

Webinar: Macroscopic Travel Demand Modelling

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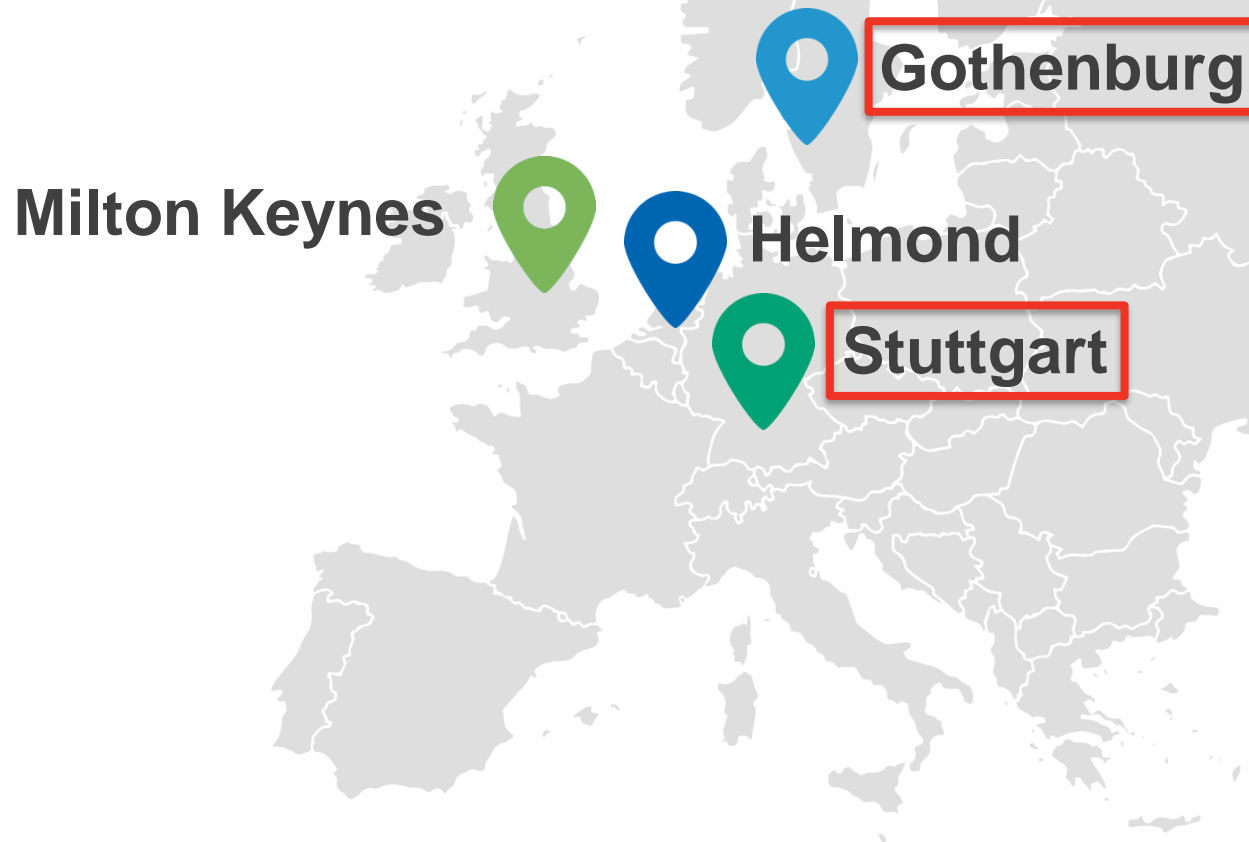
These projects have
received funding from the
European Union

Aim and Scope



- Methods for macroscopic travel demand modelling
- Modification of existing travel demand models to include characteristics and impacts of **highly automated vehicles**

Macroscopic Use Cases



Aim and Scope



- Methods for macroscopic travel demand modelling
- Modification of existing travel demand models to include characteristics and impacts of **highly automated vehicles**
- Demonstration with a travel demand model for a simplified study area
- All files including scripts will be available for download
 - Link will be sent by mail to all participants of the webinar
 - Link in Video Description on YouTube

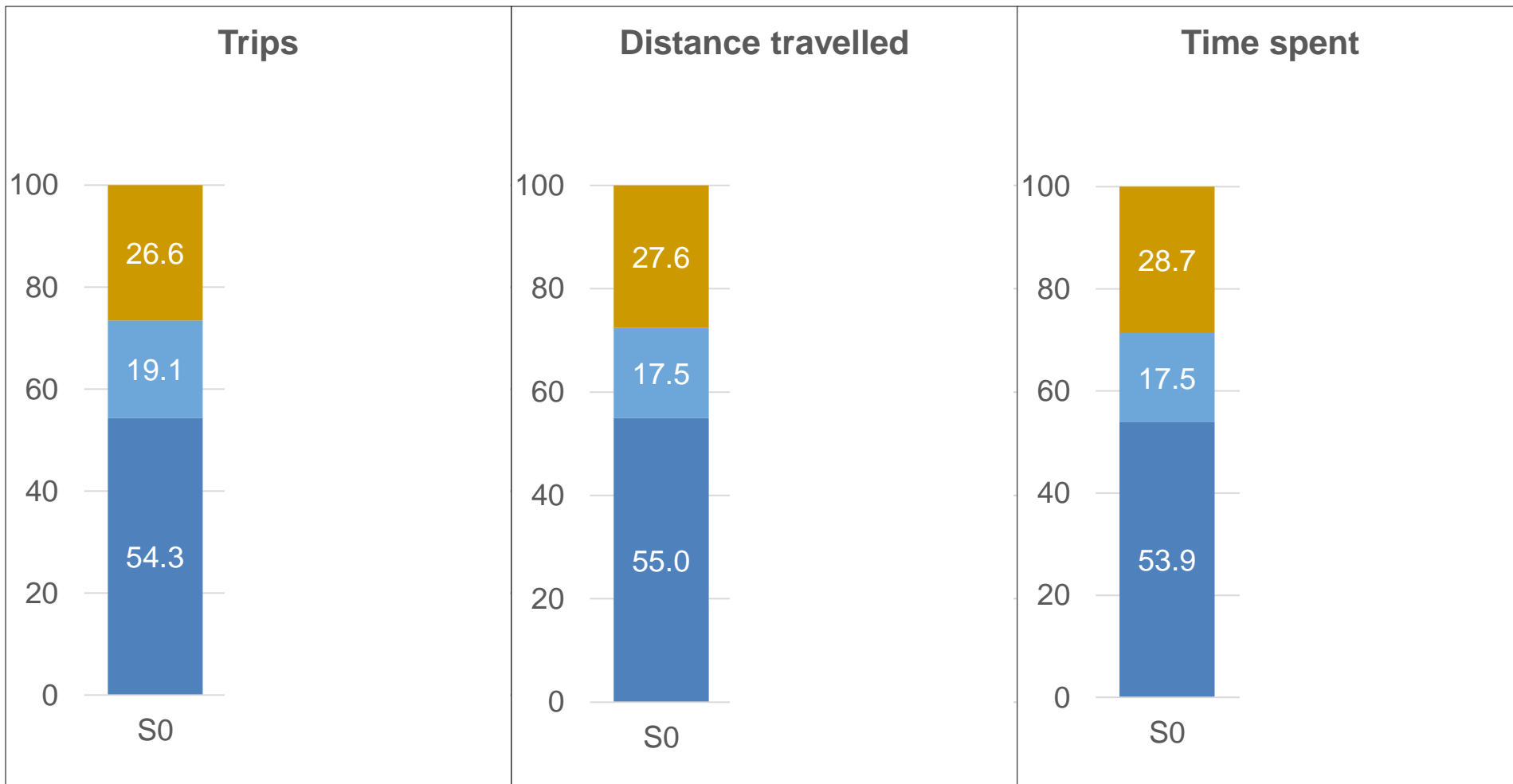
Presented scenarios

- **S0:** Baseline scenario, no AV
- **S1:** Impacts caused by changes in traffic performance
- **S2:** Impacts caused by changes in traffic performance and changes in the perception of travel time

Expectation: Impacts on supply & demand

- travel times
- mode choice
- destination & route choice

S0: Baseline scenario (No AV)



S1 & S2 with highly automated vehicles

Category	Changes
Transport Systems	new: Car_AV
Modes	new: Car_AV <input checked="" type="checkbox"/> skim calculation <input type="checkbox"/> mode choice (CV and AV \in Mode Car Driver)
AV-share	user setting
Car availability	no changes
Trip generation	no additional trips
Traffic performance	influenced by AV
Travel time perception	influenced by AV (only in S2)
Destination & Mode choice	influenced by travel time changes

Split demand according to AV-share

p^{AV} AV-share

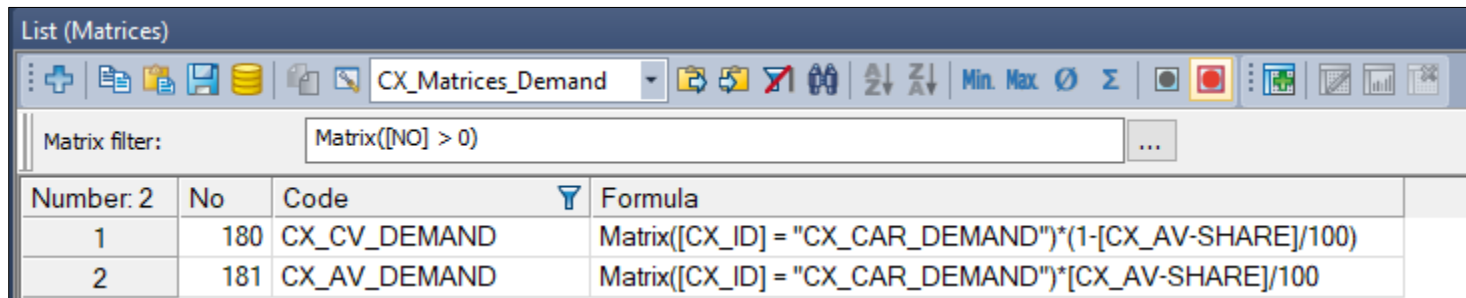
d^{Car} Demand for 'Car Driver'

Demand assigned to Transport System Car_CV

$$d^{CV} = (1 - p^{AV}) \cdot d^{Car}$$

Demand assigned to Transport System Car_AV

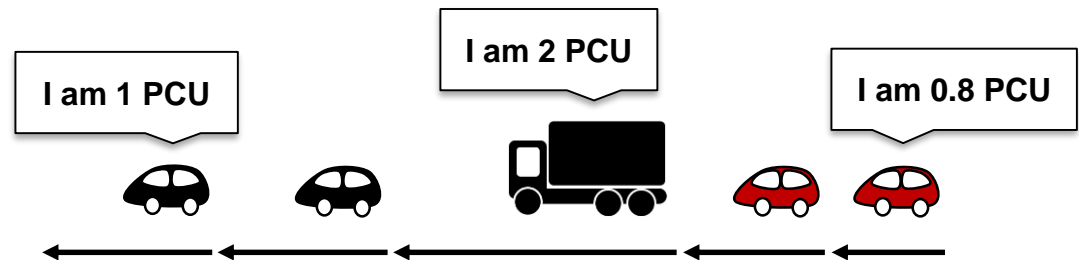
$$d^{AV} = p^{AV} \cdot d^{Car}$$



List (Matrices)			
Matrix filter: Matrix([NO] > 0)			
Number	No	Code	Formula
1	180	CX_CV_DEMAND	Matrix([CX_ID] = "CX_CAR_DEMAND")*(1-[CX_AV-SHARE]/100)
2	181	CX_AV_DEMAND	Matrix([CX_ID] = "CX_CAR_DEMAND")*[CX_AV-SHARE]/100

Traffic Performance

- AV perform differently than conventional vehicles
→ use concept of passenger car units (PCU)



- incorporate behavior of AV on different roadway types
→ PCU factors depending on AV and roadway type

e.g.

- Motorway
- Arterial
- Urban street

Volume-delay function parameters

Number:

Name:

Type:

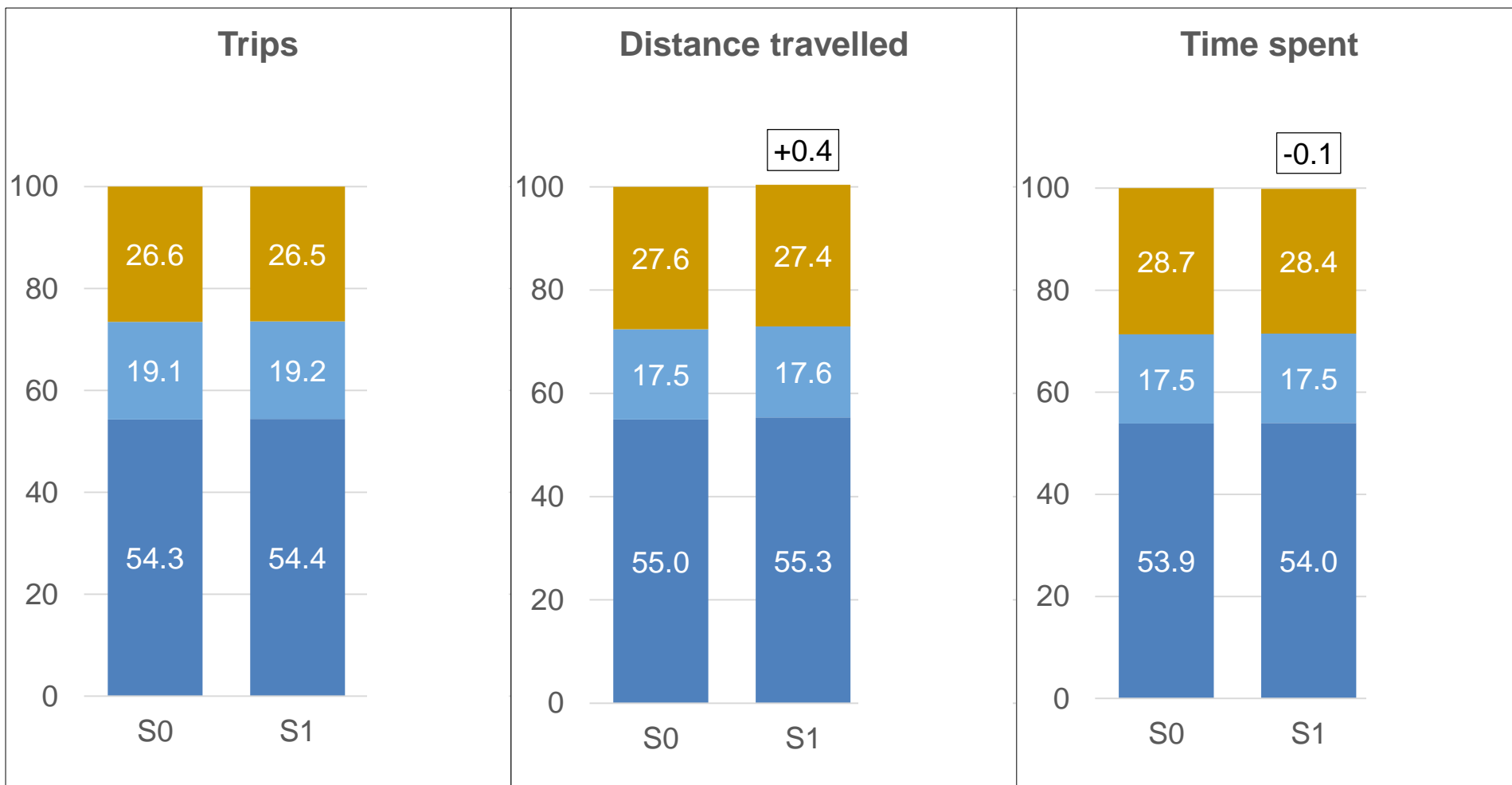
Function

$$t_{cw}(sat) = t_0 \cdot (1 + a \cdot sat^b)$$

$$sat = \frac{q_{Cav_{-}CV} \cdot f_{Cav_{-}CV}^{PCU} + q_{Cav_{-}AV} \cdot f_{Cav_{-}AV}^{PCU}}{q_{max}}$$

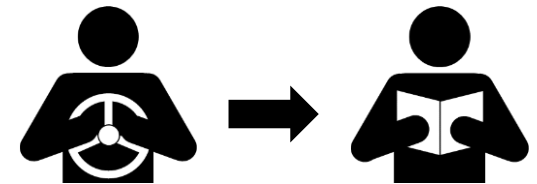
if CX_AV-READY, $f_{Cav_{-}AV}^{PCU} = CX_PCU_AV$, else $f_{Cav_{-}AV}^{PCU} = f_{Cav_{-}CV}^{PCU} = 1$

S1: Performance impact (50% AV)



Perception of travel time

- Being driven in automated mode changes the perception of travel time

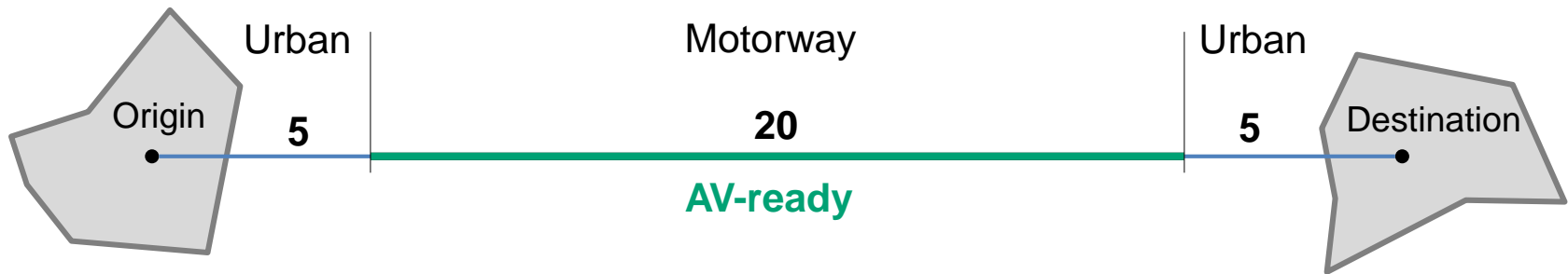


- Highly, but not fully automated vehicles
→ transport system of mode 'Car Driver'
→ influence attractiveness of this mode

- Perceived travel time \triangleq travel time -30%



Perception of travel time: Example

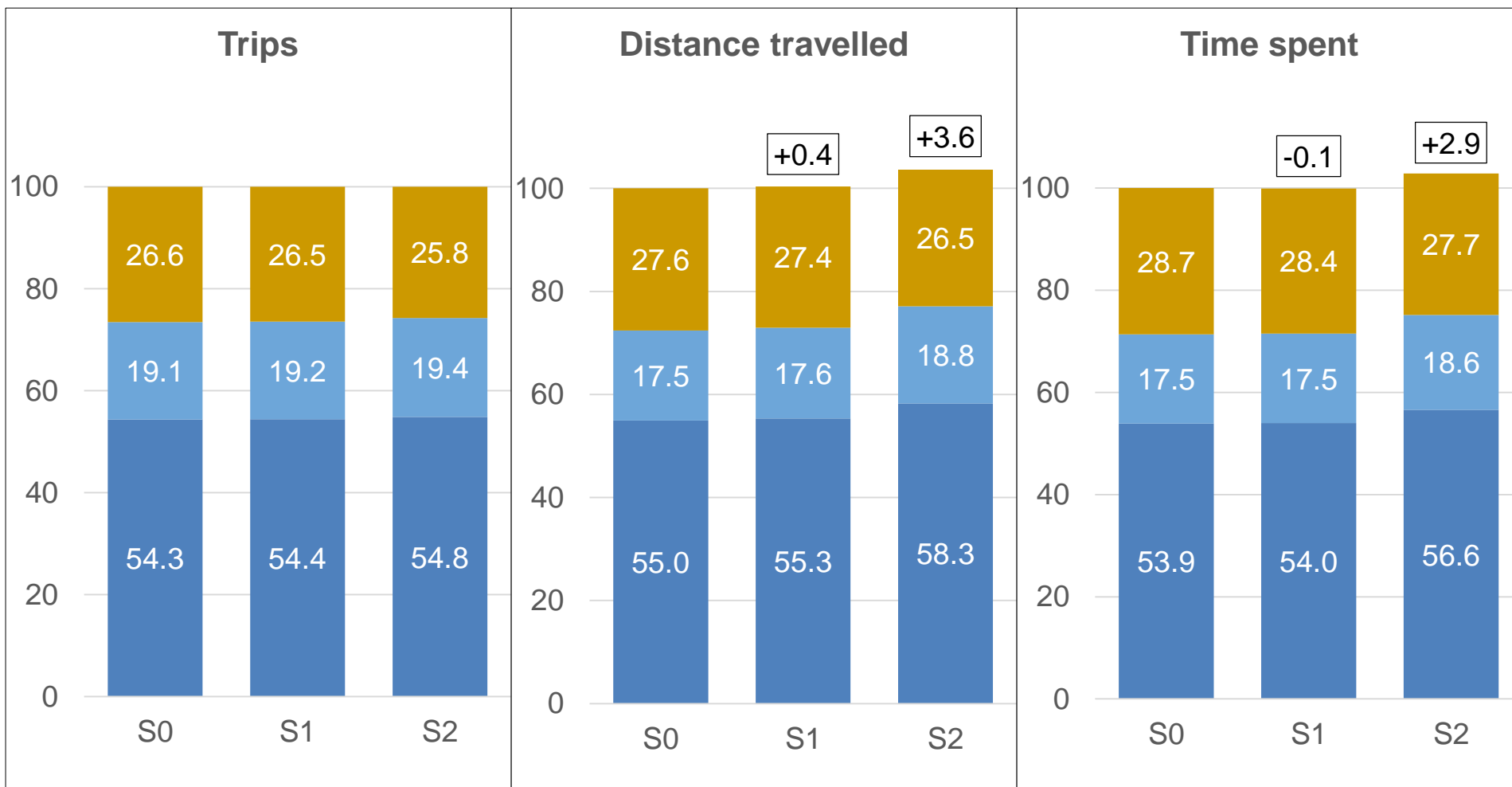


$$t^{CV,perc} = 1.0 \cdot 5 + 1.0 \cdot 20 + 1.0 \cdot 5 = 30 \quad (f^{perc,CV} = 1.0)$$

$$t^{AV,perc} = 1.0 \cdot 5 + 0.7 \cdot 20 + 1.0 \cdot 5 = 24 \quad (f^{perc,AV} = 0.7)$$

$$\begin{aligned} t^{CarDriver,perc} &= (1 - p^{AV}) \cdot t^{CV,perc} + p^{AV} \cdot t^{AV,perc} \\ &= 0.5 \cdot 30 + 0.5 \cdot 24 \\ &= 27 \end{aligned} \quad (p^{AV} = 50\%)$$

S2: Perf. & Perception (50% AV)



Conclusions

Technological development

- Automation level will increase gradually
- Cars will become better and more attractive

Objective

- We want to understand the impacts on travel demand

Solution

- Extend existing travel demand models

Methods presented

- enable models to show the impacts of AV on travel demand
- permit to analyze assumptions on traffic performance and travel time perception
- require only small modifications of existing models

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