

# Autonomous vehicles: potential impacts on travel behaviour and our industry

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Definition

Travel behaviour impacts

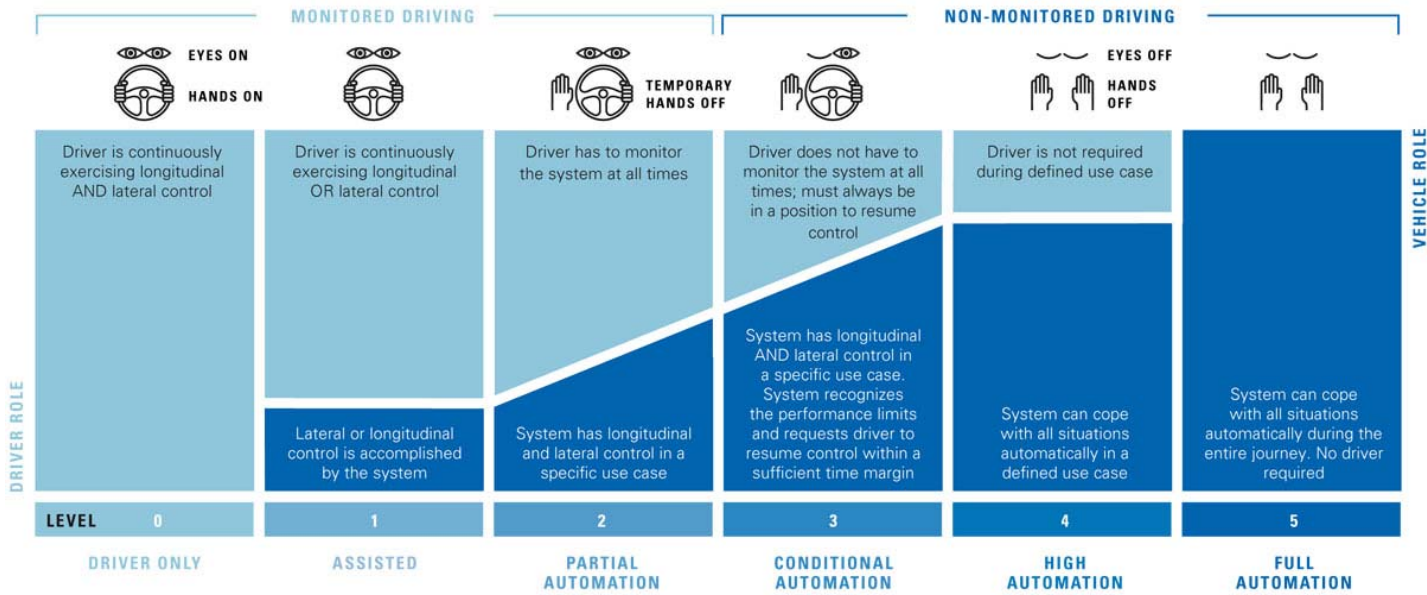
Driverless buses

Summary

**This presentation considers the potential impacts of autonomous vehicles and opportunities for the bus industry**

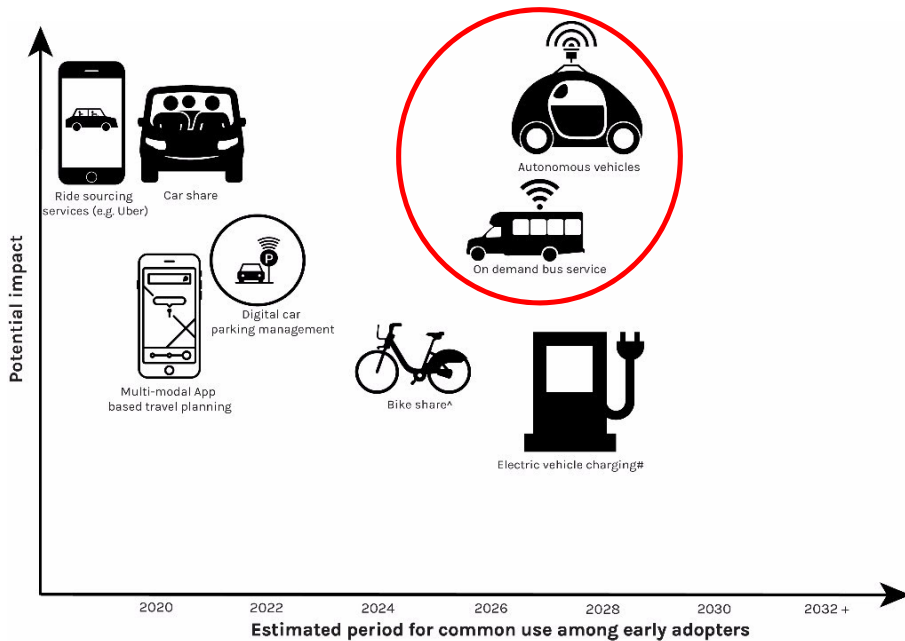
- 1 What is an autonomous vehicle?
- 2 Potential impacts on travel behaviour
- 3 Opportunities through driverless buses
- 4 Summary

# An autonomous vehicle is one that can drive itself to a predefined destination using various sensors & technologies



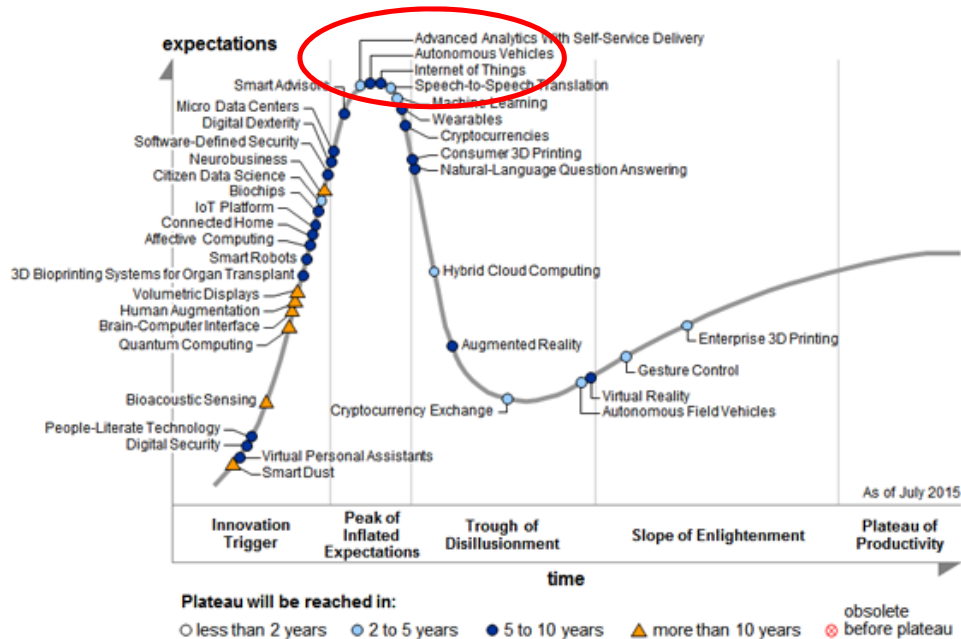
Source: <http://safety.trw.com/how-automakers/1202/>

# While autonomous vehicles are expected to be on the market by 2020, common use isn't expected until almost 2030...



Source: Institute for Sensible Transport (2016) *Emerging transport technologies: Assessing impacts and implications for the City of Melbourne*

...with some suggesting we are currently at the 'peak of inflated expectations' when it comes to autonomous vehicles



Source: <http://www.gartner.com/newsroom/id/3114217>

**We therefore need to be realistic:**

*“Ultimately, we should not view vehicle automation through rose-colored glasses. The ultimate effect of automation on travel and energy demand may be positive or negative, and we cannot yet say which. Clear-headed analysis, evaluation, and adaptive policymaking provide the greatest chance of realizing the full benefits of automation and minimizing the costs”*

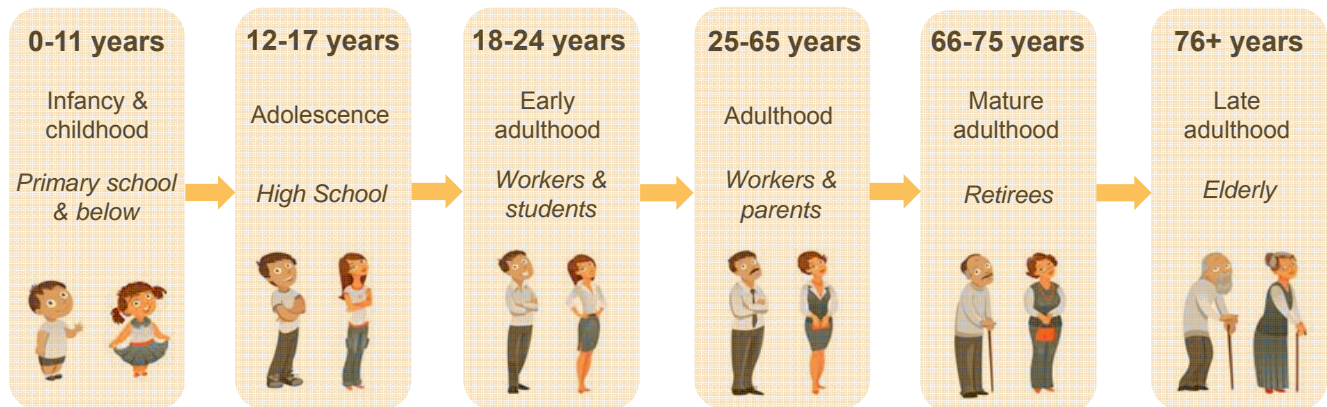
Wadud et al. (2016) Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. Transportation Research Part A, Vol. 86, pp. 1-18



Source: <http://worryandpeace.com/buzz/4-sci-fi-tech-innovations/>

## So how could we go about estimating the potential impacts of autonomous vehicles on travel behaviour?

- Plenty of predictions have been made, but who's to say they're correct?
- Numerous claims about the benefits, but where's the evidence?
- One approach is to look at how travel behavior with autonomous vehicles is likely to change over different life stages:



## Children (0-11 yrs) are highly unlikely to travel independently in an autonomous vehicle; car trips unlikely to change much

**0-11 years**

Infancy & childhood

Primary school & below

- Very limited ability to travel independently
- No driver's license or ability to drive a car
- Travel by car is always as a passenger
- Car travel generally determined by parent/s
- Public transport use may change in line with parent/s preferences towards autonomous vehicles

**No significant change in car trips expected for this group**



## Adolescents (12-17 yrs) could travel independently in an autonomous vehicle; this may result in an increase in car trips

12-17 years

Adolescence

High School



- Some ability to travel independently, e.g. public transport
- No driver's license or ability to drive a car independently
- Current car travel is generally constrained by parents
- Autonomous vehicles could remove constraints and may even result in a switch from public transport
- Additional (new) trips could occur
- However, ridesharing may increase among this group

**Increase in car trips expected for this group**

## Early adults (18-24 yrs) may rideshare more often, but there may also be some diversion from public transport

18-24 years

Early adulthood

Workers & students



- Ability to travel independently
- Lower driver licensing rates than older adults; also higher rates of public transport use and car passenger trips
- Autonomous vehicles could result in a switch from public transport, yet ridesharing may increase among this group
- Additional (new) trips unlikely to occur

**Small increase in car trips expected for this group**

## Adults (25-65 yrs) may divert from public transport into autonomous vehicles in some cases

### 25-65 years

Adulthood

Workers &  
parents



- Ability to travel independently
- Highest driving license rate (93%) across all groups
- Highest rate of car driver trips (generally double) across all groups; lowest rate of car passenger trips
- Autonomous vehicles could result in a switch from public transport; questionable whether ridesharing will increase
- Additional (new) trips unlikely to occur

**No significant change in car trips expected for this group**

## Older adults (65-75 yrs) may also divert from public transport into autonomous vehicles in some cases

### 66-75 years

Mature  
adulthood

Retirees



- Ability to generally travel independently
- Relatively high driver licensing rate (87%)
- 2<sup>nd</sup> highest rate of car driver trips across all groups
- Autonomous vehicles could result in a switch from public transport; questionable whether ridesharing will increase
- Additional (new) trips unlikely to occur

**Small increase in car trips expected for this group**

## Elderly (76+ yrs) could travel more independently with autonomous vehicles; likely to result in an increase in car trips

76+ years

Late adulthood

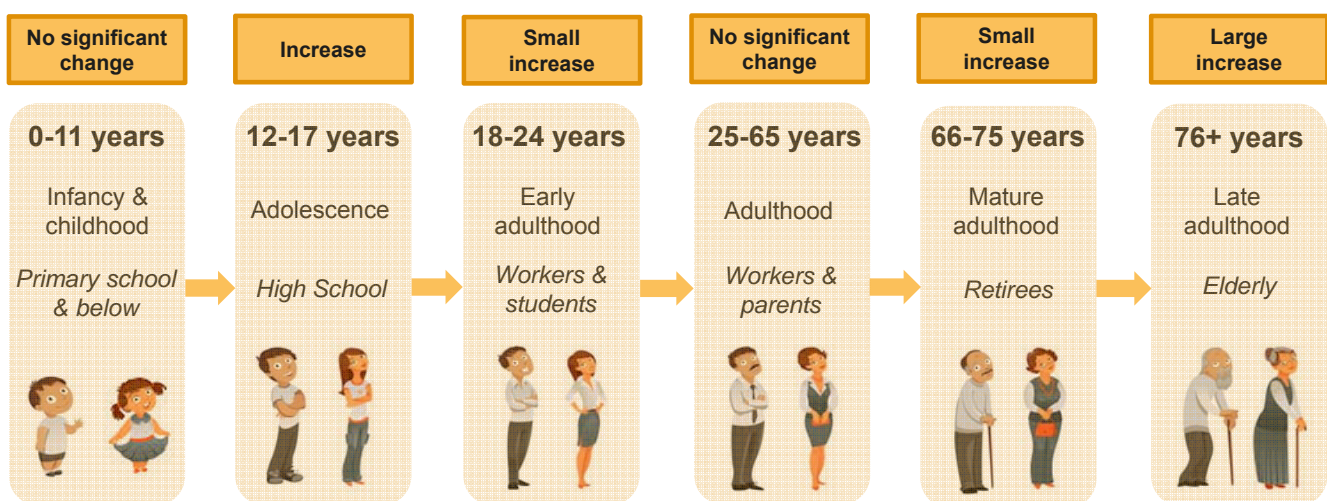
Elderly



- Limited ability to travel independently; constrained travel
- Lowest driver licensing rate (68%) across all adults
- Lowest trip rates across all groups (half of the average)
- Autonomous vehicles could remove travel constraints and may even result in a switch from public transport
- Ridesharing may decrease from current levels
- Additional (new) trips could occur

**Large increase in car trips expected for this group**

## Net result could be an overall increase in car trips, even when not accounting for empty vehicle running (e.g. return trips)



**Will traffic congestion increase with autonomous vehicles?**

**Will public transport use decline or is this an opportunity for us?**

## Driverless buses present a revolutionary opportunity for the bus industry with many benefits

- Ability to increase span of operating hours (late night services) and substantially increase service frequencies due to savings in driver costs
- Ability to fill gaps in service provision through Demand Responsive Transport (DRT), particularly in low density fringe areas
- Huge opportunities to tackle the 'last mile' problem effectively
- Potential for accident savings (drivers currently at-fault 56% of time)
- Could bus operators also be 'car operators' for autonomous vehicles?
- Driverless bus trials currently underway in many countries:



Perth, Australia



Singapore



Greece



Switzerland

## Emerging issues with driverless buses

- Employment of drivers – can they be redeployed to other roles?
- Hardware & software security issues, e.g. hacking of vehicle control
- Costs of purchasing and maintaining technology
- Transition period from driver control to autonomy
- What happens when an accident is inevitable? What rules are adopted?



China



The Netherlands



## Take home messages

- What is an autonomous vehicle?

*A vehicle that can drive itself to a predefined destination using various sensors & technologies; 5 levels of vehicle automation*

- What are their potential impacts on travel behaviour?

*Autonomous vehicles could result in an increase in car trips, particularly among adolescents (12-17 years) and the elderly (76+ years)*

- What opportunities are possible with driverless buses?

*Increased operating hours and service frequencies, greater potential for DRT, delivery of 'last mile' services, accident savings*

## Contact details



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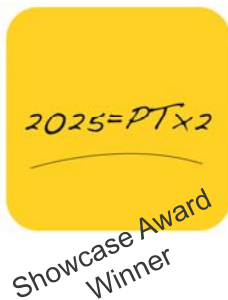
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