THE POLICY INSTITUTE

RAND EUROPE

KING'S College LONDON

Future mobility

How might new technologies influence travel, air quality and health

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Transport plays an important part in our cities

New technologies that may influence travel

And their potential impacts on air quality and health

Four technologies that may significantly impact travel

Autonomy

Ability of modes to sense their environment and navigate without human input

Alternate energy sources

New power supplies that may reduce carbon emissions and air pollutants

Connectivity

Next generation ICT connectivity to connect people, vehicles (to one another and to infrastructure) for more efficient travel

Speed / efficiency

Ability of the mode to be faster or enable a more efficient way of travel

ICT= information and communications technology

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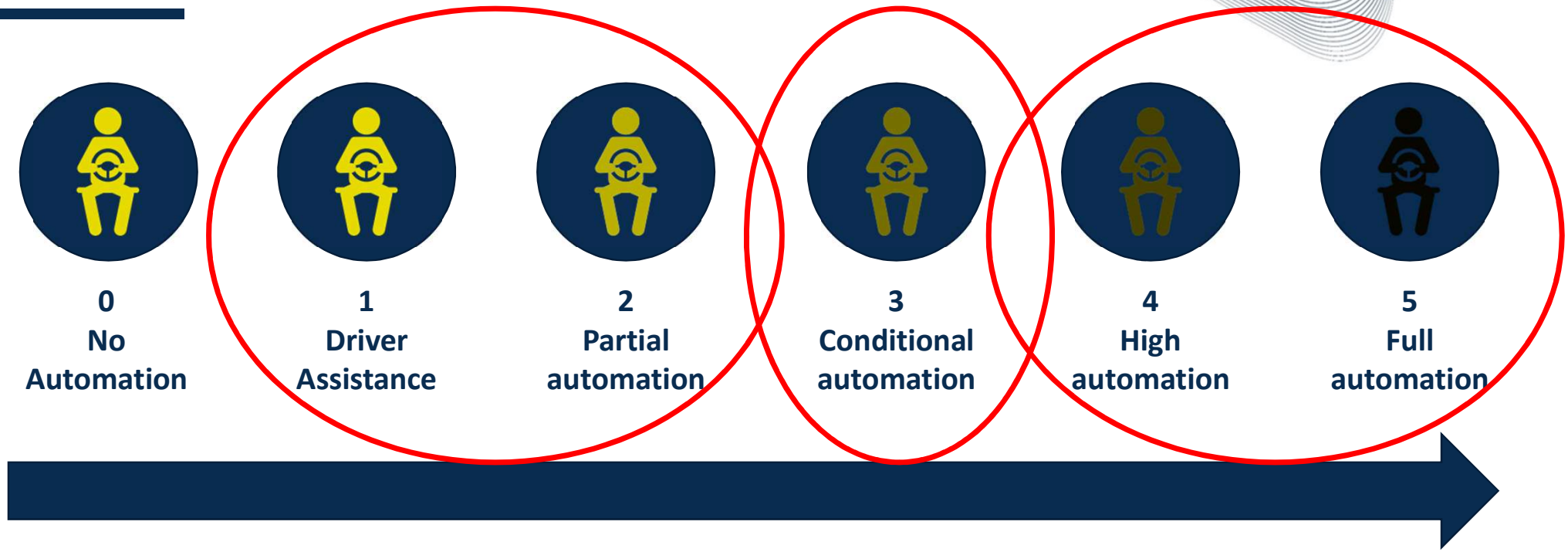
There are a number of 'levels' of vehicle autonomy



Increasing level of vehicle autonomy, different levels may have different impacts on health

Lower levels of automation provide assistance to drivers with features like 'lane assist', which may reduce accidents, but relatively little is known about their efficacy.

Many people worry about level 3, where the car can undertake much of the driving, but the human driver is still responsible.

Higher levels of automation may be transformational.

SAE Automation Levels

But FAVs may have many more impacts on society and health

- Reduction in road traffic accidents
- Increased accessibility, particularly for those who do not drive
- Reduction in harmful emissions, if combined with new energy sources
- Increased (driver) productivity while travelling
- Reduction in costs of driving, if shared and electric
- Reduction in insurance costs
- More efficient driving

- Less walking and cycling, impacting health
- Less use of public transport, impacting viability of these services
- More driving, if cost of driving is reduced
- Loss of jobs, taxis, bus drivers, lorry drivers, insurance sector
- Lower revenues for government through parking, driving offences, tax revenues from insurance

FAVs = fully autonomous vehicles

FAVs are likely to reduce road traffic accidents

- Over 90% of accidents caused by human error
- And road accident fatalities have been falling
  - In Europe fatalities fell by 40% in the 10 years between 2006 and 2015
  - They also fell substantially in the USA between 1985 and 2011, although there has been an upswing since 2011
  - Because cars are built more safely, more forgiving road designs, fewer young people are driving and improvements in health care….
- FAVs are likely to be safer than human drivers
  - By how much?
  - And questions around safety with mixture of FAVs and traditional vehicles

NHTSA, 2008; Thomas et al. 2013; European Commission (2017) Traffic Safety Basic Facts 2017: Main Figures, European Road Safety Observatory, available at:: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/statistics/dacota/bfs2017_main_figures.pdf

FAVs = fully autonomous vehicles

And roll out times for FAVs are highly uncertain

House of Lords Briefing, Automated and Electric Vehicles bill (2018)
… 'the Secretary of State for Transport, Chris Grayling, outlined his hope to see "fully self-driving cars, without a human operator, on UK roads by 2021"; an ambition he argued was "entirely realistic" given technological advances in the sector'

Arbib and Seba (2017)
'By 2030, within 10 years of regulatory approval of autonomous vehicles (AVs), 95% of U.S. passenger miles traveled will be served by on-demand autonomous electric vehicles owned by fleets, not individuals, in a new business model we call "transport-as-a-service" (TaaS). '

Boston Consulting Group (2017)*
'Shared autonomous electric vehicles will account for nearly 25% of all auto passenger miles travelled in the US by 2030.

KPMG (2015)**
'…. there will be a 25% penetration of fully autonomous vehicles by 2030'.

"Let's face it: we're talking about a technology that will never happen"
Christian Womar, Spectator magazine

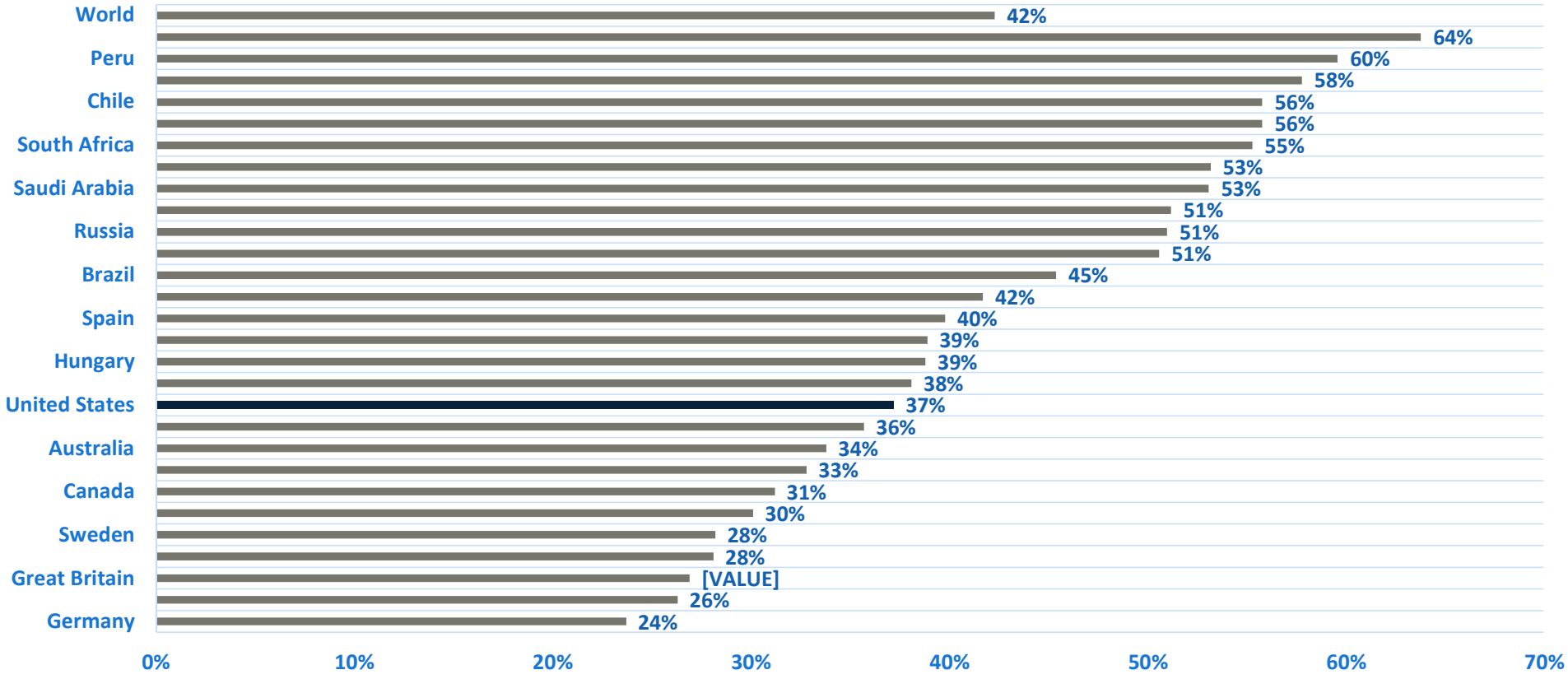
2018 2021 2030 2050 ….

* https://www.bcg.com/publications/2017/reimagined-car-shared-autonomous-electric.aspx
** https://home.kpmg/content/dam/kpmg/pdf/2015/04/connected-and-autonomous-vehicles.pdf

FAVs = fully autonomous vehicles

People in emerging economies say they are more likely to own a driverless car

Percentage who would own a self-driving car as their main form of use



Source: Ipsos MORI, Public Opinion on a Future with Driverless Cars, 2018.

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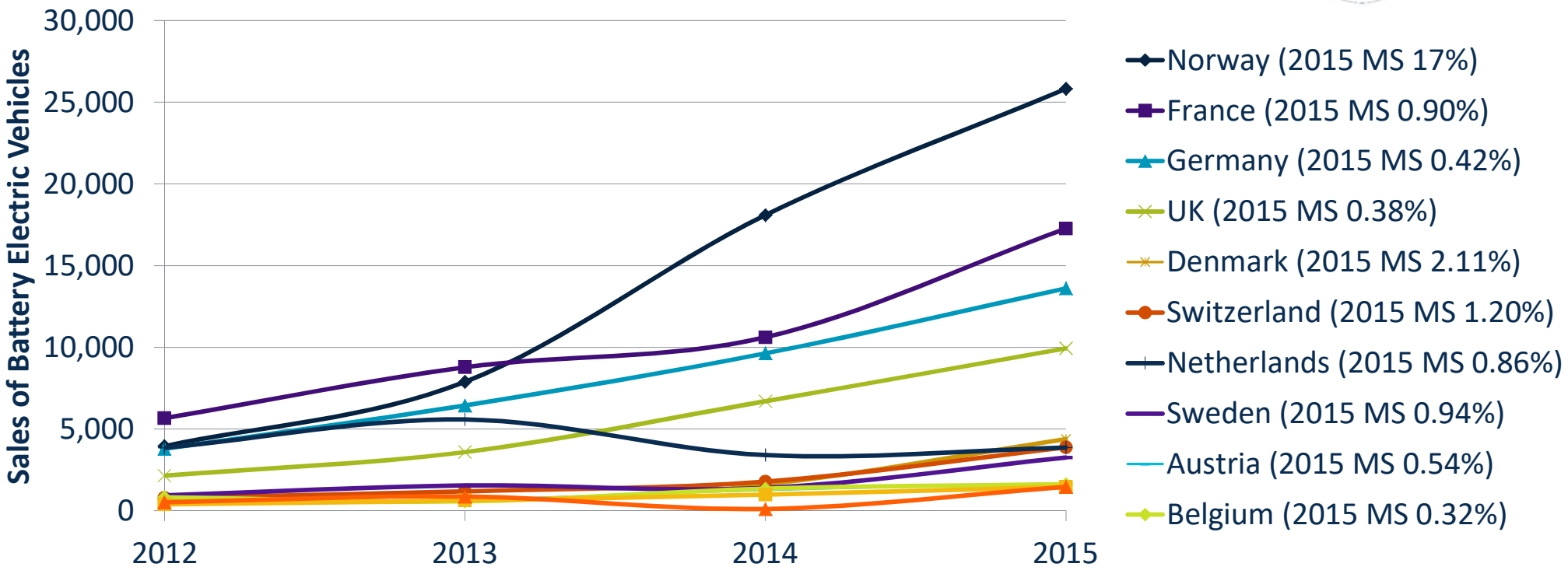
Alternatively-fuelled vehicles will reduce emissions and improve air quality in cities – but roll out has been very slow



* MS = market share of new vehicle sales

Source: AID (2016) as reported in Berkeley et al. 2017
Note that in 2017 electric vehicle sales overtook sales of vehicles with internal combustion engines,.

Barriers to adoption of electrical vehicles

- Performance, range and durability of batteries
- Time for recharging
- Availability of recharging stations
- Unsuitability of dwellings for home charging

- High upfront costs
- Anxiety over resale value
- Length of time to offset purchase price through fuel / tax savings

- Range anxiety
- Awareness of technology benefits
- Waiting for near-term improvements in technology

Drawn from N. Berkeley et al. (2017) Assessing the transition towards Battery Electric Vehicles: A Multi-Level Perspective on drivers of, and barriers to, take up, Transportation Research Part A, 106, pp 320-332

Norway – an exemplar for encouraging take up of EVs

- Goal for 2025, all new cars to have zero emissions
- Substantial subsidies for purchasing electric cars
  - And buying a (petrol or diesel) car in Norway is expensive (over twice the cost of buying a similar car in the UK)
- Subsidies for electric cars
  - Avoid heavy import / purchase taxes
  - Exemption from 25% VAT on purchase cost
- Running costs are much less than for other vehicles
  - Avoid road taxes & road tolls, pay half price on ferries
  - Get free municipal parking in cities, can use bus lanes
- But Norwegians also suffer from range anxiety!
  - Most EVs are second household cars, often used by commuters

EV = Electric Vehicle

A few caveats….

- Electric vehicles are only as green as the associated carbon emissions for generating electricity
- Non-exhaust particulates from brakes and tires remain a potential issue
  - And these may even be greater for electric vehicles because of their weight
- Need to consider full social and economic costs of electric vehicles across the life of the vehicles
  - Including the social and economic cost of precious metals for batteries
  - These costs could be reduced by other policy decisions, e.g. recycling, scrappage schemes, etc.

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The impact of ICT and big data on travel

The "theory":

- ICT can replace travel, e.g. telecommuting
- ICT plus big data and intelligent processing have encouraged new business models
  - Transportation Network Companies (TNCs) like Uber and Lyft
  - Theoretically, if people do not own cars, they may be less likely to travel by car (no sunk costs)
  - Plus, if people are willing to share parts of the same journey, the number of vehicles on the network could be reduced
    - Reducing congestion and air pollutants

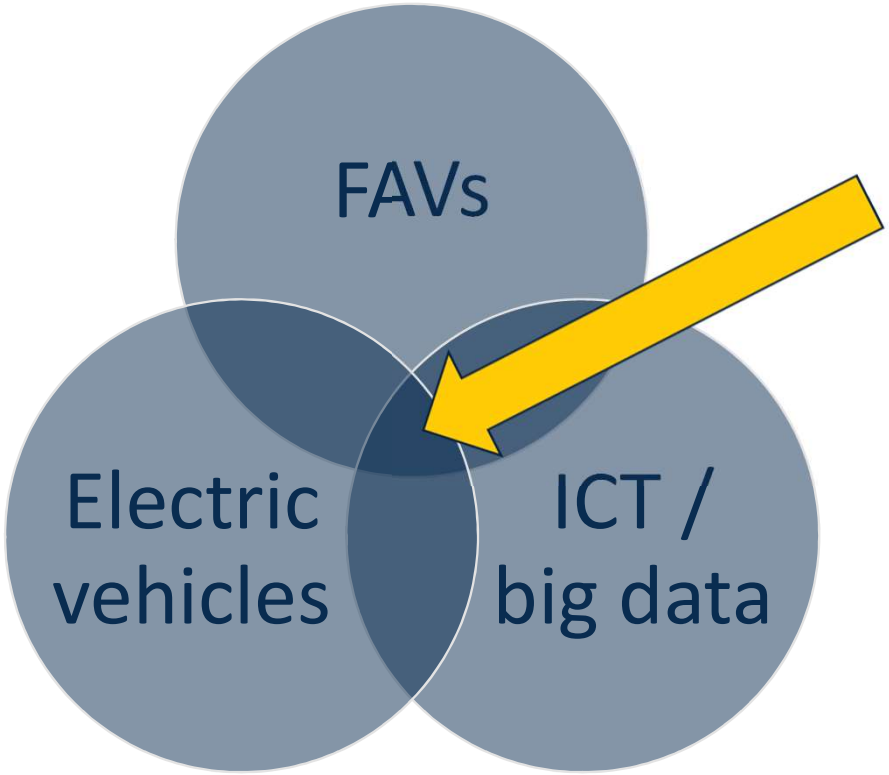
The practice:

- ICT seems to have generated additional travel
- It seems that new TNC services are increasing car travel
  - And taking demand from PT services
  - Graehler et al (2019) find that for each year after ride-hailing services enter the market, rail passenger demand can be expected to decrease by 1.3% & bus ridership by 1.7%
  - This equates to a 12.7% reduction in bus ridership in San Francisco since Uber/Lyft have entered the market
- New retail services, e.g. Amazon, are also increasing freight travel

Graehler, M., R. Mucci and G. Erhardt (2019) Understanding the Recent Transit Ridership decline in Major US Cities: Service Cuts or Emerging Modes? 98th Meeting of the US Transportation Research Board.

ICT= information and communications technology
PT = public transport

But it is the combination of these new technologies that may have the most significant effects



Shared, electric, autonomous vehicles could have a transformational change on travel

ICT= information and communications technology
FAVs = fully autonomous vehicles

Shared, electric, fully-autonomous vehicles are likely to…

- Lead to significant reductions in the cost of travel
  - No need for drivers
  - Electric vehicles are cheaper to run
  - Shared vehicles may mean shared cost

….. which is likely to lead to more car travel

- And increased car travel reduces the desirability for walking and cycling
  - Could also draw away travellers from public transportation systems
  - Reduces the quality of urban spaces
- Improve air quality
  - Bearing in mind caveats about non-exhaust particulates

New technologies may have a significant impact on travel

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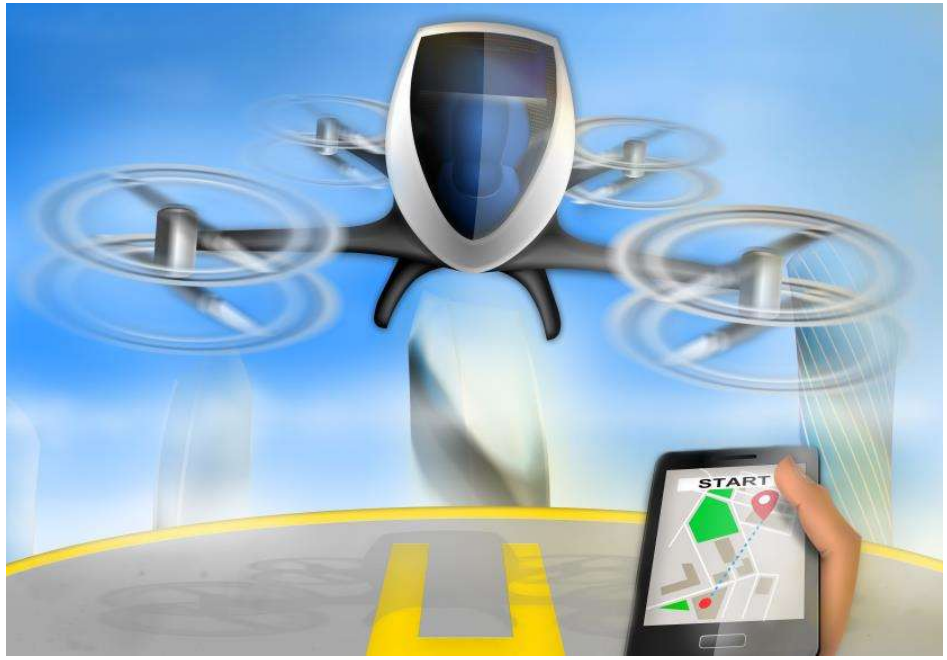
New technologies that increase speed may also affect travel

- Drones could replace freight deliveries
- Passenger drones could replace surface travel
- Hyperloop could replace short-distance air travel
- The impact on health, transport and cities more generally is less certain



Policy options

In European cities the future of mobility looks increasingly car free

In London, the Mayor's 2017 strategy is to "aim of 80 per cent of all trips in London to be made on foot, by bicycle or using public transport by 2041"

Madrid officials were aiming to ban all non-resident vehicles except zero-emission delivery vehicles, taxis and public transport from its city centre in November 2018

In Helsinki, the aim is to phase out the use of private cars in the city by 2050 by providing demand-responsive and affordable public transport

In Copenhagen, authorities are aiming to have ¾ of all trips in the city to be made by bicycle, walking or public transport by 2025

In Paris, policy-makers want to halve the number of private cars in the city centre

Promising policies to reduce car travel

- Charging people to drive is the most successful way we know to reduce car travel
- Modest reductions in car travel from other interventions
  - Improving public transport services
  - Improving walking and cycling facilities
  - Designing new areas to support use of public transportation services
  - Information provision
    - Raising awareness of health, air pollution, etc.
- Improve efficiency of freight deliveries
- Most interventions need to be combined, on their own they are unlikely to lead to necessary reductions

Stockholm Congestion Tax, the story.....

3 Jan – 31 July, 2006, Congestion charge trial
Reduction in traffic: 20-22%

August, 2006, Charge turned off
Traffic rebounds to near start levels

September, 2006, Referendum on charge
Stockholm residents vote “Yes”
Other municipalities vote “No”

October, 2006, Gov’t indicates it will implement charge

August, 2007, Permanent charge implemented
Reduction in traffic: 21%
Significant improvement in air quality

- Details
  - Toll cordon around inner city
  - Charge varies by time of day
  - Charge is levied each time cordon is crossed
  - Maximum charge is €6/day
- Aims
  - Reduce traffic congestion
  - Improve the environment

Impacts of the Stockholm Congestion Tax

- Introduction of permanent charges led to a 21% reduction in traffic
- There is no sign that the impact of the charge is wearing off
  - Rather it looks like the impacts of the charge are LARGER in the longer term, because people have made other changes, e.g. changing their home location, work destination, time of travel, etc.
- There is no sign of increased congestion on other links and bypasses – i.e. because of people changing routes to avoid the charge – although these were already heavily congested
- Evidence that the charge has led to increased purchasing of alternatively-fuelled vehicles, which are exempt from the charge
- Attitudes to the charge have grown positively, since introduction

Borjesson, M., J. Eliasson, M.B. Hugosson and K. Brundell-Freij (2012) The Stockholm congestion charges—5 years on. Effects, acceptability and lessons learnt, Transport Policy, 20, pp 1-12.

Policies to reduce harms of travel

- Encourage take-up of low emission vehicles
  - Grants, subsidies and other pricing measures
  - Provision of charging infrastructure
  - Fleets, public transport
- Low emission zones to set minimum emission standards
- Speed limits to encourage walking and cycling
- Encourage innovation in freight deliveries, i.e. night deliveries

Shared Challenges

- Efficient urban mobility, better air quality, healthier cities – are relevant both to well-being of residents and to the city's global competitive position
- New technologies may disrupt travel patterns
- Getting ahead of - not just responding to - technical changes is imperative
  - Need to understand policy objectives
  - As well as monitor and evaluate outcomes
- Planning under uncertainty – and for the long term

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Thank you!!!

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