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and Water Management

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Possible roles for humans driving in automated vehicles



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- > Problem
- > When driving what needs to be done
- > Leftovers
- > An approach to user roles
- > User roles - examples
- > Caution
- > A big thanks



Scope

- › Possible roles for humans driving in **automated vehicles**
 - Vehicles with automation that are or can be driven by a user



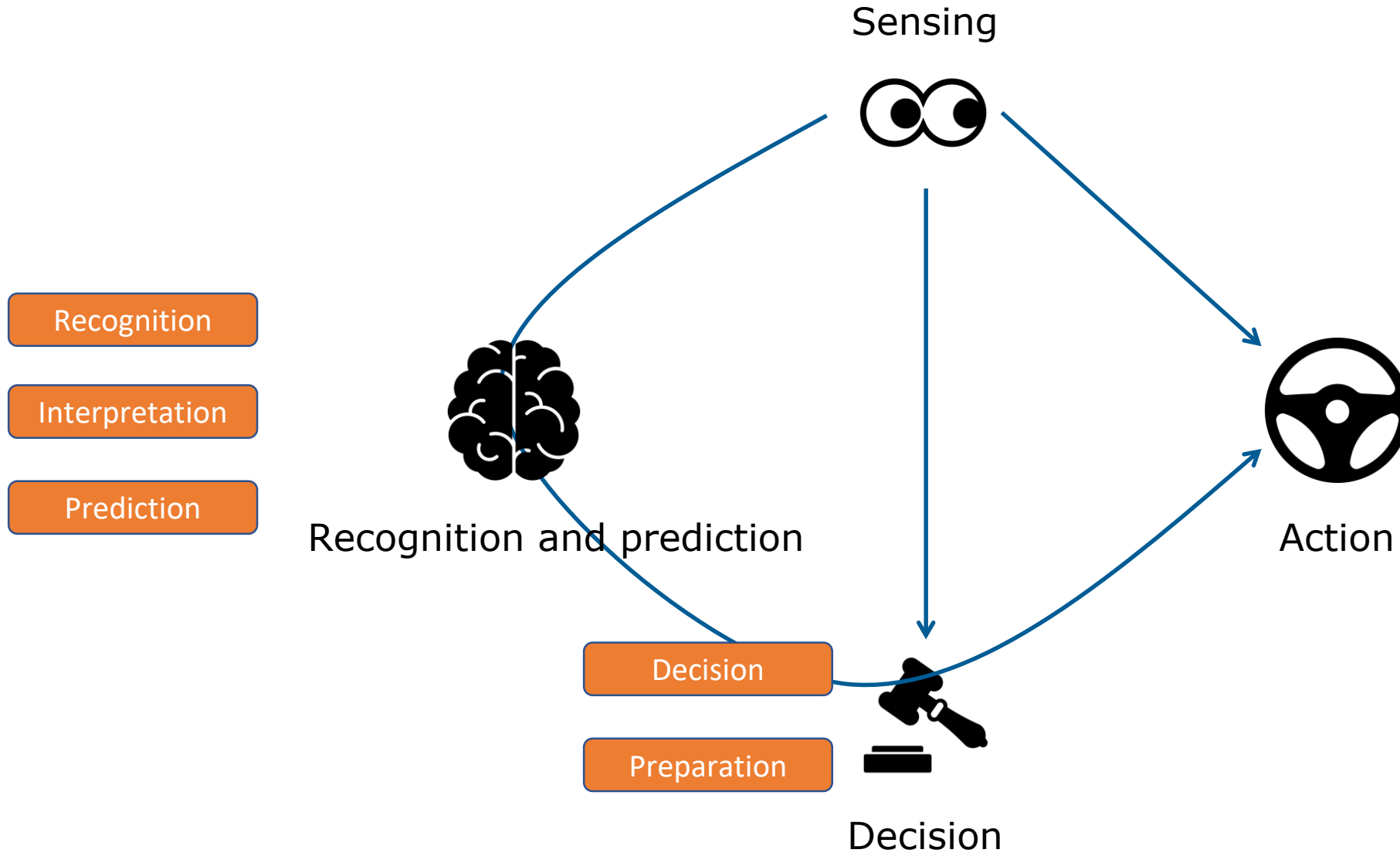
Problem

- > Vehicle automation is the automation of the driving task
- > Every part of the driving task that is not automated needs to be done by a human being
- > Every part of the driving task that is not 'perfectly' automated needs to be compensated for by a human being



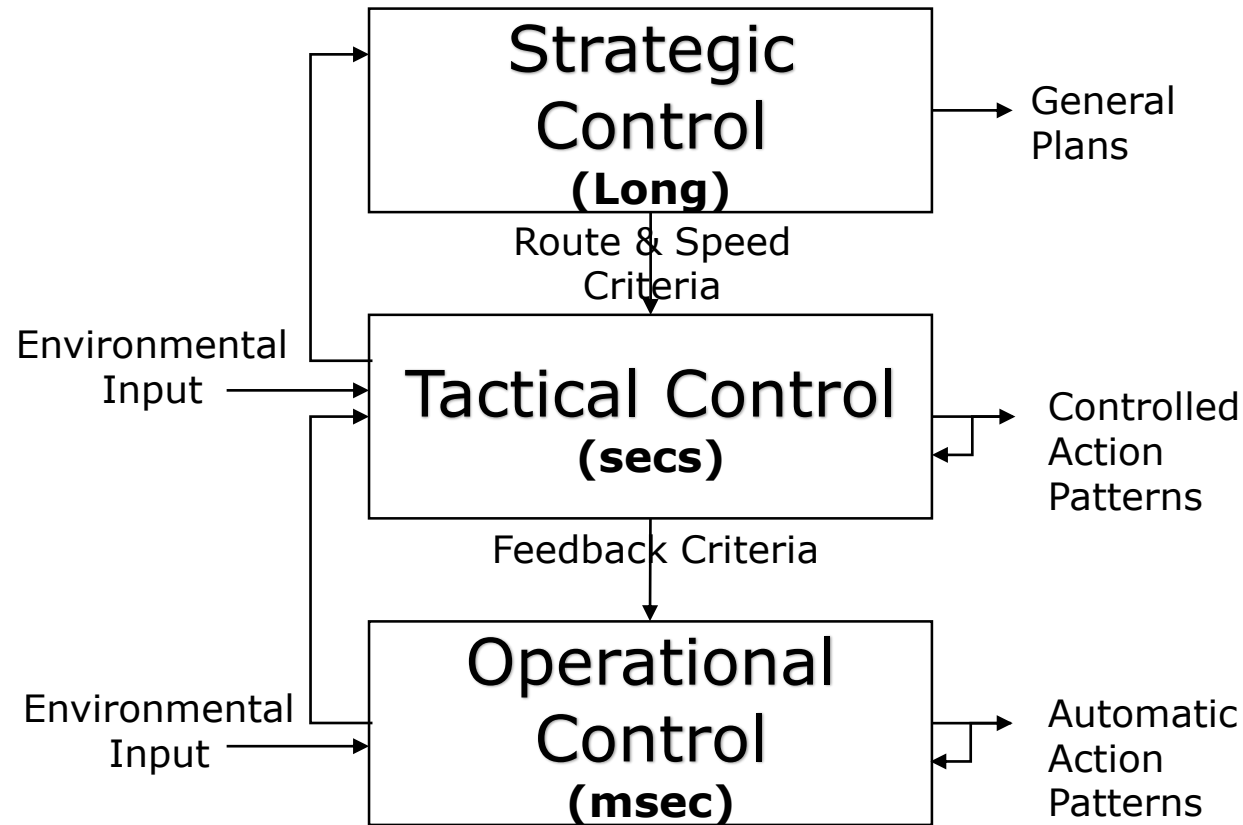


When driving what needs to be done





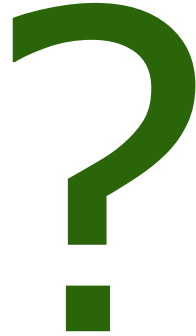
“Driving Task” as defined by Michon (1985)



The hierarchical structure of the road user task.



When driving with automation: Who does what?

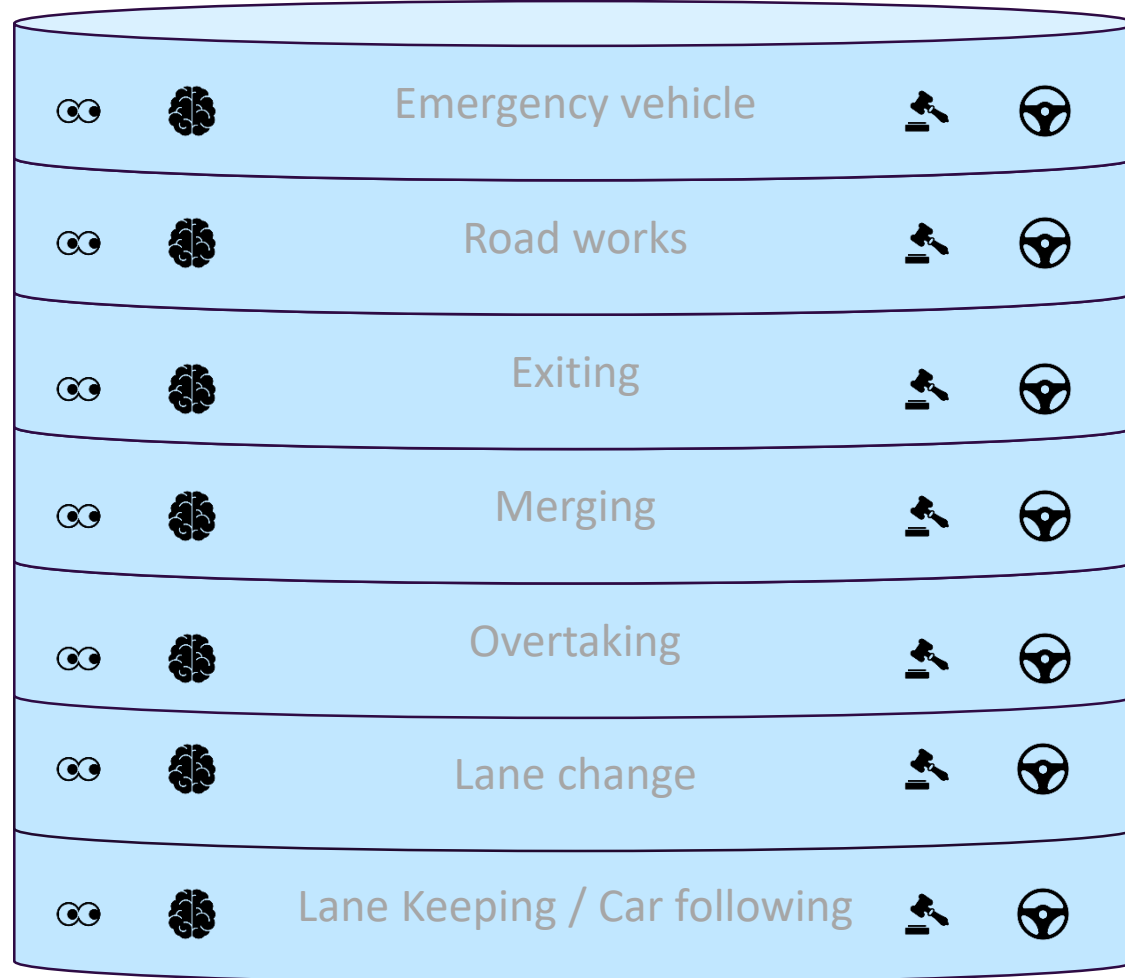
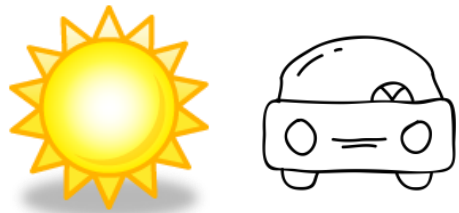




Leftovers: An example

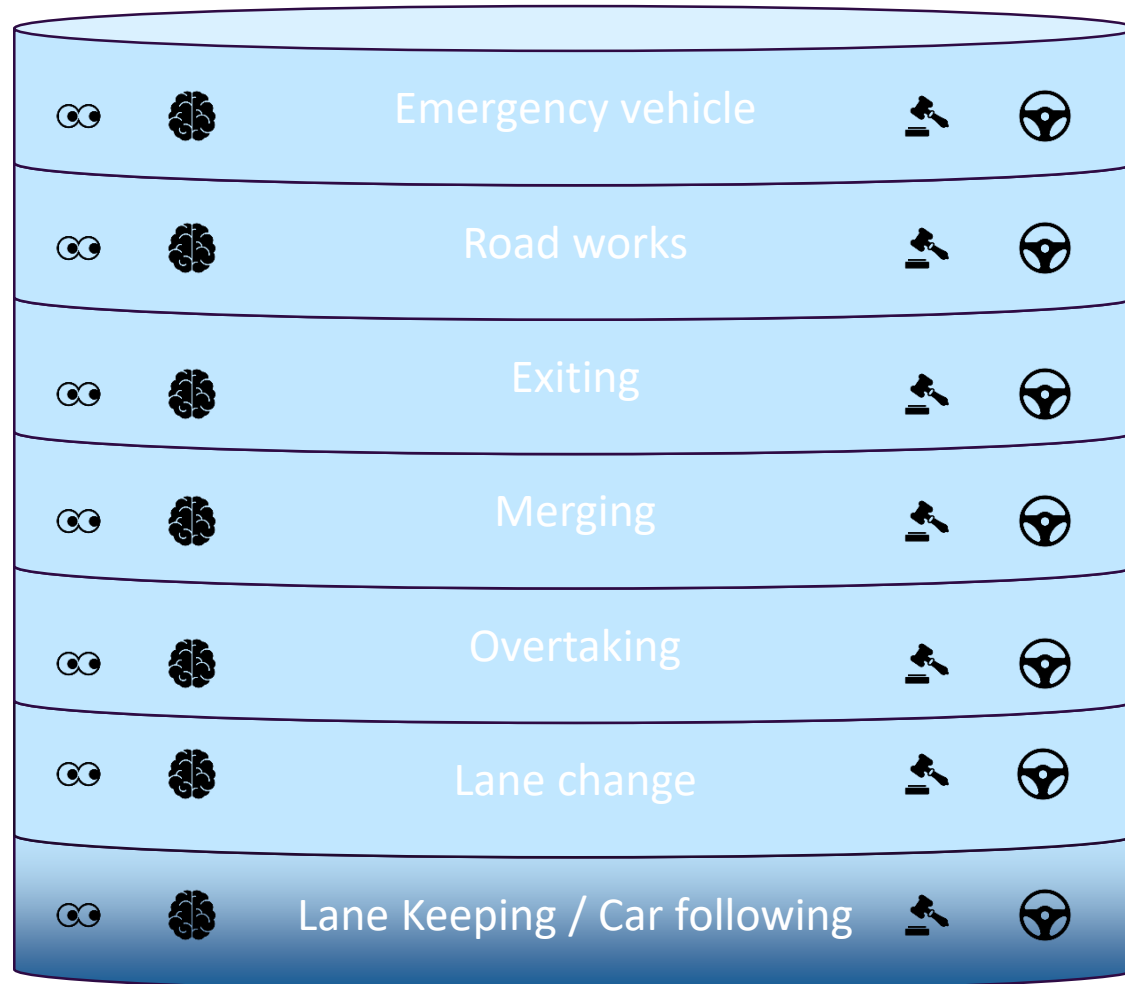
Motorway Driving

No automation



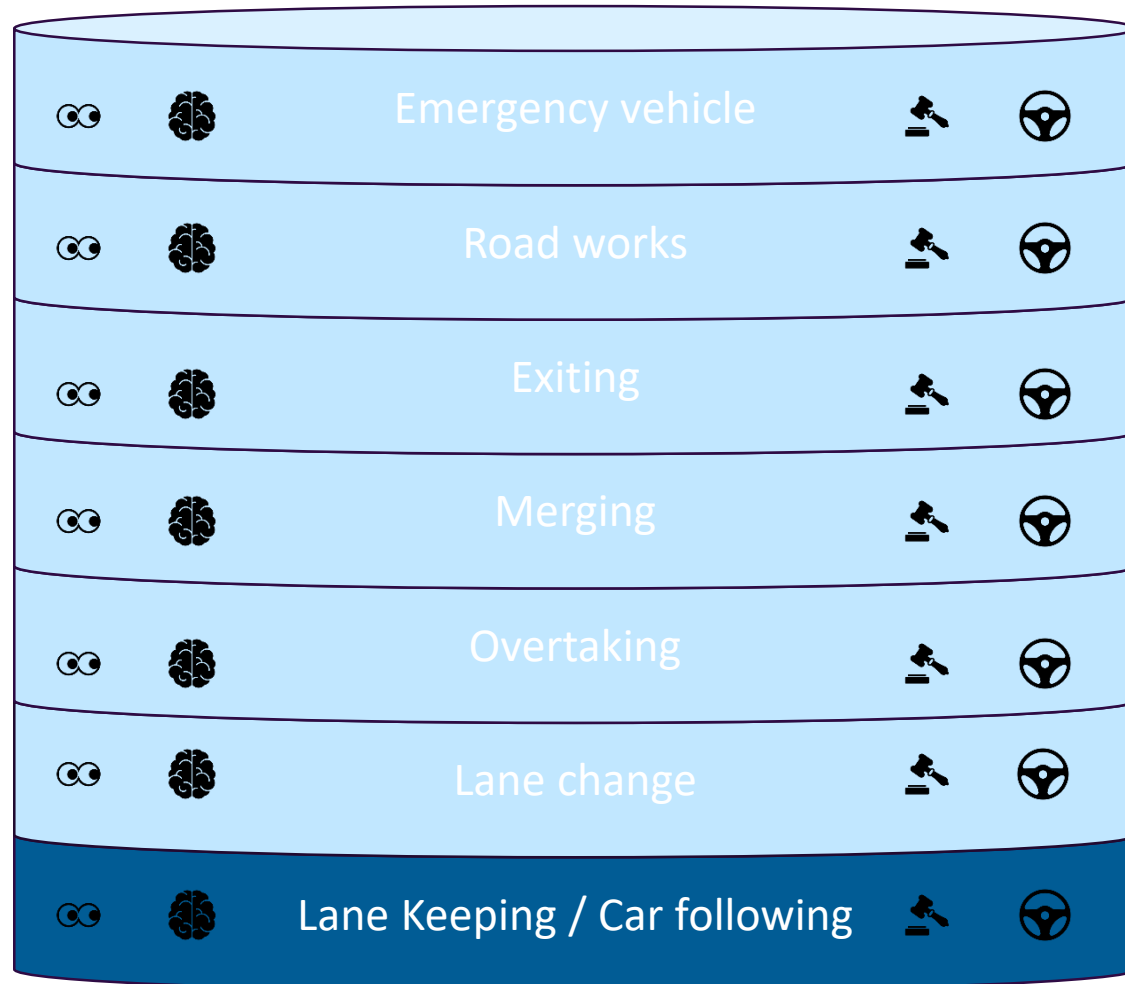


Motorway Driving
Automation Long & Lat



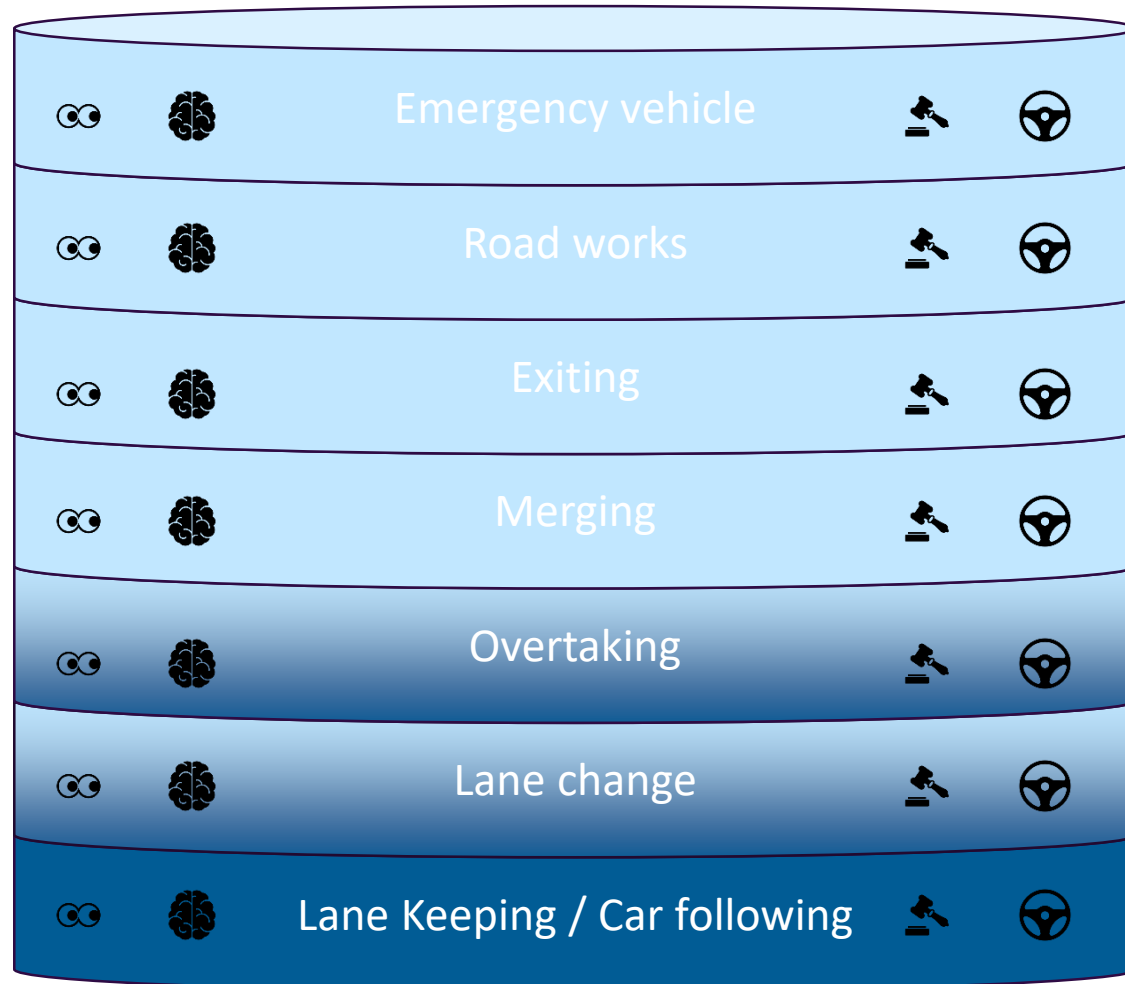


Motorway Driving
Long & Lat automated



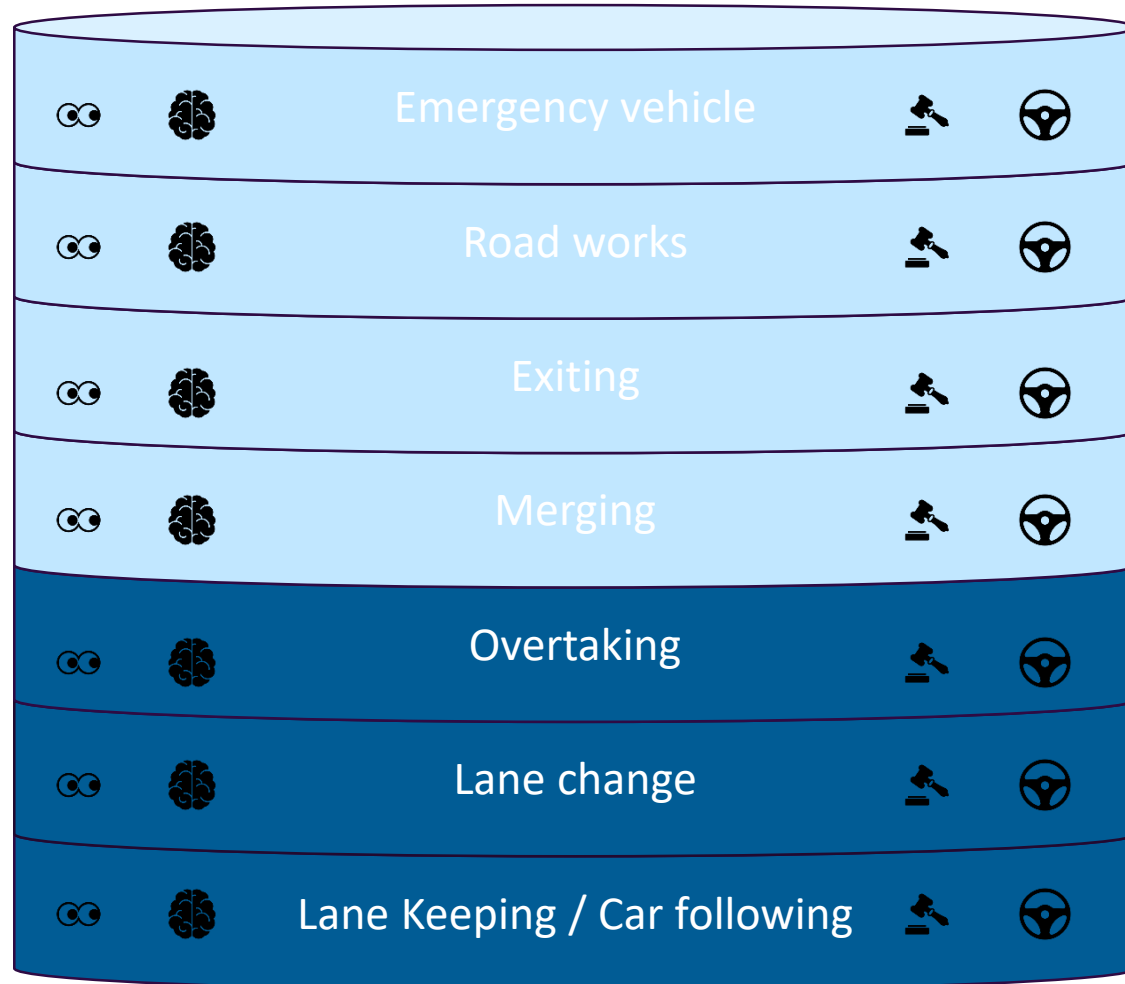


Motorway Driving
Long & Lat automated;
Automation Lane
change & overtaking



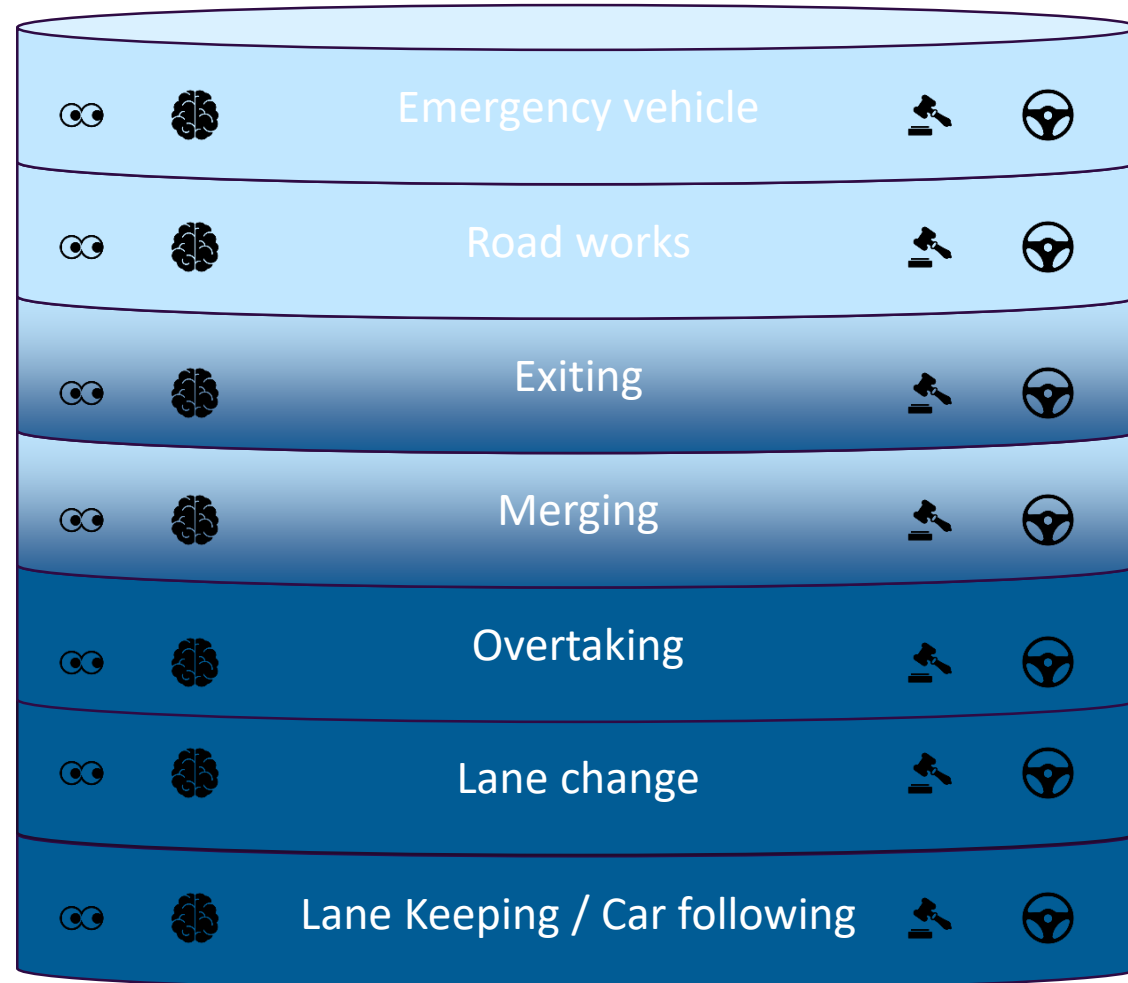


Motorway Driving
Long & Lat, Lane
change & overtaking
automated



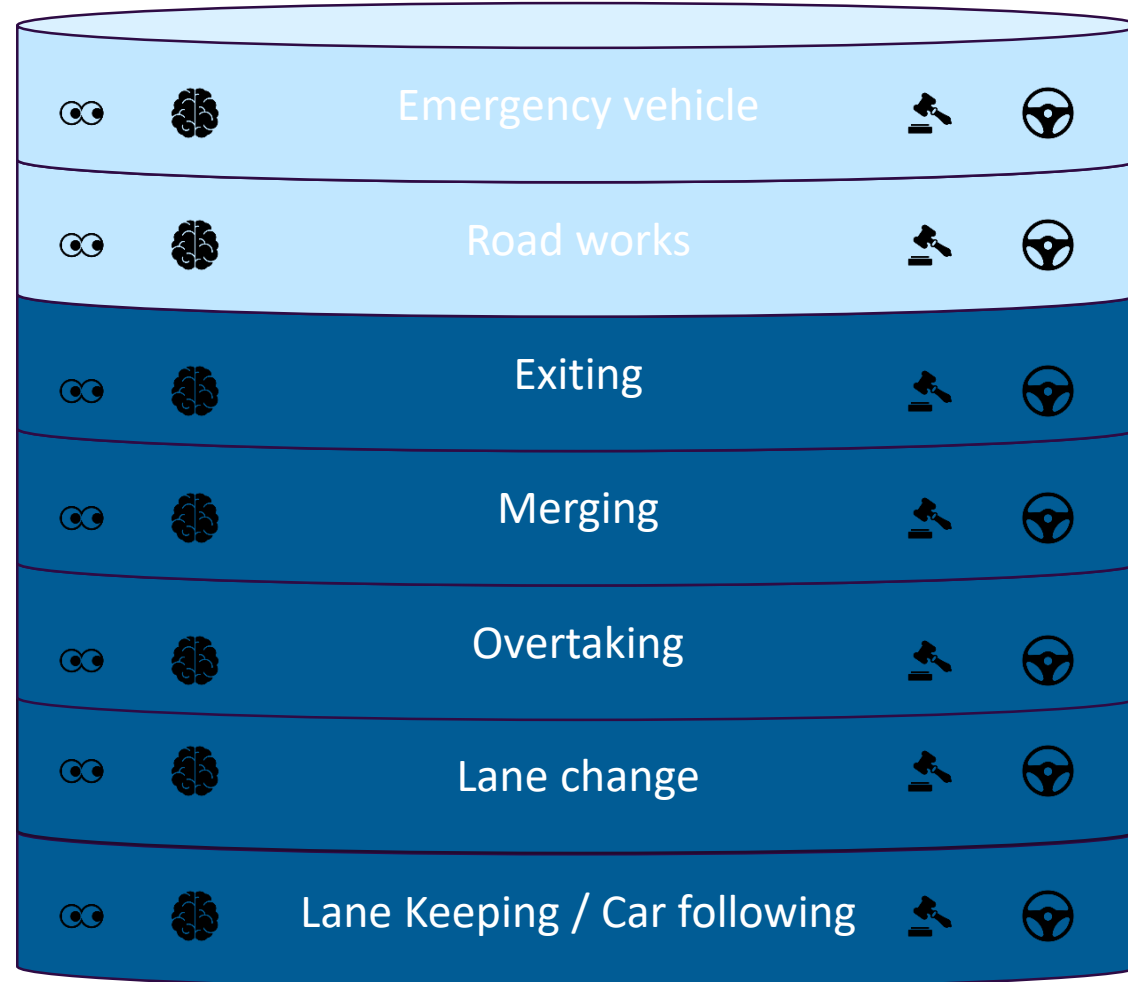


Motorway Driving
Long & Lat, Lane
change & overtaking
automated;
Automation Merging &
Exiting





Motorway Driving
Long & Lat, Lane
change & overtaking,
Merging & Exiting
automated



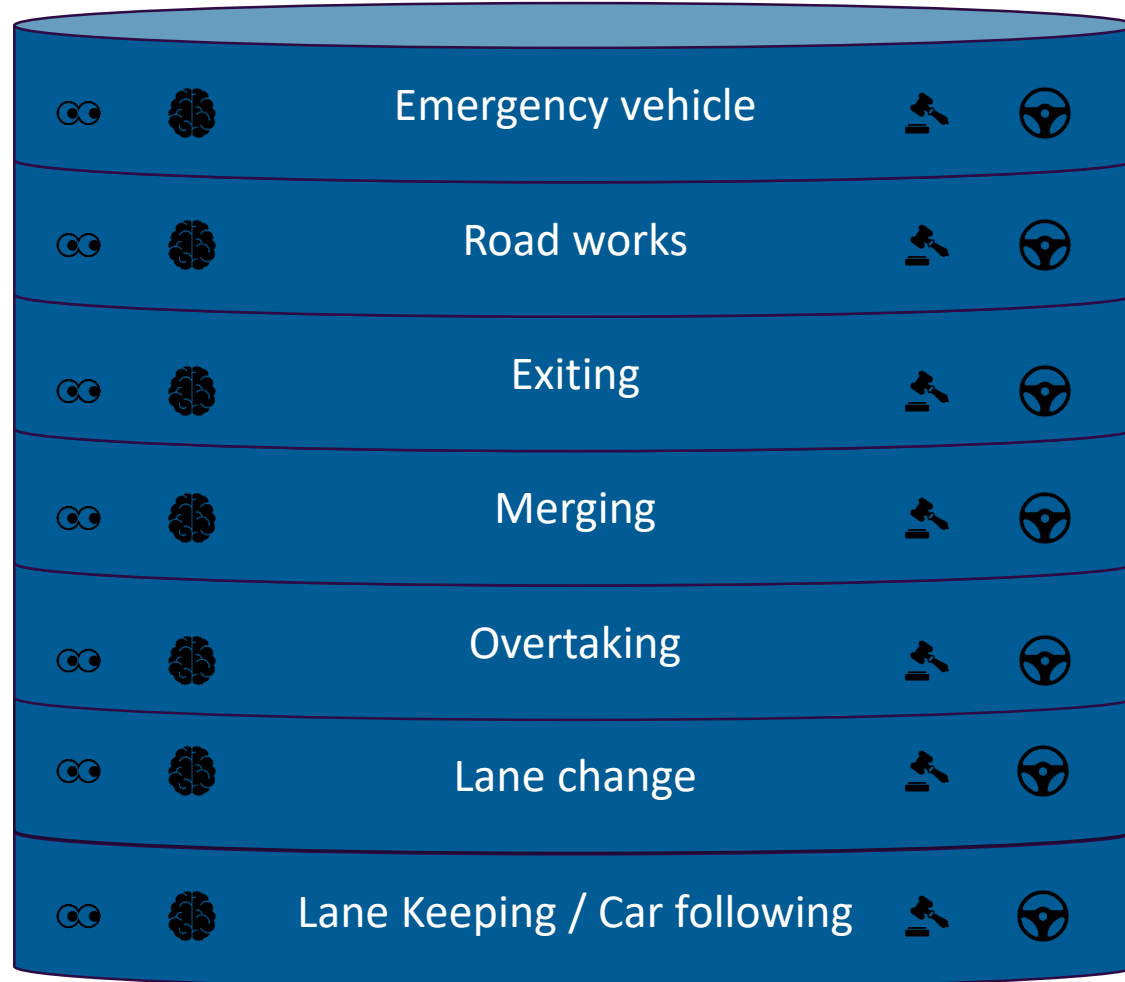


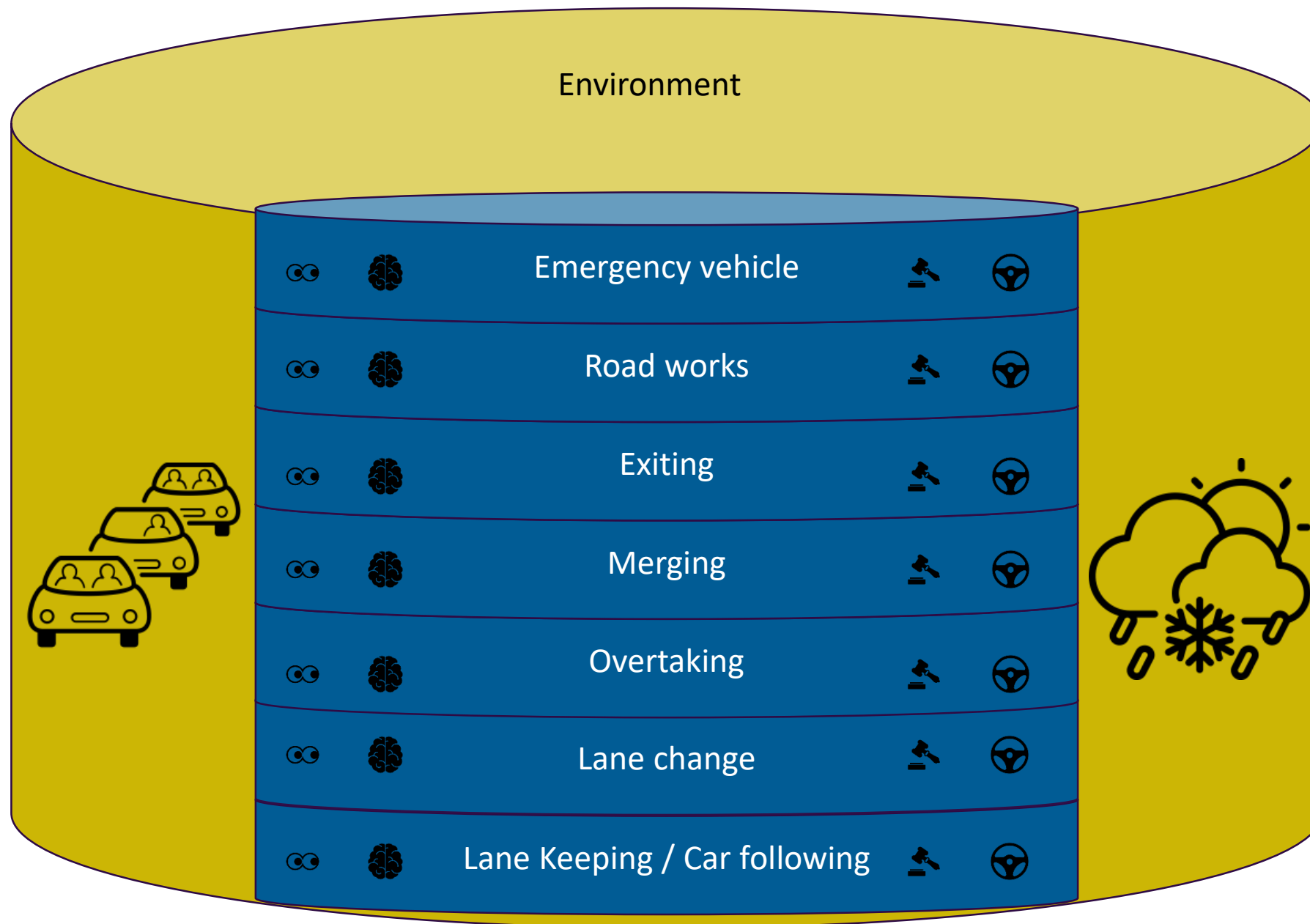
Motorway Driving
Long & Lat, Lane
change & overtaking,
Merging & Exiting
automated;
Automation Road works
& Emergency Vehicle

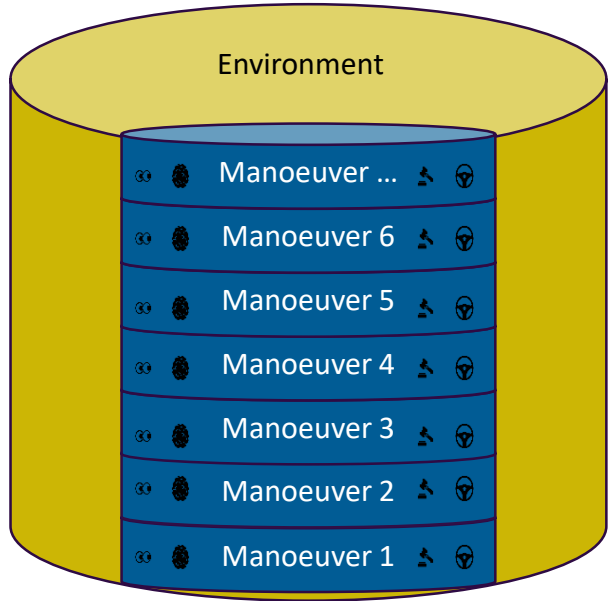




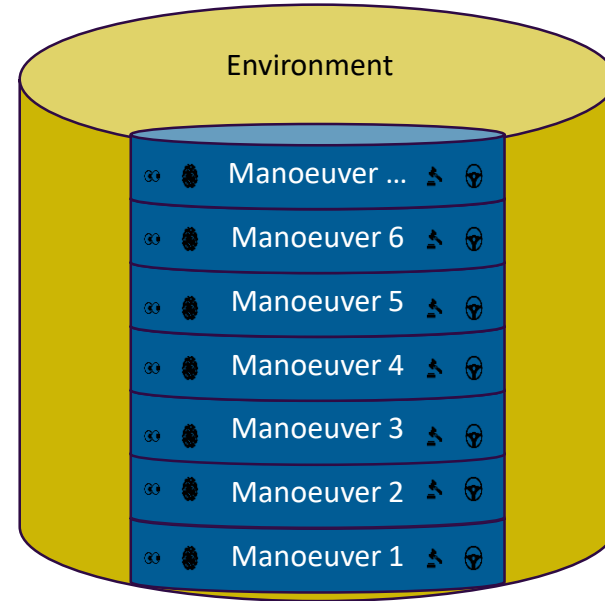
Motorway Driving
all manoeuvres
automated



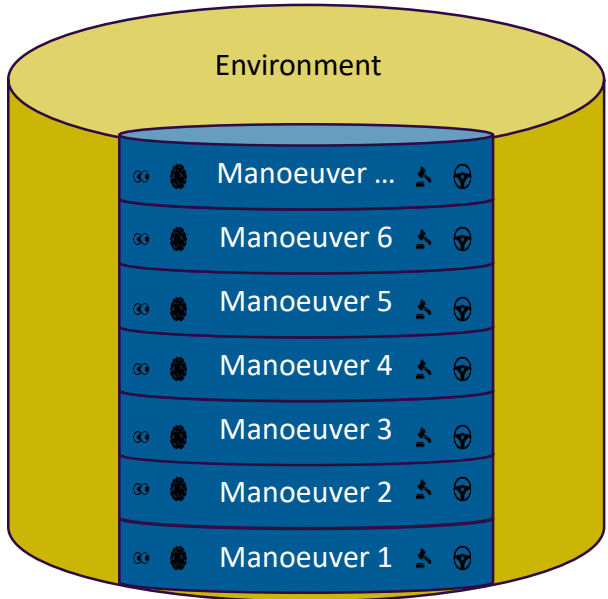
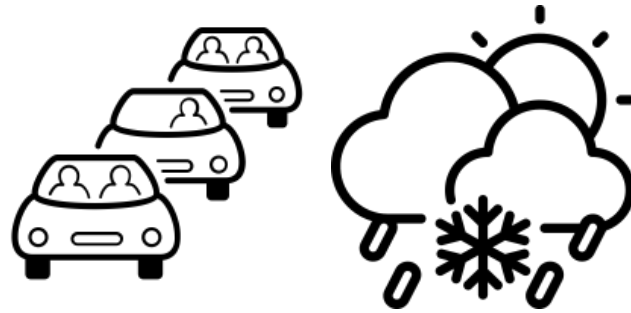




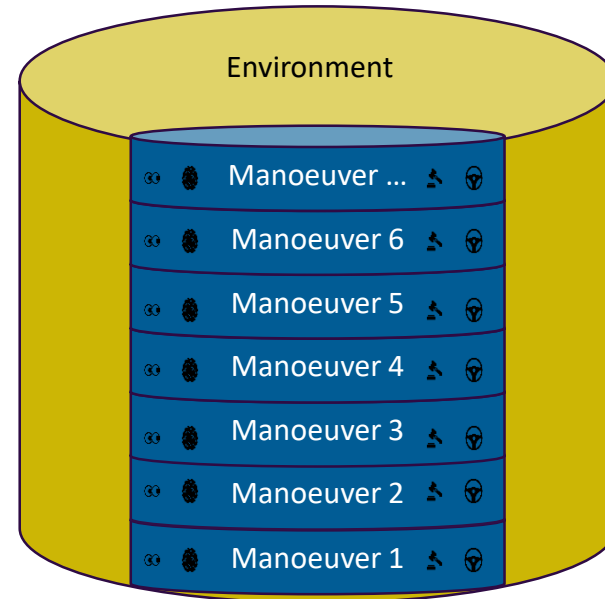
Motorway



Rural roads



Urban roads

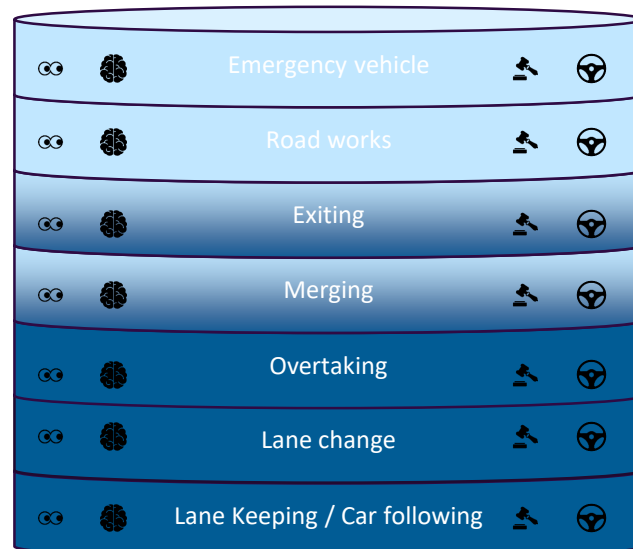


... road environment



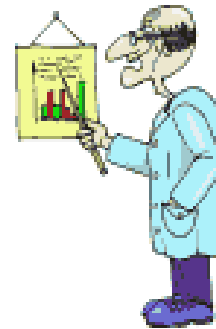
Leftovers: Reiteration

- > Every part of the driving task that is not automated is done by a human being
- > Every part of the driving task that is not 'perfectly' automated needs to be compensated for by a human being









An approach to user roles





Human Roles: Dictionary of Terms



- > **Performing:** Completing the task ✓
- > **Supervising:** Monitoring the completion of the task by the automation, the environment, and the behavior of the vehicle
 - ✓ 
 - ✓ 
 - ✓ 
- > **Available:** Conscious, able to be interrupted from another task and to then engage in either the Supervising or Performing role
 - ✓ 
- > **Not Available:** Consciousness optional, and not available to resume another role within the driving environment.



Automation Roles: Dictionary of Terms

> **Assisting:** Assisting with the task ✓

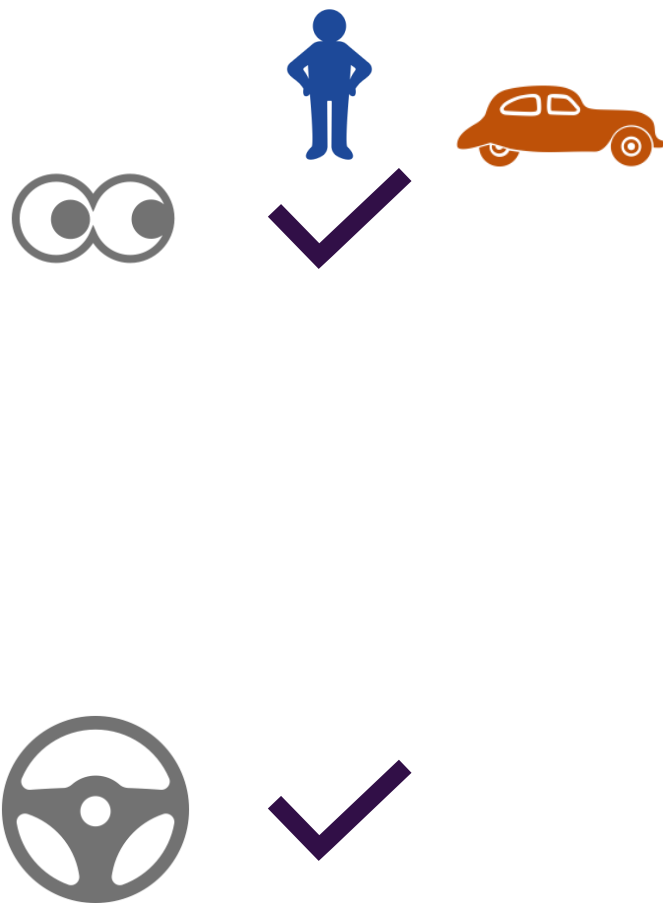


> **Automated:** Task is automated ✓

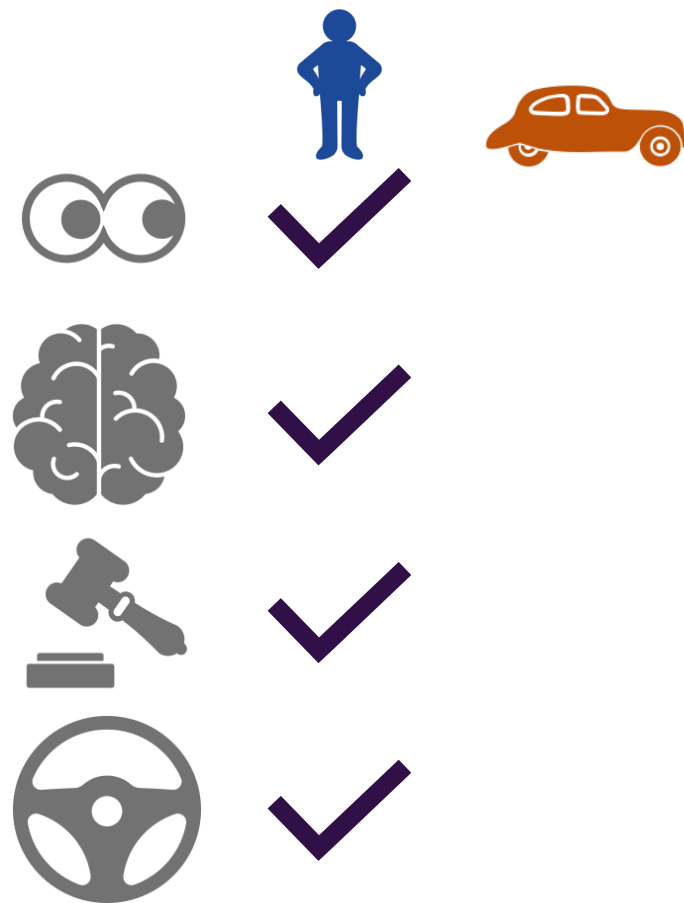


Conventional Driver

Operational



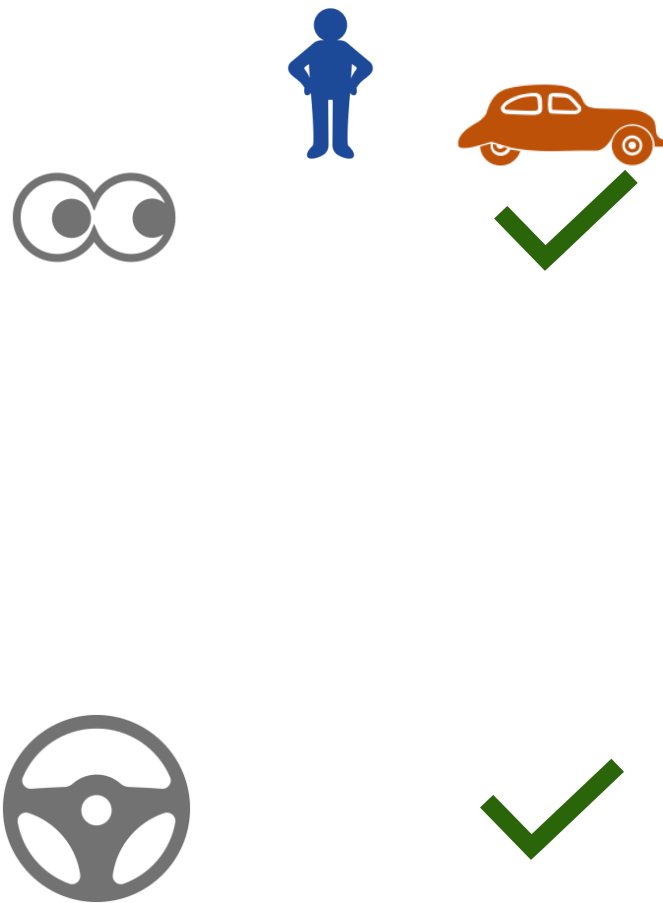
Tactical



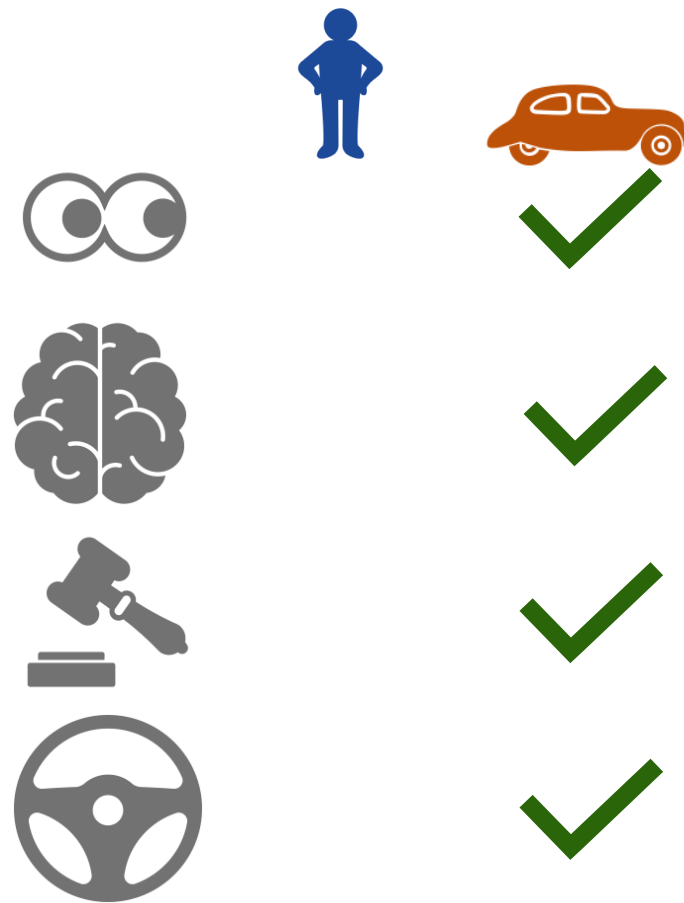


ADS User

Operational



Tactical

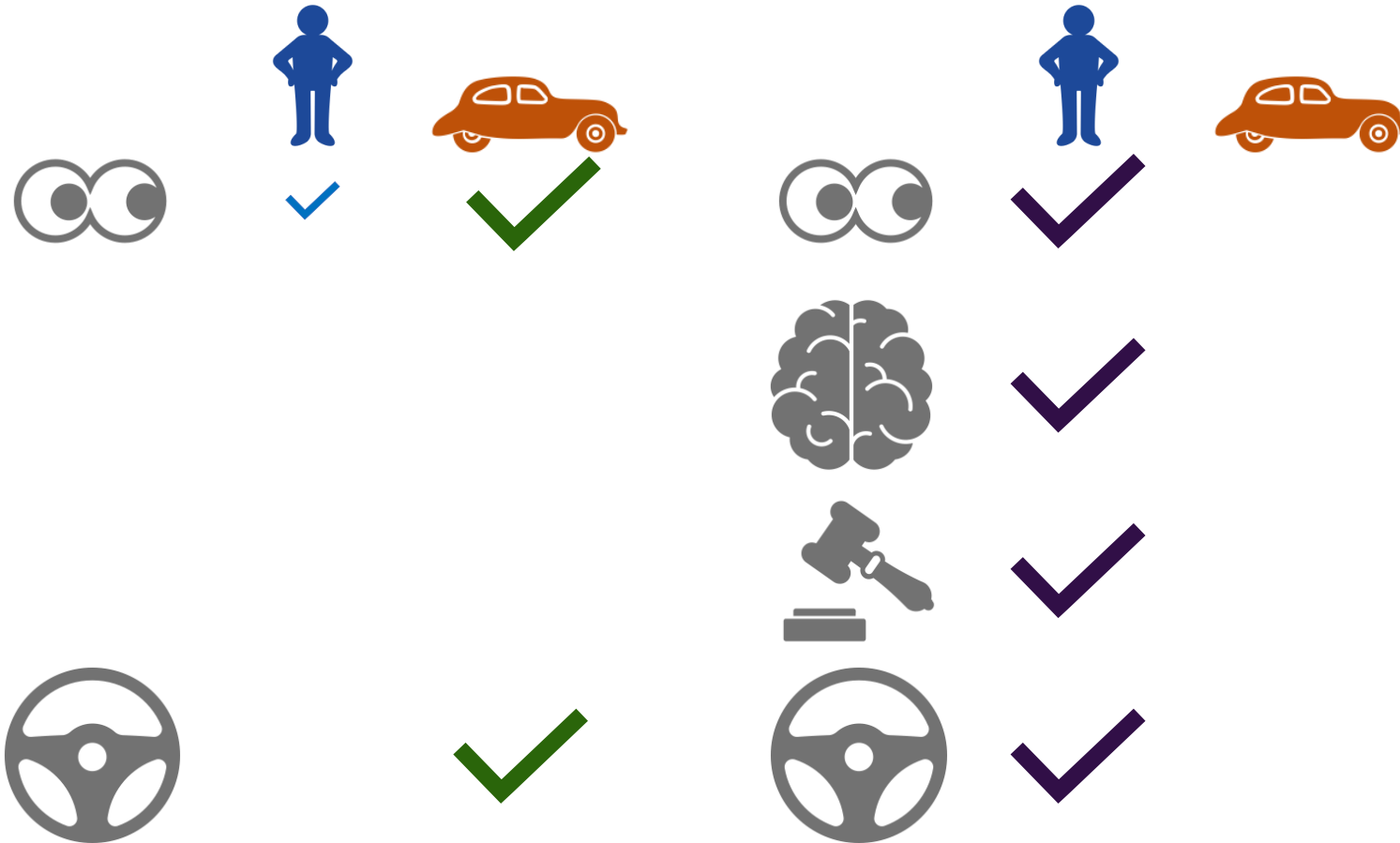




Operational Supervisory Driver

Operational

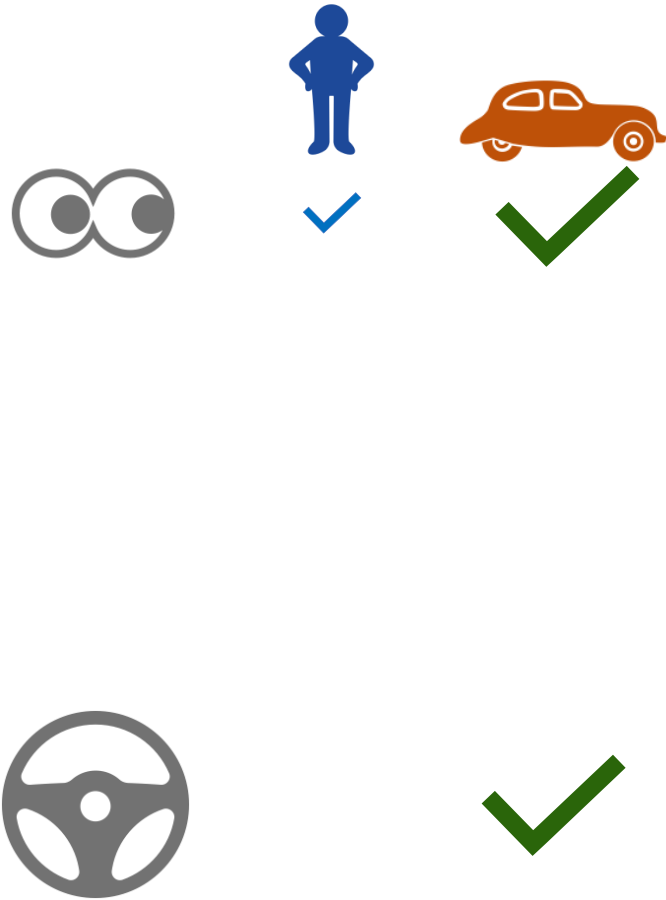
Tactical



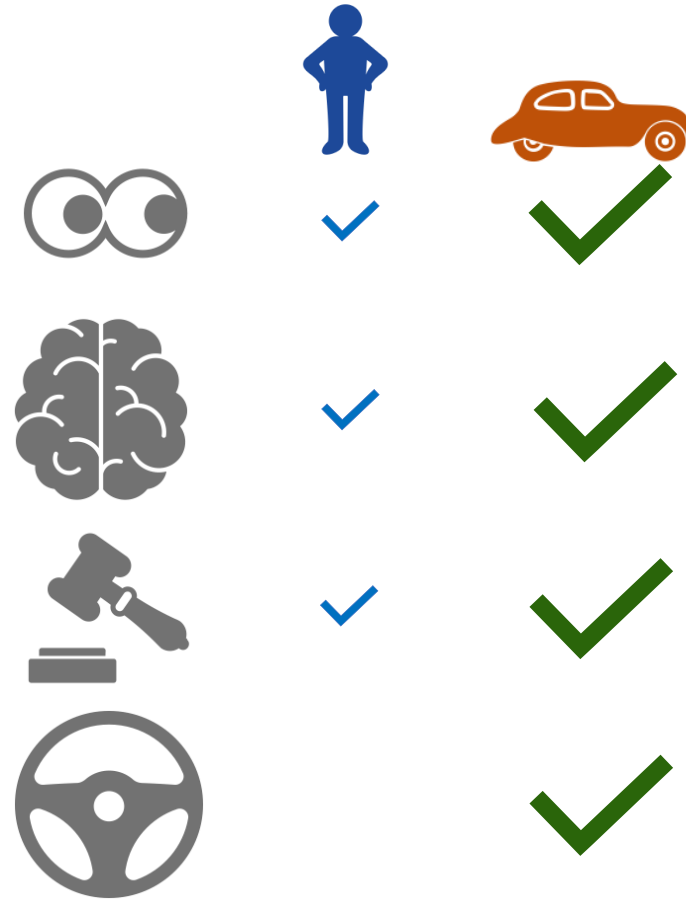


Supervisory Driver

Operational



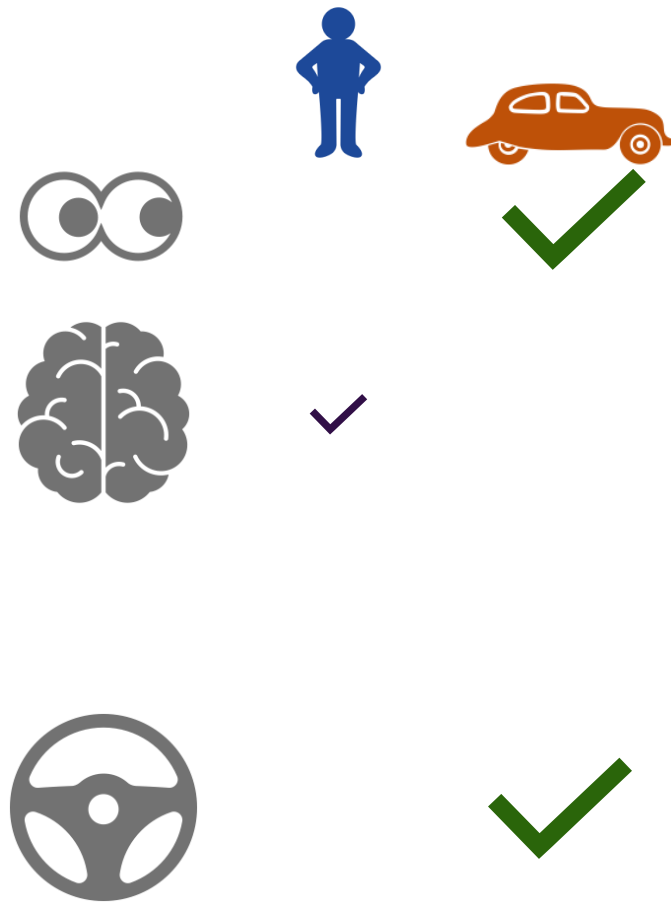
Tactical



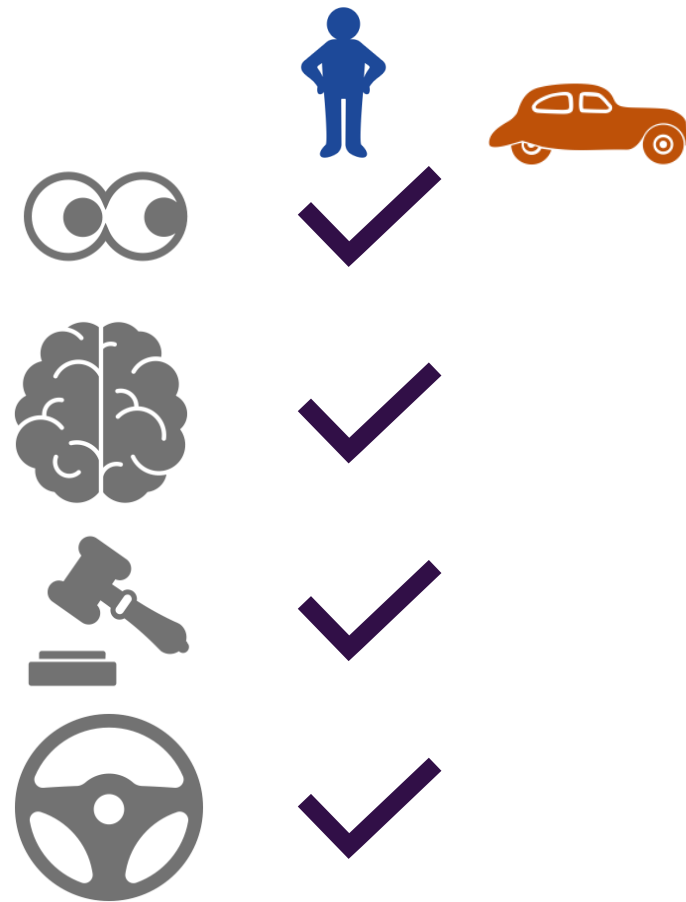


Fallback Driver

Operational



Tactical





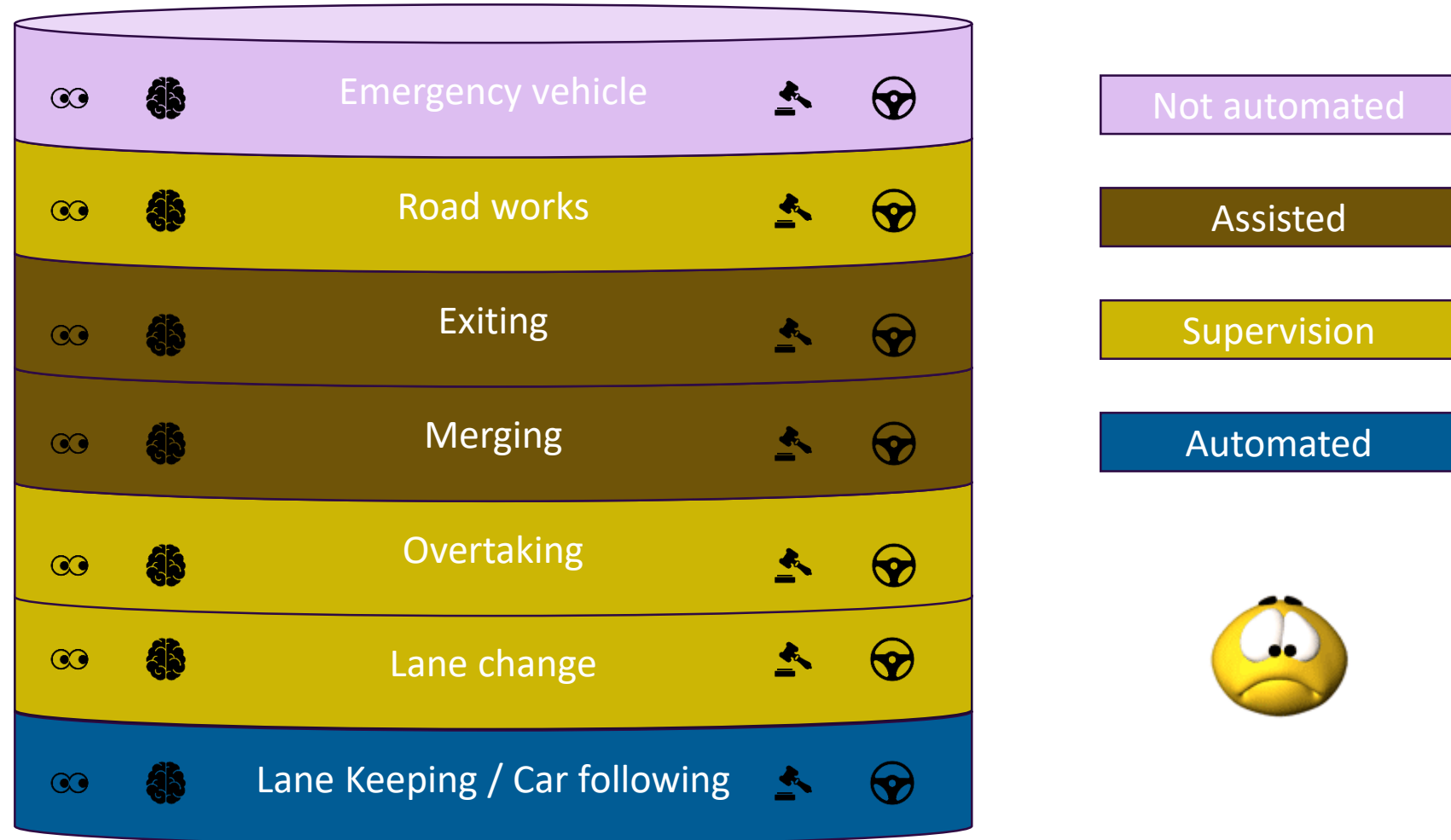
Driving Task Human Roles

1. Conventional Driver
2. Operational Assisted Driver
3. Assisted Driver
4. Operational Supervisory Driver
5. Operational Supervisory Assisted Driver
6. Supervisory Driver
7. Fallback Driver
8. Fallback Assisted Driver
9. Fallback Supervisory Driver
10. Fallback User
11. Limited Automation Driver
12. Limited Automation and Assisted Driver
13. Limited Automation and Supervisory Driver
14. Limited Automation and Available User
15. ADS User

16. Remote Driver
17. Remote User
18. Safety Steward



And it can be even more complicated





Summary

- › There are 15 possible roles that can or need to be performed by the user within a specific driving environment.
- › These roles not only pertain to controlling the vehicle
- › It most likely is even more complex



Caution

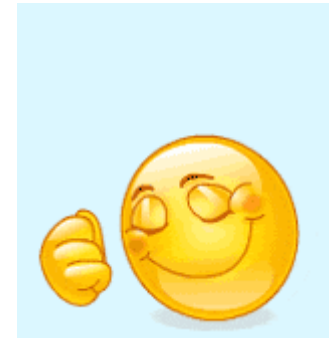
- > Not all roles in the end may exist
- > That a role may exist doesn't mean that humans can safely fulfill them
- > The quality of the automation may vary
- > Current roles say nothing about task demand
- > We have identified new roles for user and automation (not yet presented)
- > We need some more work on naming the roles





Thanks

- › This presentation reflects the discussions so far with Bobbie Seppelt, Oliver Carsten, Jan Sybren Boersma, and Espedito Rusciano
- › Also thanks to the creative, scientific, and critical minds of the HF-IRADS group*



“Human Factors in International Regulations for Automated Driving Systems” (HF-IRADS) operates under the auspices of the International Ergonomics Association (IEA). It brings together human factors experts from across the world to support UNECE activities on the safety of automated driving systems.



Thank you for your
attention!

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