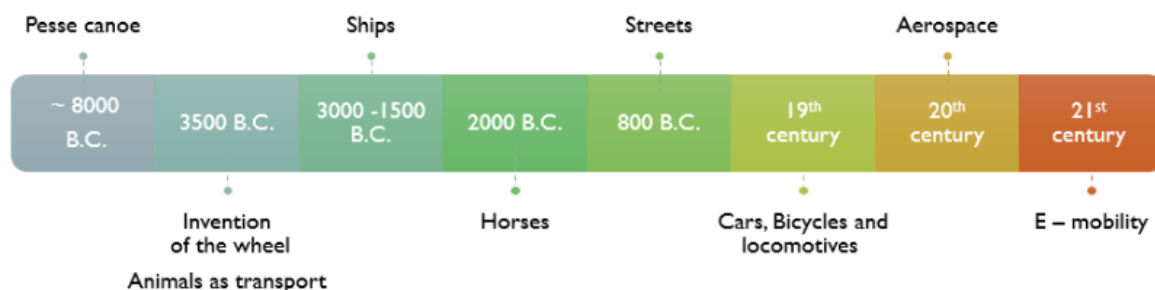


Human mobility

Ever since animals are living on this planet, there was a need to change places. For millions of years, there was only one way to do that: using the own body. Humanity is the first known species that was able to change that entirely.

In the beginning, humanity used other objects or animals, but after the invention of the wheel, this changed completely besides in a very short period. From railways and subways to cars, motorboats and airplanes, humanity managed to use all possible space to travel in a matter of some hundred years.

Some of the oldest finds of transport is the Pesse canoe, this is simply a boat made out of hollowed tree trunk and it was constructed somewhere between 8200 and 7600 BC. A number of similar finds have been found of object that are probably used for transporting people, materials and food. This was an invention that was developed multiple times and resulted among other in developing of the ships began. Already somewhere between 3000-1500 BC, the Egyptians developed some of the first ships, this was used to transport heavy load due to the construction of the pyramids.



But as mentioned, the real breakthrough came with the invention of the wheel in around circa 3,500 BC and it was quickly distributed around the world. This proved to be a revolutionary invention that became a staple of a number of transport-related innovation. This lead to a totally new kind of warfare as well as it also gave a huge extension of the reach of land. The romans were one of the first to build complicated road networks around 800 BC that even lead to more reach of land. With a jump to the late 1700th century the first steam powered automobile capable to transportation was built by Nicolas-Joseph Cugnot. About the same time humans started to use animals as necessities that further lead to a plentiful use of the horse and buggy in the late 18th century, as well as the first bicycle also got invented. The 1800th century

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had a lot of wheel based inventions, but it also worth mention that the first commercially successful steam locomotive was built in 1812–13 by John Blenkinsop.

The development of the transportation technology was boosted by the need of reaching further distances in less time as well as transporting more weight. Moving materials to build railroads and highways or taking people to work and visit far places are just simple examples of how demanding society became throughout the years when it comes to transportation. Transportation had to evolve and develop itself in order to fulfill the requirements imposed by the booming society and the toll was taken firstly upon the environment.

The environment itself became the great power resource to push transportation forward and keep the human mobility in the rise. First, wood was used to produce charcoal, which already had an instant impact on trees and on the environment. Sources of fuel were also found under the ground and they enabled people to overcome great distances by powering transportation vehicles. These mineral fuels, also known as fossil fuels, such as coal and petroleum, provided the required thermal energy to run the engines in the first cars and trains developed by the humankind. With cars and trains people were able to travel great distances in much less time, but always on land. Even though the combustion of these fossil fuels were a great hazard to the environment due to the gases which were released in the atmosphere, the human mobility depended greatly on them. The need to reach ever further places, places across the oceans, pushed the human mobility to the sky with the development of planes. At this point, fuels that were derived from petroleum played a great role in the society. Gasoline, diesel, alcohol and aviation kerosene were the main sources of energy to manage the requirements of human mobility and the used transportation vehicles. Nevertheless, the products of their combustion and the difficulties to obtain petroleum made a severe impact on the environment and the need for “eco-friendly” fuels became a reality.

Due to the concern with the environment and the impact on future generations, electricity became one of options to start replacing fossil fuels in transportation and human mobility. Trains and metros started running on electricity and electric cars were developed. Individual transportation vehicles which run on electricity, such as electric bikes and scooters, also had great evolution within the last years and nowadays play a key role in human mobility in great urban centers. Such solutions for human mobility was based on the belief that electricity is a “clean” energy. Even though its usage does not impact directly the environment, its production and storage do take tolls on nature. One of the most popular ways to produce electricity is to take advantage of heights of water reservoirs. Such water reservoirs are created by flooding huge natural areas, and therefore changing its vegetation and animal life. The batteries used to store electricity is also an issue because they are made of heavy metals. When the usage life of the batteries is over, they automatically become a great hazard to the environment because of their disposal. With that in mind, energy sources to keep the

currents standards of human mobility while aiming for more “eco-friendly” features is still and ongoing issue.

In the future we will have to find better ways to generate and store electricity. One way could be to produce hydrogen. Nowadays it could happen, that there is generated too much renewable electricity e.g. when a lot of wind blows during the night, but the consumption is very low since most of the people sleep. In this time, the too much generated electricity could be used to electrolyte water and produce hydrogen. With this hydrogen we can either power new hydrogen engines that burn the hydrogen with air to water or – what happens in nowadays hydrogen cars – produce electricity in the car and power an electrical engine. We could also create electricity in huge power plants again and charge electrical cars when needed. Right now, we still have problems to store the hydrogen since it's very reactive and has to be stored under a lot of pressure which makes it very dangerous. New research shows, that there are possibilities to store hydrogen in fluids or salts under low pressure.

But when we talk about the future of human mobility, we have to differentiate between short-distance traffic and long-distance traffic.

The short distance traffic will increase in the coming years a lot. Reasons for that are a growing population worldwide, growing wealth – also in developing countries – and cheaper possibilities to travel. The biggest percentage in short-distance traffic will be the individual car followed mainly by bus and rails, depending on the region, the prices and the distance.

For the cars of the future and the street traffic in general the sharing, the autonomy and the connectivity will become more and more important.

With the help of the smartphone, car sharing and bike sharing became a really big deal. In the future the sharing will even increase in the short-distance traffic due to a higher acceptance and cheap prices in the cities.

Right now we also have autonomous driving cars, but they still are very underdeveloped and need human drivers to act in case of emergency or a failure of the system. In the future we will have full autonomous cars that can solve all problems on its own and humans become to passengers. This will change the short-distance traffic entirely. Taxis could become cheaper since no drivers are necessary anymore but with that progress a lot of people will lose their jobs. Depending on the region this level of autonomy will be accepted sooner or earlier. Developing countries like India where a lot of people work as drivers and the infrastructure is in a bad quality later than in high developed and rich countries like Singapore.

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Apart from the autonomous driving, the connectivity is the second big deal in the short-distance traffic. Cars that can communicate with other cars or busses and even traffic lights over 5G or wireless lan will allow a constant flow of movement. This reduces the emissions since stop and go can be eliminated to a minimum and also traffic accidents can be reduced a lot.

For the long-distance traffic flying will be more advanced. New shapes of the airplanes like flying wings with the engines on top of the wing will help to reduce CO2 emissions because of the improved aerodynamics as well as the sound emission because the wing minimizes the sound waves that can reach the ground. With advanced batteries and hydrogen storage also electrical engines could become interesting in the field of aviation. And, there will probably be new ways of transportation, too. One new way could be commonly used taxi-helicopters like the now tested electrical helicopter “city airbus”. Another could be high speed cars driving very efficiently long distances through Hyperloops.

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