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Distracted driving in elderly and middle-aged drivers

Kelsey R. Thompson[a], Amy M. Johnson[b], Jamie L. Emerson[a], Jeffrey D. Dawson[b], Erwin R. Boer[c], Matthew Rizzo[a,*]

[a] University of Iowa, Department of Neurology, 200 Hawkins Drive, Iowa City, IA 52242, USA
[b] University of Iowa, Department of Biostatistics, 200 Hawkins Drive, Iowa City, IA 52242, USA
[c] Entropy Control, Inc., 7945 Avenida Kirjah, LaJolla, CA 92037, USA

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ABSTRACT

Automobile driving is a safety-critical real-world example of multitasking. A variety of roadway and in-vehicle distracter tasks create information processing loads that compete for the neural resources needed to drive safely. Drivers with mind and brain aging may be particularly susceptible to distraction due to waning cognitive resources and control over attention. This study examined distracted driving performance in an instrumented vehicle (IV) in 86 elderly (mean = 72.5 years, SD = 5.0 years) and 51 middle-aged drivers (mean = 53.7 years, SD = 9.3 year) under a concurrent auditory–verbal processing load created by the Paced Auditory Serial Addition Task (PASAT). Compared to baseline (no-task) driving performance, distraction was associated with reduced steering control in both groups, with middle-aged drivers showing a greater increase in steering variability. The elderly drove slower and showed decreased speed variability during distraction compared to middle-aged drivers. They also tended to “freeze up”, spending significantly more time holding the gas pedal steady, another tactic that may mitigate time pressured integration and control of information, thereby freeing mental resources to maintain situation awareness. While 39% of elderly and 43% of middle-aged drivers committed significantly more driving safety errors during distraction, 28% and 18%, respectively, actually improved, compatible with allocation of attention resources to safety critical tasks under a cognitive load.

1. Introduction

Multitasking involves competition for limited neural resources by behavioral tasks, such that engagement in one task affects performance of the others. There are also global effects, wherein brain activity for concurrent tasks may be less than the sum of activities for each task performed alone, even when the tasks draw on different brain systems (Just et al., 2008).

Automobile driving is a safety-critical real-world example of multitasking that requires tracking locations of surrounding vehicles, judging when it is safe to pass or merge, and navigating, while also obeying traffic signals and controlling vehicle steering and speed. Added distracter tasks can compete for the neural resources needed to drive safely. Performance may initially improve with heightened arousal (a broad construct representing one's overall stimulation [Hockey, 1984; Hancock and Szalma, 2007; Hanoch and Vitouch, 2004]) before it deteriorates under the added cognitive load (Teigen, 1994), ultimately increasing the risk of single-vehicle crashes (e.g., running off the road) and rear-end collisions (Eby and Kostyniuk, 2003).

Modern vehicles include “traditional” distracters, such as heating/cooling systems, cigarette lighters, and radios, and more modern “infotainment”, such as CD/DVD players and iPod/MP3 players (Strayer and Drews, 2007). Cell phone communication has raised particular concern among public health and policy experts, as even hands-free use may impair driving (Eby and Kostyniuk, 2003; Horberry et al., 2006; Horrey and Wickens, 2006; Shinar et al., 2005; Strayer and Drews, 2004, 2007; Watson and Strayer, 2010). Drivers using cell phones process less visual information in the driving scene (Strayer and Drews, 2004), stop incompletely at stop signs (Strayer and Drews, 2007), and have delayed breaking responses (Watson and Strayer, 2010) and more rear-end collisions (Strayer and Drews, 2007).

Driving, especially under distracted conditions, relies heavily on executive functions, including selective attention and working memory. These abilities decline with age (Shih, 2009), which can reduce driver control over the focus of attention, task switching (Chaparro et al., 2005; Craik and Bialystok, 2006) and vehicle control (Rizzo et al., 2004), increasing the risk of crashes (Trick et al., 2004). Several studies have used verbal or auditory–visual tasks to study these effects (Horberry et al., 2006; Strayer and Drews, 2007;

* Corresponding author. Tel.: +1 319 356 8748; fax: +1 319 384 7199.
E-mail addresses: kelsey-thompson@uiowa.edu (K.R. Thompson), amy-m-johnson@uiowa.edu (A.M. Johnson), jamie-emerson@uiowa.edu (J.L. Emerson), jeffrey-dawson@uiowa.edu (J.D. Dawson), ErwinBoer@EntropyControl.com (E.R. Boer), matthew-rizzo@uiowa.edu (M. Rizzo).

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