

UMTRI Technical Report 99-37
 Omer Tsimhoni, Herbert Yoo,
 and Paul Green

University of Michigan
 Transportation Research Institute
 Ann Arbor, Michigan, USA

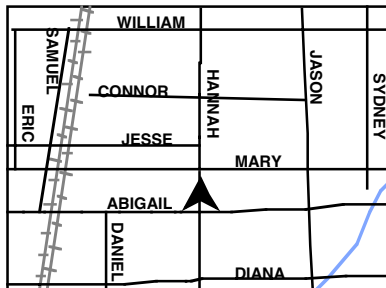
1 ISSUES

1. How does *task context (driving versus stationary)* affect driver performance and behavior for a display-intensive in-vehicle task?
2. How does *driving workload* affect driver performance and behavior for the in-vehicle task?
3. How do *age and gender* affect the above?
4. How does the *method employed, the voluntary occlusion technique*, affect driving performance and is it predictive of glance behavior while performing the in-vehicle display?
5. How does *intermittent occlusion of the road-scene* affect performance of the in-vehicle task?

2 TEST PLAN

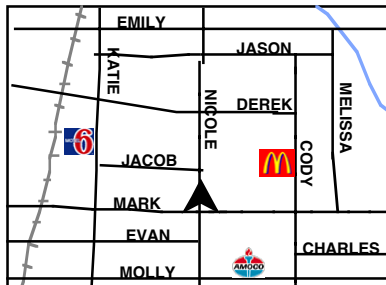
Maps & questions

SHORT TASK



What street are you on?

MEDIUM TASK



What street is the fast food restaurant on?

LONG TASK



What street intersects with VANESSA at a gas station?

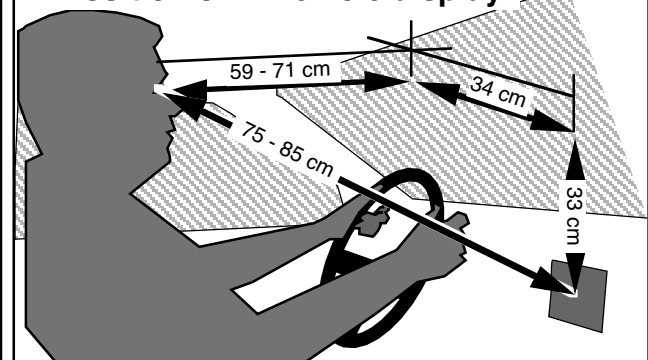
Task: drive simulator on roads with long curves while providing answers to questions about maps (3 levels of task complexity / response duration)

Subjects

	Female	Male
Young (21-30)	4	4
Old (over 65)	4	4

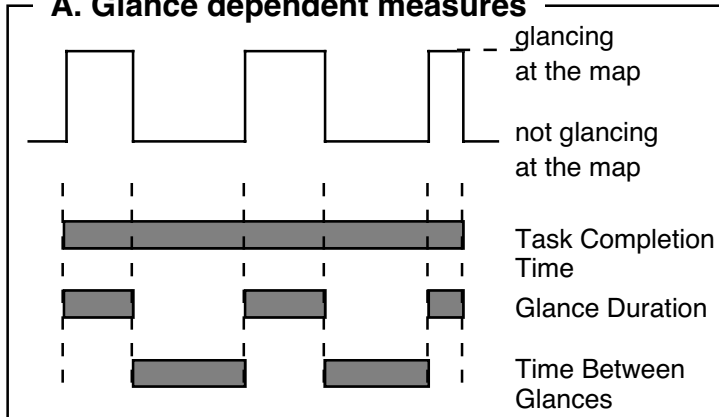


Position of in-vehicle display



3 RESULTS

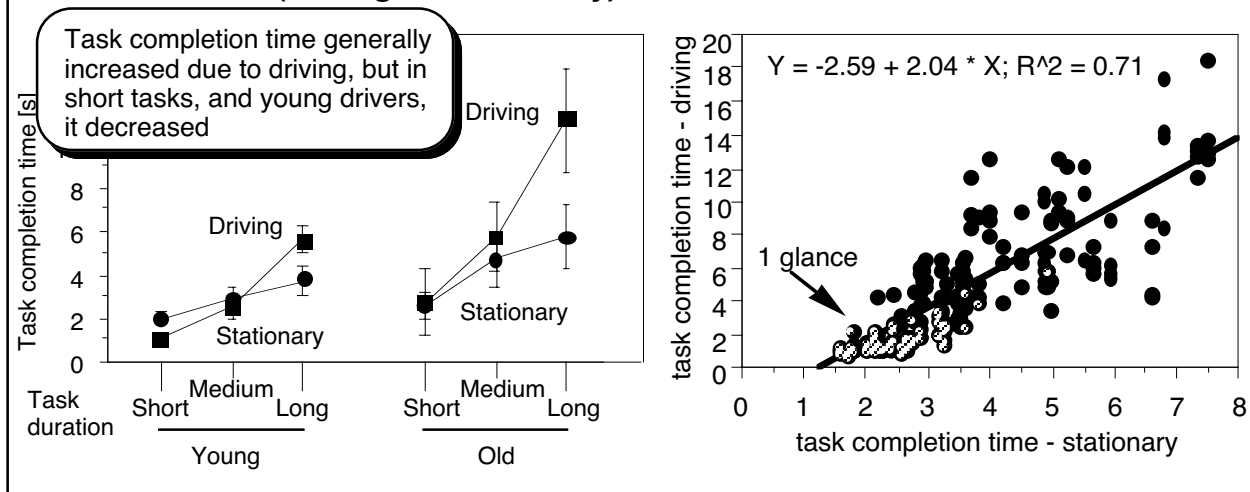
A. Glance dependent measures



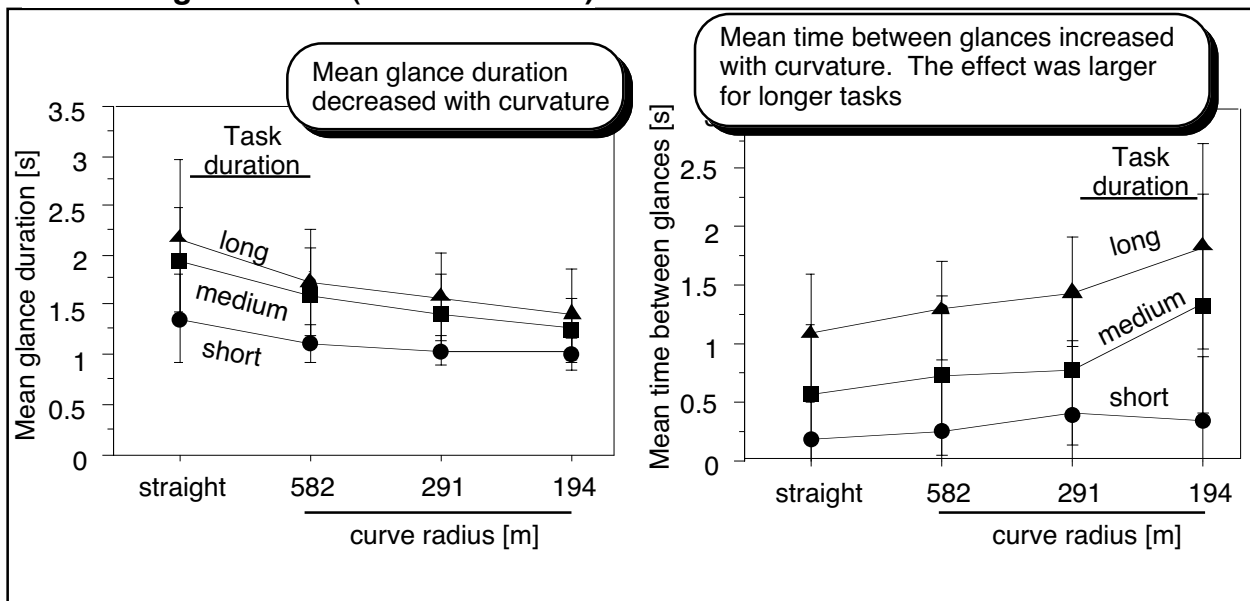
B. The effect of age and gender

Task completion time		Female	Male
Young		3.2±2.2	2.9±2.1
Old		6.1±3.8	7.1±4.5
Mean glance duration		Female	Male
Young		1.3±0.3	1.7±0.6
Old		1.4±0.4	1.5±0.6

C. Task context (driving vs. stationary)

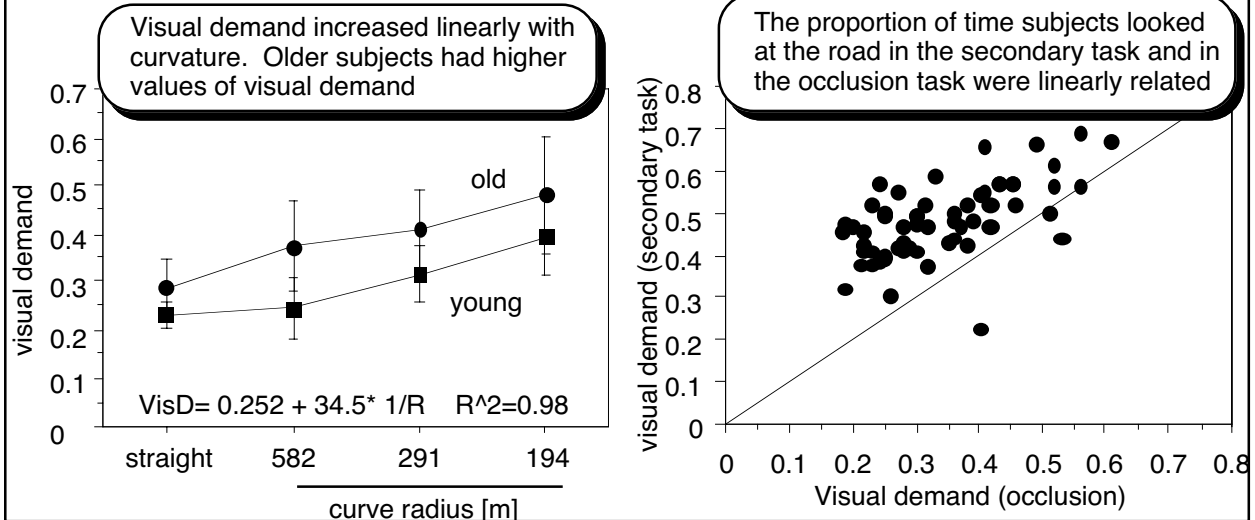


D. Driving workload (road curvature)

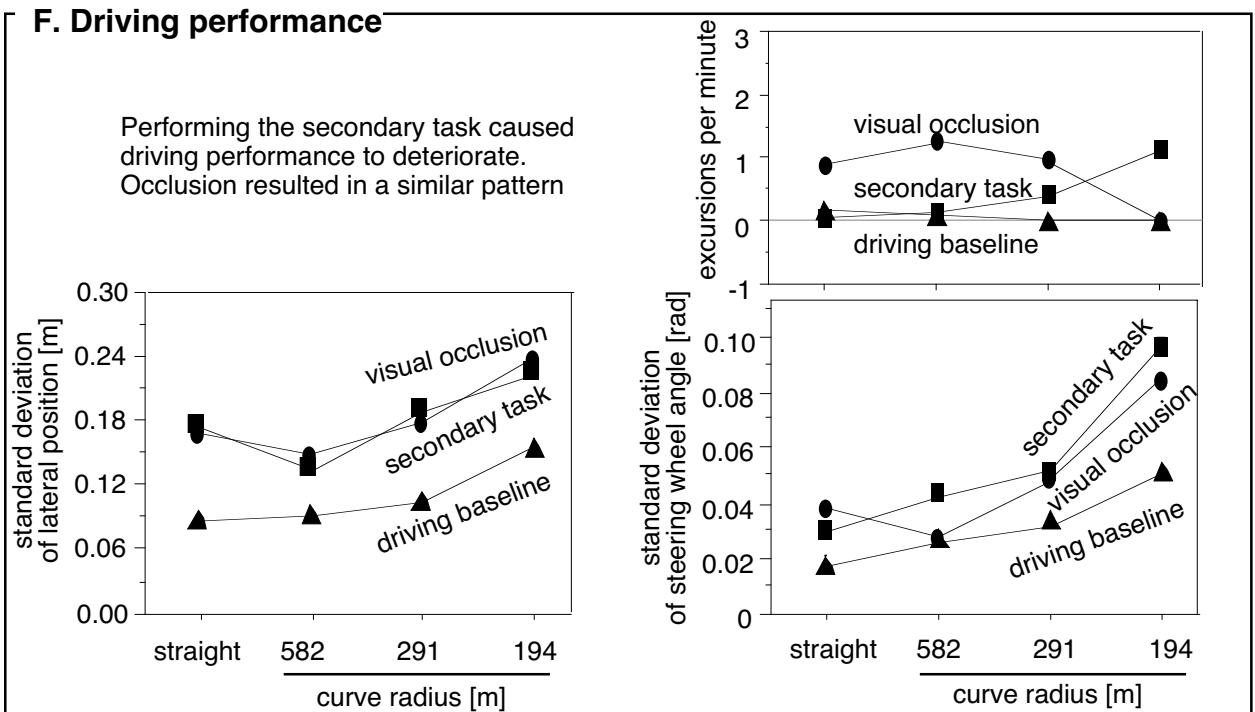


3 RESULTS (CONT.)

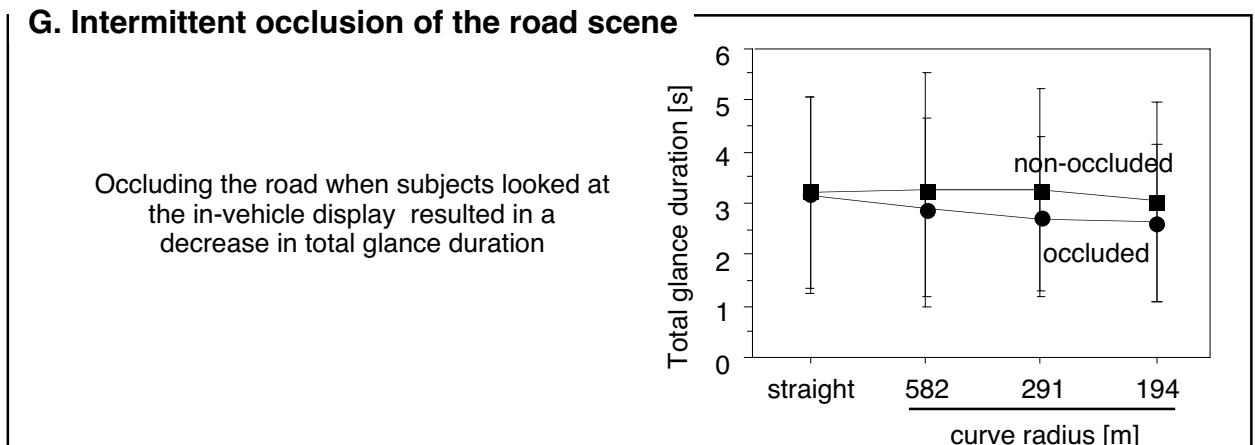
E. Voluntary occlusion



F. Driving performance

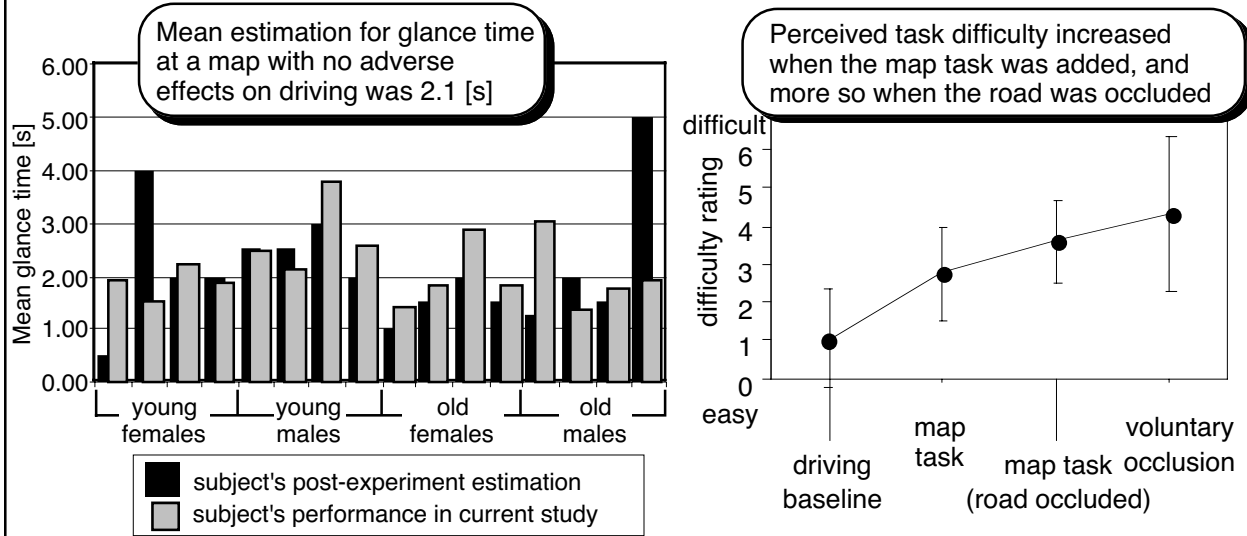


G. Intermittent occlusion of the road scene



3 RESULTS (CONT.)

H. Subjective ratings



4 CONCLUSIONS

Task context (driving versus stationary)

- Task completion time Increased when performed while driving (but decreased for short tasks)
- Total glance duration remained constant (but decreased for short tasks)

Driving workload (road curvature)

- Task completion time did not change significantly as a function of road curvature
- Mean glance duration decreased and the number of glances increased in sharper curves
- Driving performance declined as curve became sharper

Age and gender

- Older drivers made more glances, their mean time between glances were longer and their task completion times were longer
- The mean glance duration did not vary as a function of age
- Older drivers' driving performance was worse

Voluntary occlusion

- Visual demand, as measured in the visual occlusion technique, predicted glance behavior while performing the in-vehicle task
- The decline in driving performance with occlusion was similar to the decline with the in-vehicle task

Intermittent occlusion of the road scene

- Occluding the road whenever subjects looked at the in-vehicle display resulted in shorter glances
- Task completion time did not change
- Subjects chose to make more efficient glances as a result of the the lack in peripheral input