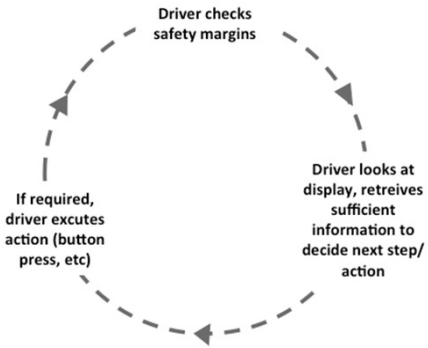
WHAT DRIVES OFF-ROAD GLANCE DURATIONS DURING MULTITASKING

– CAPACITY, PRACTICE OR STRATEGY –



Robert Broström, Mikael Ljung Aust,
Volvo Car Corporation, Sweden

Linnea Wahlberg, Laban Källgren
Swedish National Road and Transport Research Institute, Sweden

BACKGROUND

- Knowledge about visual distraction is important when designing in-vehicle tasks
- Glance requirements and testing procedures in place since many years. Increased impact since 100-car results 2006
- NHTSA released visual-manual driver distraction guidelines 2012
- Parts of the proposed test procedure and the proposed metrics are problematic for car manufacturers
- Previous research have found high prevalence of long glancers independent of task complexity/task design

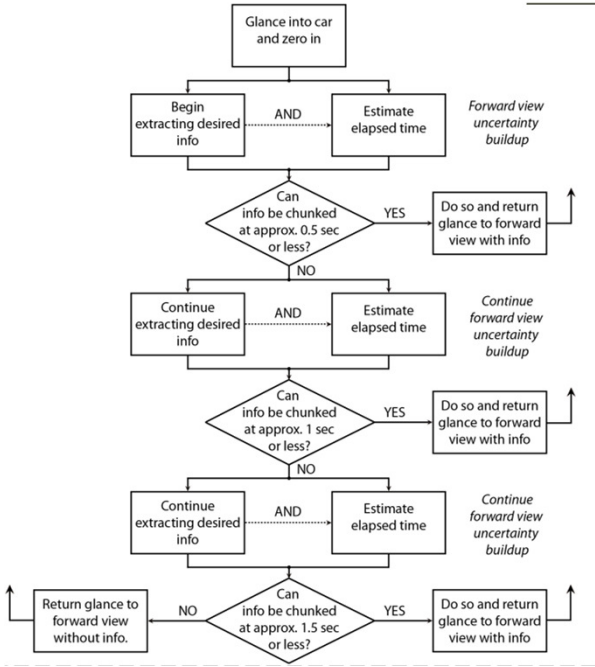


Figure 1. Model of visual sampling for in-vehicle task performance, Wierwille (1993).

PURPOSE

1. Corroborate previous open road findings (Ljung et al, 2013) on glance length variability, i.e prevalence of “long glancers”
2. Investigate possible reasons for the existence of long glancers
    - Capacity
    - Practice
    - Strategy

METHOD/ANALYSIS

High fidelity car simulator

- Highway driving with traffic
- Smart Eye Pro 5.9
- tasks on 9.7 inch tablet

16 randomly recruited participants

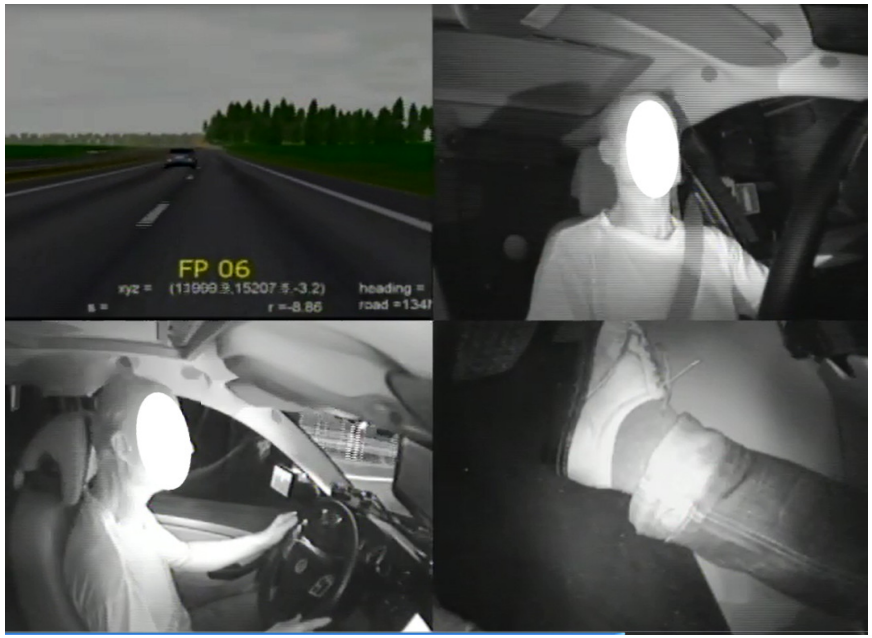
- M = 36, SD = 8.6, nine men and seven women. Minimum driving license 5 years.

Radio, phone and sound settings tasks with three repetitions for each task

- 3 * 3 mixed ANOVA with *Task type* as between subjects factor and *Repetition* as within-subjects factor

Post drive trail-making test (TMT) on 23 inch touch screen

- two-tailed Pearson correlation between the mean response times in each round of the trail-making test and 85th percentile off-road glance durations



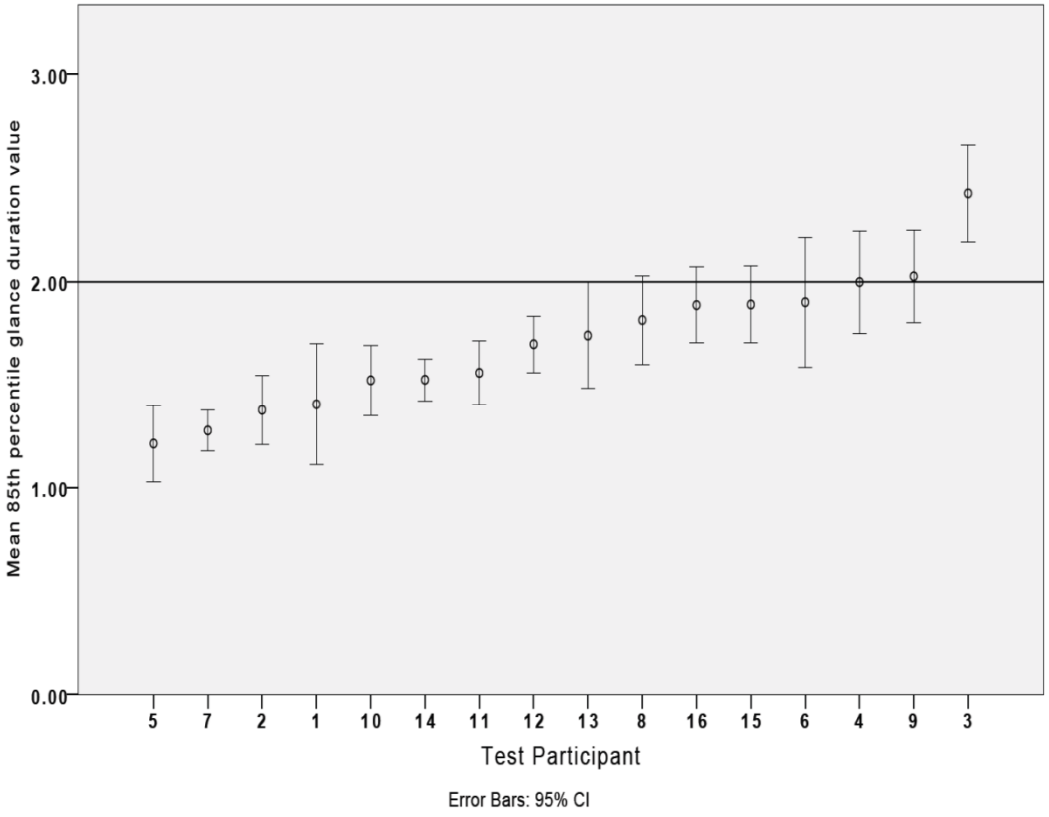
RESULTS AND DISCUSSION (-LONG GLANCERS-)

Table. 85th percentile off-road glance duration values for each participant, task and repetition. Participants are ordered by mean value. Values exceeding 2.0 seconds are highlighted.

TP	Radio 1	Phone 1	Settings 1	Radio 2	Phone 2	Settings 2	Radio 3	Phone 3	Settings 3	Mean
5	0,88	1,48	1,50	0,93	1,50	1,10	1,15	1,28	1,13	1,21
7	1,10	1,45	1,30	1,33	1,40	1,23	1,08	1,35	1,28	1,28
2	1,18	1,80	1,43	1,43	1,48	1,28	1,03	1,33	1,48	1,38
1	1,63	1,65	1,20	0,68	2,00	1,58	1,28	1,53	1,13	1,41
10	1,23	1,65	1,53	1,48	1,98	1,53	1,28	1,63	1,43	1,52
14	1,50	1,68	1,43	1,43	1,60	1,33	1,50	1,75	1,53	1,53
11	1,25	1,73	1,83	1,65	1,43	1,50	1,45	1,40	1,80	1,56
12	1,48	1,83	1,95	1,63	1,65	1,63	1,63	1,98	1,53	1,70
13	1,43	2,48	1,73	1,80	1,78	1,70	1,25	1,83	1,68	1,74
8	1,45	1,43	1,90	2,08	2,10	1,60	1,83	1,78	2,18	1,81
16	1,70	2,08	2,13	1,50	2,08	2,18	1,83	1,65	1,85	1,89
15	2,25	2,18	2,00	1,93	1,93	1,45	1,75	1,75	1,78	1,89
6	1,85	1,75	1,83	1,63	2,10	2,40	1,58	2,63	1,35	1,90
4	1,80	2,55	2,53	2,00	2,00	1,80	1,80	1,80	1,70	2,00
9	1,75	2,30	2,00	1,88	2,48	2,05	1,50	2,13	2,15	2,03
3	2,25	2,65	2,43	2,30	2,30	2,70	2,90	1,85	2,45	2,43

- "Long glancers" present and these will affect Compliance in NHTSA test
- No main effect of task type, i.e. no significant difference in long glancing between tasks

RESULTS AND DISCUSSION -STRATEGY-

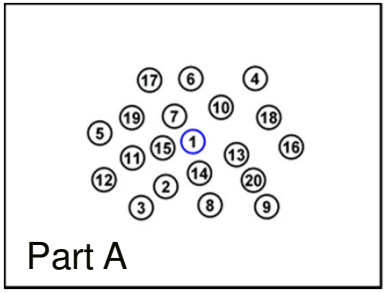


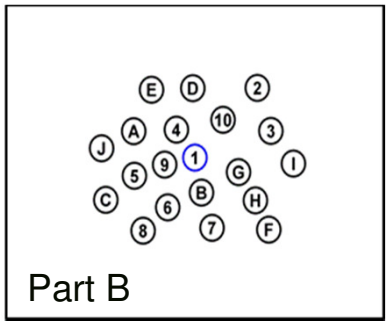
- Larger between subjects variability than within subjects variability (no main effect for task) suggest that individual visual attention sharing strategies exists, e.g. in risk taking (Donmez, Boyle and Lee, 2010) or forward view uncertainty buildup (Wierwille, 1993)

One participant carry out many tasks in the very same way while a group of participants carry out the very same task in many different ways

RESULTS AND DISCUSSION -CAPACITY-

Trail-making test

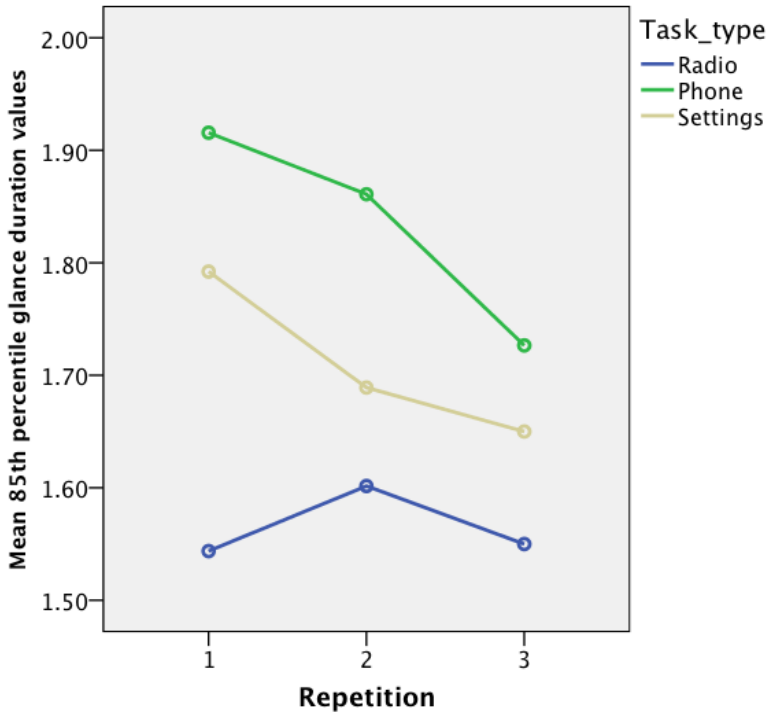




- Wikman and Summala (2005), found correlation between TMT and mean values for off-road glance durations
- In this study no correlation between mean response times of TMT and the 85th percentile off-road glance durations was found

- This show that 85th percentile off-road glances have no correlation with capacity in terms of visual search, motor speed and mental flexibility
- Or this show that TMT is not sensitive to higher percentiles

RESULTS AND DISCUSSION -PRACTICE-



- Nearly significant (p = 0.09) main effect of repetition. Main effect of repetition (F (2,60) = 3.61, p = .033) without radio task

- Practice seem to have greater effect on performance for some tasks
- This could be identified during pilot testing
- Compensation for practice effects could be used for compliance criteria

CONCLUSIONS

- Long glancers are present in random samples
- NHTSA 85th percentile single glance criterion may need reformulation
- Long glancing seems to depend on individual visual attention strategies and practice rather than on individual capacity
- Tasks may fail to meet the proposed 85th percentile glance duration criterion, simply due to normal variability in the driver population rather than to poor HMI design

FURTHER RESEARCH

- Method to identify and control for long glancers in compliance testing
- Investigate driving safety effects of “long glancers”
- Participant sampling. E.g. could the same participants be used in several tests through the development process instead of using random sampling
- Develop a compensation to NHTSA compliance criteria based on real life practice effects

THANK YOU FOR YOUR ATTENTION

WHAT DRIVES OFF-ROAD GLANCE DURATIONS DURING MULTITASKING

- CAPACITY, PRACTICE OR STRATEGY -

Robert Broström, Mikael Ljung Aust,
Volvo Car Corporation, Sweden

Linnea Wahlberg, Laban Källgren
Swedish National Road and Transport Research Institute, Sweden