Driven to Distraction
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There’s a reason we don’t drive with our eyes closed. Driving is a highly visual task, so it’s easy to understand the danger of taking your eyes off the road to change a radio station, dial a phone, or send a text message. But what happens when your eyes are on the road but your mind is not? How does being mentally distracted affect driving performance? And how might mental distraction affect a driver’s liability in a collision?

Introduction
Distraction has always affected drivers, but the recent addition of interactive devices like GPS and cell phones has raised both opportunities for distracted driving and awareness of the perils of distracted driving. Although official US statistics suggest that only 17% of injury-causing collisions involved distraction, a yearlong study monitoring drivers during regular vehicle use showed that inattention (which includes distraction) was present in the three seconds preceding 78% of all impacts. Based on these data, distracted driving is a big problem.

To curb distracted driving, many jurisdictions have enacted laws that allow only hands-free cell phone use while driving. While this removes the physical aspects of distraction created by cell phones, it does not remove the mental, or cognitive, aspects of distraction that can alter driver performance, particularly visual scanning behaviour and response times.

In this article, we describe some effects of cognitive distraction on driver performance and illustrate how human factors experts assess the role of distraction in a collision.

Cognitive Distraction: Effects on Visual Scanning Behaviour
Drivers have limited mental resources they can devote to attention. Cognitive distractions consume some of a driver’s attention and reduce the attention paid to driving. Since attention or inattention is hard to measure directly, researchers instead measure things that are affected by inattention. For example, cognitive distraction consistently narrows the field of view a driver scans while driving: a distracted driver spends more time focused on the roadway ahead and less time scanning the periphery. This narrowed visual field is commonly called cognitive tunnel vision.

Cognitive tunnel vision can lead to hazards outside of the forward field of view being missed or detected later than normal. For instance, a distracted driver with cognitive tunnel vision may not see a child running into the road until the child is almost directly in front of the vehicle, by which time it may be too late to avoid a collision.

Cognitive Distraction: Effects on Response Time
Response time is the time a driver takes to perceive and respond to a hazard. It starts when a hazard first becomes visible to a driver or first acts in a way that is hazardous and ends when a driver initiates a response, like applying the brakes.

To study how cognitive distractions affect common collision scenarios, subjects seated in a driving simulator were exposed to three unexpected hazards: 1) a stopped vehicle accelerating into the driver’s path from the right, 2) a pedestrian stepping into the driver’s path from behind a parked car on the right, and 3) an oncoming vehicle turning left across the driver’s path (Figure 1). Half of the drivers in the study were distracted by a mental recall task, the other half were not.

Response time was divided into three stages: 1) perception time – hazard onset to first eye movement towards the hazard, 2) inspection time – first eye movement to accelerator release, and 3) movement time – accelerator release to the onset of braking.

Distraction had the largest effect for the hazard created by the vehicle accelerating from the right. Distracted drivers took about 0.4 seconds longer to brake than drivers who were not distracted. This delay was observed during the perception time interval, whereas the subsequent inspection and movement times were the same for distracted and non-distracted drivers. Distraction had similar effects for the pedestrian scenario.

Distraction had a different effect on drivers responding to the left-turning vehicle. There was no delay in the time it took distracted drivers to initially look at the left-turning vehicle, but there was a delay of about 0.3 seconds between when they looked at the hazard and when they lifted their foot off the accelerator. These results suggest that cognitive distraction has varying effects depending on the type and location of the hazard.
Was the Driver Distracted?
Determining if and to what degree a driver was distracted in an actual collision is a challenging task. Establishing liability based on distraction typically requires proving that a) the driver was engaged in a distracting task (e.g. cell phone conversation) and b) the distracting task impaired the driver’s ability to avoid the collision. Since there are currently no devices in the vehicle that measure inattention or distraction, witnesses or cell phone records are needed to prove a driver was engaged in a distracting task at the time of a collision. Proving the driver’s ability to avoid the collision was impaired is more nuanced and requires an investigator to go through a series of analytical steps:

(1) Use physical evidence from the collision to estimate the driver’s response time.
(2) Find typical response times for drivers facing a similar situation from scientific studies.
(3) Compare the driver’s response time to the typical response times. A slow response time for the driver suggests inattention or distraction.
(4) Assess whether a typical response time would have avoided the collision.

For example, if a driver crests a hill and collides with a broken-down vehicle in his lane ahead, the steps outlined above might look as follows:

(1) Calculations based on skid marks on the road showed that the driver applied the brakes 2.0 seconds after the broken-down vehicle first became visible.
(2) A study of drivers encountering an unexpected hazard when crested a hill reported that 50% of drivers applied the brakes within 1.1 seconds of when the hazard appeared and 95% of drivers applied the brakes within 1.6 seconds of when the hazard appeared.
(3) The driver’s response time of 2.0 seconds was longer than would be expected for a typical driving population.
(4) Had the driver responded typically, the collision would have either been avoided or it would have occurred at a lower speed (which may have reduced the injuries).

Summary
Cognitive distraction affects both visual scanning behaviour and response times while driving. Proving that a driver was distracted at the time of a collision is difficult, but understanding how distraction affects driver response times can help establish if it contributed to causing the collision.

References

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