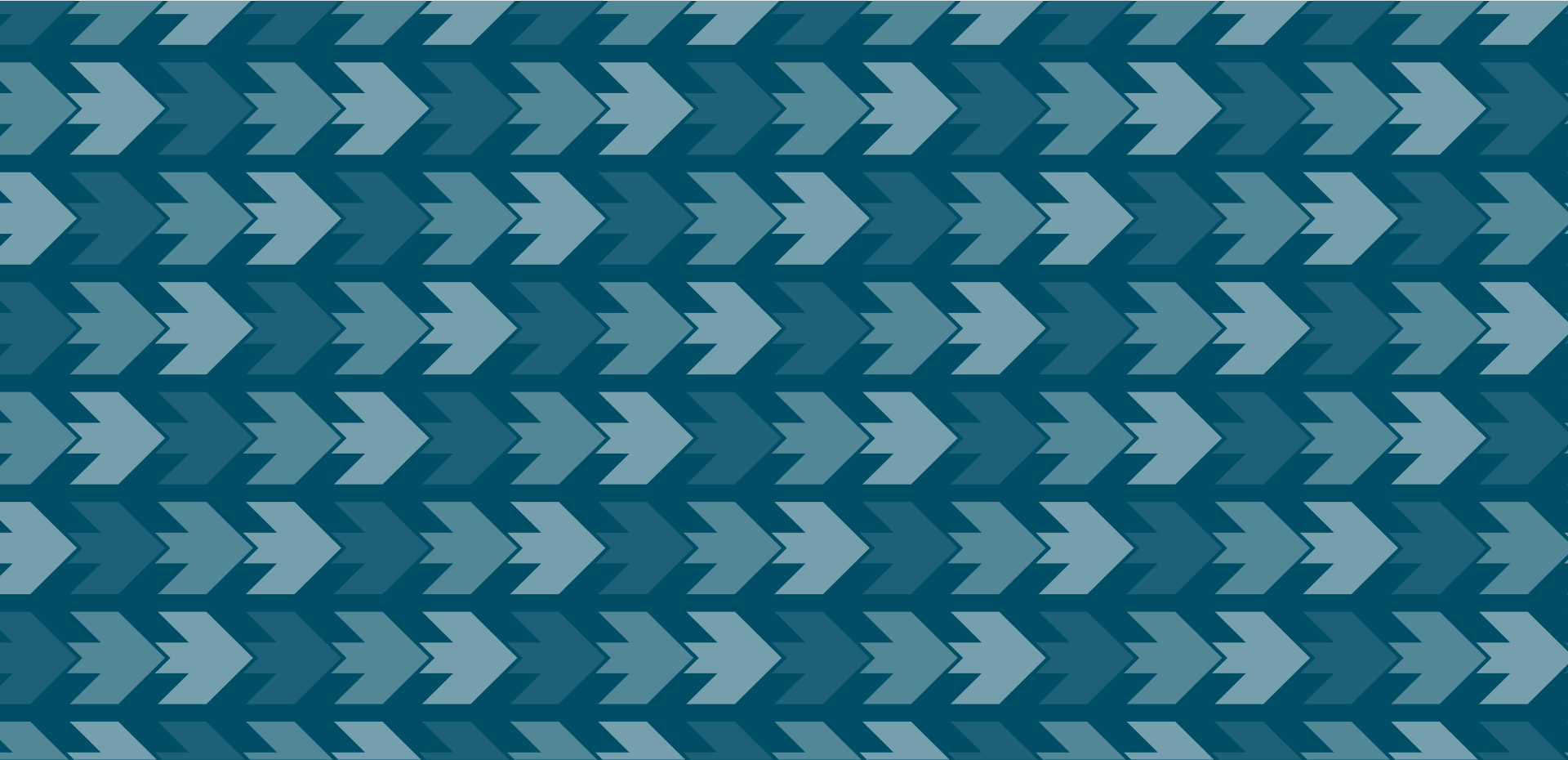




Centre for Connected
& Autonomous Vehicles

Autonomous Vehicles: Challenges and Opportunities

A regulatory framework supporting innovation



Aim of the presentation

- **Welcome**
- **Debate:** how the current regulatory framework support us
- **Learning:** current lessons? Their use for the future?
- **Creative thinking**
 - This is a free discussion based on our experience; not government positions

A common objective for all countries

Ministerial resolution “embracing the new era for sustain inland transport and mobility” ITC’s 70th anniversary – 59 countries welcomed ITC role in:

- Promoting an **enabling** regulatory framework
- Key to **harnessing the advantages** of technological innovation
- Urges us to work on **short-term solutions and common interpretation**



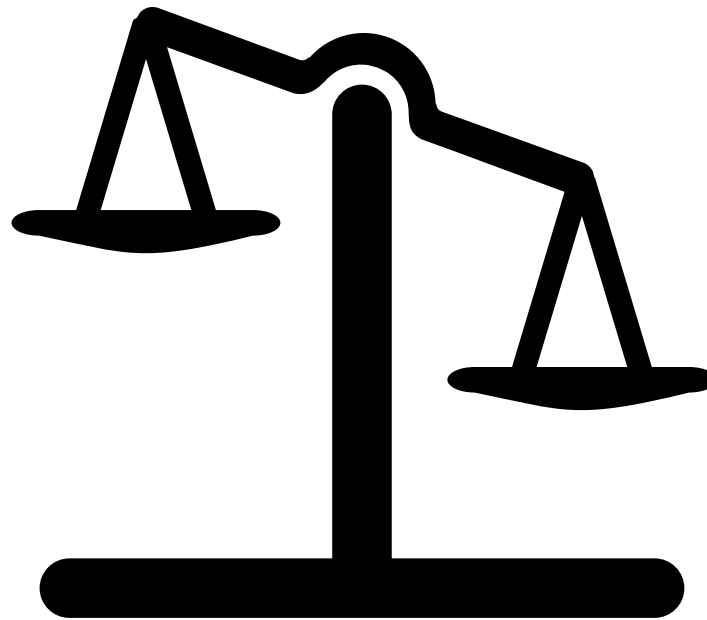
MAKE THESE DEVELOPMENTS POSSIBLE!

http://www.unece.org/fileadmin/DAM/trans/doc/2017/itc/Final_Resolution_ITC_70_years.pdf

The challenge for regulators - to enable the moment?

Benefits

- Fewer collisions
- Reduced fatalities and injuries
- Less congestion
- Better use of road space and land



Risks

- Untested technology
- Lack of systems interoperability
- Impact on employment and other new risks
- Low public confidence

Short term solutions – what the Conventions say

What the Conventions say?

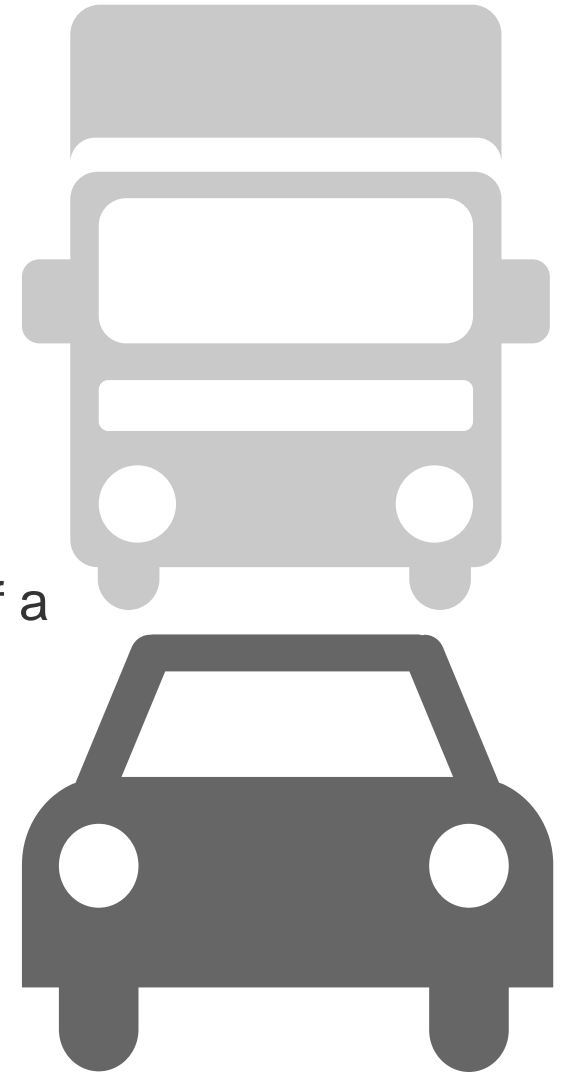
- A vehicle must be under “control”
- A “driver” is a person who drives (Vienna Convention)
- No definition of a “person”
- Minimal activity other than driving (Vienna Convention):or
- Reasonable or prudent driving (Geneva Convention)

How do we interpret ?

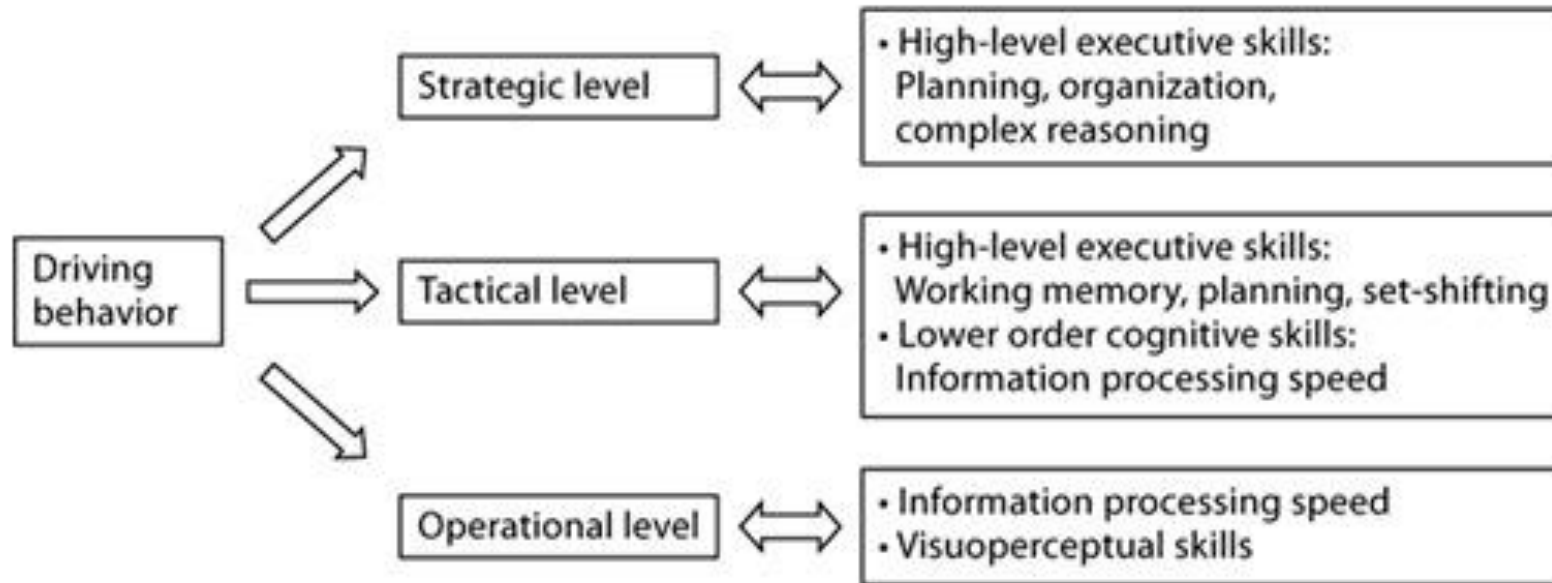
- Legal meaning of “person” can be both
 - A *natural* person, AND
 - A *legal* person
- Driving must be safe

Short term solutions – what the Conventions allow

- Allows a **human driver**
- Allows a driver to be a **legal person**
 - A manufacturer?
 - An leasing or taxi company?
- Allows **more than one driver**
- Allows **different “drivers”** during the course of a journey
- **Activity** is allowed (but must be safe)



Long term solutions – driving tasks humans excel in?

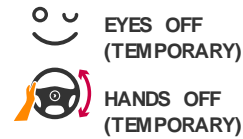


See John A Michon http://jamichon.nl/jam_writings/1985_critical_view.pdf and http://standards.sae.org/j3016_201609/

New concept of driver: possibilities on offer

- A human driver:
 - who performs in real time
 - or as a fall back able to respond to requests to intervene if systems fail
- A remote human driver –
 - a driver who is not in the vehicle, but can perform the dynamic driving task in real time (or possibly provide a response to a system request as a fall back ready user)
- A passenger - someone in the vehicle but no role in the dynamic driving task
 - May or may not be a strategic driver
- A dispatcher
 - verifies the operational readiness of the vehicle or even is the strategic driver (for example a self driving taxi service)

The levels of vehicle automation



Driver remains engaged at all times, monitoring road environment, and controls lateral AND longitudinal movement.

Driver remains engaged at all times, controlling lateral OR longitudinal movement while the system is active, and monitors road environment.

When system is active, driver actively monitors the road environment and system performance, intervening as necessary.

Driver is a fallback ready user, being prepared to intervene in response to a system takeover demand.

Driver only has control when the system is not in use.

Driver, if present, only has control when the system is not in use.

System may provide alerts and warnings when driver fails to exercise proper control.

System exercises lateral OR longitudinal control in specific use cases.

System exercises sustained lateral AND longitudinal control in specific use cases.

System can control lateral AND longitudinal movement, and monitors the road environment, in specific use cases. When system encounters a situation it cannot manage, it will issue a takeover demand, handing control back to the driver.

System can control lateral AND longitudinal movement and monitor its own performance in specific use cases. As the system is fully capable of providing the fallback function, driver intervention is not needed while the system is in use.

System can control lateral AND longitudinal movement in ALL use cases. Driver intervention is not needed.

LEVEL 0

1

2

3

4

5

DRIVER ONLY

DRIVER ASSISTANCE

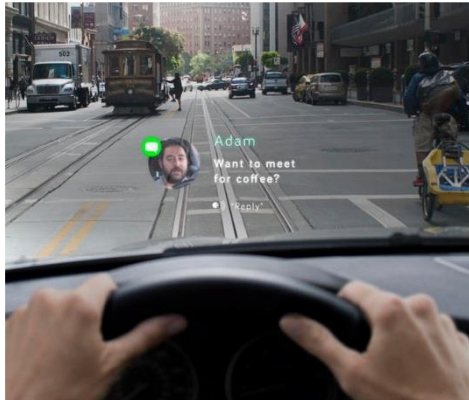
PARTIALLY AUTOMATED

CONDITIONALLY AUTOMATED

HIGHLY AUTOMATED

FULLY AUTOMATED

Examples



L3: urban pilot

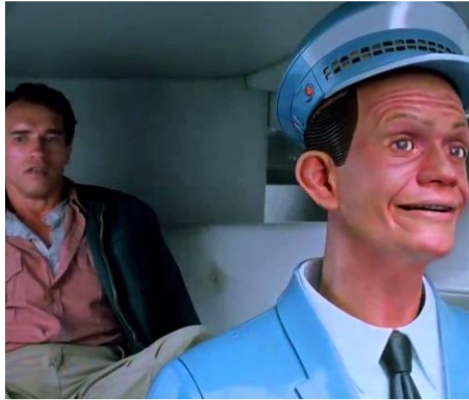
The system pilots the vehicle, performs the dynamic driving task without driver instruction and system requests 'fall back ready' driver to take back control.



L4: highway chauffer

The pilots the vehicle (on highway only), system has own fall back function (no intervention needed), driver requested to take over if exiting highway.

Examples



L5: ubiquitous self-driving taxi

a fully autonomous vehicle capable of doing any journey from start to finish without requiring intervention.



L4(D): self-driving shuttle

The system pilots the vehicle only if travelling on dedicated route, capable of own fall back function without intervention from the occupant of the vehicle, if any.

Long term solutions - What are we learning?

Control or compliance with traffic rules is the responsibility of whoever the “driver” is at any given time

Proper control of the vehicle

Think beyond the ‘traditional’ driver

The role of the “driver” in the strategic or dynamic driving tasks

Technology will impact on the “driver” role

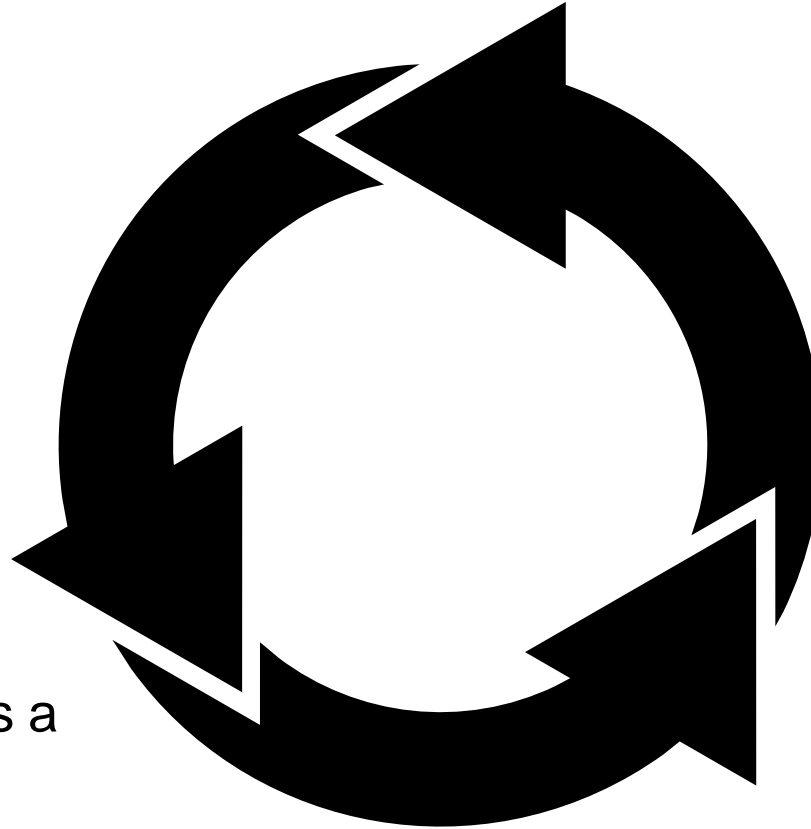
Driver may not be in the vehicle

Demands on the driver vary

The situation or context in which the vehicle is used makes different demands

Long term solutions – agile to embrace benefits

- Level of technology makes a difference
- Concept of driver makes a difference
- Context makes a difference



- Rapid innovation and technology
- Real world evidence moving at pace
- Imperfect knowledge of future needs

Short term solutions- Have we reached a cross roads?

Short term –

- Conventions cannot fix all the problems now
- We can take a common interpretation to enable progress
- We can focus on what the Conventions allow
- We can reduce our imperfect knowledge to help us for the future

Long term solutions- what next ?

- Be agile to gain the benefits
- The Conventions can change but not yet
- End goal for the Conventions to set basic standards
- Allow choice and flexibility for national regulations to suit their own specific needs



Thank you