Relationship of Self-report and Performance Measures of Impulsiveness and Risky Driving on a Simulator

Never Stand Still | Science | Transport and Road Safety (TARS) Research

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Young drivers and risky driving

Risky driving a key factor in young novice drivers
overrepresentation in crash statistics (Jonah, 1986)

Risky driving may result from

- Inexperience -> errors
- Immaturity -> intentional risky driving

Compared to older drivers younger drivers have

- Stronger motives for risk (Hatfield & Fernandes, 2009)
- Incompletely developed executive brain functions, including impulse control (Blakemore & Choudhury, 2006)

Evidence for an association between self-reported impulsiveness and risky driving

Several studies have demonstrated an association between self-report measures of impulsiveness and

- Self-report measures of risky driving

(Constantinou et al, 2011; Dahlen et al, 2005; Pearson et al, 2010; Sarma et al, 2013; Treloar et al, 2012; Wickens Toplak & Wiesentahl, 2008)

- Self-reported offenses

(Dahlen et al, 2005; Pearson et al, 2010)

- Having committed at least one speeding offense

(O'Brien & Gormley, 2013)

Patterns differ for different Barratt Impulsiveness subscales

Evidence for an association between performance measures of impulsiveness and risky driving

Concerns with self-report, and ambiguity in some items:

Eg. “I act on the spur of the moment”

Several recent studies consider relationships with performance measures of response inhibition (an important aspect of impulsiveness)

O’Brien & Gormley (2013)

Go/No-go performance discriminated young drivers who had at least one speeding offense from others

Offenders made more errors but had faster Go reaction times; both indicate impulsiveness?

Atypical Go/No-go task, drawing on short-term memory

“Soft” criterion for risky driving

No difference on “Stop Signal Task” (Logan et al., 1997)

Jongen et al (2011)

The same Stop Signal Task as O'Brien & Gormley (2013)

Longer SSRT (poorer inhibitory control) associated with variability in lateral position in driving simulator

No relationship with speeding, red-light running,or crashing

Cheng & Lee (2012)

Higher Stroop-measured interference (longer latency in print-colour-naming for incongruent versus control trials) associated with self-reported motorcycle violations

Interference associated with Barratt Impulsiveness Scores

General population sample; Odd Stroop; Self-reported DV

Unclear how to interpret latency scores

Aims

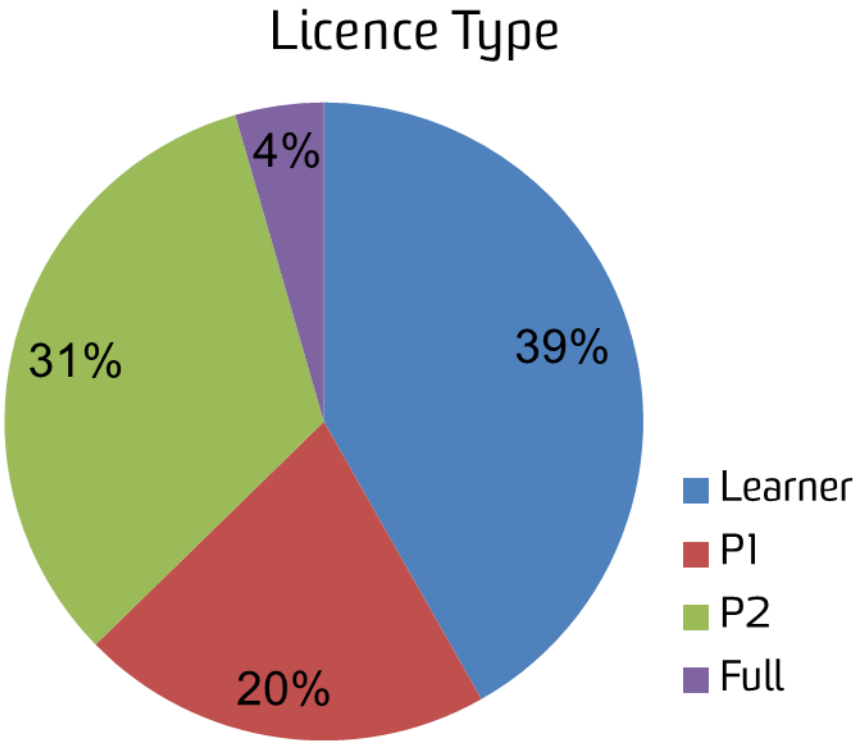
Among younger drivers, investigate the interrelationship of

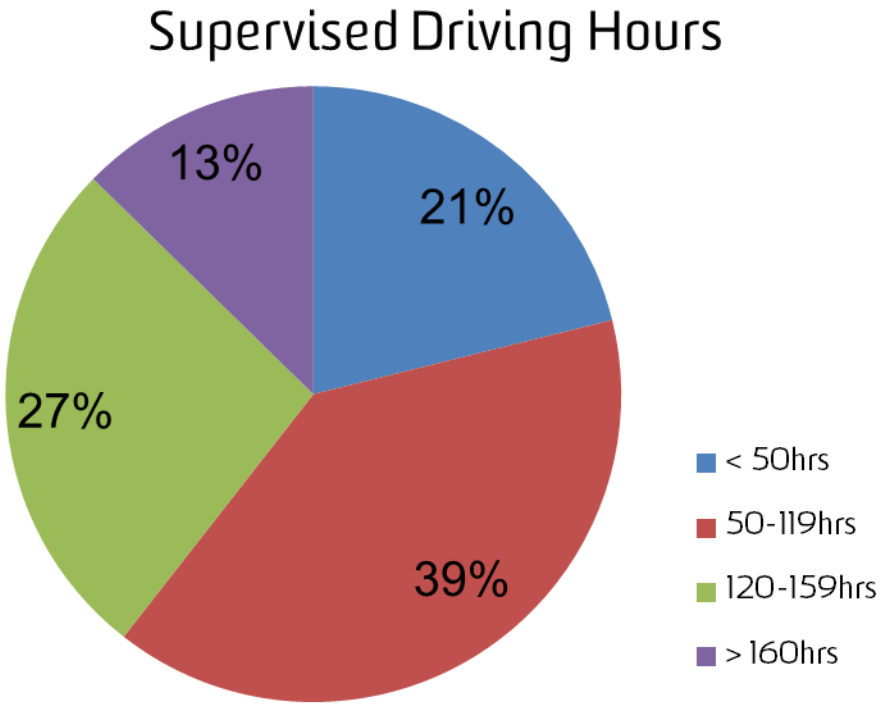
- performance measures of inhibitory control (Go/No-go task, Stroop task)
- self-report measures of impulsiveness (Barratt and Eysenck)
- performance on simulated driving scenarios designed to be sensitive to failures in inhibitory control

Participants

71 Psychology 1 students from UNSW

- 43 female
- Mean age = 18.96 (SD 1.29)





Design and methods

Group A	Group B	Group C
1. Driving Simulation	1. Computer tasks[a]	1. HPT
2. HPT	2. Driving Simulation	2. Computer tasks[a]
3. Computer tasks[a]	3. HPT	3. Driving Simulation
Questionnaires[b]	Questionnaires[b]	Questionnaires[b]

[a] Computer Tasks (Counterbalanced)

- Cued Go/No-go Task
- Stroop Colour Naming Task
- Reward Saccade Task

[b] Questionnaires

- Barratt Impulsiveness Scale V11
- Eysenck Impulsiveness Questionnaire V7
- Personal Characteristics

6km Driving Simulation

Event	Position	Event Type	Other Details	Responses
1	0.85km	Traffic lights; Turn left	Lights change from green through red	Turned on orange light? Yes(1)/No(0)
2	0.88km	Potential overtake; 40km/h lead-vehicle	Double unbroken centreline; Oncoming traffic with one safe gap (120m)	Overtook? Yes(1)/No(0)
3	2.40km	Traffic lights; Turn right	3 gaps: 50m, then 120m, then following all traffic	Turned on which gap? 50m (2), 120m (1) or After traffic (0).
4	3.05km	Traffic light; Continue straight	Lights change from green through red	Drove through orange light? Yes(1)/No(0)
5	3.35km	Cyclist travelling 23km/h	Single broken centreline; No oncoming traffic	Failed to accommodate cyclist (did not slow down or move into the right lane)? Yes(1)/No(0)
6	4.35km	Potential overtake; 50km/h lead-vehicle	Single broken centreline; no oncoming traffic	Overtook? Yes(1)/No(0)
7	5.32km	Traffic Lights; Turn right	Lights change from green through red. 3 safe gaps: before traffic[a], then 40m, then following all traffic	Turned on which gap? Before traffic (2), 40m (1) or After traffic (0).

60km/h throughout except 500m commencing 100m after Event 3

Results- Impulsiveness intercorrelations

	Barratt Motor Impulsiveness	Barratt Non-planning Impulsiveness	Eysenck Impulsiveness	Vertical No-go %correct	Horizontal No-go %correct	Stroop interference %correct	Stroop interference latency
Barratt Attentional Impulsiveness	**Pr =0.466** p= .000**		Pr =0.625** p=.000				
Barratt Motor Impulsiveness		**Pr =0.389** p=.001**	Pr =0.654** p=.000				
Barratt Non-planning Impulsiveness			Pr =0.427** p=.000	Pr =-.272* p=.022	Pr =-.296* p=.012		
Eysenck Impulsiveness							
Vertical No-go %correct					Pr =0.968** p=.000		Pr =-.314** p=.008
Horizontal No-go %correct							Pr =-.299* p=.011
Stroop interference %correct							

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Drive associations with self-report impulsiveness

	Barratt Attentional Impulsiveness	Barratt Motor Impulsiveness	Barratt Non-planning Impulsiveness	Eysenck Impulsiveness
Drive Event 1- Turned on orange?				
Drive Event 2- Overtook?				
Drive Event 3- Turned right judge gap				
Drive Event 4- Drove through orange?				
Drive Event 5- Failed to accommodate cyclist?		PBr =.303* p=.010		
Drive Event 6- Overtook?				
Drive Event 7- Turned right judge gap				
Drive- %Distance above limit 40km/h zone				Pr =0.270* p=.023
Drive- Average speed 40km/h zone			Pr =0.285* p=.016	
Drive- Average Speed Overall		Pr =0.235* p=.048	Pr =0.283* p=.017	Pr =0.319** p=.007

Drive associations with impulsiveness performance measures

	Vertical No-go %correct	Horizontal No-go %correct	Stroop interference %correct	Stroop interference latency
Drive Event 1- Turned on orange?				
Drive Event 2- Overtook?	PBr =-.269* p=.023	Sr =-.242* p=.042		
Drive Event 3- Turned right judge gap		Sr =-.239* p=.048	Sr =0.259* p=.032	
Drive Event 4- Drove through orange?				
Drive Event 5- Failed to accommodate cyclist?				
Drive Event 6- Overtook?		Sr =-.311** p=.008		PBr =0.265* p=.025
Drive Event 7- Turned right judge gap		Sr =-.246* p=.047	Sr =0.380** p=.002	
Drive- %Distance above limit 40km/h zone	Pr =-.358** p=.002	-.356** p=.002		
Drive- Average speed 40km/h zone	Pr =-.573** p=.000	-.589** p=.000	Pr =0.313** p=.008	
Drive- Average Speed Overall	Pr =-.738** p=.000	-.728** p=.000		Pr =0.234* p=.050

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Conclusions

Computer tasks hypothesized to measure impulsivity demonstrated consistent relationships with risky driving on a driving simulator

No observed significant relationships were in the direction opposite to prediction

Go/No-go

Associated with Barratt Non-planning impulsiveness

Poorer performance associated with inappropriate overtaking and right-turning, total score, & higher speed

Consistent with O'Brien & Gormley (2013)

Stroop interference

No association with self-report (versus Cheng & Lee, 2012)

High interference (latency) associated with

- poor performance on Go/No-go task
- inappropriate overtaking and higher speed (consistent with Cheng & Lee, 2012)

High interference (correct) associated with inappropriate turning right, total score, and higher speed

Supports notion that lower impulse control results in longer latency for incongruent Stroop trials

Self-report measures

Less consistent relationships with drive than performance measures; performance artefact?

Barratt Non-planning Impulsiveness demonstrated

- only associations with performance measures of impulsiveness (Go/No-go indices)
- association with speed measures of drive,
- most consistent relationships in earlier studies

Barratt Motor Impulsiveness associated with failure to accommodate cyclist and speed

Conclusions

Results are consistent with the view that poor impulse control contributes to the risky driving of young drivers.

Suggests the value of developing and evaluating driver training to improve impulse control

Go/No-go task offer a good platform, and could be developed for the driving context

Thanks for your attention!

For more information please contact

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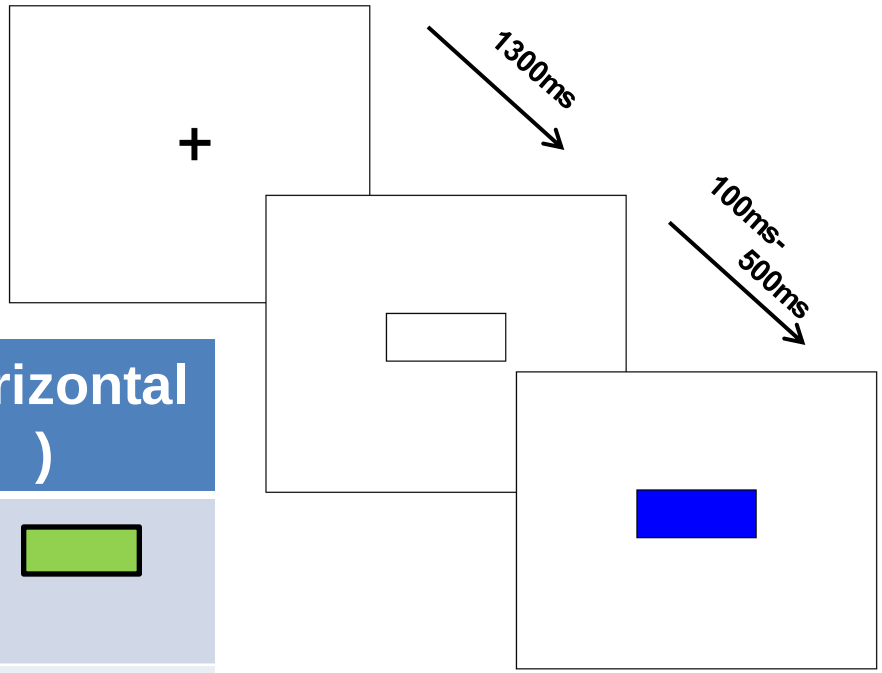
Cued Go/No-go Task Fillmore, Rush and Hays (2006)

Green= Go & Blue= No-go

Orientation creates “pre-potent response



CUE	(Vertical)	(Horizontal)
Go (Green)	~60	**~15**
NoGo (Blue)	**~15**	~60

% correct for No-go trials; Separated by orientation

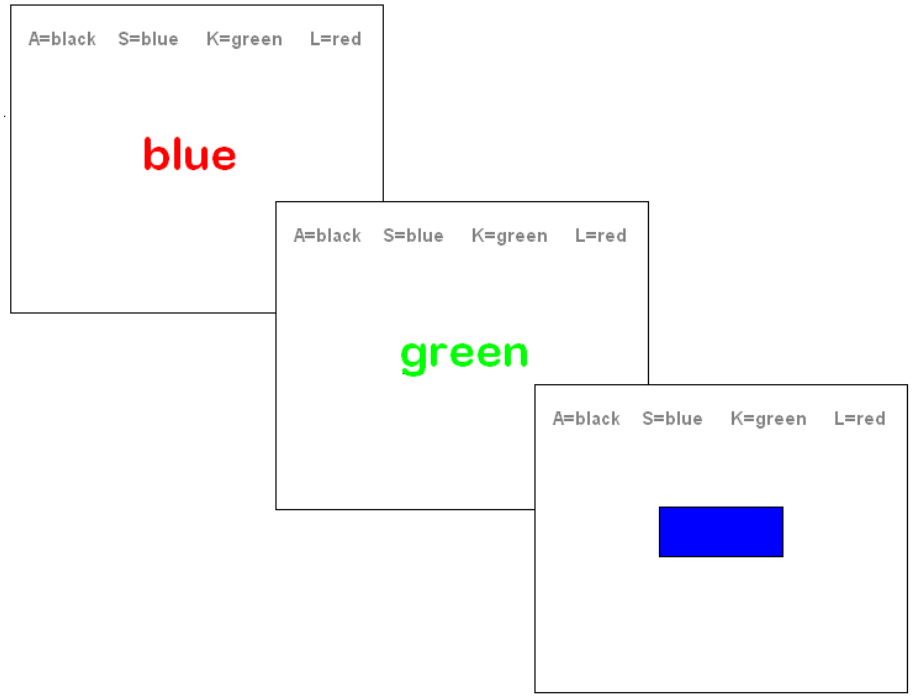
Stroop Colour Naming Task

'RED', 'GREEN', 'BLUE', or 'BLACK', or a rectangle, coloured either red, green, blue, or black

Each trial: Blank screen for 200ms followed by stimulus until valid response.

(4 congruent stimuli +12 incongruent stimuli + 4 controls) x 4 repeats = 80 trials

% of correct responses and average latency used to compute Interference



Questionnaires and Scales

Barratt Impulsiveness Scale V11

- 30 items for 3 subscales
- E.g. “I am restless at the theatre or lectures” (Rarely/Never, Occasionally, Often, Almost always/Always)

Eysenck Impulsiveness Questionnaire V7

- 18 of 54 items directly related to impulsive behaviours
- E.g. "Do you generally do and say things without stopping to think?“ (YES/NO)

Personal Characteristics

- Gender; Age; Licence Type; Hours of Driving Experience; Crash and Infringement history

Demographics associations

Younger participants

- had higher Barratt Attentional Impulsiveness scores
- responded correctly less frequently to HPT slow down events

Gender

- Only male participants overtook the 50km/h vehicle in the 60 km/h zone
- Males had higher average speed in the 40km/h zones

Demographics associations

Participants with less advanced licence types

- responded correctly less frequently for HPT Overtake events
- overtook the 50km/h vehicle
- BUT chose later gaps in one of the simulated turns (Event 7)

Participants with less supervised driving hours

- responded correctly less frequently for HPT Overtake events
- BUT chose later gaps in one of the simulated turns (Event 7)

Crashes &infringements associations

85.71% of participants reported no crashes as a driver

94.29% reported no infringement notices

Participants who reported one or more crashes

- were more likely to overtake (2 events)
- drove faster in 40km/h zone and overall

No significant relationships were observed with impulse control measures and self report crashes or infringements.