Why Talking to Your Car Drives You to Distraction

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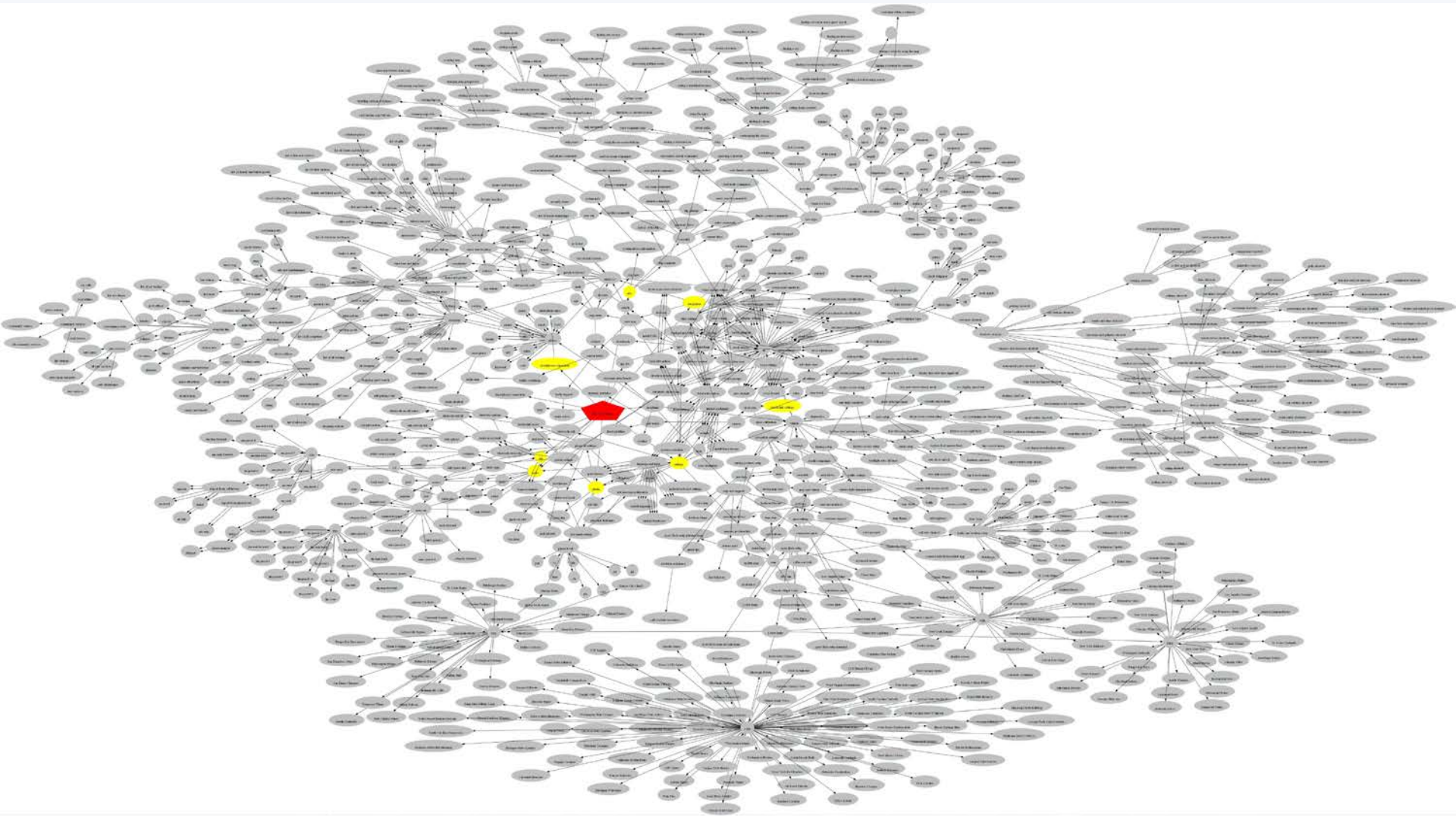
THE UNIVERSITY OF UTAH

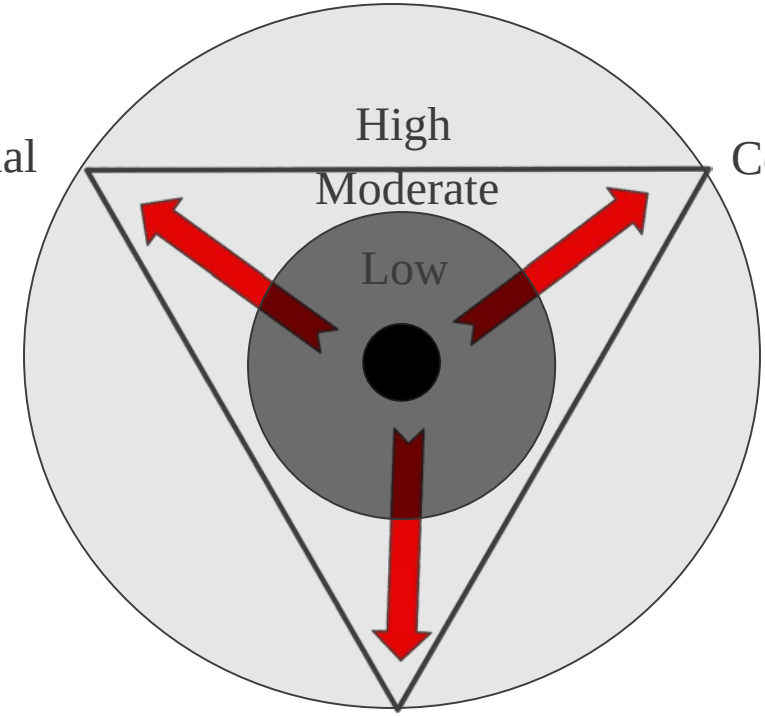
AAA Foundation for Traffic Safety

In-Vehicle Information Systems

IVIS-Function Map for Honda Accord



The Driver Distraction Triad



Visual

Cognitive

Eyes off the Road

Mind off the Drive

Manual

Hands off the Wheel

Developing a Metric of Cognitive Workload

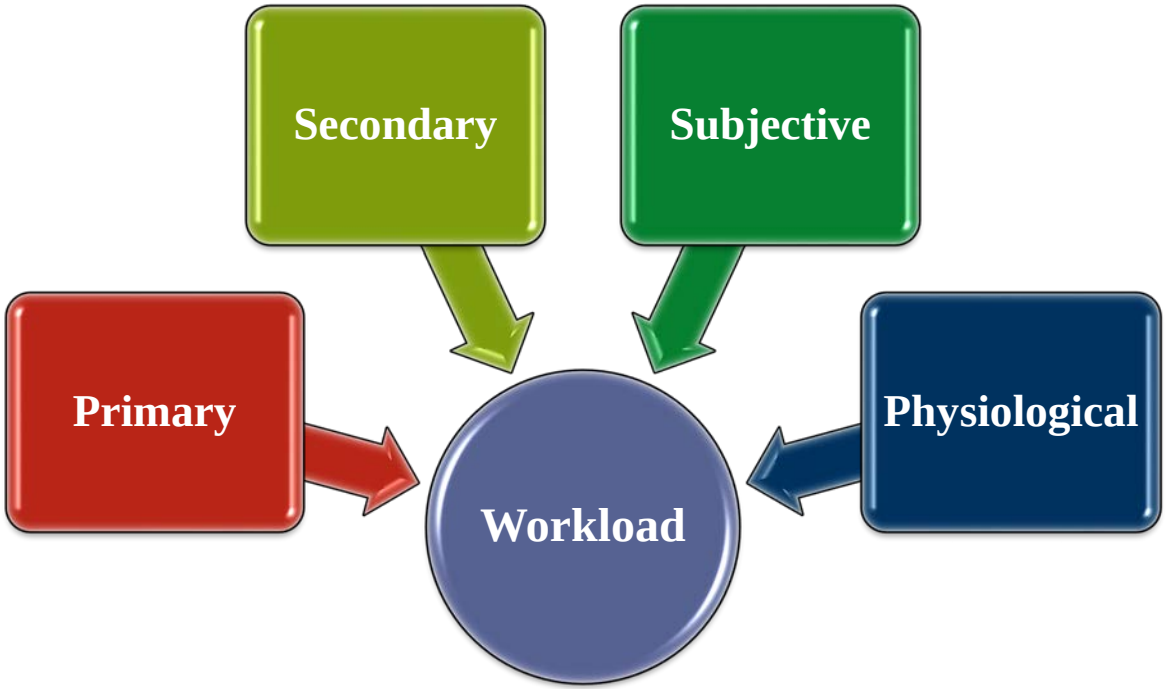
- Problem: Measuring cognitive workload is notoriously difficult
- Objective: Develop robust instrument of cognitive workload
  - Older technologies (e.g., radio, cell phone, etc.)
  - Newer technologies (e.g., speech-based in-vehicle communication)
- Standardized rating system
  - Similar to other rating systems (e.g., Richter, Saffir-Simpson, etc.) where higher ratings are indicative of greater cognitive workload

Measuring Cognitive Workload: Phase I

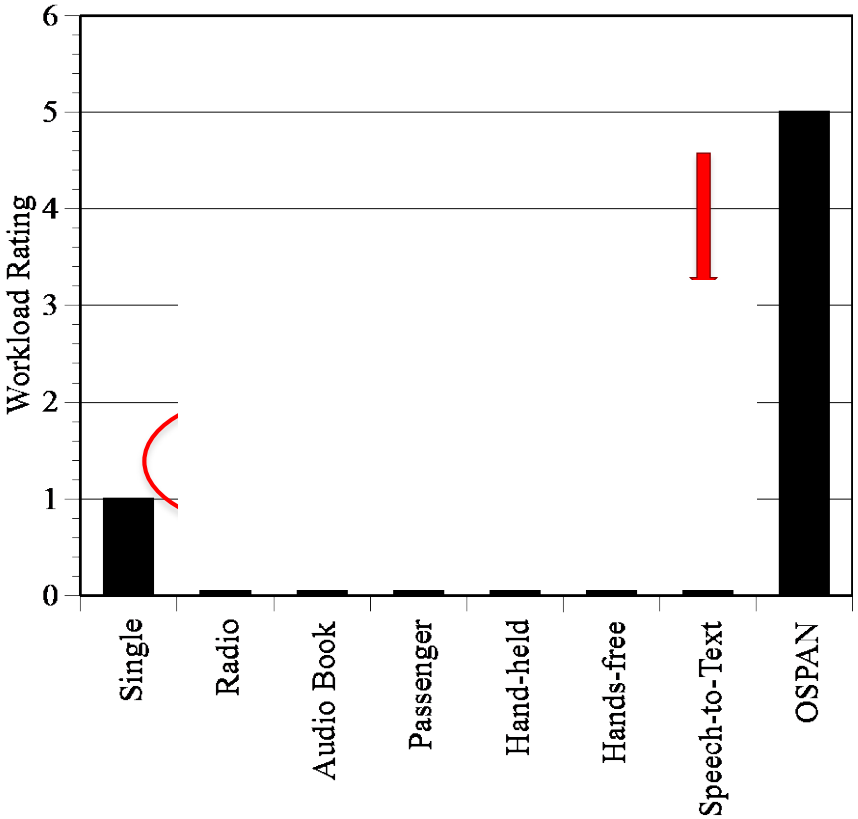
- Phase I Study Objectives:

- Develop robust cognitive workload scale for
  - 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)

Measures of Cognitive Workload



Cognitive Workload Scale: Phase I

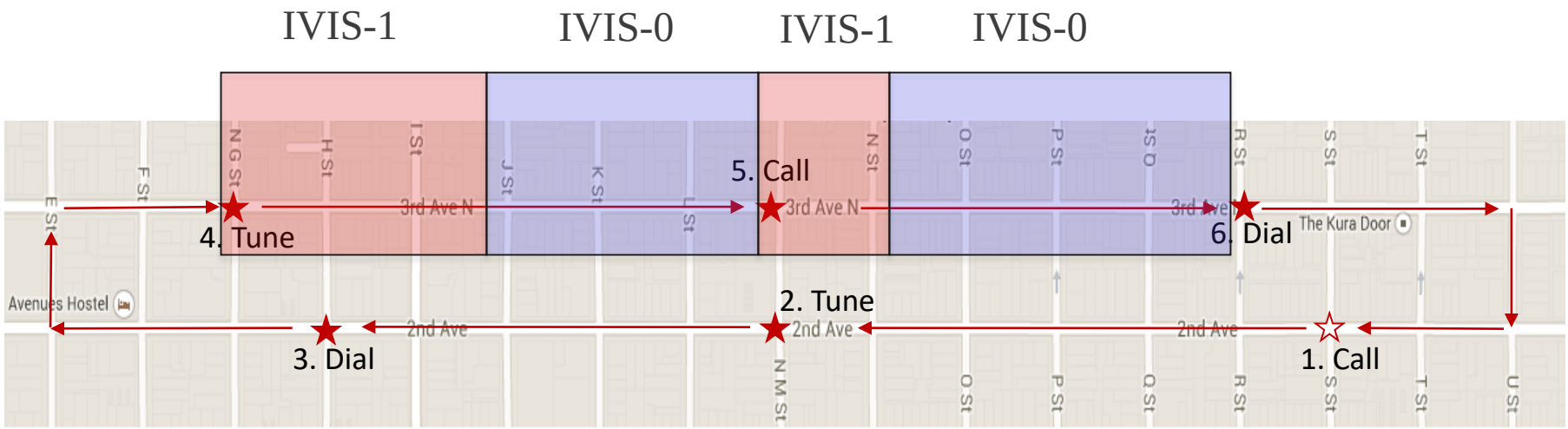


Measuring Cognitive Workload: Phase III

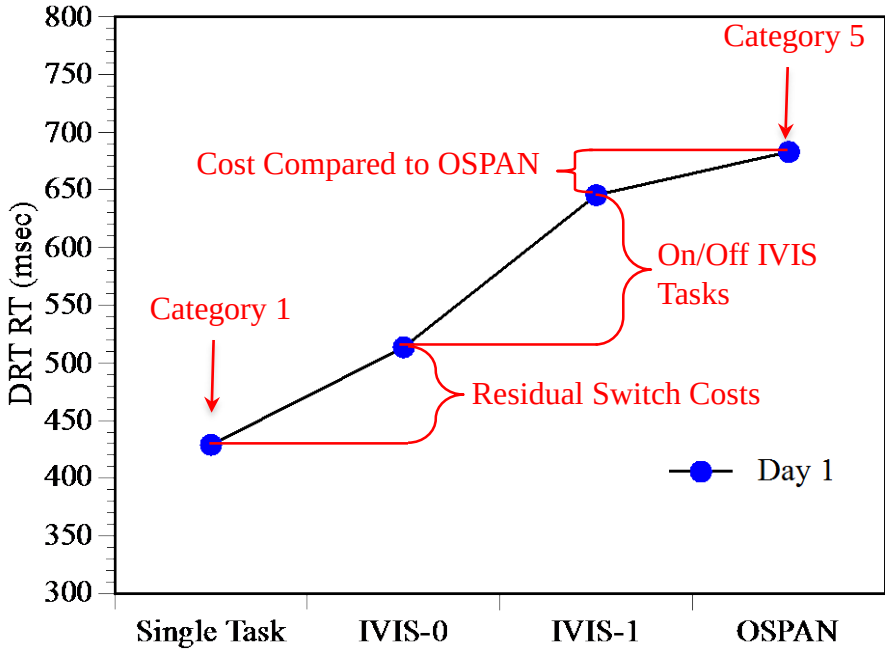
Use the workload metric to:

- Establish that the workload scale applies for all drivers
  - Across the age range (21-70)
  - Applicable for both genders
- Determine if practice reduces driving impairments
- Assess cognitive workload in
  - 10 2015 OEM voice-based interfaces
  - Intelligent personal assistants (Apple's Siri, Google's Now, Microsoft's Cortana)
  - Commonly used tasks (dialing, music selection, voice texting)

In-Vehicle Information System Interactions

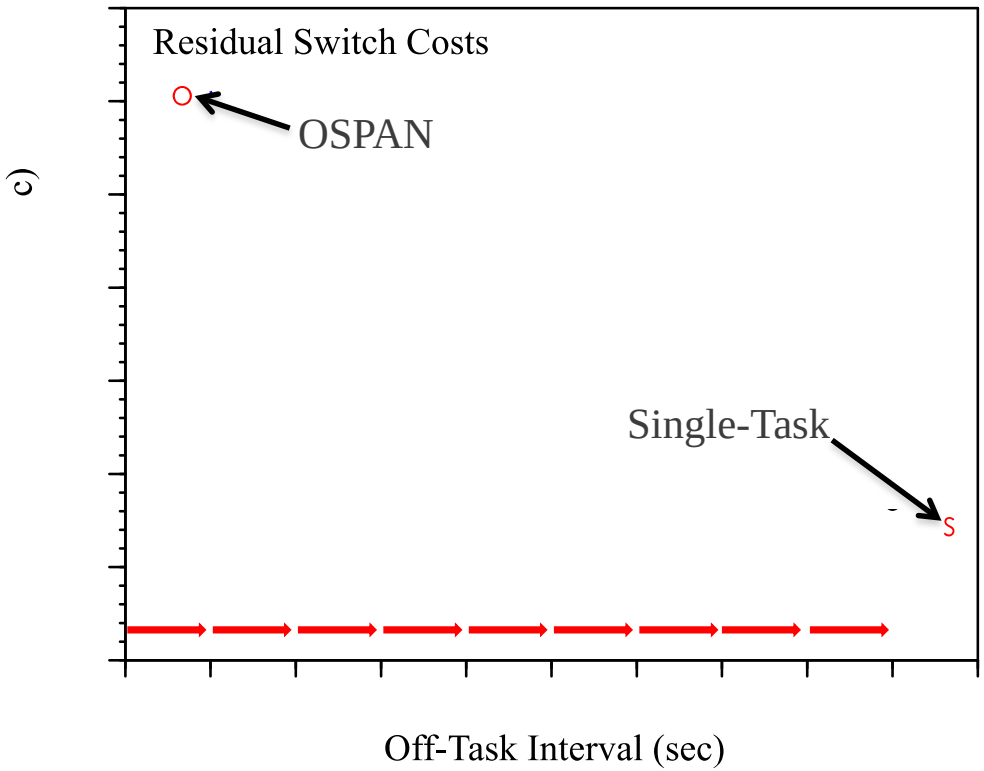


The Detection Reaction Time Task



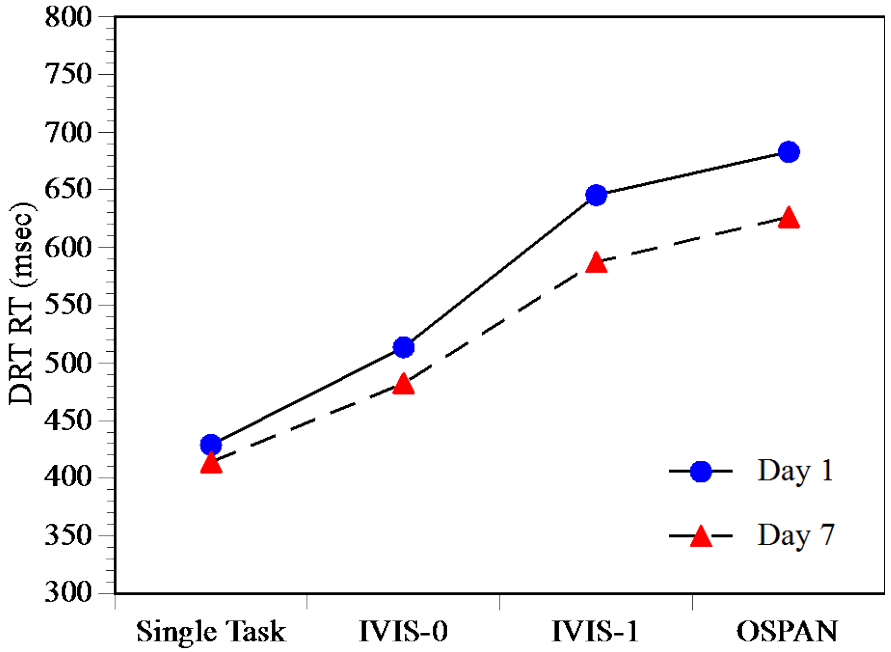
- Large costs of IVIS interactions (Category 5)

The Detection Reaction Time Task



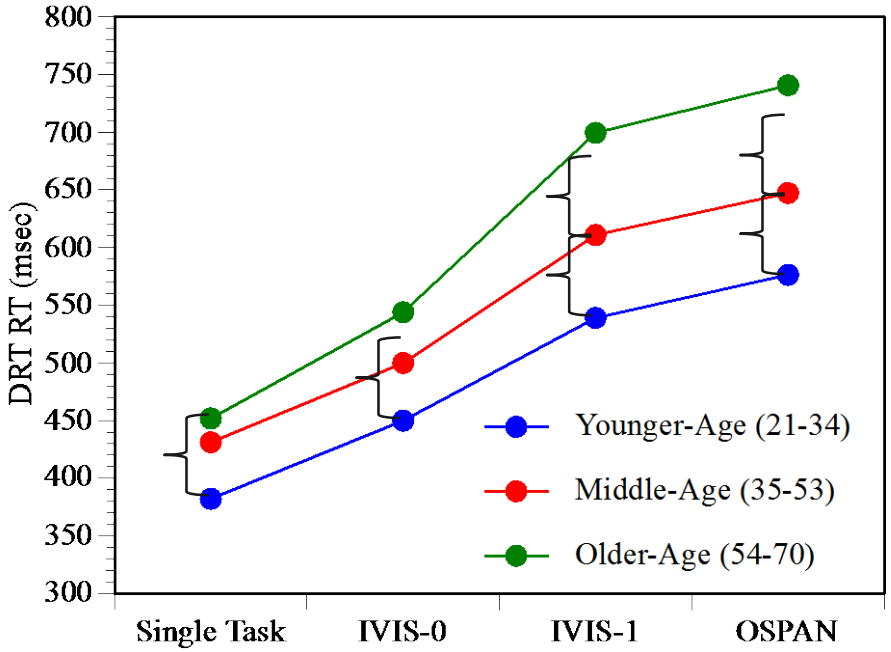
- Surprising residual costs of IVIS interactions

Effects of Practice



- Same basic patterns obtained after 1 week

Effects of Age



- Older drivers exhibit greatest costs (> 2X)

Phase IIIa Conclusions

- Cognitive demand for actual systems in line with Phase I
- Cognitive demands vary considerably between systems
  - Complexity
  - Intuitiveness
  - Time to complete tasks
- Well executed systems have the potential to create little additional demands
- Poorly executed systems can be very problematic

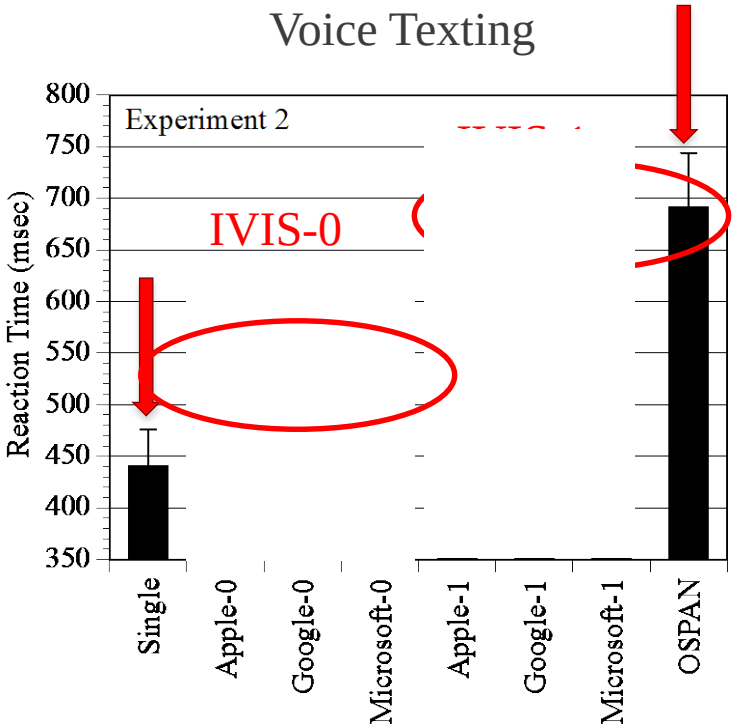
Comparing Intelligent Personal Assistants

Apple iPhone 6 with iOS 8.2

Nokia Lumia 635 running Windows 8.1

Google Nexus phone running Android 5.0.1

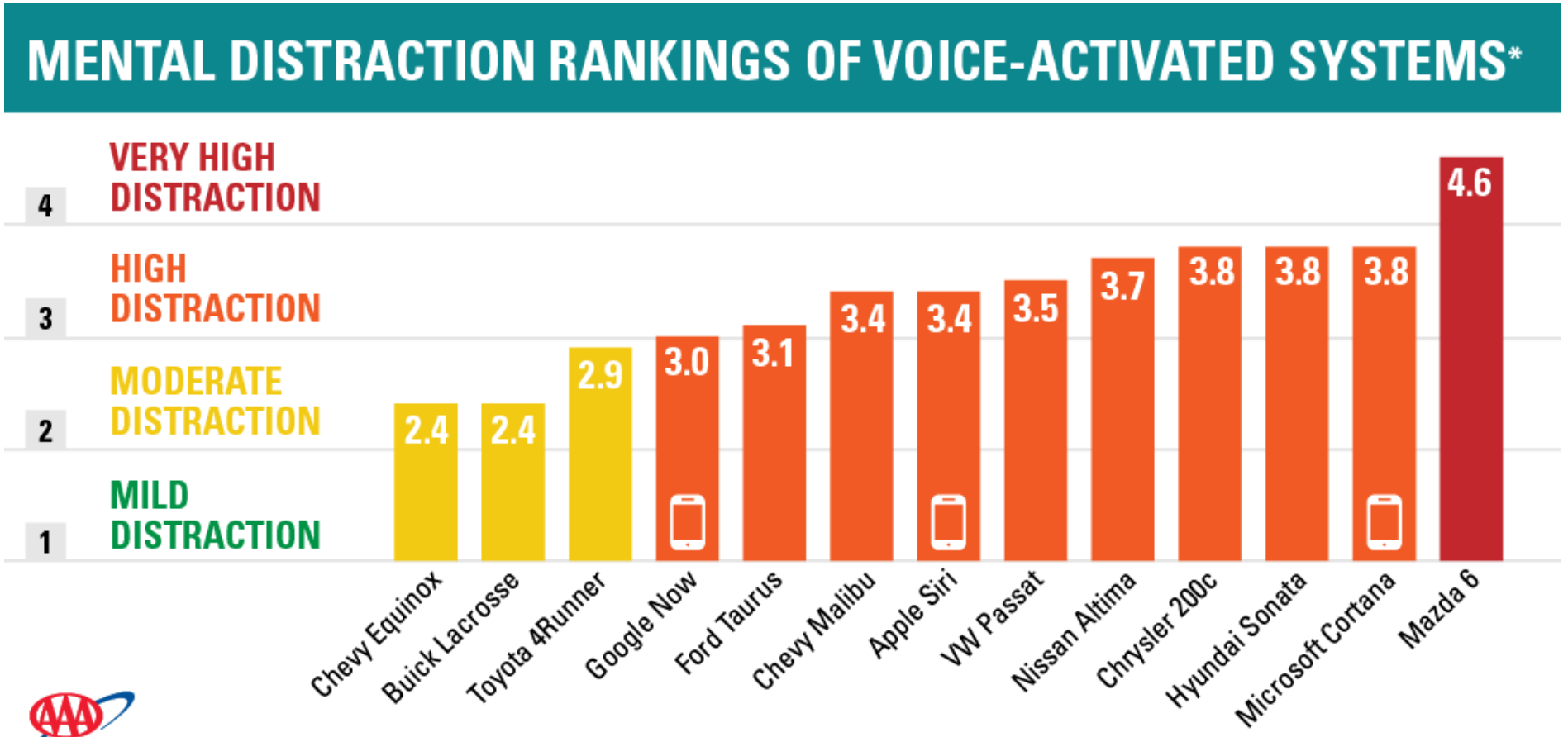
The Detection Reaction Time Task



- Large costs of Voice-based Interactions

Jimmy Kimmel Live

Cognitive Workload Scale: Phase III



Source: AAA Foundation for Traffic Safety

*Mental distraction rankings when using voice-commands to make calls or change music while driving. Includes 2015 model-year vehicles.

Talking to your Car Drives You to Distraction

- Voice-based interactions associated with high levels of workload
- Surprisingly long-lasting residual switch costs
- Practice improves performance, but does not eliminate impairment
- All age-groups show impairment, but older adults find voice-based interactions more difficult
- Vehicles/IVIS systems vary in difficulty – systems with short and robust interactions have lower levels of workload

Fini

"I wasn't texting. I was building this ship in a bottle."