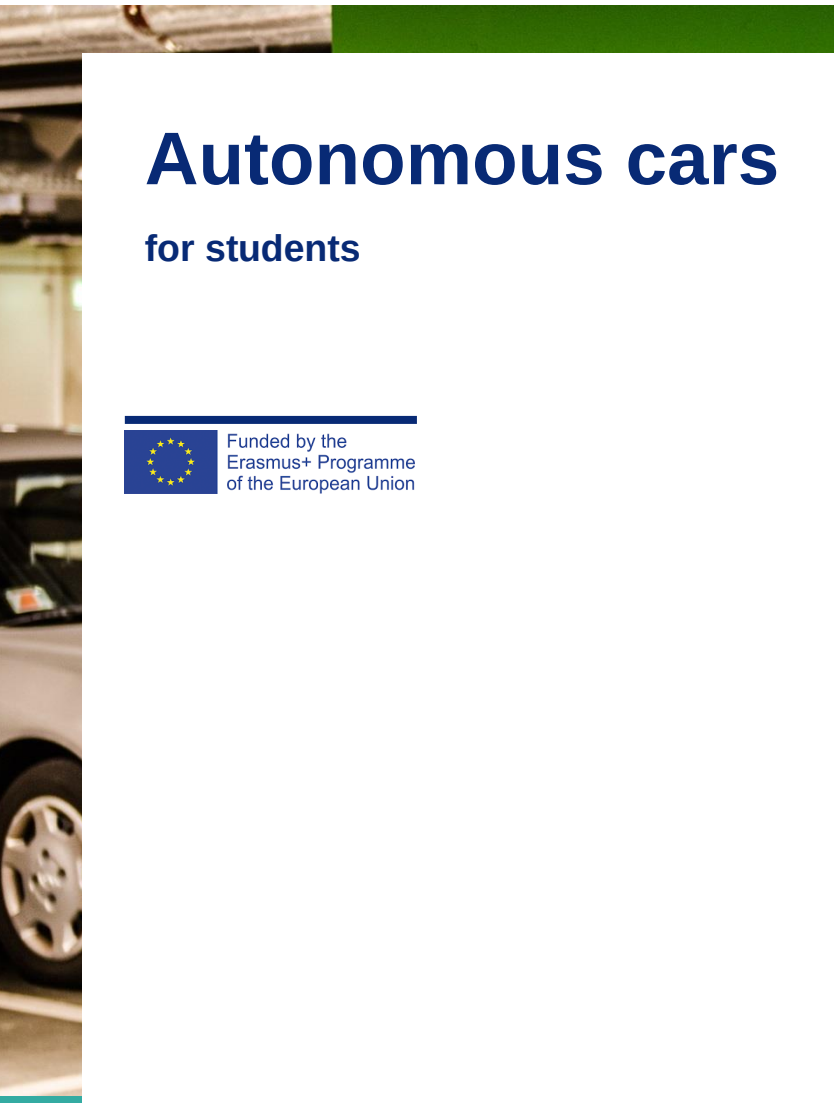
Autonomous cars

for students



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STEP AHEAD II

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Autonomous cars

The aim of the lesson:
Students will be able to recognize 5 levels of autonomous cars and describe them with their own words.

ANNEX 1

Autonomous cars - Introduction

If you're interested in the future of transport, you'll probably have heard of the autonomous vehicle levels already. Simply put, they're a set of guidelines determined by the Society of Automotive Engineers (SAE) to describe the differing levels of autonomy in driverless cars. There are currently five-ish levels in total - we'll explain why that's happened in a bit - with Level 1 being the most basic and Level 5 being the most advanced. It's pretty straightforward. What is now called Level 1 has been around for a few years now, and Level 2 is commonplace too. We're on the cusp of Level 3 and the next big thing - proper hands-off driving for long periods of time - is called Level 4 and, ultimately Level 5. For the last few years, car brands have begun to pick up and use the autonomous level terminology – the latest Audi A8's Level 3 autonomous was heavily used during its promotion – but what the levels are, or what they actually mean isn't widely publicized. To make things easier, we've explained every level of driverless tech, as well as who's in control, what features they include, and when they'll be on our roads.

Level 1 autonomous cars: a single aspect is automated

The SAE, the Society of Automotive Engineers, has created a lexicon of autonomy. Level 1, the most basic type, is where one element of the driving process is taken over in isolation, using data from sensors and cameras, but the driver is very much still in charge. This started in the late 1990s at Mercedes-Benz, with its pioneering radar-managed cruise control, while Honda introduced lane-keep assist on the 2008 Legend. These were the first steps towards removing the driver's duties behind the wheel.

- **When? The first steps in 1990s/00s**
- **Includes: Lane-keep assist, auto cruise control**
- **Who's driving? Driver *is* still in control**

Level 2 driverless cars: chips control two or more elements

Level 2 autonomy is where we're at today: computers take over multiple functions from the driver – and are intelligent enough to weave speed and steering systems together using multiple data sources. Mercedes says it's been doing this for four years. The latest Mercedes S-Class is Level 2-point-something. It takes over directional, throttle and brake functions for one of the most advanced cruise control systems yet seen – using detailed sat-nav data to brake automatically for corners ahead, keeping a set distance from the car in front and setting off again when jams clear, with the driver idle.

- **When? Current state of the art**
- **Includes: Lane-change mode, self-parking features etc**
- **Who's driving? Human hands-on at all times**

Level 2+ autonomous cars: somewhere in between

Nested in between Level 2 and Level 3, Level 2+ is more where most car makers hope to be by the end of this year. It's a level that's been coined by Nvidia, and although not quite the driverless Level 3 below, it's a little more than Level 2. With Level 2+ the driver is still alert and in control, but the vehicle is also well aware of its surroundings – and make adjustments if necessary. As well as the outside, the car is more aware of the driver too, and will monitor things like tiredness.

- **When? End of the year**
- **Includes: Driver monitoring, and more complex tasks**
- **Who's driving? Still human, but the car is aware of what's going on**

Level 3 autonomous cars: the car can boss safety-critical functions

Highly automated vehicles are not far off. The SAE calls Level 3 'conditional automation' – a specific – mode which lets all aspects of driving be done for you, but crucially the driver must be on hand to respond to a request to intervene. Audi calls its new A8 a Level 3 ready autonomous car – meaning the car has the potential to drive itself in certain circumstances, where it will assume control of all safety-critical functions. How? By refining maps, radar and sensors and fusing this environmental data with ever-wiser and faster processors and logic. Today's assumption of a two-second comms lag will soon look very slow.

- **When? The next big thing: 2020**
- **Includes: Next-gen sensors, algorithms, new laws**
- **Who's driving? Driver still on standby, but can be hands-off for periods of time**

Level 4 driverless cars: fully autonomous in controlled areas

Early next decade cars will fully drive themselves in geofenced metropolitan areas, as HD mapping, more timely data, car-to-car comms and off-site call centres (to deal with unusual hazards) improve accuracy. 'You won't really need the driver in Level 4,' says Merc's autonomous guru Christoph von Hugo. 'The likelihood is you will just be renting the car, rather than owning it. You won't take this car on vacation to Florida but you'll take it on an urban journey around New York,

say. It is easier to have ultra-detailed mapping for carefully defined areas.' Twenty car makers say they'll sell autonomous cars in the US by 2022.

- **When? Due early to middle of next decade**
- **Includes: Driverless cars, shared pods**
- **Who's driving? Genuine hands-off driving**

Level 5 driverless cars: fully autonomous, anywhere. Driver optional...

The difference between Level 4 and 5 is simple: the last step towards full automation doesn't require the car to be in the so-called 'operational design domain'. Rather than working in a carefully managed (usually urban) environment with lots of dedicated lane markings or infrastructure, it'll be able to self-drive anywhere. How? Because the frequency and volume of data, and the sophistication of the computers crunching it, will mean the cars are sentient. It's a brave new world – and one that Google's Waymo car is gunning for, leapfrogging traditional manufacturers' efforts. The disruption will be huge: analysts HIS forecast 21 million autonomous vehicles globally by 2035**.**

- **When? Not long after Level 4, mid next decade**
- **Includes: Far-roaming robo taxis**
- **Who's driving? Steering wheel optional**

Sources used:

https://www.carmagazine.co.uk/car-news/tech/autonomous-car-levels-different-driverless-technology-levels-explained/
https://en.wikipedia.org/wiki/Self-driving_car
https://www.level5design.com.au/connected-autonomous-vehicles.html
https://www.synopsys.com/automotive/autonomous-driving-levels.html
https://www.bmw.com/en/automotive-life/autonomous-driving.html

https://boingboing.net/2017/03/03/the-six-official-levels-of-au.html

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