

Dynamic Advertising on Vehicles: Effects on Driver Glance Behaviour



Background



- Public spaces full of potential costumers
- Advances in digitalization & lighting technology
- Social developments
- Economic pressure

Why not use vehicles for
(digital and moving)
advertising as well?

Effects of Roadside Advertising on Driving Behavior

- Presence of stationary billboards correlates with **crash risk**
(Wallace, 2003; Gitelman et al., 2019; Oviedo-Trespalacios et al., 2019)
- Simulator studies:
 - **Higher SDLP with dynamic advertising** than with static advertising
(Chattington et al., 2009)
 - higher speeds & **more complex ads** exacerbate **deviations from lane position**
(e.g., Schieber et al., 2014)
 - **no significant effects on longitudinal control** or signaling behaviors
(Young & Mahfoud, 2007)

Roadside Advertisings vs. Advertising on Vehicles

Roadside Advertising

Brief Exposure

Designed to capture attention

Requires gaze shifting



Advertising on Vehicles

Prolonged Exposure

Designed to capture & hold attention

Competing for attention with vehicle in front

Visual Attention Allocation: SEEV-Model (Wickens & Horrey, 2008)



Research Question

How do two central characteristics of vehicle-mounted advertising, namely

- *the temporal variability of the content (static, alternating, dynamic), and*
- *the relevance of the displayed information (relevant, irrelevant)*

affect driver (performance and) gaze behaviour?

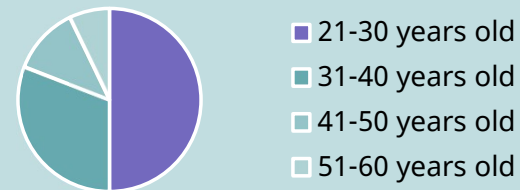
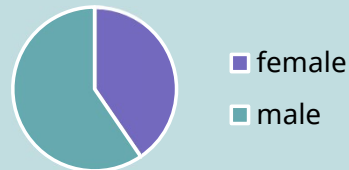


Setup & Participants

- Fixed-base driving simulator
- Mock-up: Ford Transit, automatic transmission, monitors for rear view and side mirrors, seatbelt tension system
- SILAB driving simulation software (Würzburg Institute for Traffic Sciences [WIVW])

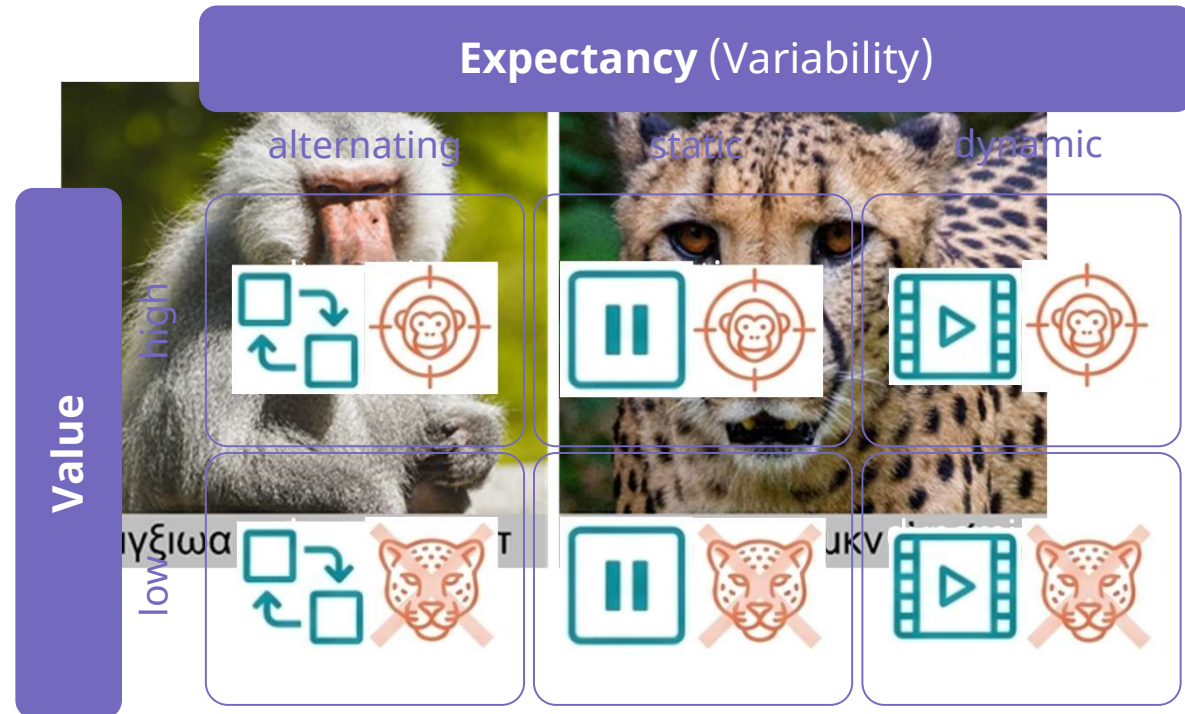


Participants
N = 42 (36)



Manipulation of the “Advertisements”

- **Value induced by instruction** (suggesting a test on the depicted monkeys after the simulation)
- **Expectancy** of new information:
 - static vs. alternating images (**change**)
 - static images vs. dynamic videos (**motion**)
- (**Greek letters** added since ads usually contain text as well)



Scenario Groups & Outcome Variables

- **Three scenario groups:**

- 1) Highway following
- 2) (Highway overtaking)
- 3) Urban following

- **Within-subjects design:** 18 trials

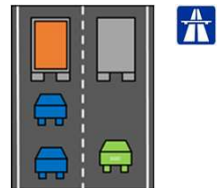
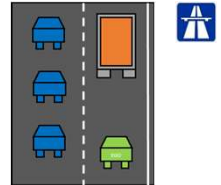
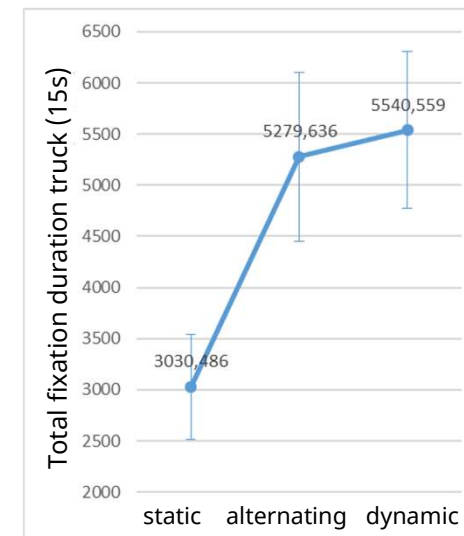
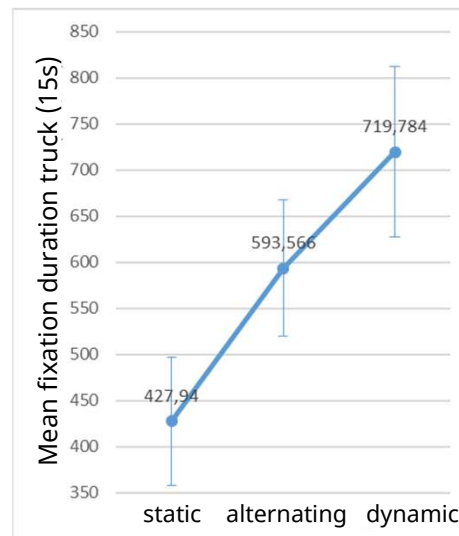
- **Outcome variables (gaze behaviour) – 6s & 15s windows:**

- Number of fixations & mean duration of fixations overall
- Number, mean duration and total duration of fixations towards the truck



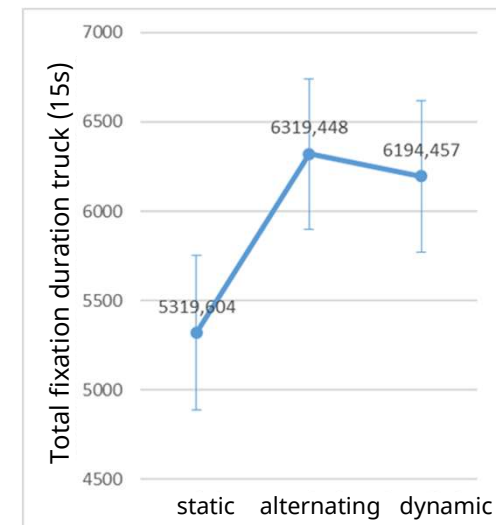
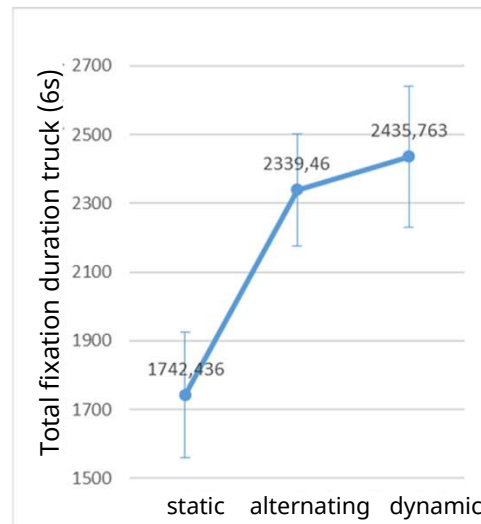
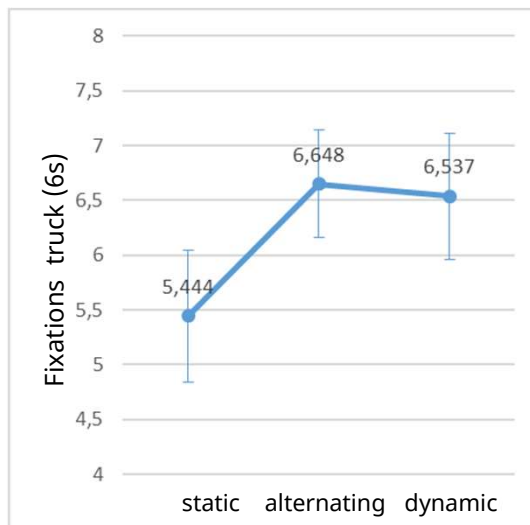
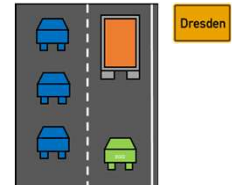
Results

- Standard highway following scenario – no effects of note for any metric
- „Elephant race“ – one truck overtaking another (slowing everything down)
- Main effects of temporal variability



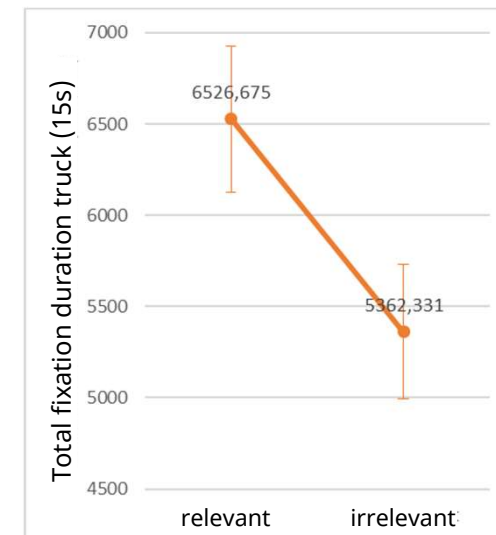
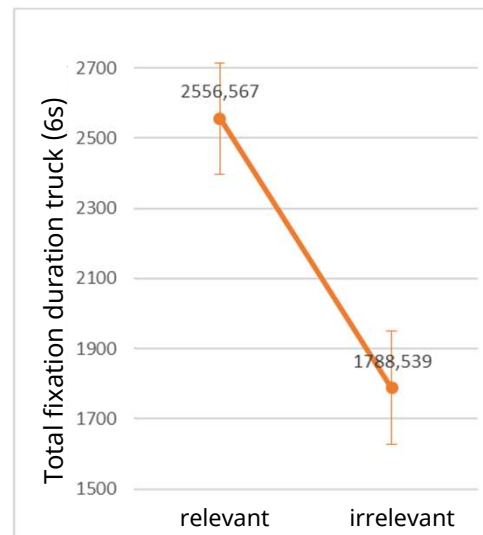
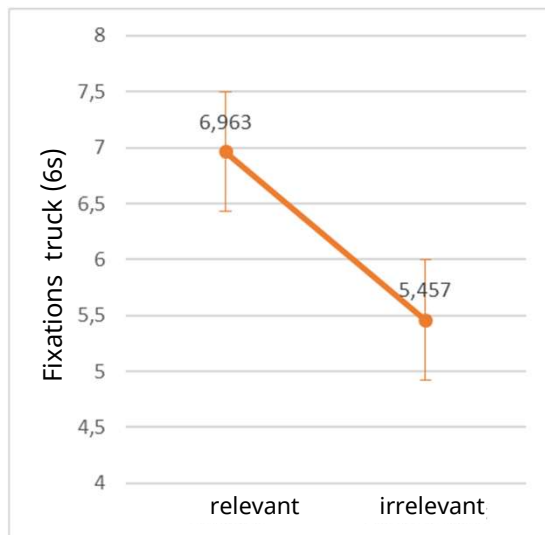
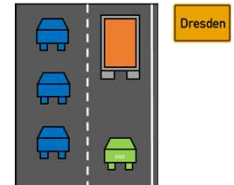
Results

- Urban following scenario:
 - Main effects of temporal variability



Results

- Urban following scenario:
 - Main effects of relevance



Summary / Discussion

- Relevant, visually variable ads have the potential to influence drivers' gaze behavior negatively
- Contextual factors seem to moderate the effects
- However - implications for real-world driving safety remain uncertain
- Analysis and interpretation of gaze data is challenging, when the potential source of distraction is, at the same time, a safety relevant AOI
- Restrictions on dynamic content or minimum display durations could help mitigate potential risks, but defining appropriate regulatory requirements remains challenging (e.g., minimum display duration, display size, placement, suitable content).

Acknowledgements & References

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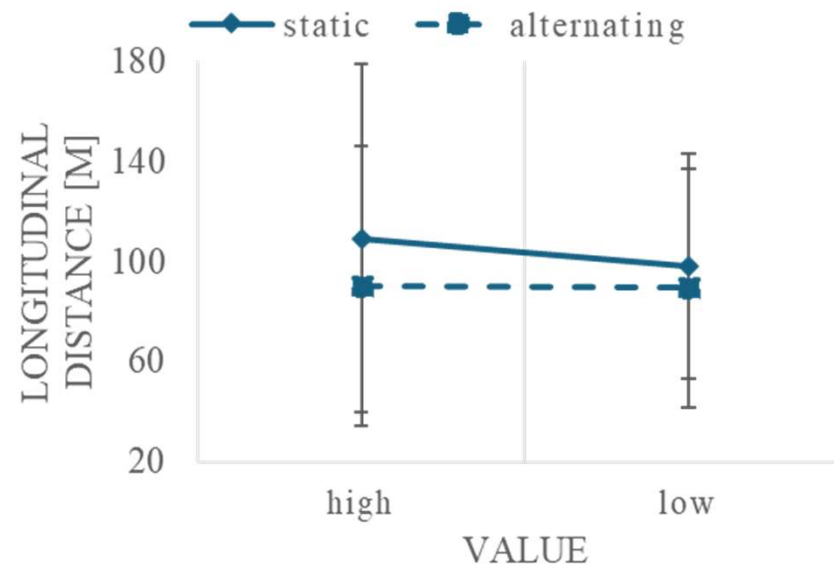
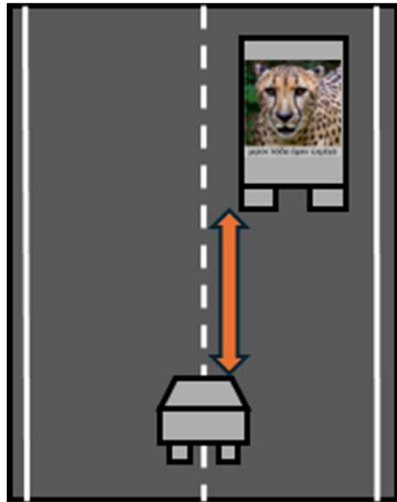
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Thank you for your attention



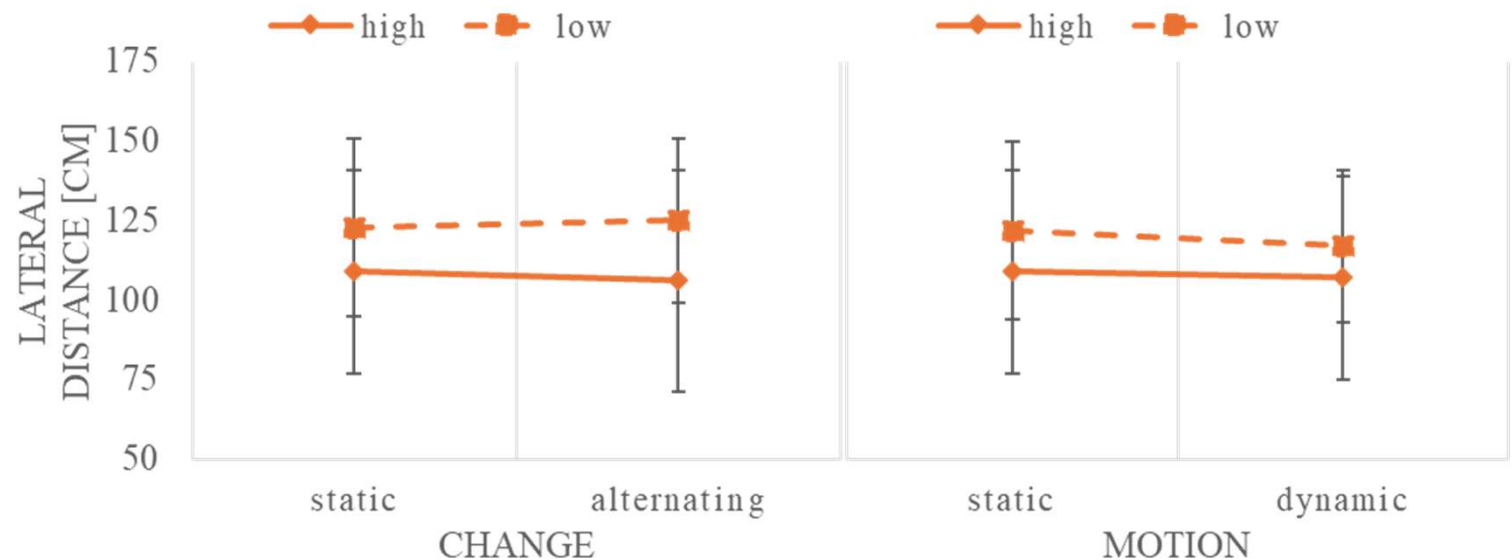
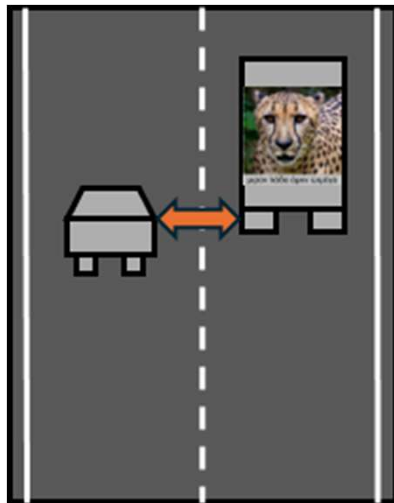
Highway with Overtaking: Risk Factor Alternating Advertising

- **Closer approach before overtaking**, when images **alternated** than when they remained static (mean difference of approx. 14m)



Highway with Overtaking: Risk Factor High-value Advertising

- **Smaller lateral distance** when passing the truck with **high-value** than with low-value stimuli (mean difference of approx. 15cm / 13cm)



Highway & Urban with Following: Mixed Results



- **Smaller longitudinal distance** when the advertisement was **dynamic** than when it was static (mean difference of approx. 5m)
- **Smaller longitudinal distance** when **high-value** than when low-value advertising was depicted (mean difference of approx. 6m)*
- (No significant effects on SDLP)



- **Smaller longitudinal distance** in **dynamic** than in static condition (mean difference of approx. 2m)
- **Higher SDLP** when the advertisements were of **high value** to the participants compared to low value (mean difference of approx. 2cm)*

*main effect observed in only one of the ANOVAs

Discussion & Conclusion

- **High-value, alternating, and dynamic advertisements were associated with smaller safety margins** – but they did not impair all aspects of vehicle control equally across environments
- **Variable displays affected:**
 - **Longitudinal distance before initiating overtaking** (alternating images)
 - Minimum **following distances** in the highway & urban environment (dynamic videos)
- **High-value advertisements affected:**
 - **Lateral distance when passing by** the advertising-bearing truck
 - Longitudinal distances & lane-keeping (SDLP) **depending on variability**