Atomic clocks:

Atomic clocks are the most accurate clocks that have been made so far. They only lose one second in accuracy every 20 million years! The most accurate one at the moment is the one in America called NIST F-1 and it is a cesium atomic clock and its time is used as the Coordinated Universal Time (UTC). It is referred to as the fountain clock because of how it works. Firstly a gas of cesium atoms is put into the clocks' vacuum chambers where six infrared lasers are pointed at right angles to each other at the center of the chamber. The lasers push the atoms into a ball, slow down their movement and cool them to nearly absolute zero. Then two vertical lasers gently throw the ball upward after which the lasers are all turned off. The ball is thrown about one meter high through a microwave filled cavity. As the atoms of the cesium interact with the microwaves, depending on the signal of the wave, some of the atoms may be altered.

The entire trip takes about one second. At the end another laser is pointed at the atoms. The atoms whose states were changed by the microwaves will start to emit light known as fluorescence. A detector measures the photons of the fluorescence. This whole procedure is repeated lots of times with

different microwave frequencies and eventually the microwave that maximizes the cesium atoms fluorescence is reached. This frequency is the cesium atoms natural resonance frequency, the characteristic that defines a second and which allows very precise time keeping possible. The natural frequency used currently by all scientists defines one second as 9, 192, 621, 770 oscillations of the cesium atoms resonance frequency.

Having such accurate clocks like the atomic clock is very useful and it gives us more possibilities in doing experiments and even in practical life for example Global Positioning Systems (GPS) would not be possible if we did not have very accurate clocks.

Conclusion:

In this poster we have shown the development of clocks through history and that it has had a big impact on society. We have also shown that electricity has been used to make clocks more accurate and that it has improved them a lot. This poster shows a lot of science being effectively applied over the last few thousand years

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