AGE DIFFERENCES IN DRIVING-SPECIFIC TESTS OF EXECUTIVE FUNCTION

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Summary

Background. The present study examined age differences in executive function as measured by novel driving-specific tests of executive function using a novel driving simulator. Developmental changes in executive function have been implicated as possible contributing factors to elevated crash statistics for both older adult (over age 65) and adolescent (between age 15 and 20) populations, however for different reasons. Poorer older adult driving performance has been attributed to age-related cognitive decline in executive function mediated by age-related frontal-lobe atrophy and neural disconnection. Immature executive function has been implicated in poorer adolescent driving performance and is thought to be expressed in situations where the developmentally high sensitivity of the socio-emotional reward system outcompetes the regulatory influence of the under developed executive system.

Methods. Using a new, high fidelity, virtual reality driving simulator, we created driving-specific tests to assess executive function. These operational tests employed driving-relevant stimuli, with driving-relevant challenges, that required driving-relevant responses, in a driving-relevant context. Fifteen older adult and 20 adolescent drivers completed these driving-specific executive function tests. We hypothesized that poorer older adult driving performance would be reflected on these driving specific tests of executive function due to general cognitive decline and that, given the absence of social-emotional reward, adolescents would outperform older adults. Analyses of both bivariate correlations and group comparisons generally supported these predictions.

Objectives

The present study aimed to:

- Examine relationships between age and performance on new driving-specific tests of executive function in a new virtual reality driving simulator
- Examine age differences in performance on these tests using two high risk groups of drivers – older adults and adolescents

We predicted:

- Age would be negatively associated with driving-specific executive function abilities
- Age would be positively associated with driving-specific executive function errors
- Older adults would make more errors due to age-related declines in executive function.

Participants

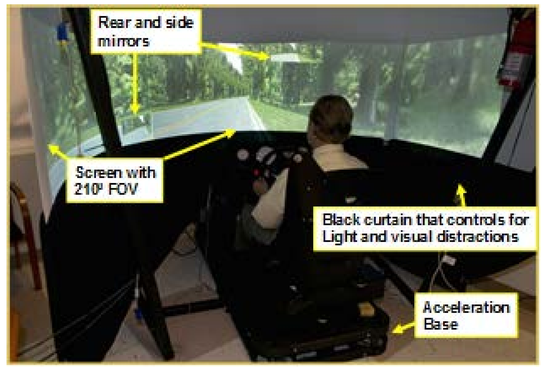
Group	Mean Age	Mean Education	% Female	% Caucasian
Teen (20)	16	10 years	53	65
Old (15)	75	17 years	40	100

Apparatus

Novel Driving Simulator

- 210° field of view
- Side and rear view mirrors.
- Automatic and manual transmission
- Seatbelt, dashboard, steering wheel, turn signal, gas and brake controls
- Doppler sound presentation of engine, tire and traffic noises.
- Steering forced feedback simulated road texture and tire friction.

Apparatus Continued



Design

Correlational and Quasi-experimental

- IV: Age
- DVs: Driving-specific Executive Function
  1 – Percent braking inhibition errors
  2 – Percent steering inhibition errors
  3 – Response inhibition divided attention errors (hitting potholes)
  4 – Driving-specific working memory

Procedure

Response Contingency Training (Dual Processing)

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Response Inhibition Test

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Working Memory Test

Results

Older adults had:

- Lower driving working memory capacity
- Higher response inhibition divided attention errors (hit more potholes during response inhibition and working memory tests)

Results Continued

Bivariate correlations between age and dependent driving variables

Measure	1	2	3	4	5	6	7
1. Age	–						
2. Response inhibition braking inhibition errors	.29	–					
3. Response inhibition steering inhibition errors	.10	-.03	–				
4. Response inhibition divided attention errors	.64*	0.18	-.22	–			
5. Working memory braking inhibition errors	-.02	.36*	.09	-.28	–		
6. Working memory steering inhibition errors	.14	.25	.32	-.11	.19	–	
7. Working memory divided attention errors	.62*	.14	-.19	.77*	-.12	-.24	–
8. Driving working memory capacity	-.59*	-.21	.13	-.44*	.01	-.09	-.48*

Note. *indicates significance (p<.05) two-tailed

Conclusion

- Both groups were able to inhibit a previously learned driving-relevant response; however, older adults hit more dangerous deep potholes than adolescents.
- Results shed light on age differences in driving-specific executive function and support the validity of the Model T3 Driving Simulator's executive function tests.
- Future research examining driving-specific executive function in adolescent drivers alone vs. in the presence of peers could help to support the simulator's utility in assessing the impact of immature executive function in teen drivers.

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