

Differences in calibration of skills in distracted driving situations

Ashleigh V. Tran, William J. Horrey, Paul Atchley



Distracted Driving

- Distracted driving has been well-established as dangerous and risky.
- These findings have clearly demonstrated in a database of distracted driving literature (Atchley, Tran, & Salehinejad, 2017).




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Constructing a publically available distracted driving database and research tool

Paul Atchley  , Ashleigh V. Tran, Mohammad Ali Salehinejad



Constructing a publically available distracted driving database and research tool

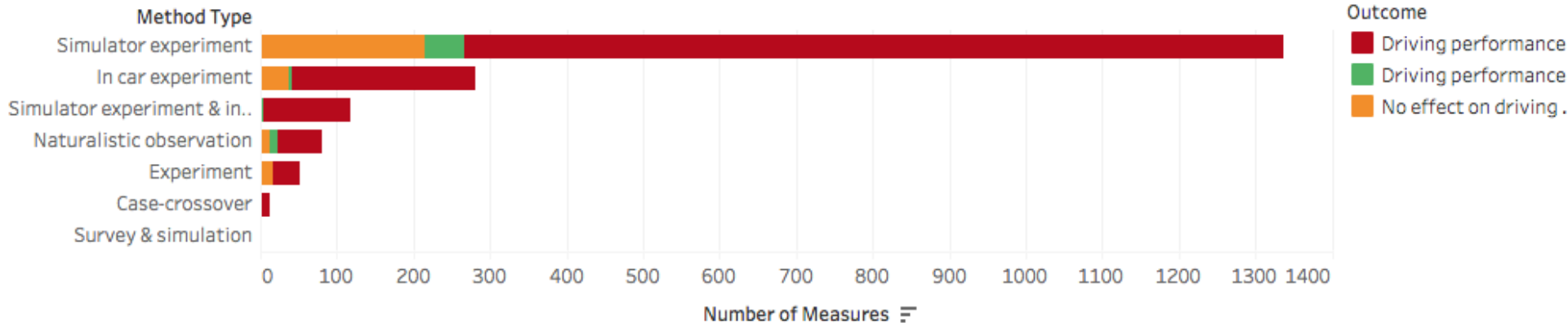
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Since **1965**, there have been **342 studies** examining **1608 measurements** with **19370 subjects** on the effects of distraction on driving performance.

(These numbers are for the current database – the new version will add over **100 new studies**)

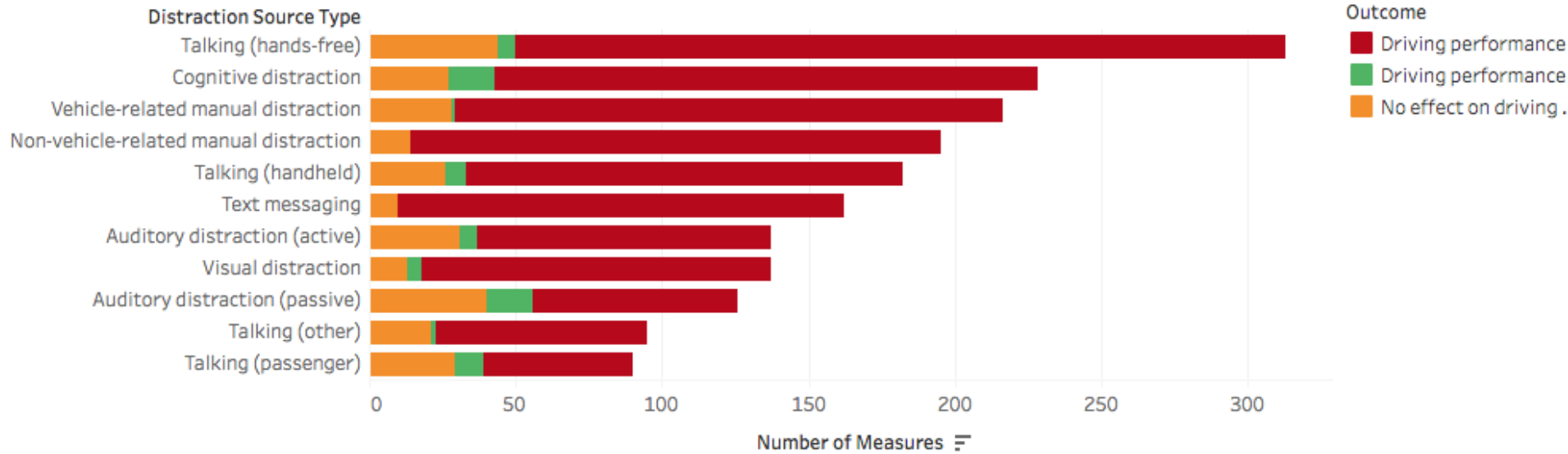
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Performance measures by outcome

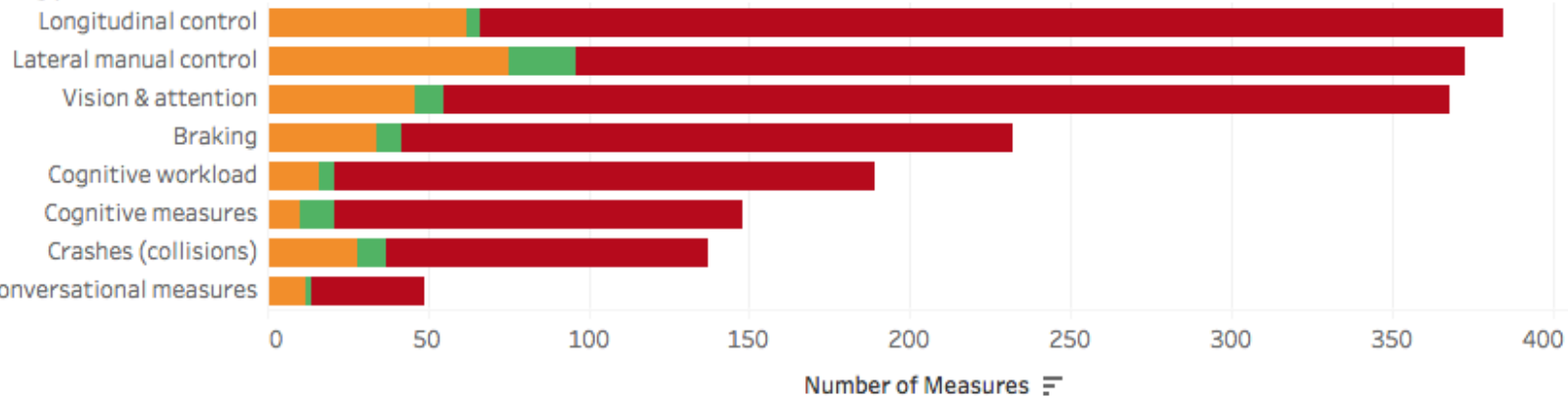
Driving performance mea..

Outcome

■ Driving performance

■ Driving performance

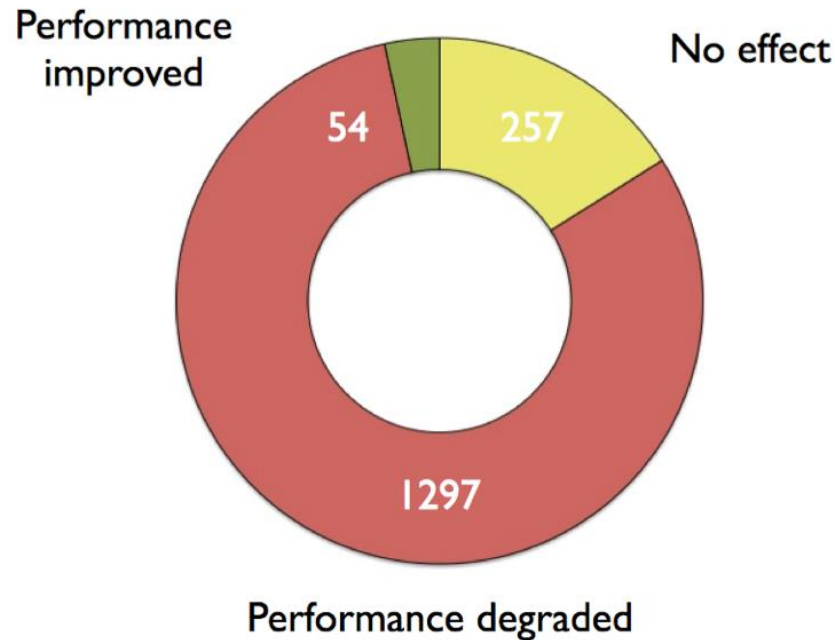
■ No effect on driving .



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1608 measurements of the effect of distraction on performance



So, what's next?

- Because distracted driving has been established as dangerous, we must now ask **why** drivers choose to drive distracted.
- A few hypotheses:
 - » Driving while distracted helps to reduce risk (Olson, Hanowski, Hickman, & Bocanegra, 2009; Fitch et al., 2013)
 - » Drivers realize they are distracted and that it does degrade their driving performance, and therefore engage in compensatory behaviors (Young & Regan, 2007)

Or, alternatively?

- Some drivers are unaware of how poorly they drive when distracted.
 - » Does distraction reduce self-awareness?
 - » Do certain personality characteristics increase this effect?
- The current work hypothesizes impulsive drivers are less aware of their driving performance while distracted.

Impulsivity Defined

- Behavior:
 - » Without adequate thought
 - » Predisposition toward rapid and unplanned reactions
 - » Without regard to negative consequences
 - » Less able to put off rewards

Measuring Impulsivity

- Barratt Impulsivity Scale (BIS; Patton et al., 1995)
 - » Example: “I plan tasks carefully.”
- Delay discounting method
 - » Generally: “Would you rather receive **smaller reward immediately** or a **larger reward** after a **delay.**”
 - » Can be applied to specific types of rewards and behaviors.
 - » Applied to assess willingness to attend to the phone while driving
 - » Procedure used here to create high and low impulsive (discounting) groups

Procedure

- Participants recruited through the Liberty Mutual Research Institute for Safety participant pool
- Basic questionnaire
 - » Demographic information
 - » Driving history
 - » Delay discounting procedure
 - » Barratt Impulsivity Scale

Procedure – Delay Discounting Questionnaire

- Scenario:
 - » Driving home from a long road trip
 - » Unable to talk to significant other in several days (Atchley & Warden, 2012)
 - » Receive a text message from significant other saying “Contact me when you can.”
 - » 2 weather conditions
 - 1) Sunny and clear
 - 2) Winter storm
 - » 2 message modalities
 - 1) Handheld phone
 - 2) Vehicle’s voice response system



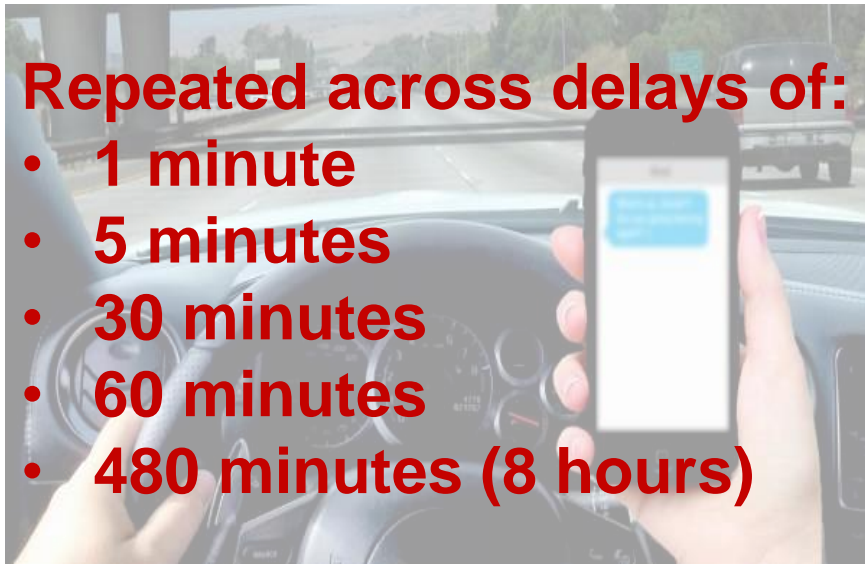
Would you rather:

- a) Receive \$20 and respond immediately**
- b) Receive \$100 and respond after 30 minutes**

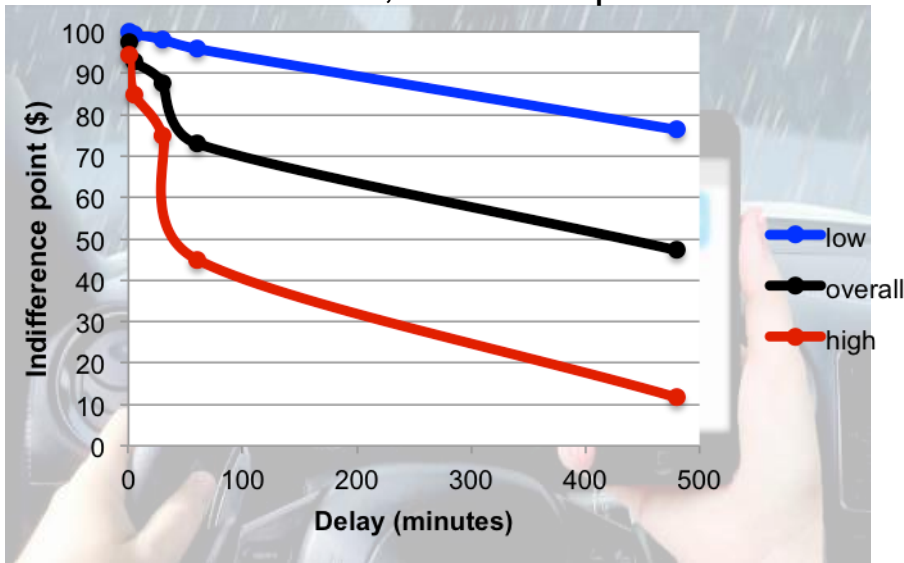


Repeated across delays of:

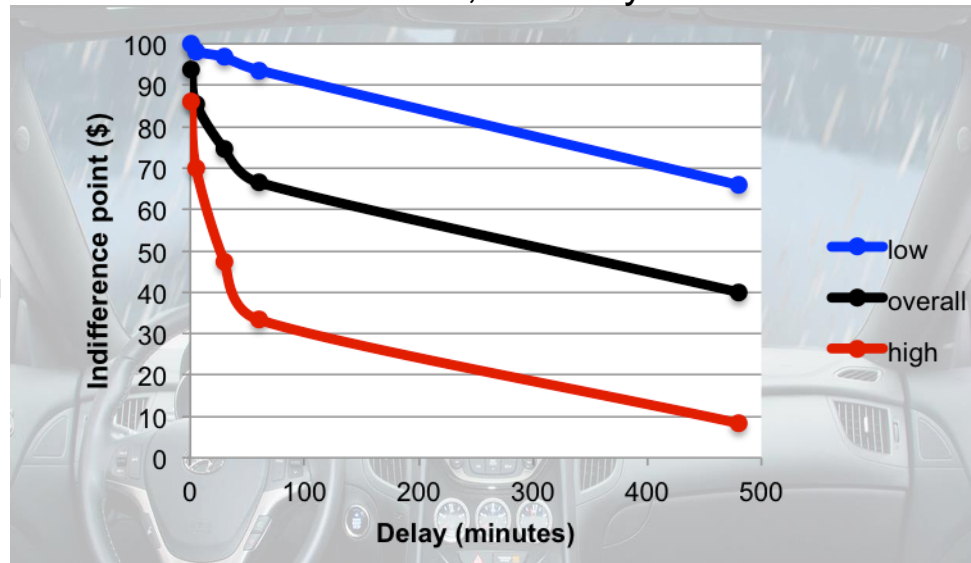
- 1 minute**
- 5 minutes**
- 30 minutes**
- 60 minutes**
- 480 minutes (8 hours)**



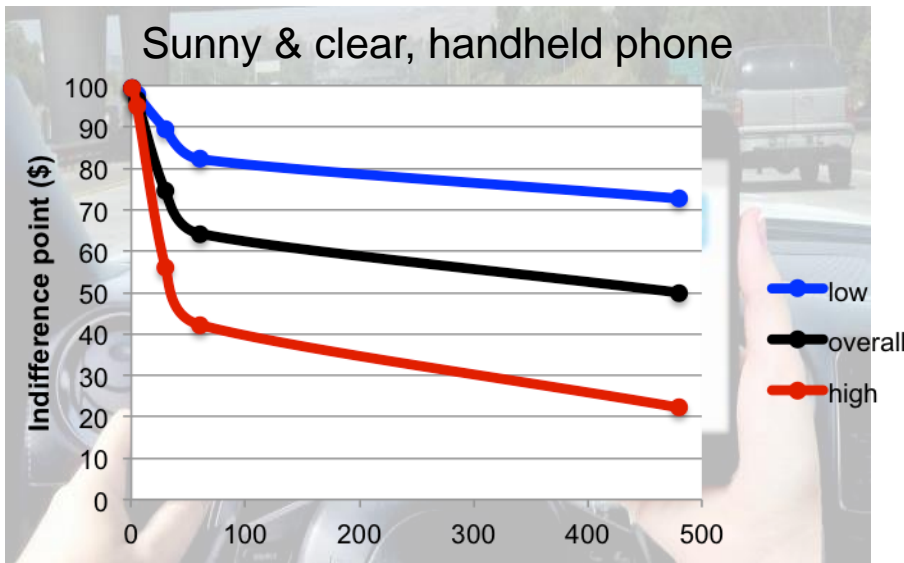
Winter storm, handheld phone



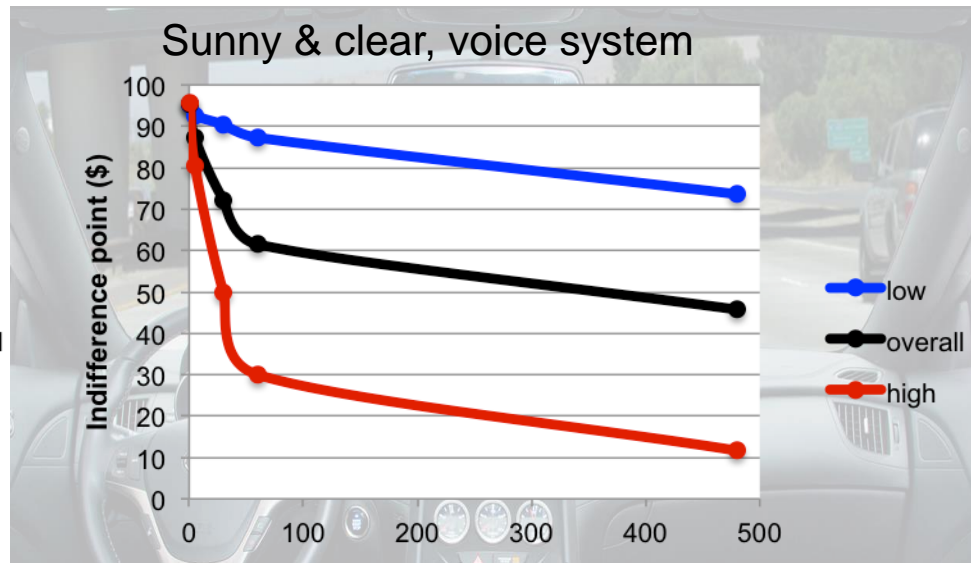
Winter storm, voice system



Sunny & clear, handheld phone



Sunny & clear, voice system



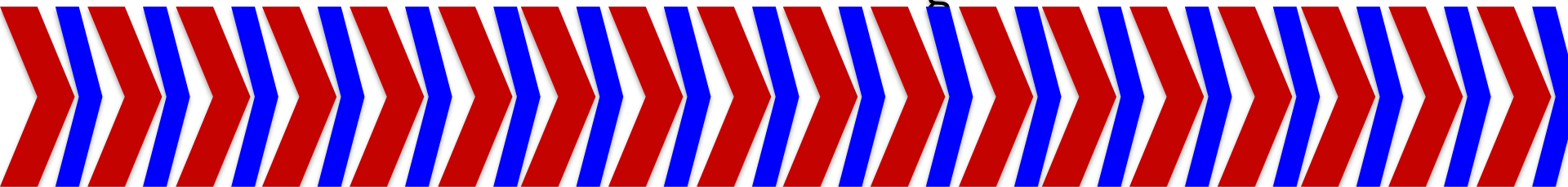
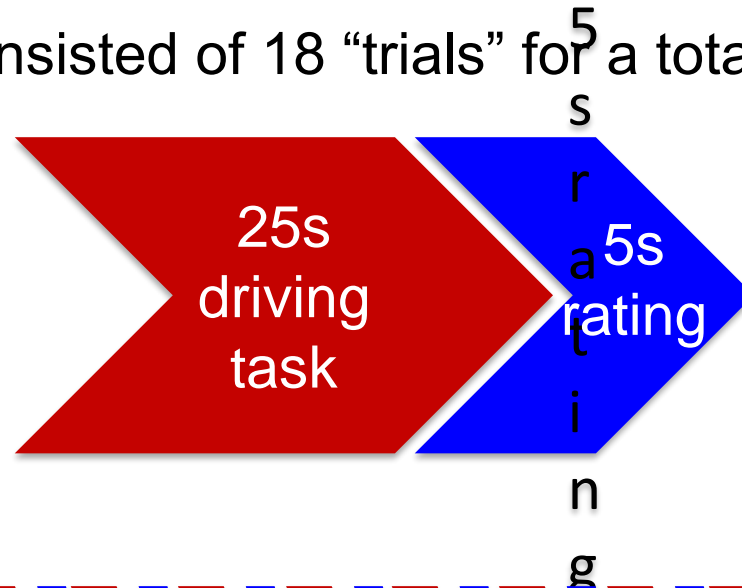
Procedure – Calibration framework

- Follows the framework described by Horrey, Lesch, Mitsopoulos-Rubens, and Lee, (2015).
 - » Drivers complete several 30-second “trials”
 - » Each 25-second trial was marked by the onset of wind gusts and the beginning of a secondary task
 - » Audio prompt marked the end of the 25-second trial asking participants to “Rate driving performance.”



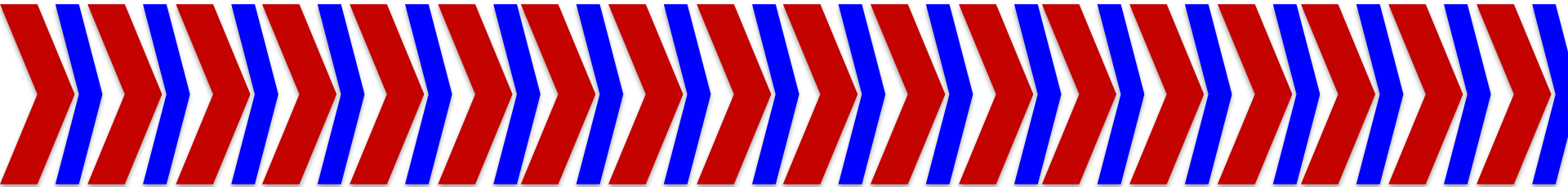
Procedure – Calibration framework

- Each “block” consisted of 18 “trials” for a total drive time of 9 minutes



Procedure – Driving conditions

- Each participant completed six different blocks (3 x 2 design):
 - » 3 different tasks
 - 1) Working memory task (N-back with 2-back)
 - 2) Text messaging task
 - 3) No secondary task
 - » 2 levels of traffic
 - 1) High traffic
 - 2) Low traffic



Measures

- Questionnaire
 - » Delay discounting questionnaire
 - » BIS
- Driving simulator
 - » Lane maintenance
 - » Speed maintenance
- Driving performance ratings
- Detection response task (DRT)

Participants

- » 20 total participants: 10 male, 10 female ($M_{\text{age}} = 39.4$)
- » Average of 22.85 years driving experience
- » Average of 20,975 miles driven annually
- » Participants split into two groups based on delay discounting performance:
 - 1) High impulsive
 - 2) Low impulsive

Driving Performance Results

Driving Performance Results

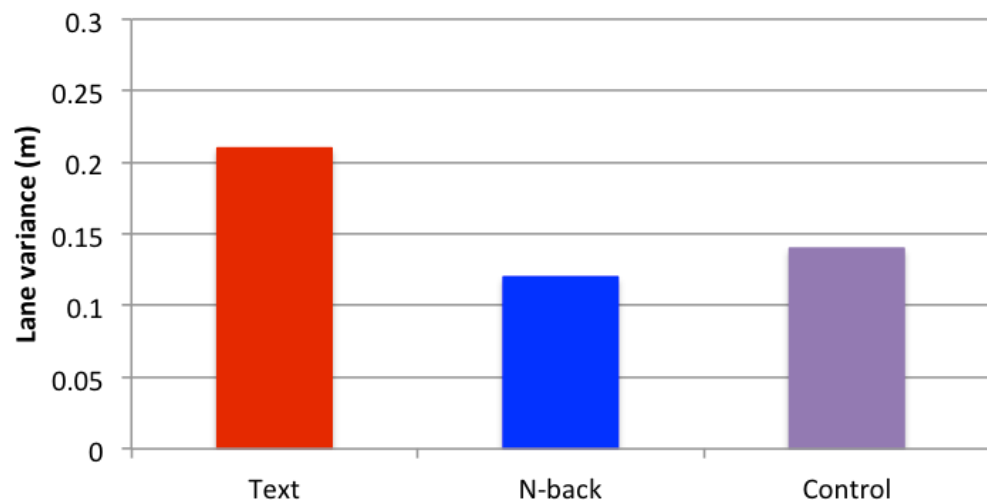
- Lane maintenance

- » Main effect for task, $F_{(2, 111)} = 20.973, p < 0.001$

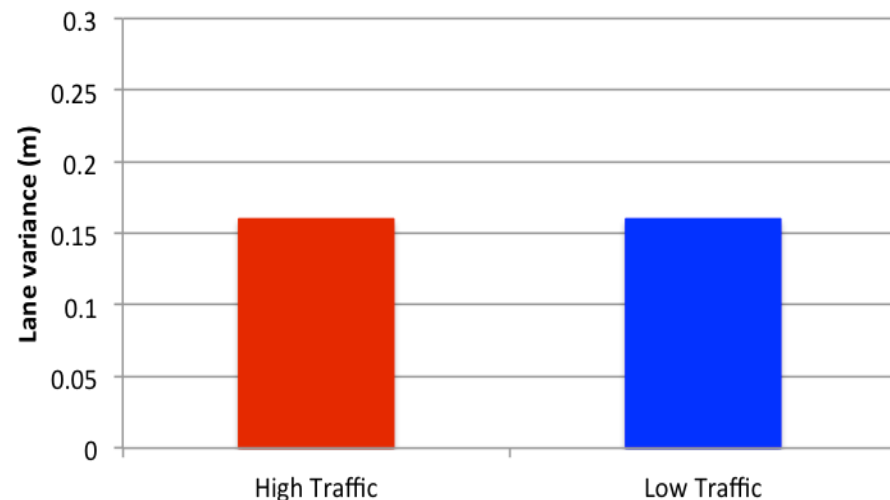
- » No main effect for traffic level, $F_{(1, 111)} = 0.010, p = 0.92$

- » No significant interaction, $F_{(2, 111)} = 0.072, p = 0.93$

Lane maintenance



Lane maintenance



Driving Performance Results

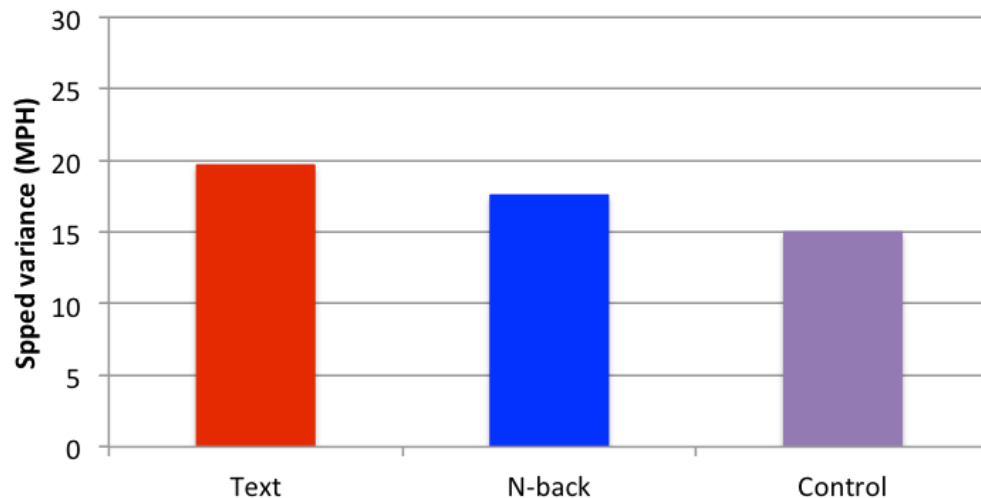
- Speed maintenance

- » No main effect for task, $F_{(2, 111)} = 0.832, p = 0.438$

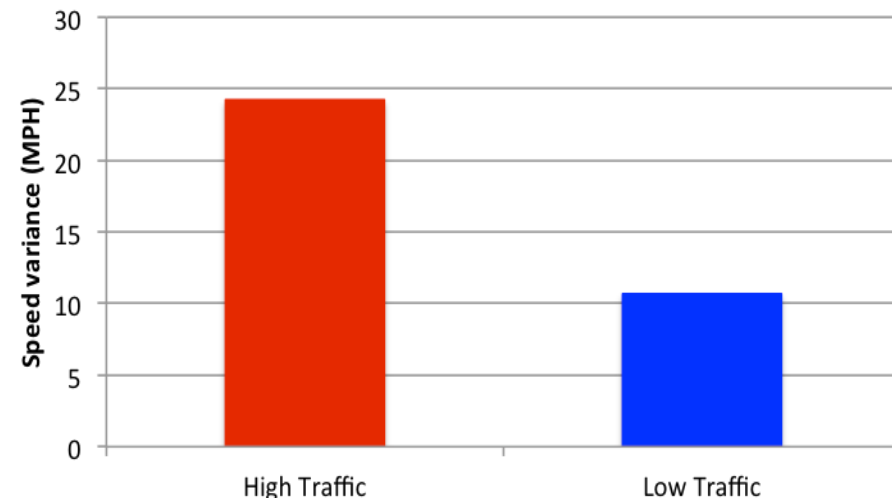
- » Main effect for traffic level, $F_{(1, 111)} = 22.762, p < 0.001$

- » No significant interaction of task and traffic, $F_{(2, 111)} = 0.101, p = 0.904$

Speed maintenance



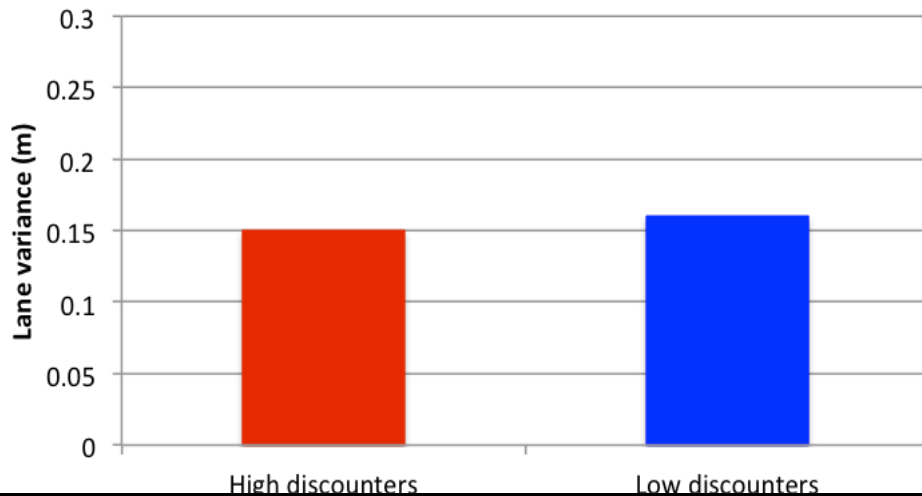
Speed maintenance



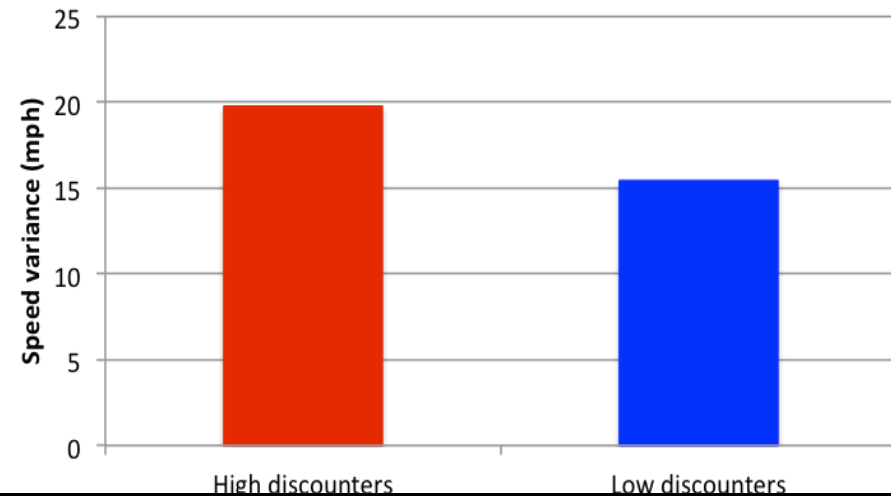
Driving Performance Results

- By discounting group: Lane maintenance
 - » No main effect for discounting group, $F_{(1, 111)} = 1.61, p = 0.204$
- By discounting group: Speed maintenance
 - » No main effect for discounting group, $F_{(1, 115)} = 3.32, p = 0.071$

Lane maintenance



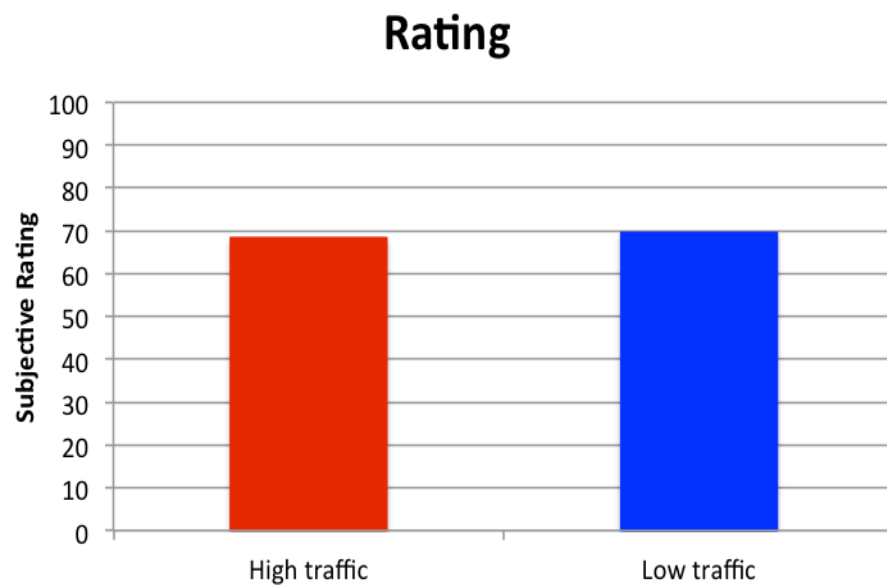
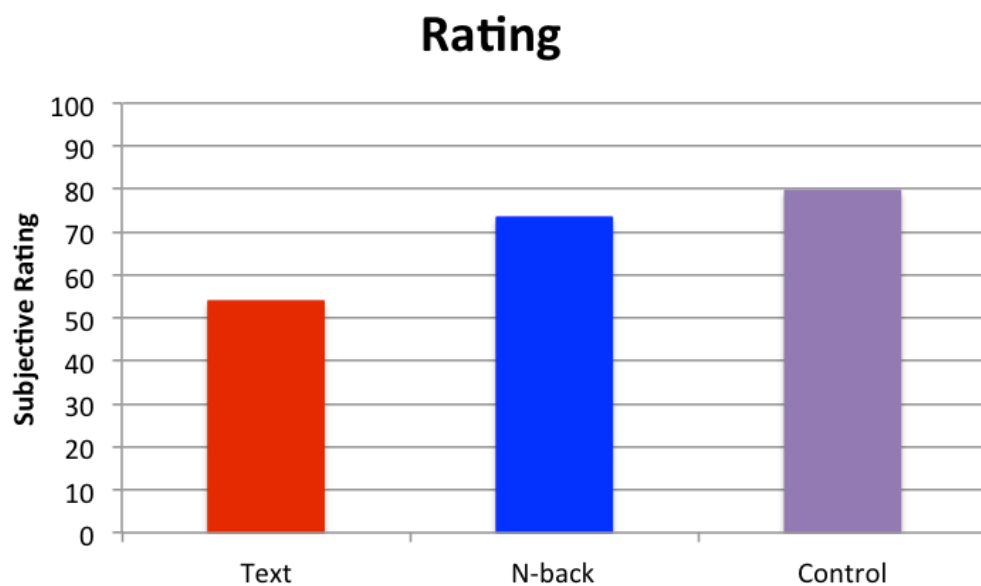
Speed maintenance



Driving Rating Results

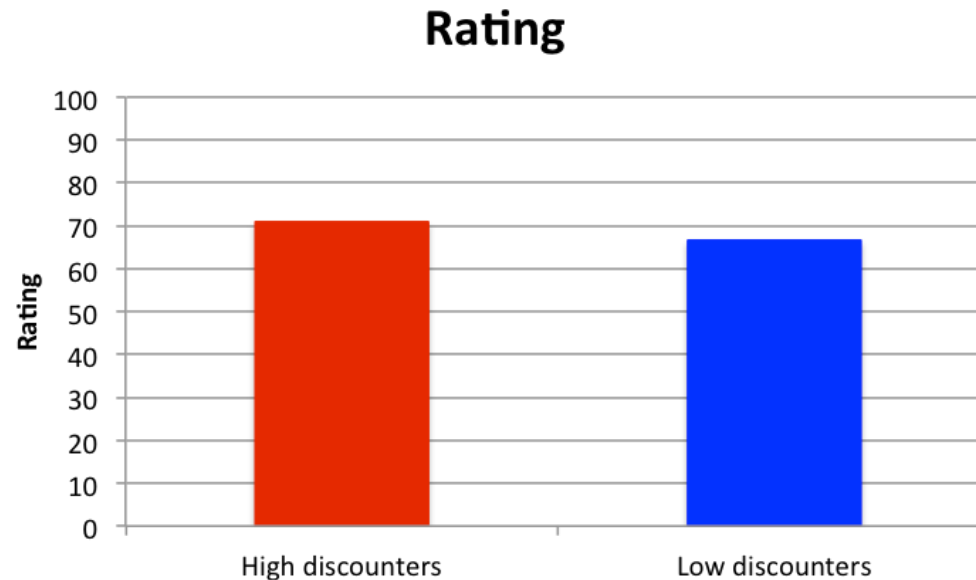
Driving Rating Results

- By task and traffic condition
 - » Main effect for task, $F_{(2, 114)} = 29.403$, $p < 0.001$
 - » No main effect for traffic level, $F_{(1, 114)} = 0.176$, $p = 0.676$
 - » No significant interaction of task and traffic, $F_{(2, 114)} = 0.138$, $p = 0.871$



Driving Rating Results

- By discounting group
 - » No main effect for discounting group, $F_{(1, 118)} = 1.547$, $p = 0.216$



Discussion

- Manual distraction degraded driving performance
 - » Regardless of group
 - » Drivers seem to be unaware of improved lane-keeping with increased mental workload
- There are distinct groups of people who are more and less willing to put off responding to a text message
 - » No measurable differences in driving performance between these groups
 - » No rating differences between these groups

Discussion & Future directions

- Previous work has either examined the impact of distraction on driving performance OR how long drivers are willing to wait to respond to messages while driving
 - » These results improve our understanding of how different personality aspects influence driving behavior
 - » Further research is needed into different aspects of personality as it relates to driving performance
 - » Further research is needed to create more effective intervention techniques

Acknowledgements



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DRT Results

DRT Results

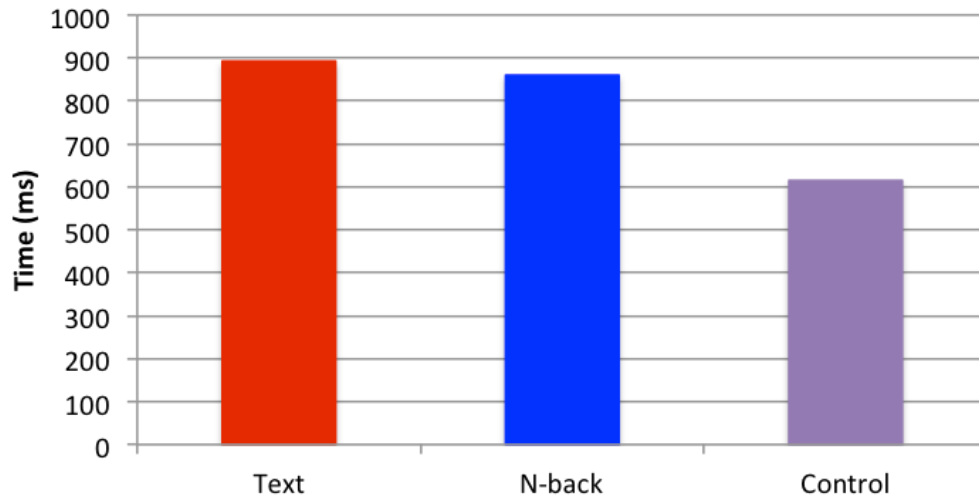
- Response time

- » Main effect for task, $F_{(2, 107)} = 18.536, p < 0.001$

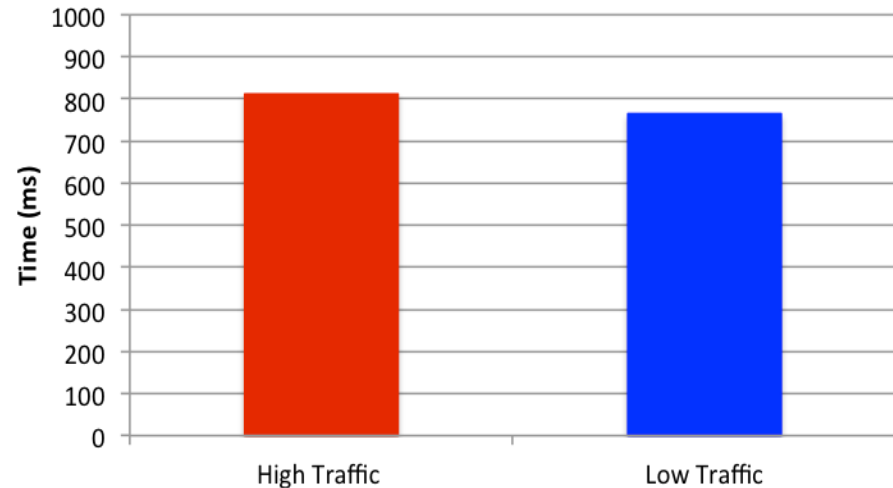
- » No main effect for traffic level, $F_{(1, 107)} = 1.243, p = 0.267$

- » No significant interaction of task and traffic, $F_{(2, 107)} = 0.487, p = 0.616$

Response Time



Response Time



DRT Results

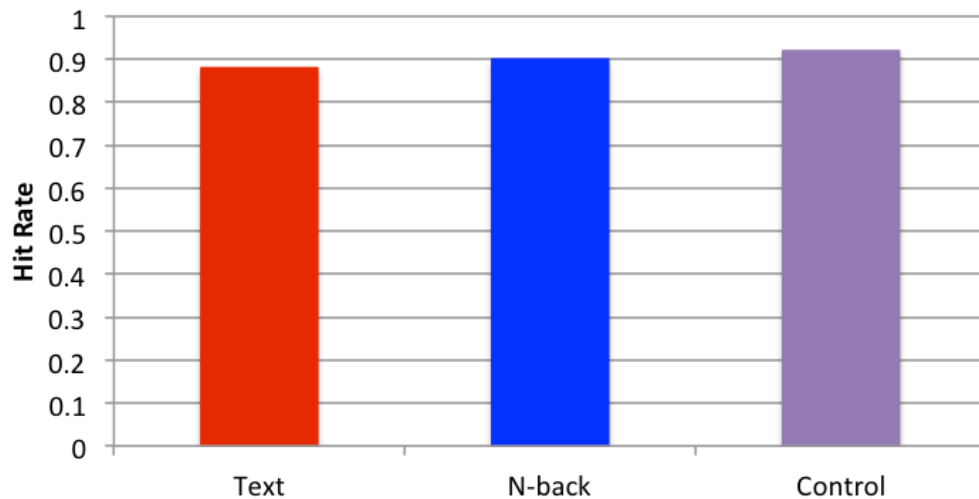
- Hit rate

- » No main effect for task, $F_{(2, 107)} = 1.387, p = 0.253$

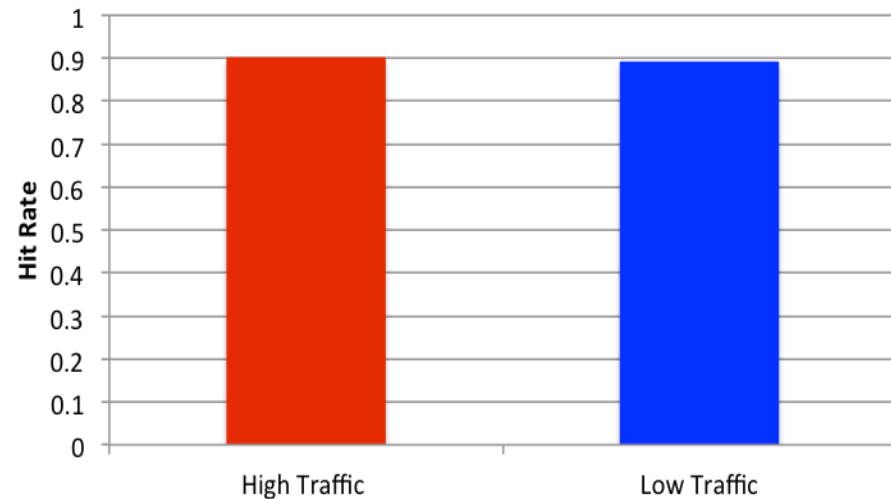
- » No main effect for traffic level, $F_{(1, 107)} = 0.185, p = 0.668$

- » No significant interaction of task and traffic, $F_{(2, 107)} = 0.493, p = 0.952$

Hit Rate



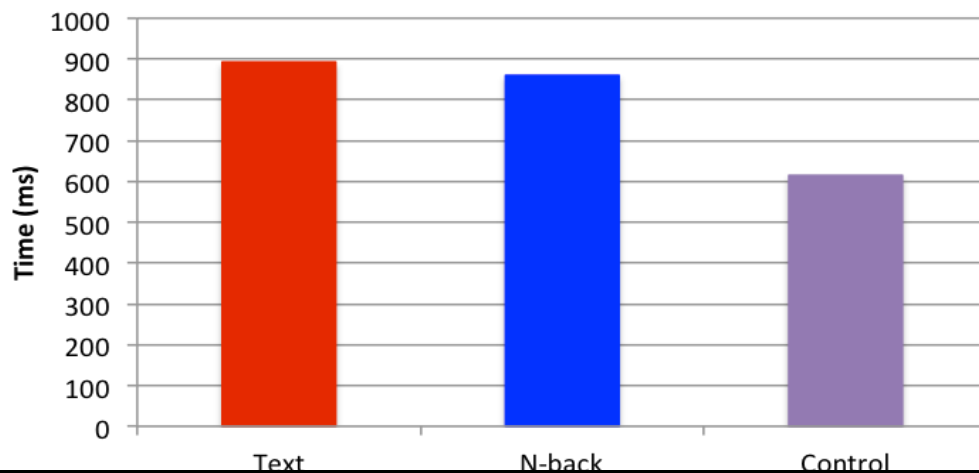
Hit Rate



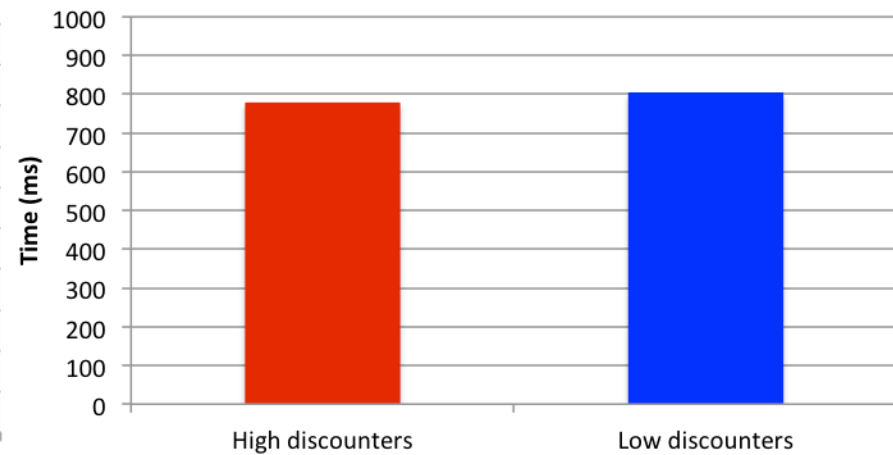
DRT Results

- Response time by discounting group and task
 - » Main effect for task, $F_{(2, 108)} = 9.978$, $p < 0.001$
 - » No main effect for discounting group, $F_{(1, 108)} = 0.443$, $p = 0.507$
 - » No significant interaction of task and group, $F_{(1, 108)} = 0.190$, $p = 0.663$

Response Time



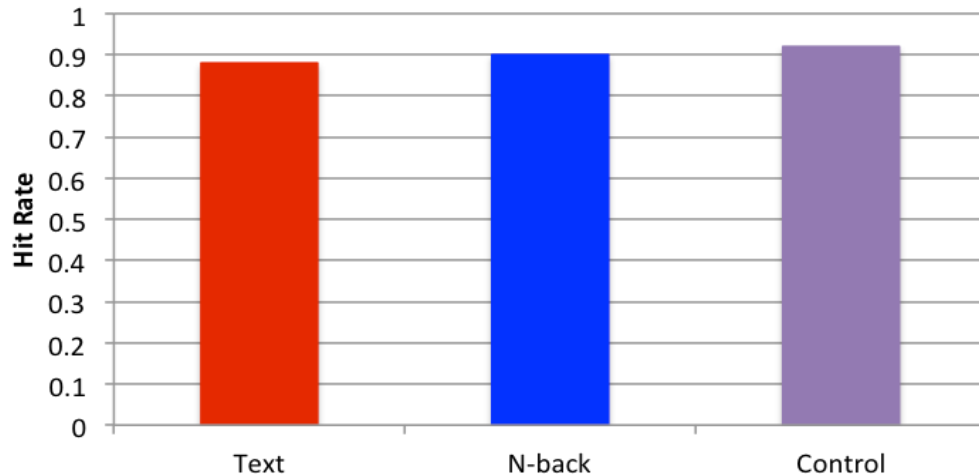
Response Time



DRT Results

- Hit rate by discounting group and task
 - » No main effect for task, $F_{(2, 107)} = 1.428$, $p = 0.244$
 - » Main effect for discounting group, $F_{(1, 107)} = 4.145$, $p < 0.05$
 - » No significant interaction of task and group, $F_{(1, 107)} = 0.015$, $p = 0.985$

Hit Rate



Hit Rate

