The Attention Network Test: A Potential Tool to Investigate the Impact of Health Status on Safe Driving
Results from the Candrive Cohort

M.Bédard, H.Maxwell, J.Rut, B.Weaver, G.Naglie, M.Rapoport, H.Tuokko, M.Man-Son-Hing, S.Marshall

Background

The safety of older drivers is an important health issue:

- Driving is a complex multi-factorial task that taps into cognition and attention

- Age is often associated with declines in cognition and attention

- Health conditions can exacerbate natural changes

Background

- Many tests of cognition and attention are associated with driving outcomes, however these associations are not strong

- Likely no test of cognition or attention will be highly accurate in determining fitness-to-drive on their own

- A better understanding of the contribution of cognition and attention to safe driving in older adults would be beneficial

Attention Network Test

The Attention Network Test (ANT) measures one's ability to rapidly select the direction of a central arrow target in a horizontal line of five arrows.
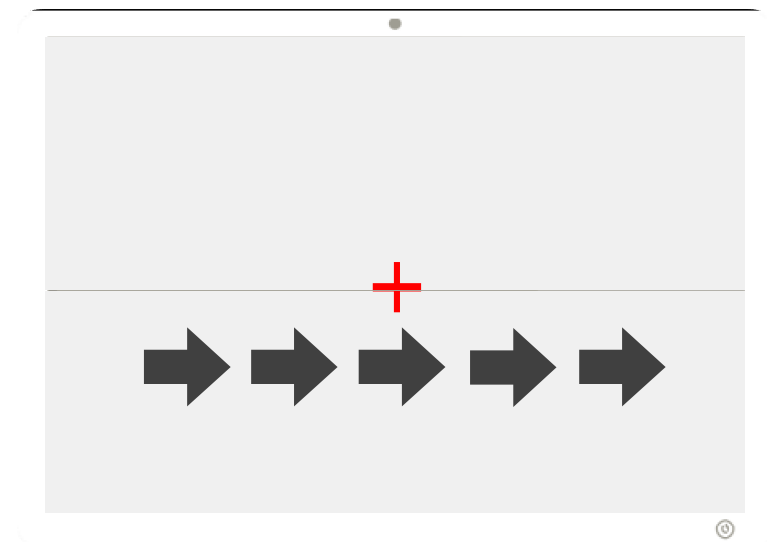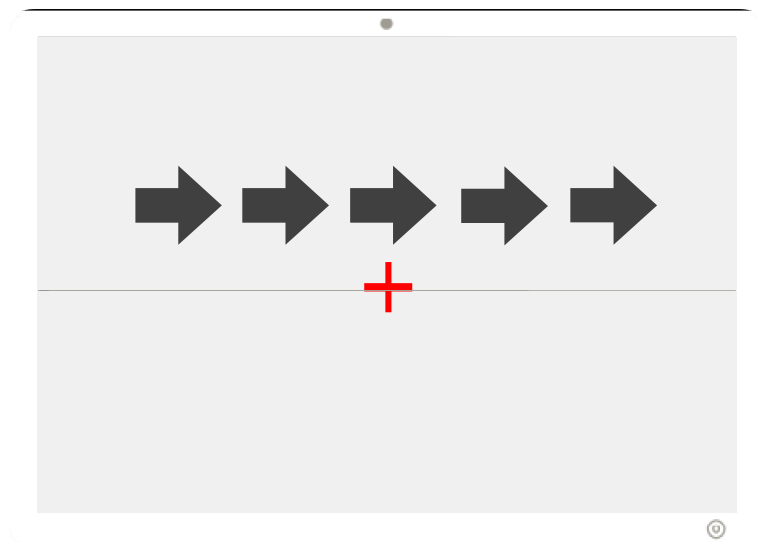
Over a series of trials, a **median response time (MRT)** is calculated.
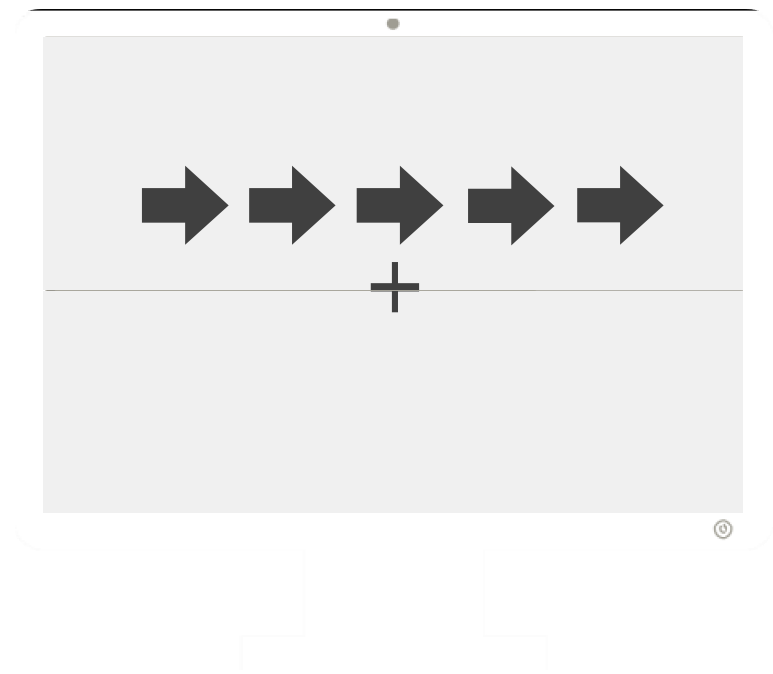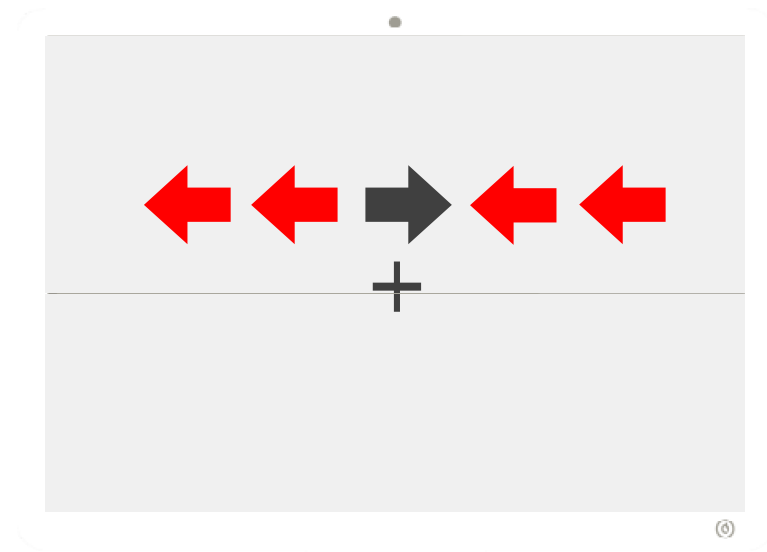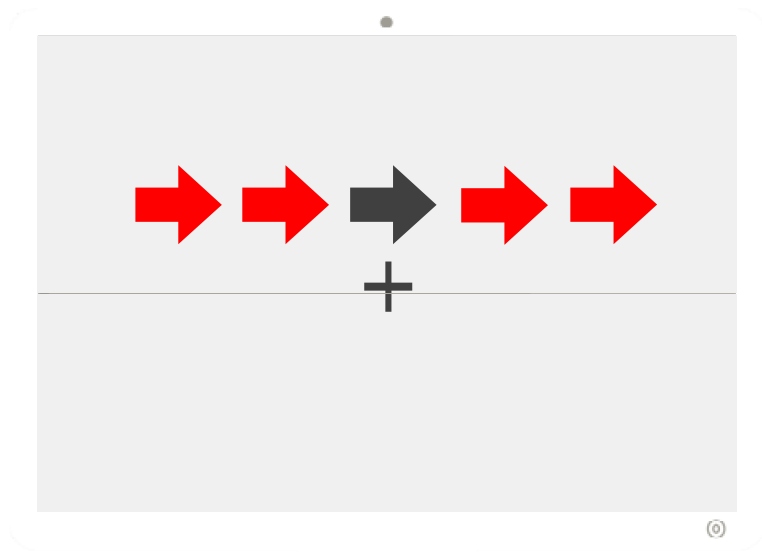
Attention Network Test

Targets may appear above or below a
fixation cross (+)…

Attention Network Test

Flankers may or may not be congruent (pointing the same direction as the target). Congruent flankers are advantageous.

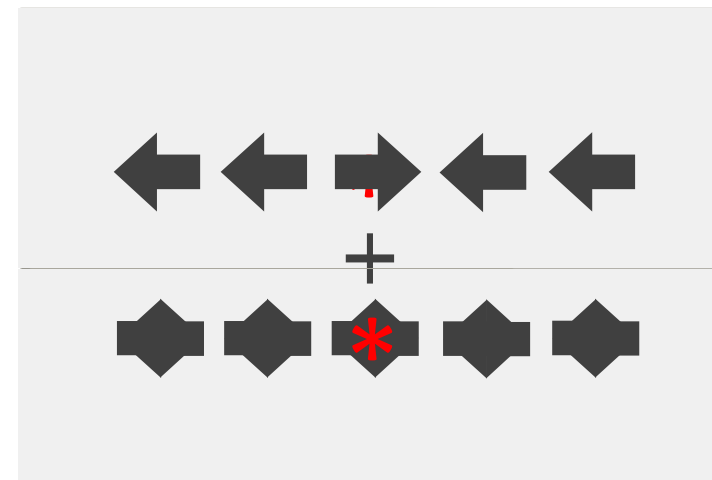# **A**ttention **N**etwork **T**est

Before the arrows appear, cues (*) may flash on the screen to indicate where and/or when the target will appear.
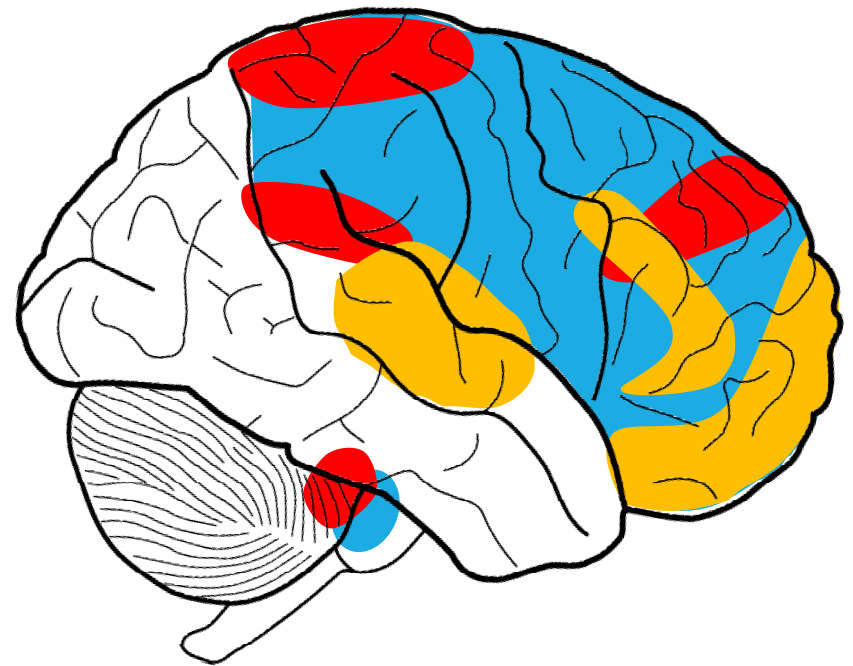
The more information a cue provides, the more advantageous it is.
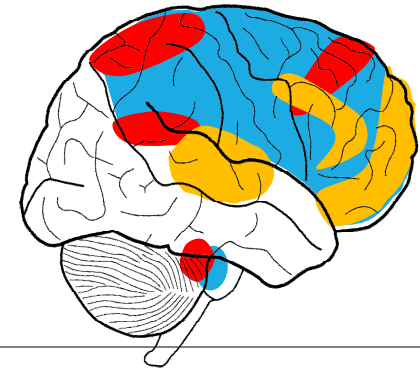
Attention **N**etwork **T**est

In addition to providing a MRT, the ANT tests three functions of attention (**Alerting**, **Orienting**, and **Conflict Efficiency**), each served by relatively independent structures and neurotransmitters.

Brain Structures and Neurotransmitters

Function	Structures	Primary Neurotransmitter
Alerting	Locus coruleus Right frontal cortex Parietal cortex	Norepinephrine
Orienting	Superior parietal lobe Temporal-parietal junction Frontal eye fields Superior colliculus	Acetylcholine
Conflict Efficiency	Anterior cingulate cortex Lateral ventral cortex Prefrontal cortex Basal ganglia	Dopamine

Aims

While examining ANT performance in the presence of various health conditions may provide insight into health related changes that affect driving, it is important to first verify that the ANT is not redundant with other tests of cognition and attention typically used for driving research and evaluation.

Aims

Thus, the major aim of this study was to determine the level of redundancy between the ANT and tests of cognition and attention used in the Candrive longitudinal study.

Methods

Data came from Y3 of the Candrive cohort:

- 451 senior drivers

- ≥70 years

To determine the level of relationship between the ANT and scores on other tests, correlations and multi-variable linear regression models were used.

Data

- ANT Median Reaction Time (ANT-MRT)

- Mini Mental State Exam (MMSE)

- Montreal Cognitive Assessment (MoCA)

- Motor-Free Visual Perception Test (MVPT-3)

- DemTect

- Screen for the Identification of Cognitively Impaired Medically At-Risk Drivers (SIMARD-MD)

- Trail Making Tests A and B (TMT)

Results: Correlations

The ANT was weakly correlated with nearly every test examined.

Correlations with ANT-MRT
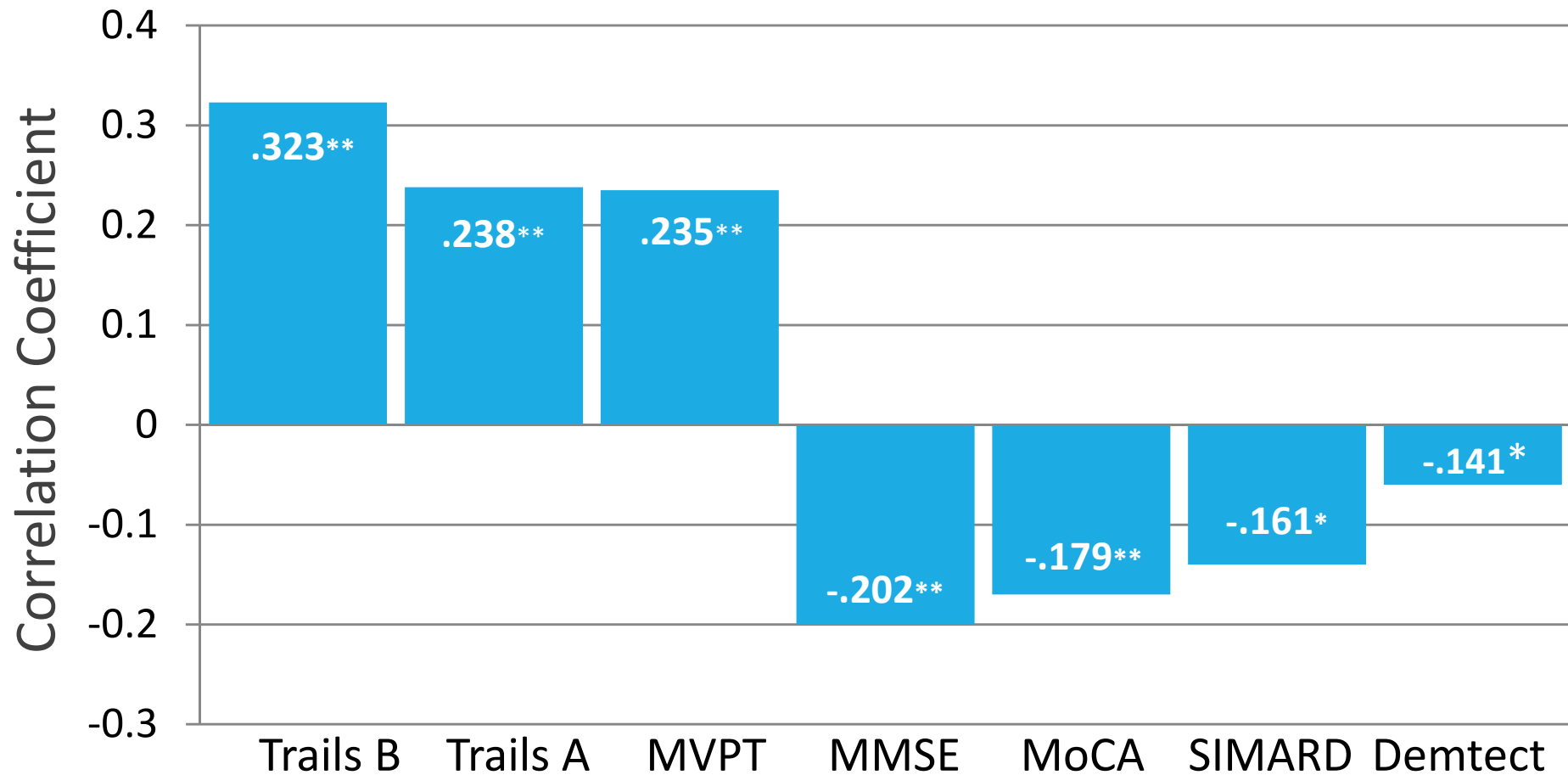
**p < .001 *p < .05.

Results: Regression

- Less than 10% of the variance in ANT-MRT was explained by scores on other tests of cognition (Adj R^2 = .098)

- Most of explained variance was related to tests of visual-cognitive abilities

Results: Regression

Variable	B	SE(B)	ß	t	p
Age	0.764	0.954	0.044	0.801	.424
MMSE	-4.858	3.134	-0.089	-1.550	.122
MOCA	-0.042	1.932	-0.001	-0.022	.983
MVPT	0.240	0.107	0.121	2.242	.026
DemTect	4.338	2.689	0.157	1.613	.108
SIMARD	-0.247	0.333	-0.070	-0.741	.459
Trails A	0.194	0.435	0.026	0.445	.656
Trails B	0.463	0.126	0.239	3.676	.001

Discussion

Our results suggest that:

- The ANT is more closely related to tests of visual perception than to those of general cognition

- While the ANT is associated with other cognitive measures of safe driving, it is not redundant among them

Discussion

Future ANT research:

- Study in relation to driving outcomes (e.g. crashes; on-road driving tests)

- Examine performance across the lifespan

Acknowledgements