Neurocognitive correlates of driving behavior

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Objective

Driver distraction is a leading cause of motor vehicle accidents. We explored the association of particular neuropsychological measures to driving behaviors with respect to distraction, as potential predictors of driving errors.

Method

Participants

- 105 healthy community-dwelling participants , currently drivers (53 men); mean age=48.51 (SD=16.29; range=22-80)

Procedure

- Participants drove in a simulator under four rural driving conditions:

Traffic	Distractor
Moderate	None
High	None
Moderate	Conversation
High	Conversation

- Driving variables:
  - lateral position of vehicle from the right-side road border (m)
  - average driving speed (km/h)
  - projected average time to collision with vehicle ahead (s)
  - sudden braking & speed violations (# of times for each)
- Neuropsychological measures:
  - processing speed (TMT-A)
  - visuospatial perception (JLO)
  - vigilance (Psychomotor Vigilance Test)
  - visual memory (BVMT)
  - visual working memory (Spatial Addition, NAB Driving Scenes)

Results

Partial correlations (covariate: age) showed associations between:

- vigilance and driving variables in both moderate and high traffic conditions with distraction
- processing speed and driving variables in both high traffic conditions and in the moderate traffic with no distraction condition
- visual working memory and driving variables in both moderate and high traffic conditions with distraction and the moderate traffic no distraction condition
- visuospatial perception and driving in the high traffic distraction condition
- visual memory and driving variables in both moderate traffic conditions

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Table 1. Correlations between neuropsychological measures and driving variables

Driving variable	TMT-A	BVMT	Spatial Addition	JLO	Driving Scenes	Vigilance
Moderate traffic – no distraction						
Lateral position	--	--	--	--	--	--
Average speed	*r*=-.361, *p*=.005					
Proj. time to collision	*r*=.327, *p*=.011	*r*=-.243, *p*=.046	*r*=-.343, *p*=.008	--	--	--
Sudden brake	--	--	--	--	--	--
Speed limit violation	--	--	--	--	--	--
Moderate traffic – distraction						
Lateral position	--	--	*r*=.267, *p*=.032		*r*=-.243, *p*=.046	
Average speed	--	*r*=.249, *p*=.042				*r*=-.245, *p*=.045
Proj. time to collision			*r*=-.282, *p*=.025	*r*=-.310, *p*=.015	*r*=-.253, *p*=.040	
Sudden brake	--	--	--	--	--	--
Speed limit violation	--	--	--	--	--	--
High traffic – no distraction						
Lateral position	--	--	--	--	--	--
Average speed	*r*=-.263, *p*=.034					
Proj. time to collision	--	--	--	--	--	--
Sudden brake	--	--	--	--	--	--
Speed limit violation	*r*=-.255, *p*=.039	--	--	--	--	--
High traffic – distraction						
Lateral position				*r*=-.326, *p*=.011		*r*=.267, *p*=.032
Average speed						
Proj. time to collision						*r*=.240, *p*=.049
Sudden brake	*r*=-.253, *p*=.040		*r*=.305, *p*=.017			
Speed limit violation					r=-.261, p=.035	

Conclusions

Among the driving variables examined, average driving speed was related to several neuropsychological domains (processing speed, vigilance, visual memory) in most driving conditions. Similarly, projected time to collision was associated with several neuropsychological domains (processing speed, vigilance, visual memory and working memory, visual perception) in the moderate traffic condition regardless of distraction. Larger samples are necessary to support the reliability of this pattern, which may then serve as a guide in assessing the driving competence of individuals with cognitive impairment.

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