Distraction and road user behavior: An observational pilot study across intersections in Washington, D.C.

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ABSTRACT

In 2015, traffic crashes involving driver distraction contributed to 3447 deaths and approximately 391,000 injuries in the United States (NCSA, 2017). Cell phones were involved in 14% of these fatal crashes and 8% of these injury crashes. The purpose of this study was to observe road user, specifically pedestrian and driver, distraction prevalence and patterns (Phase I) and then to examine the potential conflict between these road users (Phase II). Observational data was collected at four intersections in Washington, D.C. Road user data included but was not limited to: distraction type (e.g., cell phone), sex, age, location, and conflict indicators. In Phase I, 4871 road users were observed; 60% were pedestrians and 40% were drivers. Of the total, 49% were distracted by single or multiple distractors. There were 46% of individuals distracted by engaging with other people, and 27% were distracted by cell phones. The main distractor for both pedestrians (44%) and drivers (49%) was engaging with other people. Pedestrians had approximately 1.5 greater odds of being distracted than drivers. Females had 14% greater odds of being distracted than males. The odds of being distracted were almost two times higher for road users ages 16–25 compared to road users 26–35. The high prevalence of distraction, specifically engaging with other people, shows that electronic device use may not be the only important source of distraction. In Phase II, 20 out of 21 interactions between distracted pedestrians and distracted drivers resulted in evasive maneuvers by either road user. In these interactions, drivers altered course more frequently than pedestrians. These results suggest that distraction while driving or walking is related to potential conflicts. Future research could explore different methods of quantifying distraction and should continue to focus on the effect of distraction on road user behavior.

1. Background

In 2015, distraction-affected crashes—“in which a driver was identified as distracted at the time of a crash”—resulted in 3447 deaths and approximately 391,000 injuries in the United States. Distracted driving has been defined as any diversion of attention that causes the driver of a motor vehicle to focus on some other task (NCSA, 2017). There are three recognized types of distraction: visual (taking eyes off the road), manual (removing hands from the wheel), and cognitive (taking mind off the road) (NHTSA, 2010; CDC, 2016). As technology and research methodology have evolved, the definition of distraction, or what qualifies as a distractor, has shifted. Between 2000 and 2010, over 350 independent scientific research studies were conducted to better understand distraction (GHSA, 2011). These studies found that distractors may include, but are not limited to, the following: other people, eating and...
drinking, personal grooming, talking to passengers, changing CDs, looking at signs on the roadway, reading a book or magazine, using tablets, personal grooming, pushing strollers, rolling suitcases, and adjusting vehicle controls. In some cases, even the act of driving or walking itself could be considered a distraction. The wide array of potential distractors emphasizes the multifaceted nature of distraction. Literature has found that driver and pedestrian distraction patterns differ; some of these differences are discussed below.

1.1. Driver distraction

Of all distractors, cell phone use while driving has become an increasingly important traffic safety issue. Cell phones were involved in 14% of fatal crashes and 8% of injury crashes in 2015. It is important to note that these statistics of fatalities associated with cell phone use are likely higher, but they are believed to be underreported (Bunn et al., 2005; Meyens and Boyle, 2008). It has been estimated that 542,000 drivers in passenger vehicles used their cell phones or other electronic devices at any typical daylight moment while driving (Pickrell et al., 2016). The 2012 National Survey on Distracted Driving Attitudes and Behaviors found that 48% of drivers answered their phones at least some of the time while driving (Schroeder et al., 2013). An American Automobile Association (AAA) Foundation for Traffic Safety (2013) survey estimated that 70% of drivers talked on their cell phones while driving in the last 30 days. Twenty-five percent reported typing messages and 35% reported reading messages while driving. Even at local levels distraction prevalence is high such as in Birmingham, Alabama where Huisingh et al. (2014) found that the prevalence of distracted driving was 32.7%.

Cell phone use has been negatively correlated with driving performance. Caird, et al. (2008) found that across the 33 studies analyzed, reaction time increased by an average of 0.25 s when drivers engaged in any activity involving a cell phone. Specifically looking at texting and driving performance, Caird et al. (2014) analyzed 28 studies and confirmed the growing body of evidence suggesting that texting compromises driver safety.

Other forms of distraction besides cell phone use have been explored for drivers. Driver distraction by vehicle occupants and outside persons, objects or events is currently documented when a distraction-affected crash occurs on a U.S. roadway (NCSA, 2016). In addition to cell phones, Huisingh et al. (2014) observed drivers distracted by interactions with passengers and external-vehicle distractions (i.e., any distraction outside the vehicle). Conversational distractions were found to narrow a driver’s field of view which resulted in more errors (Atchley and Dressel, 2004; National Safety Council, 2014), and visual-manual distractions (e.g., dialing or texting) increased an experienced driver’s crash risk by three times compared to non-distracted drivers (NHTSA, 2013; Klauer et al., 2014). This risk increased significantly among novice drivers (Klauer et al., 2014).

Driver distraction varies by demographics. Electronic device use has been identified as a major contributor to teen driver distraction (Goodwin et al., 2012b). In 2015, of 15–19 year olds involved in distraction-related fatal crashes 22% were using cell phones (NCSA, 2016). Passengers are also a source of distraction for teen drivers. Curry et al. (2012) found that young males with peer-aged passengers were more likely to engage in aggressive driving that resulted in a crash than those driving alone. Also, Goodwin et al. (2012a) noted that teen drivers with one teen passenger were two-and-a-half times more likely to engage in risky behavior and were three times more likely to engage in at least one risky behavior with multiple passengers than those driving alone. To mitigate some of the risk, Graduated Driver Licensing (GDL) laws in 46 states restrict the number of passengers that novice drivers can have in vehicles (GHSA, 2016). Furthermore, males and females exhibit different distraction patterns. According to Goodwin et al. (2012b), females were twice as likely as males to be using an electronic device while driving.

Driver simulator studies are a useful tool for determining the effects of distraction on driver safety (Papantoniou et al., 2015). These types of studies have been used to replicate several types of distraction, including cell phone use, conversation with other passengers, and eating and drinking (Papantoniou et al., 2015). Driving simulations indicate that cell phone use can create both cognitive and verbal distraction (Strayer and Johnston, 2001; Lin and Chen, 2007). While these results mirror those of observational studies, observational studies are beneficial because they allow researchers to observe drivers in everyday driving conditions.

1.2. Pedestrian distraction

Cell phone distraction is also an issue for vulnerable road users such as pedestrians. A survey conducted by The Pew Research Center found that 53% of cell phone owners were linked to “distracted walking” (Smith, 2014). Distracted walkers included cell phone owners who bumped into an object or another person if either party was using a cell phone at the time. Cell phone use while walking can cause inattentional blindness, which is the failure to notice visible objects because of focusing on another task, event or object (Hyman et al., 2010). In a localized study, Basch et al. (2014) recorded audio device and cell phone use among pedestrians in Manhattan and found that over 25% of their sample was distracted. Cell phone use has also been associated with longer road crossing times and increased likelihood of changing crossing patterns (e.g., weaving, changing direction, or stopping) (Hyman et al., 2010; Thompson et al., 2012; Bungum et al., 2005). Similarly, texting pedestrians were found to be more likely to exhibit unsafe traffic behaviors such as disobeying the traffic light (Thompson et al., 2012).

Other studies have looked at pedestrian distraction beyond cell phone use. Bungum et al. (2005) considered eating, drinking, smoking, and talking to other pedestrians as distractors in addition to electronic devices and found that 20% of pedestrians were distracted while crossing the street. The presence and behavior of other pedestrians in a group can encourage a change of behavior and potentially influence distracted walking patterns (Farina et al., 2010). In the Rosenblum (2009) study, pedestrians were more likely to cross on a red-light when standing alone; additionally, pedestrians in a group at a crosswalk exhibited less risk-taking behavior than lone individuals. Moreover, when a pedestrian saw another pedestrian crossing on a red-light, they had a tendency to
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