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The Role of Mobile Phone Distraction in Road Traffic Accidents

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Abstract

Studies have indicated that death as a result of road traffic accidents will rise to fifth position globally by 2030. This has generated much concern among road safety professionals, traffic engineers and policy makers. Several factors such as over speeding, drink-drive, distraction, fatigue, overloading, brake failure, pot holes, poor geometric design, poor visibility, and so on are some of the causes of road traffic accident. Currently, the use of mobile phone while driving has been shown to be one of the leading causes of driver's distraction. Therefore, this paper presents a review on the audio and visual activities involving mobile phone while driving and their contributions to road traffic accident. Based on the articles consulted during this work, it has been shown that both the audio and visual activities involving mobile phone usage during driving have significant influence on driver's performance by increasing reaction time, shortening headway, changing lane position and so on. However, these negative driving behaviours were shown to be riskier during visual

activities like texting and accessing social media application such as Facebook, Telegram, WhatsApp, and so on.

Keywords: Distraction, mobile phone, road safety, audio activity, visual activity

Introduction

According to World Health Organization (WHO) report (2011), every year nearly 1.3 million people die and 50 million are injured as a result of road traffic crashes. These deaths and injuries have an immeasurable impact on families and communities as they tragically and irrevocably change people's lives. In addition to the huge emotional toll these injuries exact, they also cause considerable economic loss to casualties, their families and nations as a whole.

Road traffic injuries affect all age groups, but their impact is particularly striking among the young people (aged 15-29) because they are the leading cause of death worldwide among them (WHO, 2023). Trends suggest that between now and 2030, road traffic injuries will rise from being the ninth leading cause of death globally to the fifth. This rise is particularly driven by the dramatic increase in motorization in a number of low- and middle-income countries – an increase that now demands improved road safety strategies and land-use planning. A number of factors have been identified as affecting the likelihood of a road traffic injury, and limiting the exposure to these risk factors is critical to the success of efforts to reduce road traffic injuries. For example, there is now a large body of scientific research showing the increased risk of road traffic fatalities and injuries resulting from excessive or inappropriate speed, drink–driving, and non-use of seat-belts, child restraints or motorcycle helmets. Over the past few decades, evaluation of programmes around the world has helped provide a solid foundation of evidence-based solutions that policy makers can draw upon in efforts to improve road safety within their countries. Distraction in traffic is another risk and is becoming an

increasing concern among policy makers. Most research and attention in this area relates to driver distraction, largely because of drivers' increasing use of mobile phones and other technologies. However, the extent of the problem of driver distraction including that created by mobile phones and its contribution to risky driver behaviour and road traffic crashes is not very well known, even in countries with a good road safety record (WHO, 2011).

Therefore, this paper provides a review of some of the current available literatures on driver distraction with emphasis on audio and visual activities involving mobile phone usage while driving. Although limited work was done on the negative effect of the visual activity, the paper discusses on the comparison between the audio and visual activities, and how they contribute to the road accidents.

Methodology

This study uses a comparative analysis research design to examine the role of mobile phone distraction in road traffic accidents. The paper primarily focuses on comparing the effects of mobile phone audio and visual activities on the performance and safety of drivers. Relevant articles, reports, and studies that explore the relationship between the use of mobile phone and road traffic accidents were identified through a comprehensive literature review. All the publications used in developing this paper were downloaded from different reputable databases using some specific search words such as: effect of distractions on driving performance, the impact of mobile phone use on driving performance and safety, effect and impact of mobile phone audio and visual activities on road safety, and so on.

Distracted driving

Distracted driving has been a long-standing traffic problem, despite the fact that there are other evolving common secondary tasks (Cox et al., 2023). Distraction is the diversion of attention away from activities critical for safe driving towards a competing activity (Shi et al., 2023). In recent periods, extensive research and study indicated that distraction is among the major causes of road traffic accidents/crashes. Distraction on roads and highways is occurring daily, putting all road users at risk of a crash that can result in serious injury or death. When drivers

are distracted, their attention is temporarily divided between what is often referred to as the "primary task" of driving and "secondary tasks". For example, during a mobile phone conversation a driver's cognitive (i.e. thinking) resources are being used to analyse both the driving situation (the primary task) and the conversation taking place (the secondary task). As a result, the driver's situational awareness, decision-making and driving performance are impaired.

According to Lipovac et al. (2017), categories of distraction which may be associated with mobile phone use can be defined as follows:

- Physical distraction occurs when a driver needs to use one or both hands in order to operate a mobile phone when dialling a number or answering or rejecting an incoming call, instead of focusing on physical tasks required to drive such as steering, shifting gears, giving light or sound signals.
- Visual distraction involves looking away from the road to a mobile phone, as well as a loss of visual ''attentiveness", often referred to as ''looked, but did not see", when drivers, although their eyes are on the road, fail to see what is in front of them.
- Auditory distraction occurs during the ringing of the mobile phone or during a conversation on the mobile phone, when a driver is focused on the sounds not related to driving.
- Cognitive distraction involves lapses in attention and judgement. This type of distraction occurs when two or more mental tasks are performed at the same time.

More than one of these categories of distraction may occur at one time, depending on the particular trigger.

Mobile phone use while driving

Driving is a complex task, requiring the concurrent execution of various cognitive, physical, sensory and psychomotor skills (Shi et al., 2023). Despite these complexities, it is not unusual to observe drivers engaging in various non-driving-related activities while driving. These activities range from conversing with passengers and listening to the radio, to applying make-up and even reading. With the advent of wireless communication (e.g., mobile phones), more sophisticated

entertainment systems and the introduction of technologies such as route navigation and the Internet into vehicles, preoccupation with electronic devices while driving is also becoming increasingly common. Any activity that competes for the driver's attention while driving has the potential to degrade driving performance and have serious consequences for road safety (Parnell et al., 2018). Police in most countries do not systematically report the use of a particular distracting activity, such as using a mobile phone, in crash reports, and thus it is difficult to estimate the contribution distraction makes to road traffic crashes, and the consequent danger it poses on the world's roads. Where police do include distraction in crash reports, drivers are less likely to disclose their use of mobile phones as it can indicate fault, and thus data are likely to be underreported. Witness statements may also be unreliable (WHO, 2011).

According to Mirman et al. (2017) mobile phone use during driving quadruples the risk for a motor vehicle crash. The use of mobile phone while driving has been shown to cause difficulty scanning, detecting, and responding to traffic hazards and signals, impair braking, and makes it difficult for drivers to stay in their designated lane. Meta-analytic studies have found that mobile phone use while driving (MPUWD) slows reaction time by at least 0.25 s on average (Caird et al., 2008); reaction time consistently shows the largest negative effects of MPUWD compared to other types of performance errors (Horrey & Wickens, 2006). Performance errors lead to cascading effects via disrupting traffic flow (e.g. increasing the proximity of vehicles) and increase crash risk for other road users beyond the index driver (Stavrinos et al., 2013).

Lipovac et al. (2017) conducted research on mobile phone use while driving by reviewing 60 papers. The researchers studied the connection between mobile phone use while driving and a risk of car crash occurrence, frequency of mobile phone use while driving, characteristics of persons inclined to use mobile phones more often while driving, impacts of using various modes of mobile phones while driving on driving performance (hands-free or hand-held, and factors predicting behaviour, that is, a tendency among drivers to use mobile phones while driving. By summing up the results they obtained, the researchers concluded that these results confirm the prevalence of mobile phone use while driving and the connection between mobile phone use and a car crash risk. Also, it has been

confirmed that the mobile phone use while driving impairs driver performance, and that using a hands-free mobile phone while driving does not completely remove the adverse effect of mobile phone use while driving. This is because the results showed that irrespective of which mobile phone mode is used (hands-free or hand-held), the contents and a level of emotional intensity attached to the conversation have significant influence on reduction of driving performance. Generally, a group of traffic participants (drivers), who are more likely to use mobile phones while driving may be identified based on the results obtained. Some results show the negative connection between the mobile phone use and a safety belt use rate. That is to say, a safety belt use rate was lower with respect to drivers who use mobile phones while driving. They added that, in addition to confirming negative effects of mobile phone use while driving, the results obtained also confirm the existence of certain phases in the process of understanding the issue of mobile phone use while driving. These phases differ between each other, and include the following: researching into the prevalence of mobile phone use, determining the characteristics of drivers who are more inclined to use mobile phones while driving, examining the influences on driving performance of using different modes of mobile phone while driving (‘‘hands-free” or ‘‘hand-held”), and looking at risks associated with hands-free or hand-held mobile phone use.

Audio activity involving mobile phone while driving

Choudhary & Velaga (2019) highlighted that the effect of phone audio activity such as conversation on driving is observed in terms of significant reduction in speed, increment in headway and delayed response to the sudden events. They further state that increased response time is an indication of performance deterioration, but, reduced speed and increased headway are assumed as compensatory measures rather than performance impairments. The researchers stated that though the effect of conversation on longitudinal performance control measures is found to be similar in most of the previous studies, it is not straightforward on the lateral performance control measures. Some of the studies report significant effects of conversation on standard deviation of lane positioning (SDLP), steering reversal rates (SRR) and lane excursions, whereas, few studies found the effects to be non-significant. More focused sight on the road ahead is one

of the possible reasons for non-significant effect of conversations on the lateral control. Another possibility is the level of complexity of the testing scenario (urban/rural) or the conversation task (simple/complex conversation) in the experimental design of the studies. Muehlegger & Shoag (2014) examined the relationship between car accidents and directly observed hourly data on cell phone call volumes, and estimated that a 100% increase in call volumes was associated with a 15%–43% increased likelihood of a serious crash.

The study conducted by Gariazzo et al. (2018) indicated that there is a relationship between the use of cellular telephones while driving and a subsequent crash with fatalities. The researchers found out that the use of phone for calls to be positively associated with road crash fatalities with incremental risks of 17.2%.

It was observed by Strayer et al. (2001) that conversing on either a handheld or a handsfree cell phone led to significant decrements in simulated-driving performance. Thus, the available evidence indicates that there are at least two sources of interference with driving associated with concurrent cell-phone use: one due to peripheral factors such as manipulating the phone while dialling and one due to the phone conversation itself.

The braking behaviour of young drivers distracted by mobile phone conversations was examined by Haque & Washington (2015). In the study, a group of young drivers aged between 18 and 26 years were exposed to a simulated driving environment using the CARRS-Q Advanced Driving Simulator. Drivers' braking behaviour in response to a pedestrian in the zebra crossing was investigated and modelled in distracted and non-distracted conditions. Overall, the model suggests that drivers distracted by mobile phone conversations are more likely to reduce their initial speeds by aggressive braking while responding to a pedestrian at the zebra crossing. Aggressive braking by distracted drivers might create an unexpected scenario for following vehicles in a traffic stream, and might lead to a greater likelihood of rear-end collisions.

Visual activity involving mobile phone while driving

Studies from Canada, Australia and the USA have shown that the self-reported prevalence of cell phone use while driving is on the rise, particularly texting while driving, and that young people are particularly inclined to this (Asbridge et al.,

2013). It was shown previously that texting had worse effect on reaction time compared to conversation task. A study in the United Kingdom found that 45% of drivers reported text messaging while driving. Australian research suggests that one in six drivers report regularly sending text messages while driving. A study in the United States found that 27% of American adults report having sent or read text messages while driving (WHO, 2011).

According to Choudhary & Velaga (2019), texting during driving causes a considerable deterioration in driving performance. Similar to the conversation, texting also shows a significant effect on longitudinal control of the vehicle. However, texting during driving also diverts the visual attention away from the roadway which leads to reduced lateral control.

The effects on driving behaviour of sending or receiving text messages are potentially very important. In fact, people who text during driving are 6 times more possibly to be involve in accidents than those who drive under the influence of intoxicants (Atubi, 2023). While there is still a lack of research in this area, existing studies (mostly experimental) suggest that text messaging leads to increased cognitive demands in order to write text messages, physical distraction resulting from holding the phone, and visual distraction that results from creating or reading messages: these in turn impact on critical driving tasks. For instance, one experimental study found these results among drivers who were text messaging:

- The amount of time that drivers spent with their eyes off the road increased by up to 400% when retrieving and sending text messages.
- Drivers made 28% more lane excursions and 140% more incorrect lane changes when sending and receiving text messages; texting drivers did attempt to compensate for distraction by increasing their following distances or reducing their speed.

In another recent simulator study carried out in the United Kingdom, reaction times of young drivers (aged 17–24 years) who used their mobile phones to send and read text messages showed a decreased ability to stay in the correct lane, a reduced ability to maintain a safe distance from the vehicle ahead and an increase in reaction time.

The study conducted by Gariazzo et al. (2018) indicated that there is a relationship between the use of cellular telephones while driving and a subsequent crash with fatalities. The researchers found out that the use of phone for texts and Internet to be positively associated with road crash fatalities with incremental risks of 8.4%, and 54.6%, respectively.

According to Haque & Washington (2015), distractions that might involve both cognitive and physically demanding tasks such as responding to a complex text message may present the most challenging of loads.

Also, Oviedo-Trespalacios et al. (2016) highlighted the effects of concurrent use of mobile phone control and interfaces like texting, answering, dialling using the keyboard, and navigation on mobile phone distracted driving. The scholars stated that simultaneous use of mobile phone controls and interfaces imposes a high workload on drivers and thus has been reported to represent a high-risk situation.

He et al. (2014) carried out research by comparing the distracting effects of handheld versus speech-based texting on driving performance. In the study, participants were instructed to repeat a text message, either verbally or manually on the cellular phone. The text message consisted of a 10-digit telephone number presented to participants via a texting application installed on the HTC Android smartphone. The texting task consisted of 10-digit numbers and was chosen because it simulated the cognitive process and manual entry of a cell-phone dialling or texting task while also allowing the measurement of secondary texting performance. The result of the study shows that both handheld and speech-based texting significantly affect driving performance. Handheld texting increased brake response time, increased variation in gap distance and lane position. Drivers who texted using a handheld smartphone had greater following distances and drove further toward the left lane boundary. They concluded that the results were consistent with previous studies that reported longer brake response time, impaired lane-keeping and longer gap/headway distance, when drivers engage in a texting task.

How mobile phone use while driving contribute to road accidents

As mentioned by many researchers and road safety engineers, certain tasks considered essential for safe driving are referred to as "primary tasks". Others, such

as using a mobile phone, constitute "secondary" tasks. Studies show that it is hard for drivers to carry out the primary tasks essential to driving a vehicle safely when they are involved in a secondary task. Most of the researches on how distraction leads to deteriorated driving behaviour relates to the use of mobile phones, although other sources of distraction also impact on driving behaviour.

Talking on the mobile phone, chatting, sending an e-mail, searching for an address on the GPS, are activities that, if made while driving, might become distractions that might cause an accident. The driving task requires repeated eye fixations on the road environment in order for the driver to maintain an appropriate speed and lateral position relative to the carriageway and other road users. Driving while using a hands-free device is not safer than using a hand-held phone to conduct calls, as concluded by case-crossover studies, epidemiological, and meta-analysis (*Https://En.Wikipedia.Org/Wiki/Mobile_phones_and_driving_safety#Texting*, n.d.).

The risk of distraction influencing a driver's performance rest on a number of factors that include:

- the complexity of the distracting task;
- its duration;
- its frequency;
- the situation on the road.

According to the world health organization report (2011), mobile phones use while driving can cause drivers to take their:

- eyes away from the road (visual distraction);
- minds away from the road (cognitive distraction);
- hands away from the steering wheel (physical distraction).

The report also stated that auditory distraction, in the form of responding to a ringing phone, can also occur, although the duration of this distraction is likely to be shorter than for other forms of distraction.

The report further highlighted that mobile phone use while driving can impair performance on a number of driving tasks, leading to:

- longer reaction times to detect and respond to unexpected driving-related events;
- impaired ability to maintain correct lane position;
- slower braking reactions with more intensive braking and shorter stopping distances;
- impaired ability to maintain an appropriate speed (i.e. usually driving slower);
- slower reactions to traffic signals/missed signals;
- reduced field of view (i.e. drivers more likely to look straight ahead and not at periphery or in mirrors);
- shorter following distances;
- accepting gaps in traffic streams that do not give sufficient time for the driver to safely manoeuvre the vehicle into the traffic flow;
- increased mental workload, resulting in higher levels of stress and frustration;
- reduced driver-awareness of what is happening around them.

Conclusion

Mobile phone use while driving has been shown by many researches to have a lot of negative influence on driver's performance as a result of the distractions it causes. These distractions include cognitive, visual, physical and auditory, and the level of the distractions are determined by factors such as complexity of the distracting task, how long it takes and how often it is repeated. Several research works were carried out to study the impact of hand held and hands-free mobile phones, as well as conversation, texting, web-browsing etc. Although some scholars highlighted that there is no significance difference in terms of conversation between hand held and hands-free mobile phones, but it is obvious that hand held mobile phones causes more distraction than hands-free mobile phone. It was also shown that the distraction cause by audio activity is less compared to that of visual activity.

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