

The slowest to respond: reaction time, accidents and driving errors in neurology patients in urban simulated driving

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BACKGROUND & AIMS

Reaction time to unexpected events is a critical driving parameter that is associated with crashes, yet it has been neglected in driving simulator studies.

The study examines the proportion of drivers with different neurological disorders showing extreme RT; the association of diagnostic category and extreme RT with number of accidents at unexpected incidents; and driving errors associated with diagnostic category.

METHODS

Participants

- Depending on the driving condition, 125-149 drivers participated, both controls of different ages and patients with different diagnoses. Control drivers: 22-78 years, patients: 34-90 years. All participants were regular drivers.
- Drivers included in comparisons: 66 control drivers; 49 mild cognitive impairment (MCI) drivers; 23 mild Alzheimer's disease (AD) drivers, 22 Parkinson's disease (PD) drivers.

Driving simulator experiment

- Data from **Distract and DriverBrain** research projects
- All participants underwent a neurological, neuropsychological and ophthalmological assessment
- Driving simulator assessment:** all drivers drove a quarter-cab FOERST driving simulator (3 LCD wide screens 42", full HD: 1920x1080pixels - total field of view 170 degrees, validated against a real world environment) in **4 urban conditions**, counterbalanced across participants:

Moderate traffic without (U1) & with distraction (U3)

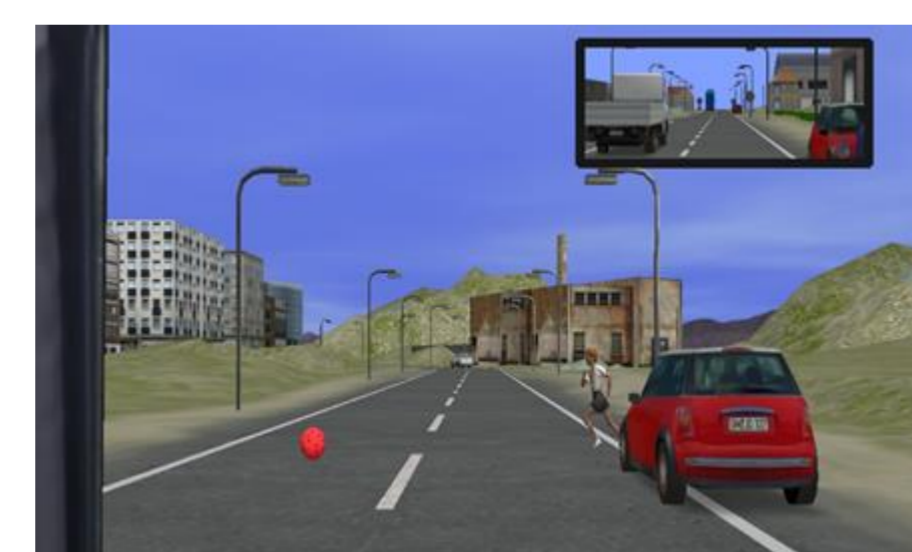


High traffic without (U2) & with distraction (U4), shown

- A practice drive (10-15 minutes) preceded the driving assessment
- The urban drive took place in a dual carriageway route (for the biggest part) in an urban area with narrow sidewalks, commercial uses and parking at roadsides. Two traffic-controlled junctions, one stop-controlled junction and one roundabout were placed along the route.



Distraction condition: conversation with passenger

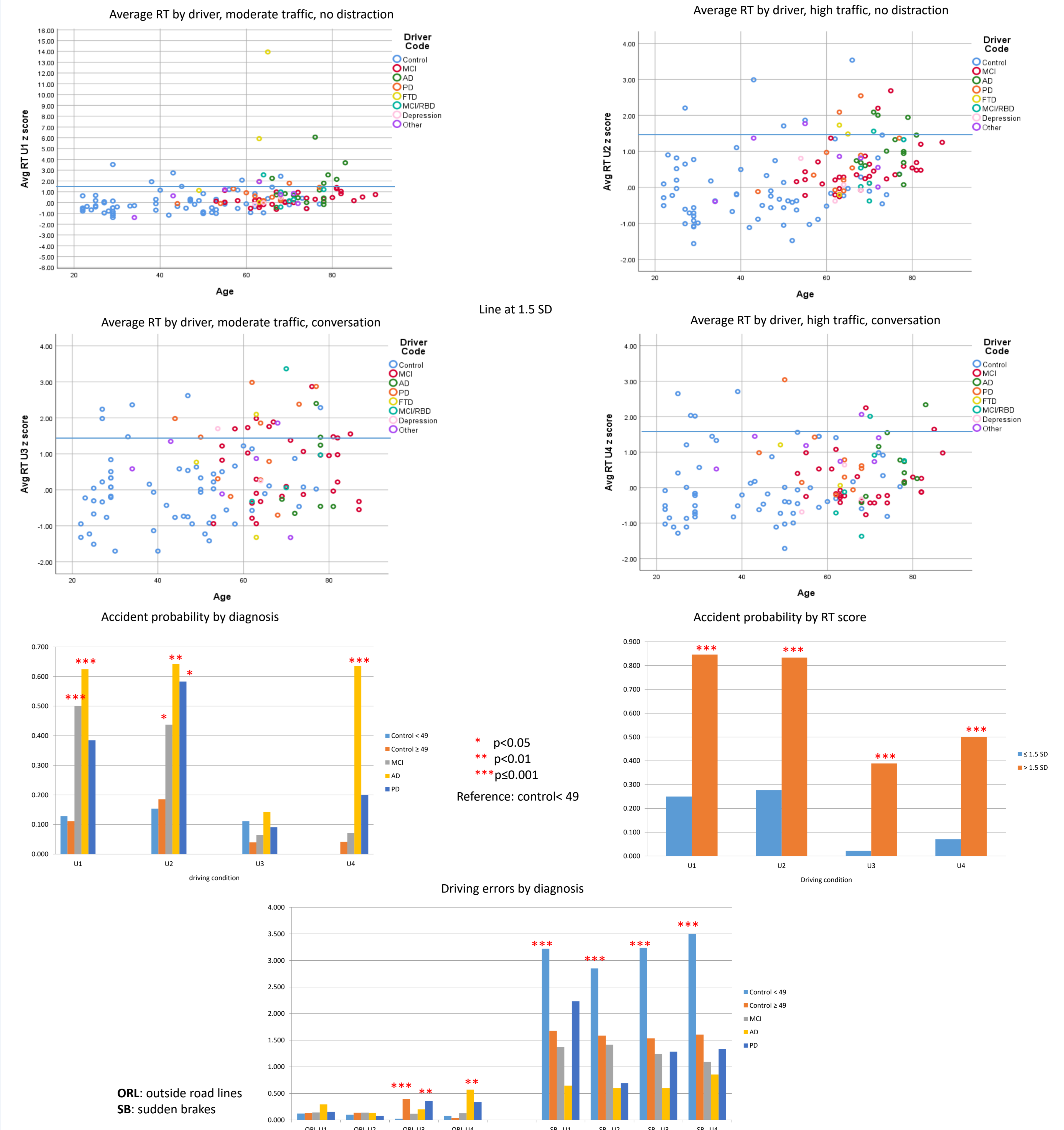


Unexpected incident

Measures

- Average braking reaction time (RT)** at unexpected incidents (in ms)
- Accident probability:** number of accidents divided by number of unexpected incidents (2 incidents per condition)
- Driving errors:** number of times outside of road lines (ORL); number of sudden brakes (SB)
- RT was z-transformed based on the performance of the 66 control drivers and the number of drivers deviating by >1.5 SD from the mean in each of the driving conditions was computed.

RESULTS



CONCLUSION

- MCI, mild AD (in 3 conditions) and PD patients (in 1 condition) had more accidents than younger control drivers in urban driving.
- Drivers with RT > 1.5 SD had more accidents than those with shorter RT irrespective of diagnosis.
- Older control drivers, mild AD and PD patients made more ORL errors than younger control drivers in some conditions (with distraction); younger control drivers made more SB than patients in all conditions.