Distracted Driving: What Research Shows

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Objectives

- Review research on hazards of distraction
- Make individuals more aware of their distraction habits
Distraction—Definition

Diversion of attention from what should be paid attention to.
Categories of Distractions

- Visual—Eyes on what we are doing
- Mechanical—Hands on
- Cognitive—Mind on what we are doing
Driving while doing something other than driving.
Driving while doing something other than driving.
Driving while doing something other than driving.
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Driving while doing something other than driving.
Driving while doing something other than driving.
Driving while doing something other than driving.
How Dangerous Is Cell Phone Distraction?

- Driver distraction is 18% of crashes
- Caused 3,450 deaths & 391,000 injuries in 2016
- Talking on a cell phone increases the crash risk 4 times
  - The rate equal to that of drunken driving at .10 level
Large-Scale Naturalistic Driving Study

- Drivers own vehicles
- Instrumentation with video
- Over 2000 drivers
<table>
<thead>
<tr>
<th>Activity</th>
<th>Car</th>
<th>Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating and drinking;</td>
<td>3.3</td>
<td>--</td>
</tr>
<tr>
<td>Reaching for object</td>
<td>7.68</td>
<td>6.72</td>
</tr>
<tr>
<td>Texting</td>
<td>4.33</td>
<td>23.24</td>
</tr>
<tr>
<td>Talk/listen to CB</td>
<td>--</td>
<td>.6</td>
</tr>
<tr>
<td>Interact w/dispatching device</td>
<td>--</td>
<td>9.93</td>
</tr>
<tr>
<td>Personal grooming;</td>
<td>3.1</td>
<td>4.48</td>
</tr>
<tr>
<td>Reading, including maps;</td>
<td>3.4</td>
<td>7.02</td>
</tr>
<tr>
<td>Adjusting a radio, music player</td>
<td>.6</td>
<td>--</td>
</tr>
<tr>
<td>Interact with passenger</td>
<td>.3</td>
<td>.35</td>
</tr>
</tbody>
</table>

Committed traffic violations:
- 75% -- Drivers using cell phone
- 25% -- Drivers not using cell phone
## Braking Distance at 70 MPH

<table>
<thead>
<tr>
<th>Item</th>
<th>Feet</th>
<th>Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal reaction</td>
<td>102</td>
<td>31</td>
</tr>
<tr>
<td>Alcohol affected</td>
<td>114</td>
<td>35</td>
</tr>
<tr>
<td>Cell Phone in Use</td>
<td>148</td>
<td>45</td>
</tr>
</tbody>
</table>
## Which is Worse, Hands-Free or Hand Held?

<table>
<thead>
<tr>
<th>Variable or Condition</th>
<th>Mean Increase in Reaction Time (seconds)</th>
<th>Standard Deviation (seconds)</th>
<th>Number of Studies</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handheld Phone</td>
<td>.21</td>
<td>.16</td>
<td>5</td>
<td>157</td>
</tr>
<tr>
<td>Hands-Free Phone</td>
<td>.18</td>
<td>.29</td>
<td>16</td>
<td>518</td>
</tr>
</tbody>
</table>

Conversations using any cell phone technology diverts the driver’s mind from driving.
Does talking on a cell phone interfere with driving?

- **Car-following paradigm**
  - Follow periodically braking pace car
  - Required timely and appropriate reactions
  - Hands-free cell phone (set-up in advance)
  - Naturalistic conversations

- **Conditions**
  - Single (driving) vs. dual-task (driving & talking)
  - Low & moderate traffic density
Reaction Time

- Low Density
- Moderate Density

- Single
- Dual
Following Distance

- Low Density
  - Single
  - Dual

- Moderate Density
  - Single
  - Dual
Rear-end Collisions

- Low Density
- Moderate Density

- Single
- Dual

3 Rear-end Collisions
2
1
0
Cell Phone Driver vs. Drunk Driver

- Car-following paradigm
  - Follow periodically braking pace car
  - Required timely and appropriate reactions

- Conditions
  - Single-task driving
  - Cell-phone driving *
  - Intoxicated driving (BAC= 0.08 wt/vol)
  * Hands-free = Hand-held
Reaction Time

- Intoxicated Driving
- Cell-Phone Driving

Reaction Time (Milliseconds): 1050, 1000, 950, 900, 850, 800, 750, 700

23
Following Distance

Intoxicated Driving

Cell-Phone Driving
Rear-end Collisions

- Intoxicated Driving: 1
- Cell-Phone Driving: 4
Car-following paradigm
- Follow periodically braking pace car
- Required timely and appropriate reactions

Conditions
- Driving vs. driving & texting
Reaction Time

- **single task**
- **dual task**

The graph shows a comparison between single-task and dual-task reaction times. The dual task results in significantly longer reaction times compared to the single task.
Following Distance

<table>
<thead>
<tr>
<th></th>
<th>mean (m)</th>
<th>min (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>single task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dual task</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rear-end Collisions

- Single task: 0 collisions
- Dual task: 7 collisions
Conditions

- Driving without distraction
- Conversing on cell phone
- Conversing with passenger
Cell Phone vs. Passenger Conversations
Lane Keeping Errors

RMS Error

Single-Task  Passenger  Cell Phone

0  0.2  0.4  0.6  0.8  1  1.2
Successful Navigation

% Correct Exit

Single-Task

Passenger

Cell Phone

33
Inattention Blindness

A narrowed scope

Where drivers not using a cell phone looked

Where drivers using a hands-free cell phone looked

Source: Transport Canada
Inattention Blindness

- A type of cognitive distraction
  - “looking” but not “seeing”

- Cell phone drivers less likely to see:
  - High and low relevant objects
  - Visual cues
  - Exits, red lights and stop signs
  - Navigational signage
  - Content of objects

Source: Transport Canada
Brain Processes in Driving & Language

- Experienced drivers steer a car in a virtual reality display while a MRI scan is being done
- Measure: Brains activation
37% decrease in parietal lobe activity when listening

Source: Carnegie Mellon University
Spoken language especially distracting

• Auditory tasks take precedent over visual tasks
• Processing is automatic, it can’t be “turned off” or ignored
• Language processing takes away resources from other concurrent tasks
• Safety Implications: Don’t talk to someone performing a critical task
Cognitive Demand by Vehicle and Task Type

2017 Model Year Vehicles

<table>
<thead>
<tr>
<th>Navigation</th>
<th>Text Messaging</th>
<th>Calling and Dialing</th>
<th>Audio Entertainment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi Q7 QPP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadillac XT5 Luxury</td>
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<tr>
<td>Chevrolet Equinox LT</td>
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<tr>
<td>Chevrolet Traverse LT</td>
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<tr>
<td>Chrysler 300 C</td>
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<tr>
<td>Dodge Durango GT</td>
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<td></td>
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<tr>
<td>Dodge Ram 1500</td>
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<tr>
<td>Ford F250 XLT</td>
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<tr>
<td>Ford Fusion Titanium</td>
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<tr>
<td>Ford Mustang GT</td>
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<tr>
<td>GMC Yukon SLT</td>
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<td></td>
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<tr>
<td>Honda Civic Touring</td>
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<tr>
<td>Honda Ridgeline RTL-E</td>
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<tr>
<td>Hyundai Santa Fe Sport</td>
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</tr>
<tr>
<td>Hyundai Sonata Base</td>
<td></td>
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<tr>
<td>Infiniti Q50 Premium</td>
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<td></td>
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<tr>
<td>Jeep Compass Sport</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Jeep Grand Cherokee Limited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kia Sorento LX</td>
<td></td>
<td></td>
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<tr>
<td>Lincoln MKC Premiere</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mazda 3 Touring</td>
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<td></td>
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<tr>
<td>Nissan Armada SV</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nissan Maxima SV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subaru Crosstrek Premium</td>
<td></td>
<td></td>
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<tr>
<td>Tesla Model S</td>
<td></td>
<td></td>
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<tr>
<td>Toyota Camry SE</td>
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<tr>
<td>Toyota Corolla SE</td>
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<td></td>
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<tr>
<td>Toyota RAV4 XLE</td>
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<td></td>
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<tr>
<td>Toyota Sienna XLE</td>
<td></td>
<td></td>
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<tr>
<td>Volvo XC60 T5 Inscription</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Standardized Score
Cognitive Demand by Task Type and Modality

2017 Model Year Vehicles

<table>
<thead>
<tr>
<th>Task Type</th>
<th>Center Console</th>
<th>Auditory Vocal</th>
<th>Center Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio Entertainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calling and Dialing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text Messaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standardized Score
Walking and Cell Phones

- Distracted walking is no different than distracted driving
## Walking and Cell Phones

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Cell phone user</th>
<th>Single</th>
<th>Music player</th>
<th>Pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing time</td>
<td>82.5 sec</td>
<td>74.8 sec</td>
<td>73.7 sec</td>
<td>86.2 sec</td>
</tr>
<tr>
<td>Changed direction</td>
<td>29.8 %</td>
<td>4.7 %</td>
<td>11.1 %</td>
<td>17.3 %</td>
</tr>
<tr>
<td>Weaving</td>
<td>21.3 %</td>
<td>14.0 %</td>
<td>5.6 %</td>
<td>9.6 %</td>
</tr>
<tr>
<td>Acknowledge others</td>
<td>2.1 %</td>
<td>11.6 %</td>
<td>13.0 %</td>
<td>7.7 %</td>
</tr>
<tr>
<td>Stopped</td>
<td>4.3 %</td>
<td>2.3 %</td>
<td>9.3 %</td>
<td>11.5 %</td>
</tr>
<tr>
<td>Near collisions</td>
<td>4.3 %</td>
<td>0 %</td>
<td>1.9 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>
### Unicycling Clown

<table>
<thead>
<tr>
<th>Question</th>
<th>Cell Phone user</th>
<th>Single Music Player</th>
<th>Pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>What did you see?</td>
<td>8.3 %</td>
<td>32.1 %</td>
<td>57.1 %</td>
</tr>
<tr>
<td>Did you see the clown?</td>
<td>25.0 %</td>
<td>51.3 %</td>
<td>71.4 %</td>
</tr>
</tbody>
</table>
Even self-identified “rarely distracted drivers” engage in risky behaviors

- Talking on the Phone:
  - Distracted Drivers: 93%
  - Rarely Distracted Drivers: 59%

- Texting or Emailing:
  - Distracted Drivers: 63%
  - Rarely Distracted Drivers: 10%

- Viewing GPS Navigation:
  - Distracted Drivers: 96%
  - Rarely Distracted Drivers: 77%
I WANT YOU TO TURN OFF YOUR CELL PHONE
Cognitive Demand by Vehicle

2017 Model Year Vehicles

Standardized Score

Audi Q7 QPP
Cadillac XT5 Luxury
Chevrolet Equinox LT
Chevrolet Traverse LT
Chrysler 300 C
Dodge Durango GT
Dodge Ram 1500
Ford F250 XLT
Ford Fusion Titanium
Ford Mustang GT
GMC Yukon SLT
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