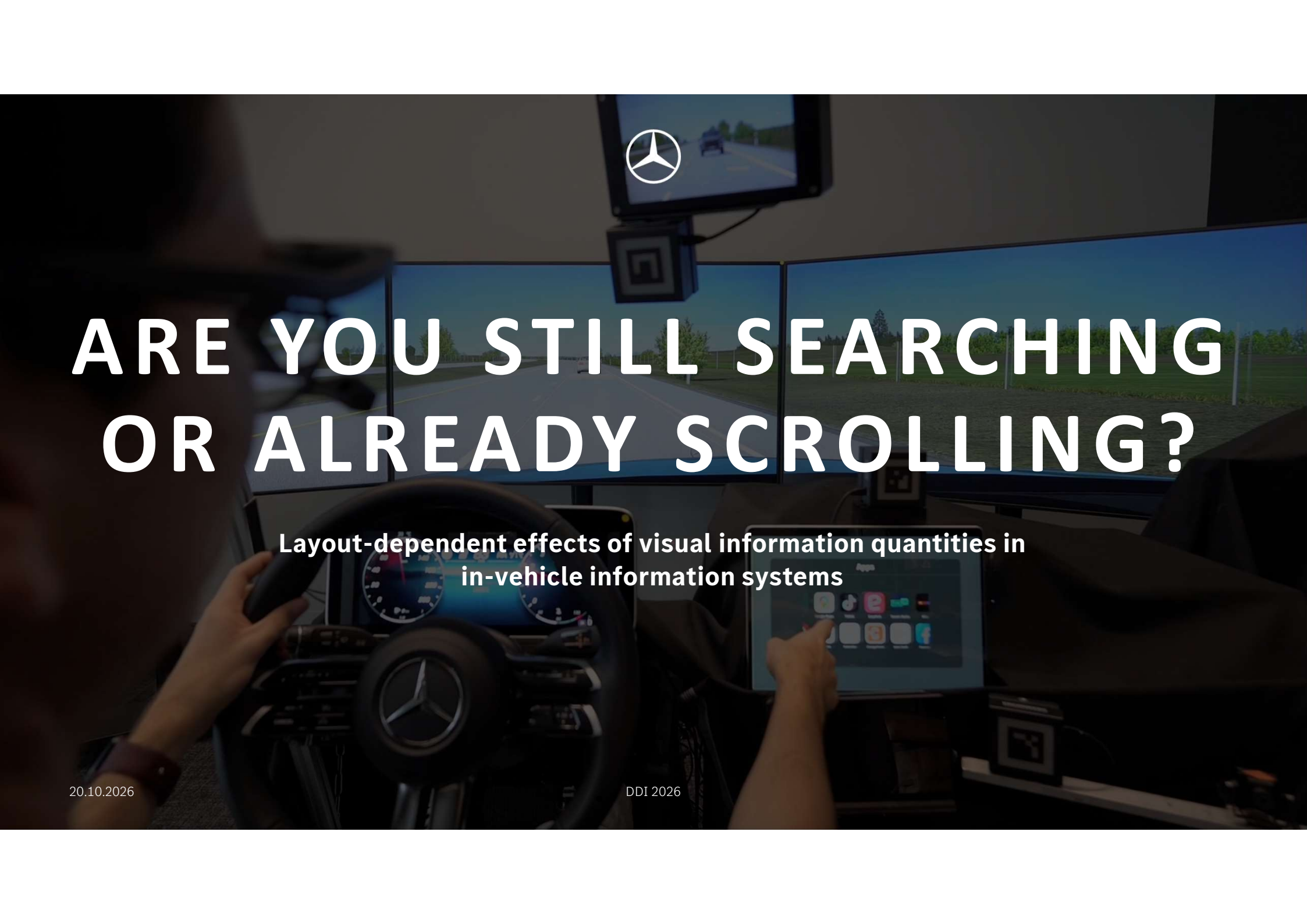




ARE YOU STILL SEARCHING OR ALREADY SCROLLING?

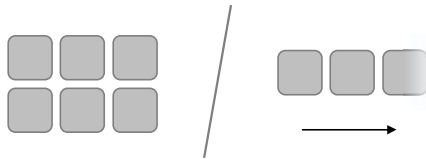
Layout-dependent effects of visual information quantities in
in-vehicle information systems

Background Literature

- High cognitive load affects driving performance, task duration and gaze times (Hancock & Matthews, 2019; Jung et al., 2021; R. Li et al., 2017; Lovell et al., 2022; Patten, 2007; Strayer et al., 2019; Feng et al., 2018)
→ Hypothesis: More visual information leads to increased distraction
- 15 buttons with text led to over 2 s average single-ganze time and over 20 s task duration (Feng et al., 2018)
→ Transfer to visual elements?
- A study suggests that a hierarchical vs. grid layout affects task duration (Li et al., 2017)
- The number and duration of glances increase with more pages and scroll interactions; however, neither a high density nor a high depth of information is optimal (Louveton et al., 2024)
→ Balance must be found between the amount of displayed information depicted to the layout

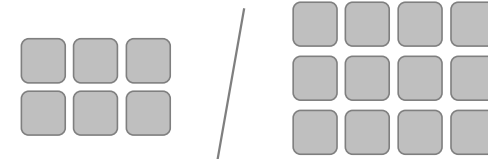
Research Questions

Layout-Effekt



Effect of single-page grid vs. multi-page scroll layout

Quantity-Effekt



Effect of number of displayed visual items

Interaction-Effekt

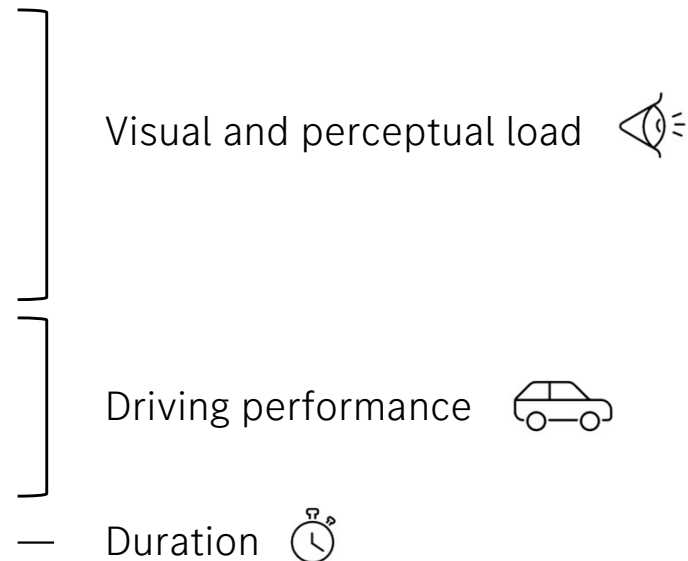
Interaction effects between layout (grid/scroll) and quantities of information (12/15/18/20)

Study Design

- Driving simulator study
- Two-factor (2 layouts x 4 quantities) within-subjects design

- 9 variables

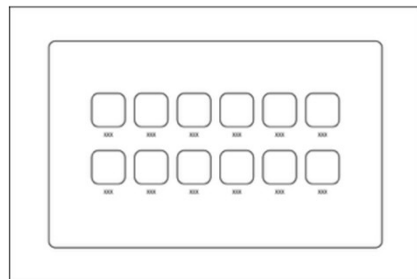
1. Single gaze duration
2. Total gaze duration
3. Number of gazes
4. DRT reaction time
5. Number of DRT misses
6. SD of speed
7. SD of distance to the leading vehicle
8. SD of lateral lane position
9. Task duration



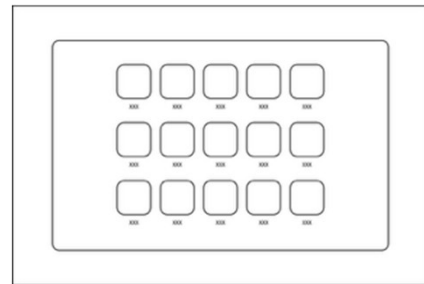
Study Design

Grid

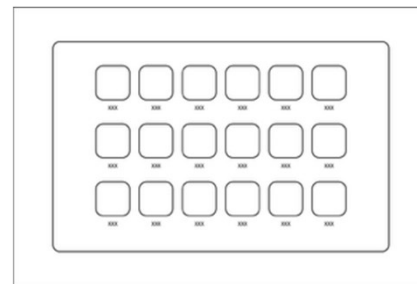
12 items



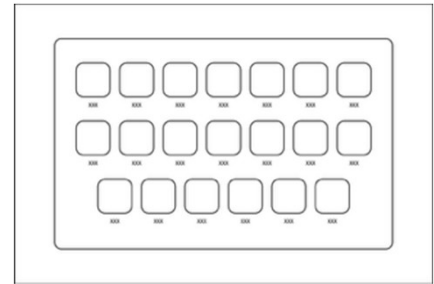
15 items



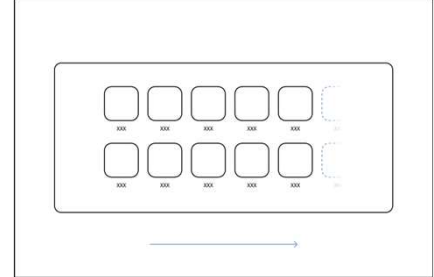
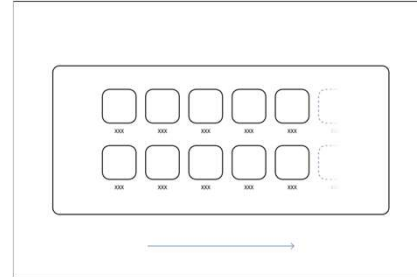
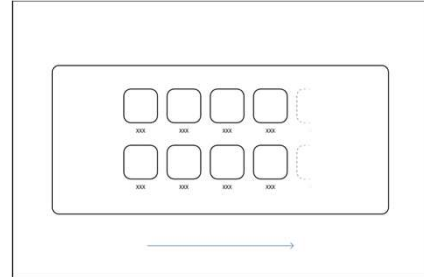
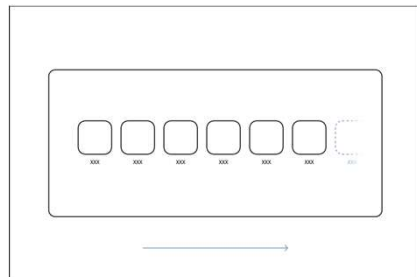
18 items



20 items

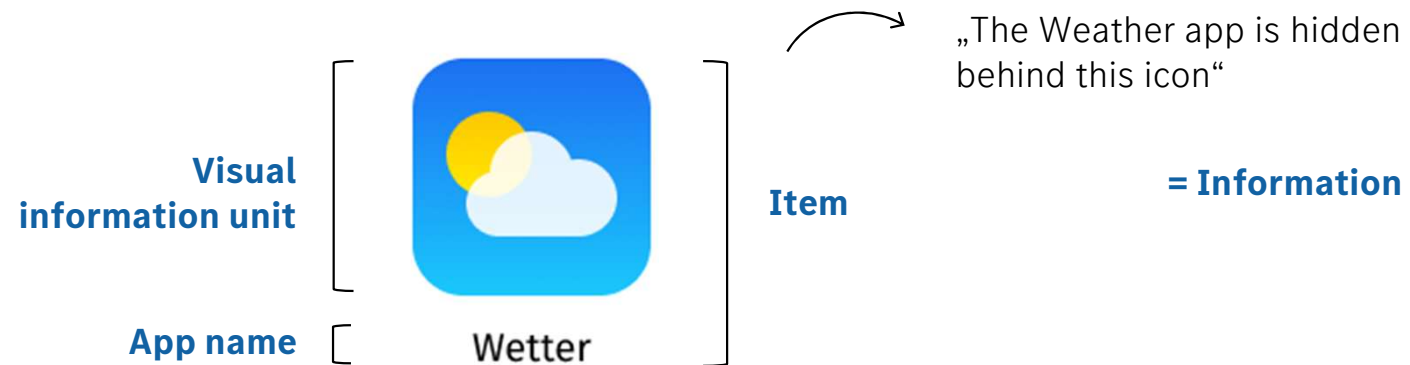


Scroll



Study Design

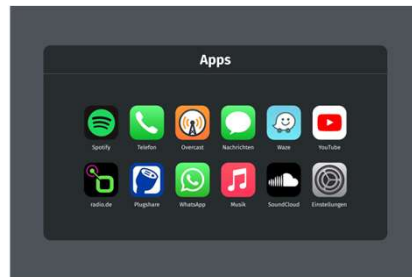
- Apple CarPlay Apps as visual information units
- Both widely known and relatively unknown apps
- Put together to app overview screen



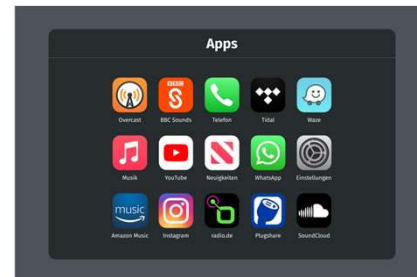
Study Design

Grid

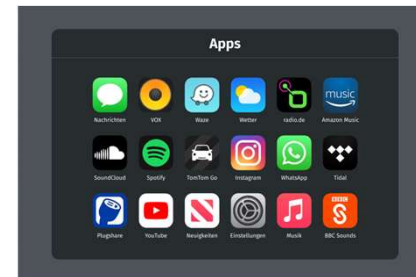
12 items



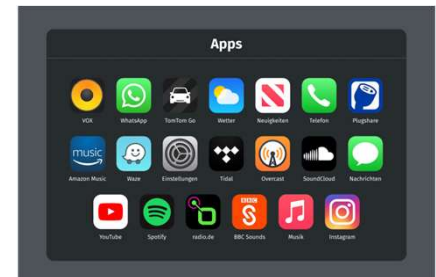
15 items



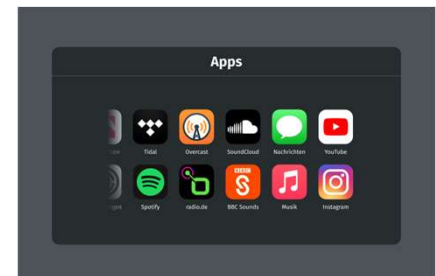
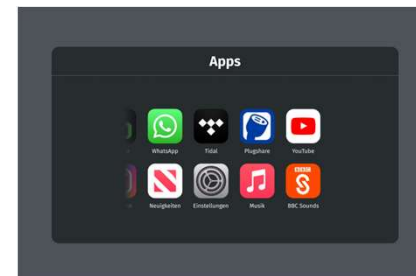
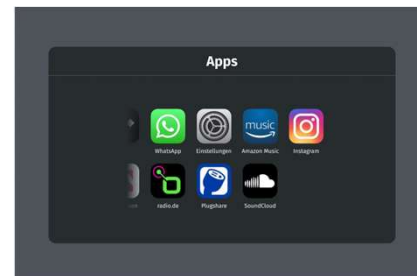
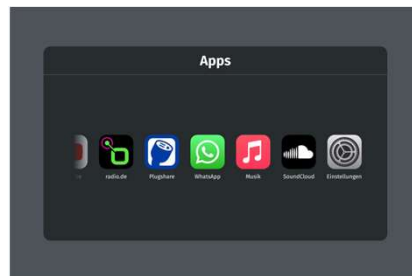
18 items



20 items



Scroll



Research Methods

- Driving simulator study
- Eye tracking
- Detection Response Task (DRT)
- Questionnaire (before and after the drive)

Subject Tasks

- Following another vehicle
- Maintain a constant speed of 80 km/h and a distance of 50 m from the vehicle in front
- DRT reaction task
- Visual search tasks





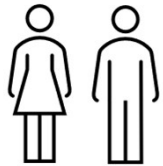
Mercedes-Benz

RESULTS

Sample description

- N = 33 (30 complete datasets)

Gender



W: 17 (52 %)
M: 16 (48 %)

Age



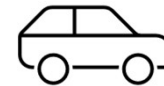
Ø 40,4 Years
SD: 16,5 Years
Range: 18 - 69
Years

Driver's license ownership



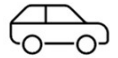
Ø 22,4 Years
SD: 15,9 Years
Range: 1 - 51 Years

Annual mileage

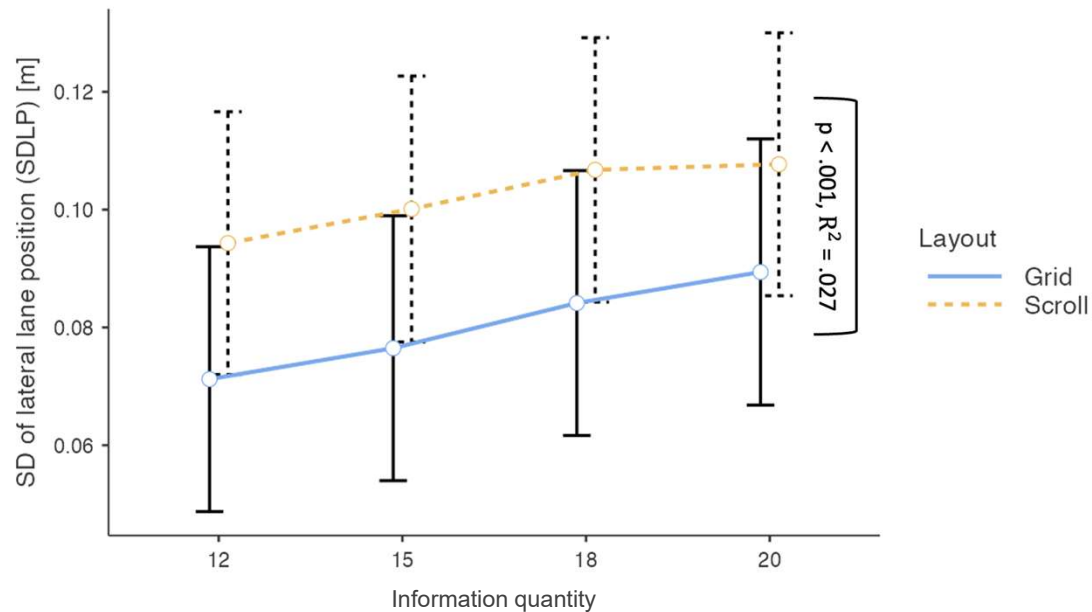


Ø 13.562,5 km
SD: 6.691,1 km
Range: 4.000 -30.000 km

Layout Effect (for all quantities)



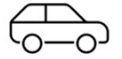
SD of lateral lane position (SDLP):



- Significant difference between grid and scroll layout
- 0.022 m (= 2.2 cm) difference

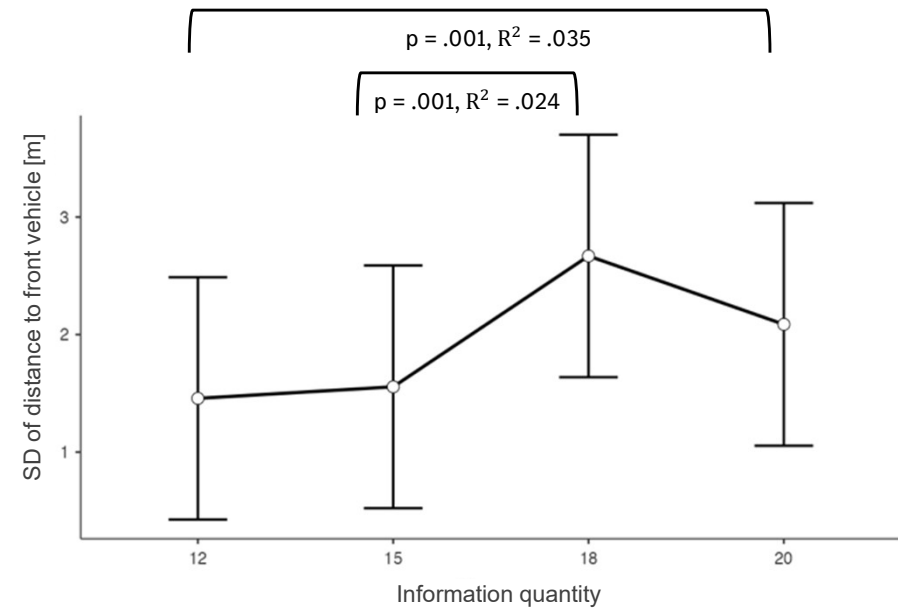
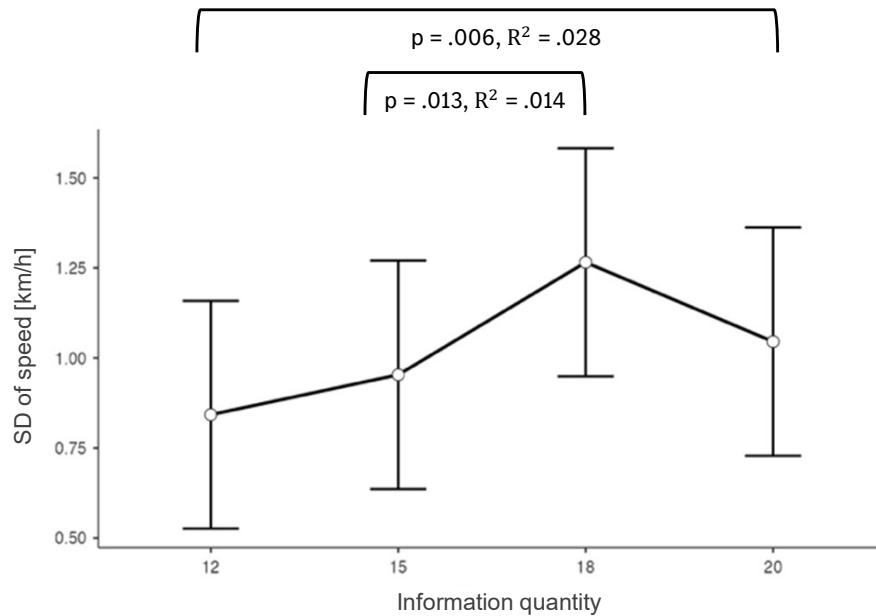
→ Slightly more stable tracking in grid layout than in scroll layout

Quantity Effect (for both Layouts)



SD of speed:

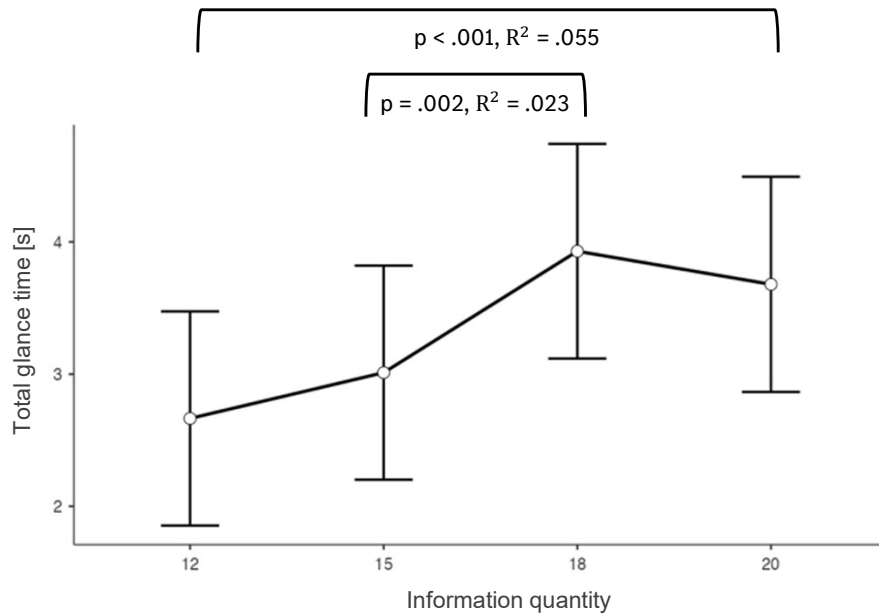
SD of distance to leading vehicle:



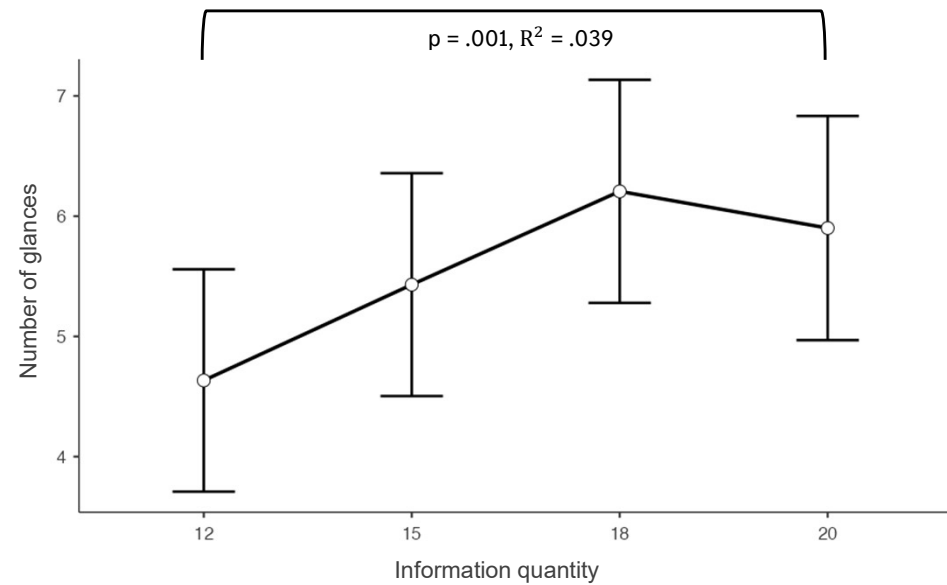
Quantity Effect (for both Layouts)



Total glance time:



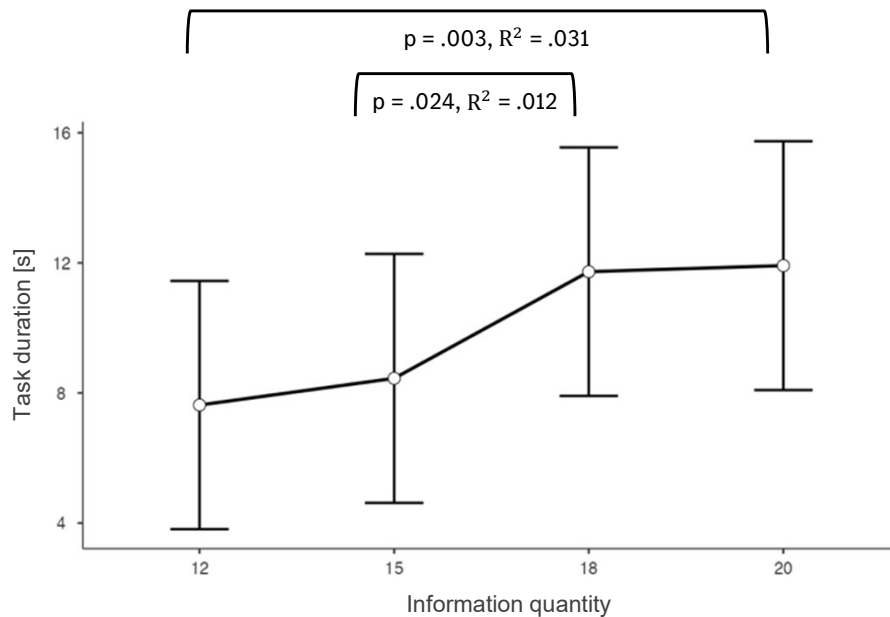
Number of glances:



Quantity Effect (for both Layouts)



Task Duration:

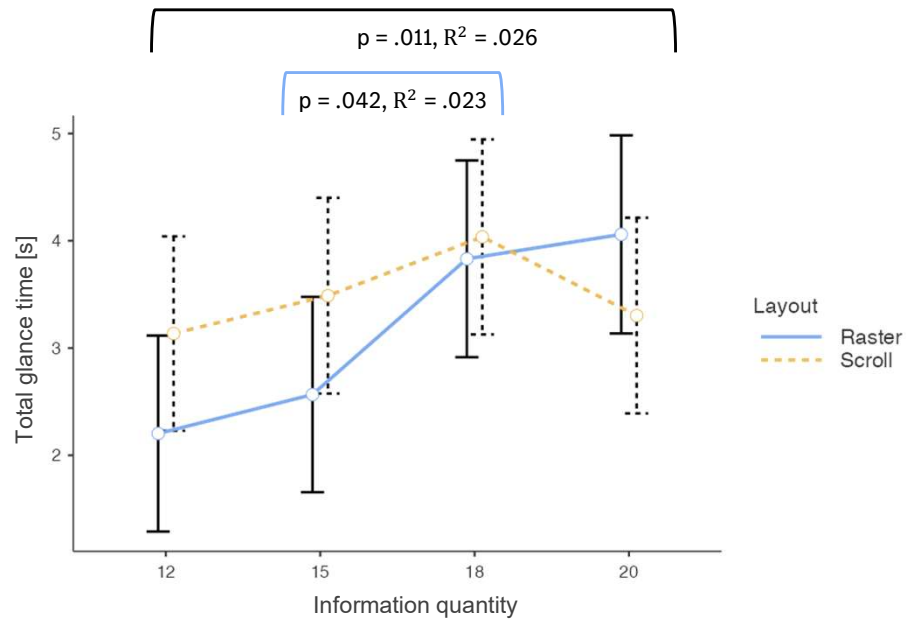


- Significant quantity effects between 15 and 18 items
- Presumption of additional view from 18 items
- No linear effect
- Additional investigation necessary for even higher quantities of information

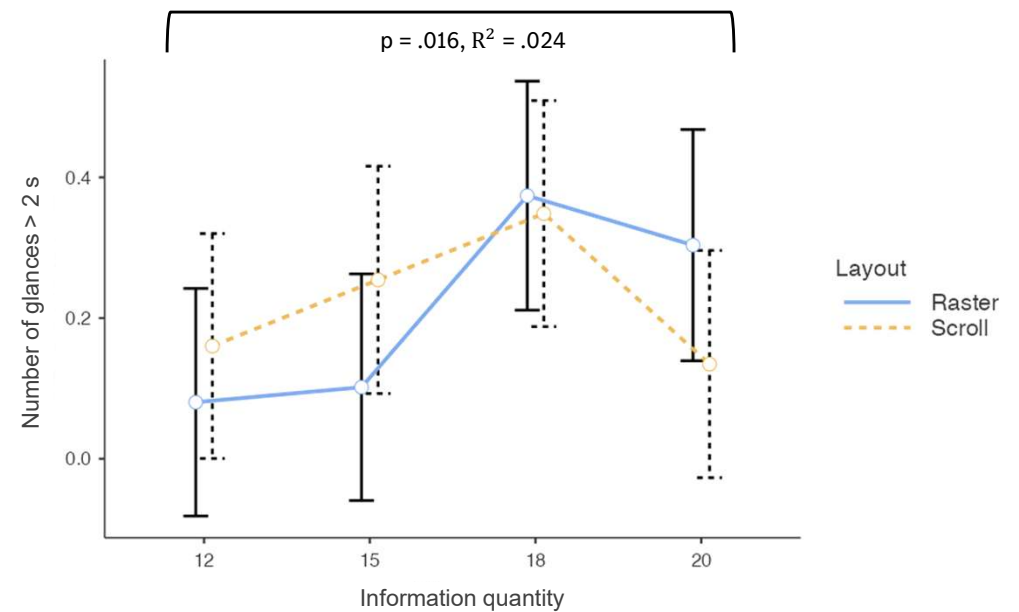
Interaction Effect



Total glance time:



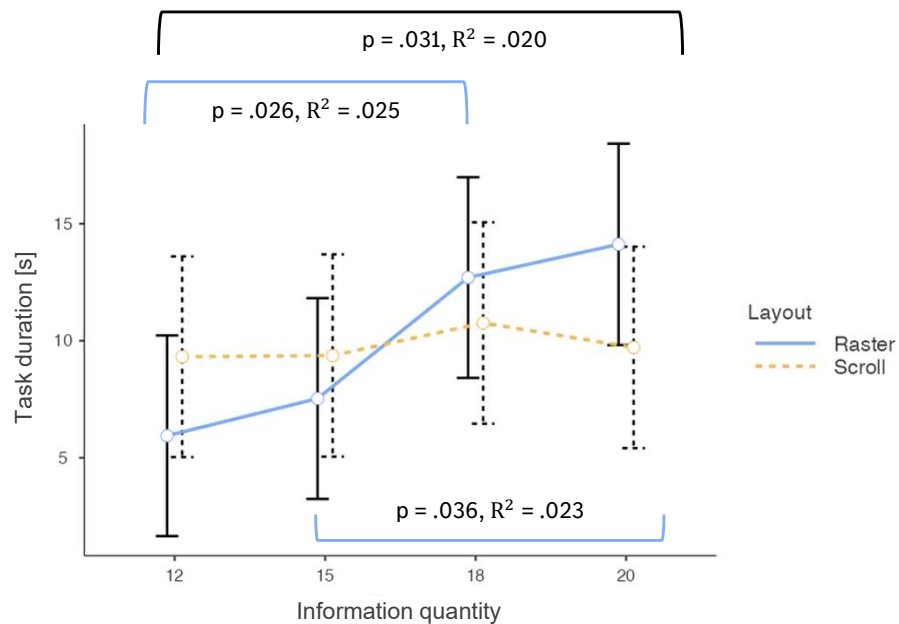
Number of glances > 2 s:



Interaction Effect



Task Duration:



- Significant interaction effects between 15 and 18 items

→ Amount of information has a stronger influence in grid layout

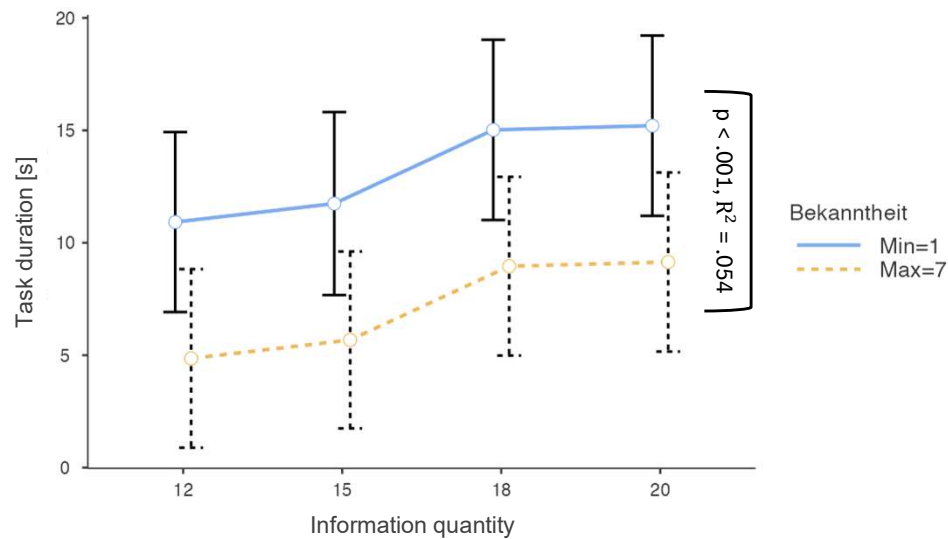
→ Above 15 items: scroll layout more efficient than grid layout

Exploratory findings



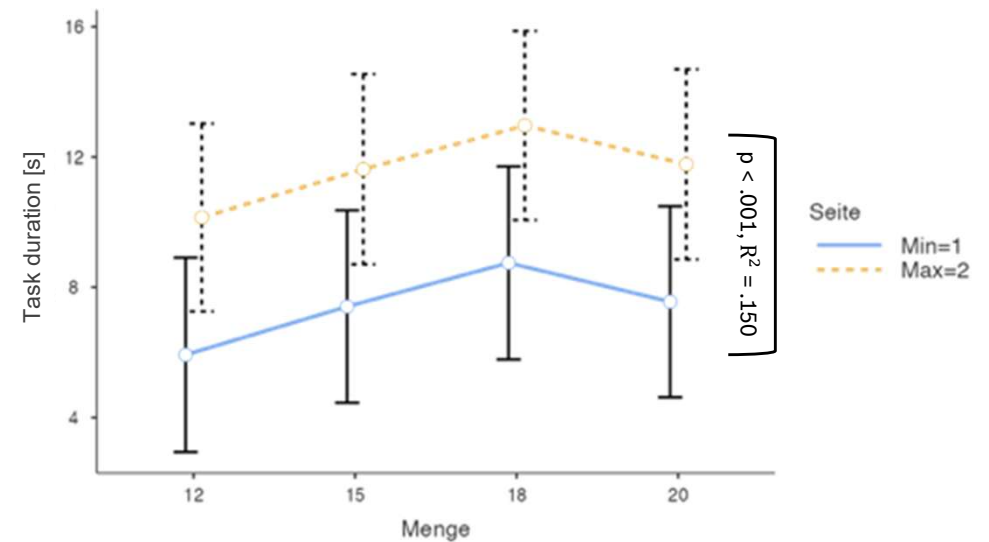
Familiarity Effect

Task duration:



Scroll/ Page Effect

Task duration:



SCOPE OF THE FINDINGS

Summary

Results	Recommendations
More stable vehicle control (SDLP) with grid layout than with scroll layout.	For up to 15 items use grid layout instead of scroll layout.
5 dependent variables increase with increasing amounts of information, especially between 15 and 18 items.	Use as few items as possible .
Interaction effects on task duration, total viewing time, and number of views > 2 s.	For more than 15 items use a scroll layout instead of a grid layout.
For more than 15 items: Scroll layout has a shorter task duration than the grid layout.	
Recognition and location affect search efficiency.	Use personalization and familiar visual items , place frequently used items on the first page .

THANK YOU!

**Do you have any
questions?**



Isabel Mötsch

University of Media Stuttgart
isabel.moetsch@web.de



Natalia Sevcenko

Mercedes-Benz AG
natalia.sevcenko@mercedes-benz.com

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