

★ ★ ★ ★ Safety Culture

Measuring Cognitive Distraction in the Automobile

Fact Sheet

Background

- Distracted driving is a significant highway safety threat, responsible for well over 3,000 fatalities each year.
- There are three main sources of driver distraction:
 - **Visual** (eyes off the road)
 - **Manual** (hands off the wheel)
 - **Cognitive** (mind off the task)
- Of these, *cognitive distraction* has been the hardest to study.
- Prevailing assumptions have held that “hands-free” = safe:
 - 66% of licensed drivers say driver use of hand-held cell phones is **unacceptable**; 56% say hands-free is **acceptable**.
 - New speech-based in-vehicle technologies and infotainment systems have proliferated.
- The AAA Foundation for Traffic Safety set out in 2011 to study this issue and investigate potential sources of cognitive distractions for drivers.

New Study: Measuring Cognitive Distraction in the Automobile

Objectives:

- Isolate the cognitive elements of distracted driving;
- Evaluate the amount of cognitive workload caused by various tasks performed by drivers; and
- Create a rating scale ranking tasks according to how much cognitive distraction they cause.

Methods:

Three experiments were performed:

Laboratory



Driving Simulator



Instrumented Vehicle



Several measures were used to assess cognitive workload, such as:

Subjective workload ratings
(survey)

Brainwave (EEG) activity

Brake reaction time and
following distance

Reaction time & accuracy to
peripheral light detection test

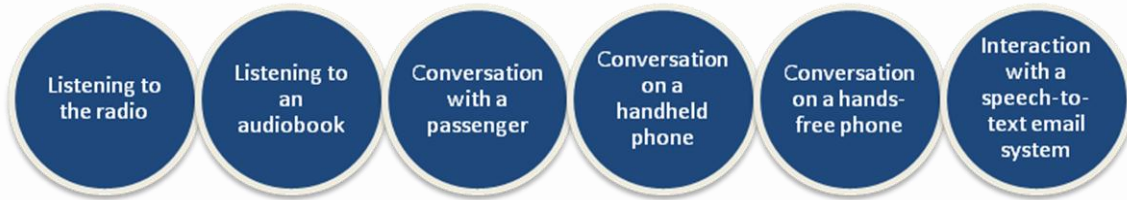
Eye and head movements

(Continued)



Car crashes rank among the leading causes of death in the United States.

Six common driver tasks were analyzed in each experiment



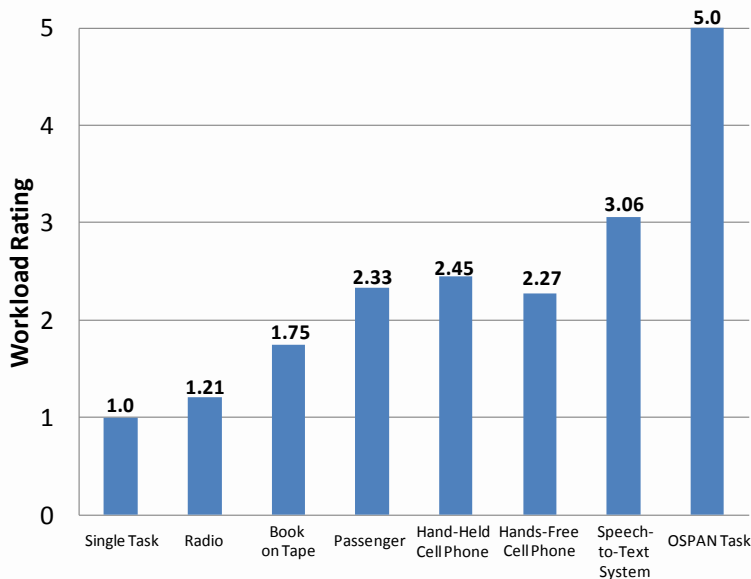
A seventh and eighth condition – non-distracted driving, and a complex series of math and verbal problems (OSPA task) – were included to anchor the low and high ends of the rating scale, respectively.

Measurements from all experiments were standardized to create one rating scale

Key Findings

- Even when a driver’s eyes are on the road and hands are on the wheel, sources of *cognitive* distraction cause significant impairments to driving, such as:
 - **Suppressed brain activity** in the areas needed for safe driving;
 - **Increased reaction time** (to peripheral detection test and lead vehicle braking);
 - **Missed cues** and decreased accuracy (to peripheral detection test); and
 - **Decreased visual scanning** of the driving environment (*tunnel vision*, of sorts).
- Driver interactions with in-vehicle speech-to-text systems (such as the infotainment offerings in many new vehicles) create the highest level of cognitive distraction among the tasks assessed.
- Simply put: **“hands-free” does not mean risk free!**

Cognitive Distraction Rating Scale



The scale to the left ranks the six common driver tasks according to the amount of cognitive workload they impose on drivers. The two anchor conditions (single-task non-distracted driving, and the complex OSPAN math and verbal task) represent the low (1) and high (5) ends of the scale, respectively. The other scores are standardized from the three experiments, and demonstrate that while some tasks, like listening to the radio, are not very distracting, others – such as maintaining phone conversations and interacting with speech-to-text systems – place a high cognitive demand on drivers and degrade performance and brain activity necessary for safe driving.

For More Information

For more information about the Foundation’s research pertaining to distracted driving and traffic safety culture, please visit www.AAAFoundation.org/research.

Established in 1947 by AAA, the AAA Foundation for Traffic Safety is a not-for-profit, publicly funded, 501(c)(3) charitable research and educational organization. The AAA Foundation’s mission is to prevent traffic deaths and injuries by conducting research into their causes and by educating the public about strategies to prevent crashes and reduce injuries when they do occur. This research is used to develop educational materials for drivers, pedestrians, bicyclists and other road users. Visit www.AAAFoundation.org for more information.