Emerging Technology and Distracted Driving:
From the Model T to the Model S

David Strayer, Ph.D.
University of Utah
Distracted Driving – The Early Years
Proposed Car Radio Bans

- In 1930, legislation was proposed in Massachusetts to ban radios while driving
- An Auto Club of New England poll in 1934 found that 56% of respondents deemed the car radio a dangerous distraction
And Then Came the Car Phone
In-Vehicle Information Systems
AAA: Phase I
Measuring Cognitive Workload: Phase I

Develop robust cognitive workload scale for measuring

- Single-task (undistracted driving – Category 1)
- Radio
- Audio book
- Passenger conversation
- Hand-held cell phone conversation
- Hands-free cell phone conversation
- Speech-to-text email/text (perfect fidelity)
- OSPAN (high workload memory/math task – Category 5)
Cognitive Workload Scale: Phase I
AAA: Phase II
Measuring Cognitive Workload: Phase II

- Examining voice-based texting/e-mail in greater detail
  - Complexity of commands
  - Quality of speech

- Menu-based interactions to support navigation (e.g., locate closest ATM)
  - Perfect reliability
  - Medium reliability

- Apple’s hands-free Siri
Cognitive Workload Scale: Phase II
AAA: Phase III
Measuring Cognitive Workload: Phase III

• Establish that the workload scale applies for all drivers
  • Across the age range (21-70)

• Determine if practice reduces driving impairments

• Assess cognitive workload in
  • 10 OEM voice-based interfaces
  • Commonly used tasks (dialing, music selection, voice texting)
In-Vehicle Information System Interactions
In-Vehicle Information System Interactions

- Large costs of IVIS interactions (Category 5)
• 27 seconds of residual costs of IVIS interactions!
AAA: Phase IV
The Driver Distraction Triad

- Eyes off the Road
- Hands off the Wheel
- Mind off the Drive

Visual

High
Moderate
Low

Cognitive

Manual

Hands off the Wheel
Research Question #1

Are some task types more impairing than others?

- Audio Entertainment
- Calling and Dialing
- Text Messaging
- Navigation
Overall Demand by Task Type

The red dashed line represents the mean visual and mental demand accounting for time-on-task.
Research Question #2

Are some modes of interaction more distracting than others?

- Center Stack
- Auditory Vocal
- Center Console
The red dashed line represents the mean visual and mental demand accounting for time-on-task.
Research Question #3

Are IVIS interactions easier to perform in some vehicles than others?

- Evaluated 50 new 2017 vehicles
- Comprehensive on-road assessment
Overall Demand by Vehicle

- Summary: 7 vehicles generated moderate overall demand
- Summary: 11 vehicles generated high overall demand
- Summary: 12 vehicles generated very high overall demand
AAA: Phase V
Level-2 Automation: Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.
YERKES-DODSON LAW

The Yerkes-Dodson Law illustrates the relationship between performance and stress level. It shows that performance is highest when stress is moderate, with increases or decreases in stress leading to decreased performance. The diagram includes stages of fatigue, inattention, optimal range, active distraction, and overload.
Tesla Model 3 with Autopilot
Cadillac CT6 with Super Cruise
Spectral EEG

Disengagement of Visual Cortex

![Graphs showing spectral EEG data for different electrode placements and age groups.](image)