Driver Distraction and Cognitive Load

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What is Driver Distraction?
Multiple Definitions Exist with Little Agreement Among the Scientific Community

“Driver distraction is the diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving.”

Based on Regan et al. (2011, p. 1776) as amended at Toyota CSRC Driver Distraction Definitions Workshop March, 2012
Sources of Distraction

- Cognitive
- Auditory
- Vocal /Verbal
- Visual
- Motoric
- Somatosensory/Vestibular
- Smell
- Taste

Source: Toyota CSRC Driver Distraction Definitions Workshop March, 2012
Cognitive Workload

- Cognitive
- Auditory
- Vocal / Verbal
- Visual
- Motoric
- Somatosensory / Vestibular
- Smell
- Taste

Three categories often grouped together in simplified discussions of “cognitive workload” but have different neurological underpinnings and potential effects on attention and behavior.

Source: Toyota CSRC Driver Distraction Definitions Workshop March, 2012
The MIT n-back

An Evolving International Procedure for Grading Cognitive Workload

- Series of 10 single digit numbers (0-9) presented in random order aurally at 2.25 sec intervals
- Subject instructed to respond with nth digit back
- Across levels
  - Auditory demands constant
  - Vocal demands “relatively” constant
- Aims to manipulate secondary cognitive demand

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>6 9 1 7 0 8 4</th>
</tr>
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<tbody>
<tr>
<td>0-back Response</td>
<td>6 9 1 7 0 8 4</td>
</tr>
<tr>
<td>1-back Response</td>
<td>. 6 9 1 7 0 8</td>
</tr>
<tr>
<td>2-back Response</td>
<td>. . 6 9 1 7 0</td>
</tr>
</tbody>
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Mehler, Reimer, Dusek & Coughlin (2011)
A Common Perception of The Three Major Pillars of Distraction

- Cognitive
- Visual
- Manipulative
In reality

....... the pillars are highly overlapping
Workload & General Arousal

Yerkes-Dodson Law
The relationship between performance and physiological or mental arousal

![Diagram showing the relationship between workload/stress and performance, highlighting the optimal range between fatigue and overload.](image-url)
Cognitive Oriented Interfaces.....

...using voice and hands free technology offer the promise of reducing the time a driver’s eyes are drawn away from the roadway and maximizing the time a driver’s hands are on the wheel, however

Distraction Related Accident Risk
Visual Distraction Is Obvious

Eyes on road ≠ Mind on road

Cognitive demand is harder to “see”