Technology and Distracted Driving

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What is Distracted Driving?

- The safe operation of a motor vehicle requires that a driver focus a portion of his or her attentional resources on driving-related tasks.

- A driver may also engage in non-driving activities (e.g., talking on a cell phone) that compete for attention.
What is Distracted Driving?

- **Attentive driving**
- **“Routine” driving**
- **Distracted driving**
- **Impaired driving**

Driving Environment:
- **Low Demand**
- **Moderate Demand**
- **High Demand**

- Attention allocated to driving tasks
- Attention allocated to non-driving tasks
Distraction Sources

- Things outside of the vehicle:
  - Incidents
  - Billboards
  - Scenery

- Things inside the vehicle:
  - Passengers
  - Eating
  - Personal grooming
  - Pets
  - Smoking
  - Reading
  - Objects moving in vehicle
  - Using built-in technology
  - Using nomadic technology
Societal Factors

- Many new technologies in past decade:
  - MP3 players (iPod);
  - Smart phones;
  - Electronic book readers (Kindle);
  - Portable DVD players;
  - Personal digital assistants;
  - Tablet computers (iPad);
  - Texting.

- We can expect this development to continue.
Societal Factors

- Technology use in vehicles is increasing:
  - GPS devices sold in US: increase from 20 million in 2008 to 28 million in the next 5 years.
  - NOPUS Survey shows more than a doubling of driver cell phone use between 2000 and 2005.
- Michigan data:

![Graph showing Handheld Cell Phone use in Michigan](image)
Societal Factors

- Roadways are getting more congested:
  - The number of licensed drivers in the US increased by 23 million between 1996 and 2006 and few new roadways are being built;
  - As the driving task demand increases, more attention needs to be devoted to driving and less attention can be allocated to secondary tasks.
Societal Factors

- Our population is aging.
  - By 2030, Michigan older adults will represent about 20% of the driving population.
- Young drivers are the most frequent users of nomadic technology.
  - Young drivers have the highest crash rates of any age group.
  - Study: 20% of young survey respondents reported selecting songs on their portable music player while driving.
  - NOPUS: teen drivers use cellular phones while driving more than any other age group.
THE BUCKETS

CHANGE THE CD, TOBY.

WHY DON'T YOU DO IT?

BECAUSE I'M DRIVING.

PFFT

WHEN I GET MY LICENSE, I'LL DRIVE.

CHANGE A CD...

WHILE EATING A BURGER...

... TALKING ON THE PHONE...

... AT NIGHT...

... IN THE RAIN.

DO YOU HAVE ANY IDEA HOW DANGEROUS THAT IS?

NOT WHEN YOU'RE A GOOD DRIVER LIKE ME!
Technology and Driver Distraction

- Any technology that engages a driver’s attention can be distracting.
- Multiple factors can influence the level of distraction and crash risk.
- Little research on distracting effects of technology except for cell phones and, much less so, navigation devices.
Driver Distraction Research

- Two most important safety outcome measures:
  - Driver performance (e.g., lane keeping);
  - Effects on crash risk.
Distraction Research Methods

- **Simulator**
  - Advantages:
    - Risky situations can be investigated;
    - Objective measures of performance;
    - Excellent control over variables.
  - Disadvantage:
    - Not real driving.

- **Instrumented vehicles**
  - Advantages:
    - Real driving;
    - Objective measures of performance.
  - Disadvantages:
    - Little control over variables.
Distraction Research Methods

- Epidemiological (Case-Crossover Design)
  - Phone use records are compared to crash records.
  - Advantages:
    - Actual crashes are addressed;
    - Exposure can be managed and crash risk estimated;
    - Each case is its own control.
  - Disadvantages:
    - Don’t know exactly what the person is doing at time of crash;
    - Not all technology use can be studied.
## Technology and Driver Distraction

<table>
<thead>
<tr>
<th>Technology</th>
<th>Driving Performance Affected?</th>
<th>Crash Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP3/IPod</td>
<td>Yes, for song selection and video watching</td>
<td>Increased crash risk in simulator</td>
</tr>
<tr>
<td>DVD Player Watching/listening</td>
<td>Yes, in most studies. Greater for watching</td>
<td>Unknown</td>
</tr>
<tr>
<td>Radio/CD Manipulating/listening</td>
<td>Minimally. Greater for manipulating.</td>
<td>Slight increase in crash risk in simulator</td>
</tr>
<tr>
<td>Navigation System Destination entry</td>
<td>Yes, but depends on system. Manual entry is worse.</td>
<td>Likely increased, if not locked out</td>
</tr>
<tr>
<td>Navigation System Destination following</td>
<td>Yes, but depend on system. Verbal Instructions are best. Most better than maps</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
# Cellular Phones

<table>
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<th>Technology</th>
<th>Driving Performance Affected?</th>
<th>Crashes/Near Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld Dialing/answering</td>
<td>Yes, operational skills</td>
<td>Higher risk than when conversing</td>
</tr>
<tr>
<td>Handheld Conversing</td>
<td>Yes, tactical skills (situation awareness)</td>
<td>Increased</td>
</tr>
<tr>
<td>Handsfree Dialing/answering</td>
<td>Moderate, but less so than with manual dialing</td>
<td>Likely increased</td>
</tr>
<tr>
<td>Handsfree Conversing</td>
<td>Yes, tactical skills (situation awareness)</td>
<td>Increased, generally less than for handsfree</td>
</tr>
<tr>
<td>Integrated</td>
<td>Moderate, but less so than nonintegrated handsfree cell</td>
<td>Unknown</td>
</tr>
<tr>
<td>Cell Phone Overall</td>
<td>Yes, operational and tactical</td>
<td>4-9 fold increase in crash risk</td>
</tr>
<tr>
<td>Texting</td>
<td>Yes, for both novice and experienced drivers</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
Benefits of Technology

- Manage the distraction source
  - Workload management systems (Examples: Saab Dialogue Manager, Volvo IDIS, SAVE-IT, AIDE).

![Diagram showing the process of managing driver workload with driver state and environmental state inputs, followed by determining driver workload, informing, warning, and intervening as mitigation strategies.](image-url)
Benefits of Technology

- Reduce workload of driving task
  - Navigation systems
  - Adaptive cruise control
  - Lane-keeping assistance
Benefits of Technology

- Mitigate negative outcomes of distraction
  - Crash warning systems
  - Automatic notification systems
Research Needs

- **Data**
  - Need to better link technology-related distraction to at-fault crashes.
  - Need better exposure data on technology-related distraction.

- **Model of Distracted Driving**
  - Link together the various components of distracted driving and how all types of driving performance are impacted.
  - Technology and task independent

- **Improved HMI design**
  - Common practices
  - Design for older adults (universal design)
Policy Implications

- Develop policy based on preponderance of research evidence;
- Policy should reflect how technology is used in vehicles;
- Policy should recognize trends (what will tomorrow’s technology be?);
- Bring all stakeholder’s to the table.
Thank You

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