

Seeing Through Occlusion: Validation of the Occlusion Test Protocol for IVIS Interactions

Rachael Wynne, Rita Dixon
Discipline of Psychological Sciences
The University of Newcastle



Background

NHTSA Occlusion Test Protocol

- ☛ Globally accepted tool to understand the impact of visual and cognitive distractions on drivers.
- ☛ Widely used to evaluate influence of IVIS on driver attention and safety (Aust et al., 2018; Domeyer et al., 2014; Perez et al., 2013).
- ☛ According to OTP, an IVIS task should not exceed eight 1.5 second glances, or 12 seconds cumulative (Pournami et al., 2015)
- ☛ Justification for OTP comes from Rockwell (1988) manual radio tuning task
- ☛ Protocol has not been experimentally validated against real-world glance behaviour nor updated for advances in vehicular technology; realignment required (Perez et al., 2013).

Research Aim

- ☛ Validate the OTP and test its efficacy as a tool for measuring driver glance behaviour

Method

$N = 40$ licensed, regular drivers (25 female, 15 male);
 $M_{age} = 35.4$ yrs ($SD = 12.3$).

Seated in a stationary Toyota Hilux, while watching driving video, they completed a series of IVIS tasks based on Strayer et al. (2015) while wearing occlusion goggles (VOG) or eye tracking glasses (“no occlusion”). Each participant completed three of six tasks in pseudo-randomised allocation.

Recorded total shutter open time (VOG) and summed duration of glances on AOIs (eye tracking).

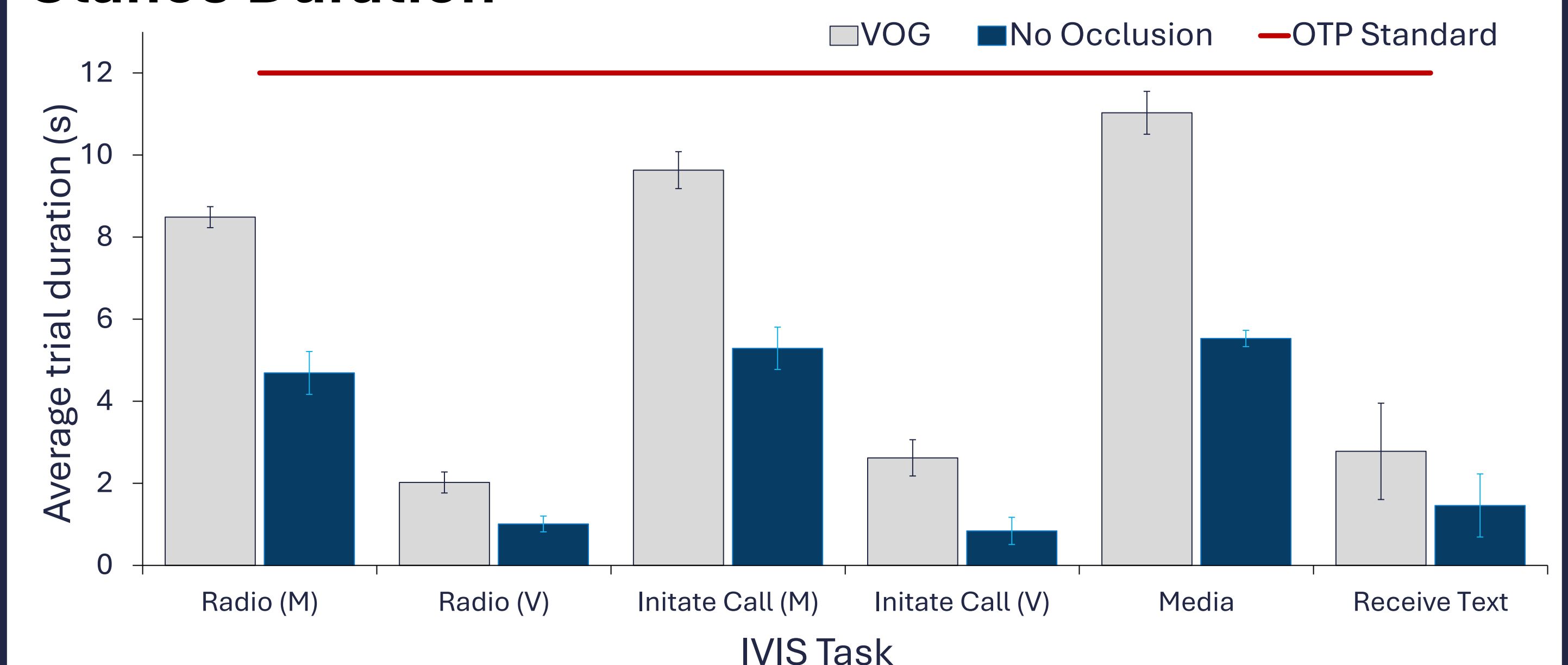


Contact

Rachael.Wynne@newcastle.edu.au

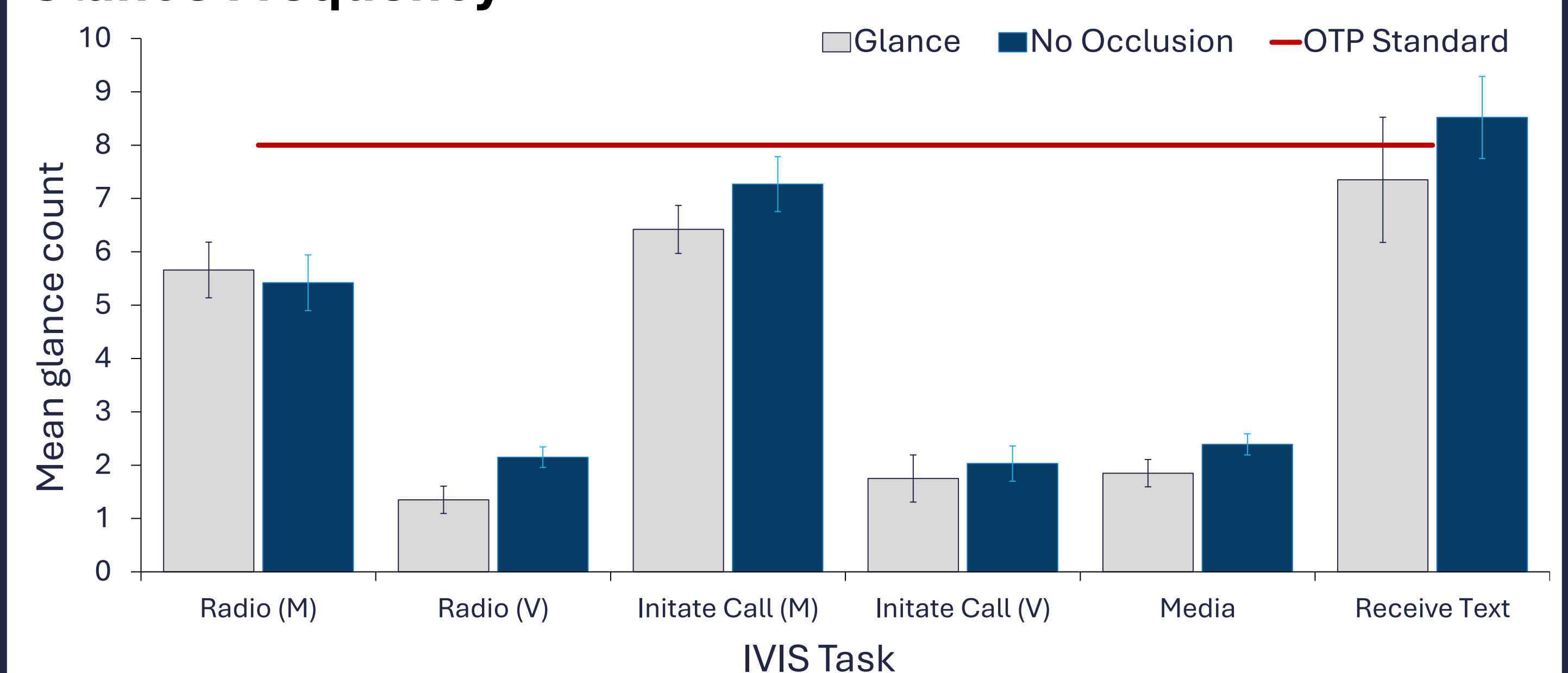
Results

Glance Duration



All durations were significantly lower than the OTP standard, that is not valid ($p < .001$, $BF_{10} > 1,000$), except Media using VOGs ($p = .419$).

Glance Frequency



Significantly fewer glances than OTP standard for all tasks ($p < .001$, $BF_{10} > 1,000$), except Media (VOG $p = .419$; no occlusion $p = .570$).

Conclusions

- ☛ Driver glances occurred less frequently and for shorter durations than anticipated
- ☛ Inability to achieve absolute validity suggests the OTP is not sensitive to current IVIS tasks.
- ☛ Visual distraction is only one element of driver distraction, must consider cognitive distraction of secondary tasks.
- ☛ Results emphasise need for task-specific regulations rather than universal standard.

References

- Aust, M. L., Broström, R., & Lindvall, S. (2018). Assessing in-vehicle secondary tasks with the NHTSA visual-manual guidelines occlusion method. In N. A. Stanton (Ed.), *Advances in Human Aspects of Transportation* (pp. 373–382). Springer International Publishing.
- Domeyer, J., Diptiman, T., & Hamada, H. (2014). Using occlusion to measure the effects of the NHTSA participant criteria on driver distraction testing. *Transportation Research Part F: Traffic Psychology and Behaviour*, 58(1), 2205–2209.
- NHTSA. (2014). Visual-manual NHTSA driver distraction guidelines for in-vehicle electronic devices..
- Perez, M. A., Hulse, M. C., & Angell, L. (2013). *Support for NHTSA visual-manual guidelines: Expert review of the visual occlusion method and how it compares to driver eye-glance behavior*. Report number DOT HS 811 763 National Highway Traffic Safety Administration.
- Pournami, S., Large, D. R., Burnett, G., & Harvey, C. (2015). Comparing the NHTSA and ISO occlusion test protocols: How many participants are sufficient? *Proceedings of the 7th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*, 110–116.
- Rockwell, T. H. (1988). Spare visual capacity in driving-revisited: New empirical results for an old idea. In *Vision in vehicles II. second international conference on vision in vehicles* (pp. 317–324). Elsevier Science Publishers B.V. (North-Holland)
- Strayer, D. L., Turrill, J., Cooper, J. M., Coleman, J. R., Medeiros-Ward, N., & Biondi, F. (2015). Assessing cognitive distraction in the automobile. *Human Factors*, 57(8), 1300–1324.

