Future of cars: a human factor and safety perspective

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AUTONOMOUS VEHICLES
A world of driverless cars

Fully autonomous vehicles are developing faster than anyone would have thought just a few years ago, with many experts predicting that they will become widely available in the next 5-10 years. Many questions remain, but it is already possible to imagine how this new world of driverless cars will work.

PERCEPTION
Vehicles use radar to detect obstacles, a laser ranging system to map the surroundings in three dimensions, and safety cameras to identify objects such as traffic lights, construction signs, pedestrians and other vehicles.

COMMUNICATION
Vehicle-to-vehicle (V2V) radios send signals between cars, trucks and infrastructure items such as traffic lights.

DETECTION AND ACTION
To make the appropriate responses to rare events — such as a ball bouncing in from a playground, or a plastic bag blowing down the roadway — the cars rely on algorithms refined through millions of kilometers of test driving.

ADAPTIVE TRAFFIC FLOW
Smart infrastructure integrates V2V signals from the moving cars to estimate speed limits, traffic light timing and the number of lanes in each direction on the basis of the actual traffic flow. The result is a smoother flow, shorter travel time and less energy wasted on traffic lights or in traffic jams.

ROUTE PLANNING
An on-board computer uses sensor data to plot a route that gets the car where it needs to go, while avoiding people, obstacles, pot holes and other obstacles.

LOCATION
Mapping software uses Global Positioning System data to tell the car where it is in relation to roads, traffic signals, and other landmarks.

2020s
The decade when driverless cars are predicted to become widespread.

10%
Fuel savings for cars that travel in formation.

ROAD TRAINS
Vehicles can take advantage of aerodynamics and save fuel by following one another almost bumper to bumper. They are protected from catastrophic failure by their V2V radios, which allow all the cars in line to hit their brakes at the same time.

CITIES TRANSFORMED
MASS TRANSPORT
People increasingly give up owning cars in favour of calling companies to pick them up wherever they are and drop them off wherever they need to go — a driverless version of a ride-sharing service.

LAND USE
Urban centres begin to undo the many accommodations they have made for personal vehicles — starting with the vast quantities of real estate devoted to parking, which could be adapted to more productive uses.

800 million
One estimate of the number of US parking spaces. Many could be used for other purposes if people ride-share more.
**Ditch the Driver**

1.24 million traffic fatalities every year worldwide

90% of all accidents are due to driver error

4 US states and the District of Columbia have passed laws to allow driverless cars on their roads

20-50% increase traffic capacity

10-15% reduction fuel consumption

*Photo: John Chapple/Splash News/Corbis. Sources: WHO; NHTSA highway traffic safety administration; Center for Internet and society*
By 2020

• 25 Billion connected devices
• 1 in 5 cars have wireless connections
• €170 Billion global market for connectivity components and services
ANALYTICS

INTERNET of THINGS

BIG DATA
Fully automatic control will be safer, the difficulty lies in the transition to full automation … semi-automation…

As machines start to take over more and more, they need to socialize and improve the way they communicate and interact…
Teach the car to respond to the long tail of unlikely critical events…
Acceptance (trust) of automation
Responsibility
Authority
Liability

Recognition intent/state
Share situation awareness
Understand the rationale of judgment
Understand limitations of functional abilities
Driver’s mental models will change!

“the mechanism whereby humans are able to generate descriptions of system purpose and form, explanations of system functioning, observe system states, and prediction of future system states”

Rouse & Morris (1996)
• Cognitive demands for autonomous/ cooperative systems?
• Future shape of cognition & risk perception?
• How to convey relevant & contextualized info?
• How to fit driver’s perceptual & cognitive process?
• How much will they cost?
• Who will own them — individuals, or service companies that provide transportation on demand?
• Who will face legal liability when a driverless car gets into a crash?
• And will people accept and trust them?
VIDEO CAMERA
Mounted near the rear-view mirror, the camera detects traffic lights and any moving objects.

LIDAR
A rotating sensor on the roof scans the area in a radius of 60 metres for creation of a dynamic, three-dimensional map of the environment.

POSITION ESTIMATOR
A sensor mounted on the left rear wheel measures lateral movements and determines the car’s position on the map.

DISTANCE SENSORS
Four radars, three in the front bumper and one in the rear bumper, measure distances to various obstacles and allow the system to reduce the speed of the car.

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Thank you
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