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through research
and education

Measuring Cognitive Distraction in the Automobile

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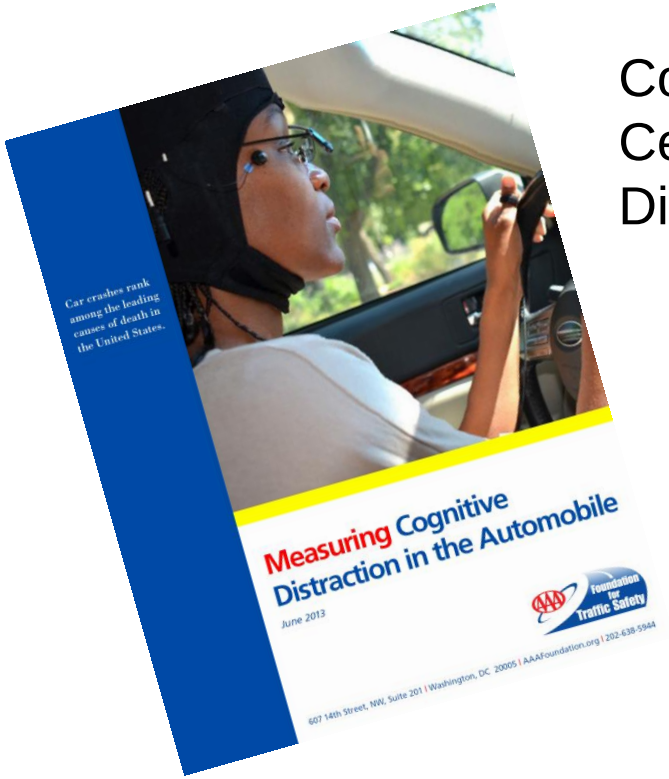
Background

- Distracted driving is a major threat to highway safety, and is responsible for **well over 3,000** fatalities each year.
- There are three types of driver distractions:
  - **Visual** (eyes off the road)
  - **Manual** (hands off the wheel)
  - **Cognitive** (mind off the task)
- Of these, *cognitive distraction* is the hardest to observe and study

Background (cont.)

- Prevailing assumption: “hands-free” = safe
  - Public: 66% say driver use of hand-held devices is **unacceptable**; 56% say hands-free is **acceptable**
  - Policymaker: 41 States + DC ban texting while driving; **0** ban hands-free devices
  - Industry: In-vehicle speech-based technologies and infotainment systems are proliferating and are often marketed as safe by virtue of being hands-free
- AAA Foundation set out in 2011 to investigate this issue

The Study (June 2013)



Conducted by the University of Utah Center for the Prevention of Distracted Driving

Available at www.AAAFoundation.org

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Objectives

1. **Isolate** the cognitive elements of distracted driving;
2. **Evaluate** the amount of cognitive workload caused by various tasks performed behind the wheel; and
3. **Create** a rating scale that ranks tasks according to how much cognitive distraction they cause.

Methods

3 Experiments performed:

1. Laboratory (baseline assessment)

2. High-fidelity driving simulator

3. Instrumented vehicle

Methods (cont.)

Several measures/outcomes assessed:

1. Subjective workload ratings (survey)
   - Laboratory, Simulator, Vehicle
2. Brainwave (EEG) activity
   - Laboratory, Simulator, Vehicle
3. Reaction time & accuracy to peripheral light detection test
   - Laboratory, Simulator, Vehicle
4. Brake reaction time and following distance
   - Simulator
5. Eye and head movements
   - Vehicle

Methods (cont.)

Six common tasks analyzed in each experiment:

Two additional tasks provide reference points:

- Single-task non-distracted driving (least distracting)
- Complicated math and verbal task (OSPAN; most distracting)

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Key Findings

- Even when a driver's eyes are on the road and hands are on the wheel, sources of *cognitive distraction* impair driving by:
  - **Suppressing brain activity** in the areas crucial for safe driving
  - **Increasing reaction time** (to peripheral detection test and lead vehicle braking)
  - **Decreasing accuracy** (missed cues in peripheral detection task)
  - **Decreasing visual scanning** of the driving environment

Key Findings (cont.)

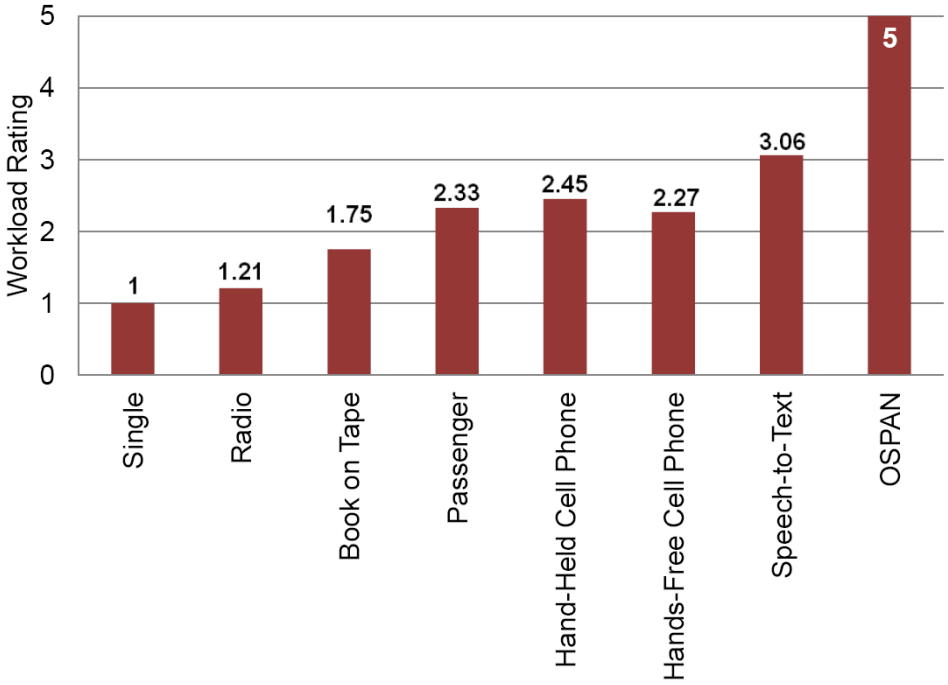
- Of all the tasks assessed, **driver interaction with speech-to-text systems** (such as the infotainment and other voice-activated tech offerings in many new vehicles) creates the **highest level of cognitive distraction**

Bottom Line

“Hands-Free” ≠ Risk Free

Cognitive Distraction Rating Scale

1. Ranks the six tasks relative to the two “anchor” conditions (1 & 5)
2. Ratings use standardized scores of workload across all experiments
3. Some tasks, like listening to the radio, are not very distracting
4. Maintaining conversation and interacting with speech-to-text systems create high levels of cognitive distraction



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Discussion & Implications

- Strong evidence that drivers are **not necessarily safe** just because eyes are on the road and hands are on the wheel
- Rush to incorporate speech-based technologies in new vehicles may have **harmful effects** on traffic safety
- **More research needed** to map levels of cognitive distraction to quantified crash risk increases

For more information, go to:

AAAFoundation.org

★ ★ ★ ★ Safety Culture

Established by AAA in 1947, the AAA Foundation for Traffic Safety is a 501(c)(3) not-for-profit, publicly-supported charitable educational and research organization. Dedicated to saving lives and reducing injuries on our roads, the Foundation's mission is to prevent crashes and save lives through research and education about traffic safety.

The Foundation supported by donations from AAA/CAA Clubs, AAA/CAA members, and other organizations associated with AAA/CAA.

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