Naturalistic Distraction and Driving Safety in Older Drivers

Aksan, N., Dawson, J. D., Emerson, J. L., Yu, L., Uc, E. Y., Anderson, S. W., & Rizzo, M. (2012).
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Seminar: Language Comprehension and Aging
Saarland University

Overview

- Introduction
- Methods and materials
- Results
- Summary
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Background: distracted driving

Ohh! You forgot the traffic sign!

"What did you do yesterday?"

What do you think about who has more fatal crashes: middle-aged or older drivers?

Video

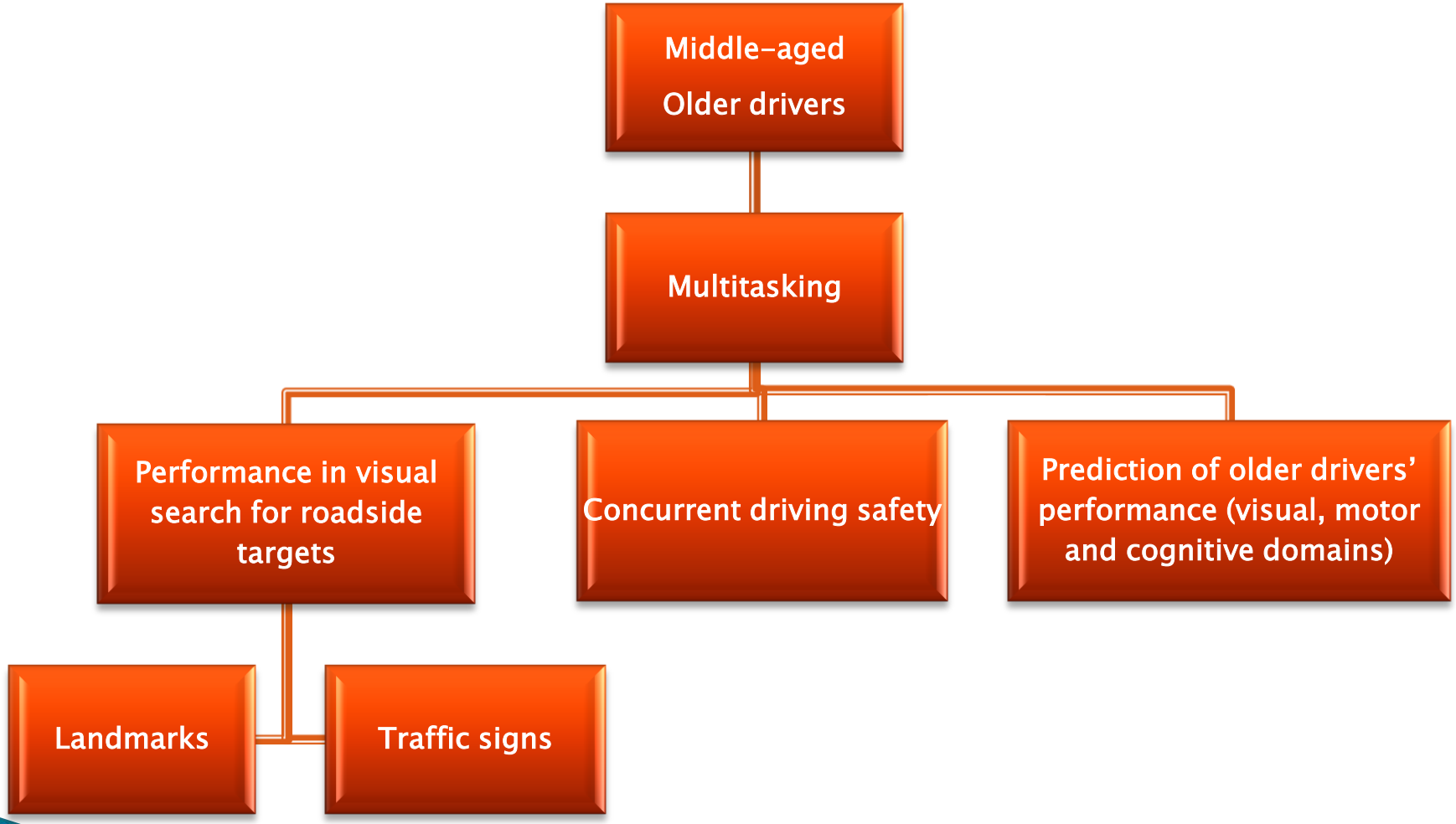
Motivations

- The increase of the percentage of older drivers who are at greater risk for fatal crashes

Question to solve:

- Are there other factors, different as visual acuity, that can influence the driving performance in middle-aged and older drivers during a naturalistic distraction ?

Multitasking: naturalistic distraction



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How the experiment was conducted?

Participants

Older drivers		61 men 59 women 120 in total Ages 65 to 89 years
Middle-aged drivers		38 men 45 women 83 in total Ages 40 to 65 years
Recruited	From local community through public service announcements and advertisements in newspapers, senior centers, and churches.	

How the experiment was conducted?

Landmark and Traffic Sign Identification Test (LTIT)

Instrument	Driving	Experimental performance data	Frecuency and safety errors
-ARGOS (Automobile for Research in Ergonomics and Safety) - Ford Taurus - Multiple road and Challenges	- 45 min - 1.5 miles - Speed :30 – 45 mph - Research assistant	- Verbal question - Traffic sign : 16 - Restaurant:13 - A four-view video	-76 error types - Vehicle speed, acceleration and steering wheel

Off-Road Testing Battery
Neuropsycological tests

- **Information** : demographic, familiarity, driving habits questionnaire(DHQ).

- **Motor**: tests of motor abilities. The Get-Up-and-Go test appears to predict an elderly individual's ability to safely go outside alone.

- **Visual**: the ability to resolve details in low light conditions. Drivers with poor contrast sensitivity (Pelli-Robson chart) may have difficulty seeing low contrast vehicles, particularly at night or in wet weather.

- **Cognitive**: the tests that require visual processing of information: lower-order visual perception (Judgment of Line Orientation) and higher-order visual cognition (Complex Figure Test-Copy).

Executive function refers to abilities necessary for planning and organizing (Trail Making Tests).

For measuring the Verbal memory was used the Auditory-Learning Verbal Test-Recall.

Which are the cognitive abilities require for safe driving?

Processing speed
How quickly a person can comprehend a situation and take the relevant information

Visual Selective Attention
How well a person can select and attend to relevant information

Visual search
The ability to scan a scene for vital information

Executive function
The capacity to use all relevant information to plan a response, and to use higher level thinking strategies

Working memory
The capacity to hold information in mind while processing it (the capacity to 'dual task')

Reaction time
The time it takes to respond to a stimulus (It can be measured in foot or hand)

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Comparisons of Predictor Variables Between Middle-Aged and Older Drivers

Predictor Variable	Middle-Aged Drivers		Older Drivers		p Value
	n	*M* (*SD*)	*n*	*M* (*SD*)	
Demographics					
Age	83	57.28 (6.70)	120	72.52 (5.13)	<.001
Education (years)	83	15.63 (2.31)	120	15.75 (2.72)	.613
Driving characteristics					
Miles per week	83	131.82 (116.42)	120	143.26 (175.26)	.742
Days per week	83	6.08 (1.35)	120	6.01 (1.41)	.725
Familiarity (*yes* and *somewhat*)	82	87.80%	110	73.64%	.018
Basic vision	83	0.35 (0.59)	120	–0.25 (0.79)	<.001
Motor	83	0.36 (0.53)	120	–0.27 (0.78)	<.001
Visual perception	83	0.28 (0.60)	120	–0.19 (0.63)	<.001
Visual cognition	83	0.20 (0.70)	120	–0.14 (0.69)	.002
Verbal memory (AVLT-Recall)	83	11.28 (2.87)	120	9.49 (3.21)	<.001
Executive function	83	0.25 (0.73)	120	–0.17 (0.84)	<.001
Overall cognition (COGSTAT)	83	429.12 (40.87)	120	396.27 (43.66)	<.001

- **Predictor variable:** Demographics, driving characteristics and neuropsychological test
- **Outcome:** Performance in landmark, traffic sign identification and concurrent driver safety errors
- **The older drivers** performed **worse on all domains** of functioning, including basic vision, Motor and cognition, compared with the middle- aged drivers.

Comparison of Landmark and Traffic Sign Identification Test Performance Between Middle- Aged and Older Drivers

	Middle-Aged Drivers		Older Drivers		
Performance Measure	*n*	*M* (*SD*)	*n*	*M* (*SD*)	*p* value
Behavioral measures					
Restaurants identified	83	6.43 (1.94)	118	5.58 (2.05)	.002
Traffic signs identified	83	10.89 (2.38)	118	10.48 (2.85)	.397
Total safety errors	80	1.74 (1.22)	111	2.69 (1.74)	<.001
Electronic Measures					
Average miles per hour	82	23.81 (3.29)	117	22.36 (3.67)	.005
Lateral acceleration	80	0.022 (0.022)	118	0.015 (0.018)	.010
Longitudinal acceleration	80	0.026 (0.017)	118	0.020 (0.015)	.005
Steering (degrees)	80	4.14 (11.07)	118	4.83 (8.52)	.624

- Older drivers identified fewer restaurants – no significant disadvantage with respect to sign identification

- The older drivers drove at lower speeds and had lower average lateral and longitudinal accelerations but the older drivers committed more safety errors.

Proportion of Middle-Aged and Older Participants Making a Specific Safety Error Type at Least Once During Landmark and Traffic Sign Identification Test (LTIT)

	Middle-Aged Drivers		Older Drivers	
Error Type	*n*	Proportion	*n*	Proportion
Lane change	82	40.2	119	50.4
Lane observance	82	15.9	119	36.1
Control of speed	82	0	119	9
Turns	82	53.7	119	62.2
Turn signal	82	12.2	119	25.2

- Most safety errors involved lane changes, lane observance, turns, and turn signals.
- Older adults but not younger adults were observed to show speed control errors and to drive slower than 10 miles below the posted speed limit.

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To Summarize

- **Cognitive aging** is associated with declines in many of the functions necessary for **safely operating** a motor vehicle.

- **Cognitive functioning**, particularly, executive function and visual cognition **predicted** driver **performance** over and above vision, among healthy older adults.

- **Older drivers** identified fewer landmarks, drove slower and **committed** more **safety errors** compared with middle-aged drivers.

- Greater **familiarity** benefited middle-aged but **not older adults'** performance.

Recommendations

- Results have implications for designing on-road tests for older drivers and supporting cognitive testing.
- It is required to find creative ways of implementing and quantifying performance in specific driving tasks in the real world, which are typically tested in simulator studies.
- Development of training programs including competent use of GPS devices to support safe wayfinding by older drivers.

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Discussion

- According to the four cognition domains (visual perception, visual cognition, verbal memory and executive function), which of them do you find more relevant in the case of middle-aged and older drivers for driving safety?
- Do you think that the age should consider as a restriction factor for driving licensing or other factors have to be taken into account?
- Would be convenient to have available special traffic signs and artificial landmarks for older drivers in contrast of the conventional ones?

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