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DOES THE USE OF CELL PHONES AND HEADPHONES AT THE SIGNALISED PEDESTRIAN CROSSINGS INCREASE THE RISK OF ACCIDENT?

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Abstract. Reduction of the number of fatalities among pedestrians remains a topical issue in Poland. For many years, this percentage has remained at around 30% of all those who were killed on the road. At the same time, there is an increase in the use of electronic devices by pedestrians and cyclists that may affect their perception when crossing the road. This can lead to traffic accidents. In order to investigate the problem, field studies were carried out and their results are presented in the article. Pilot studies on pedestrian and cyclist behaviour were carried out at three pedestrian crossings with traffic lights in Gdansk. Attention was paid to whether pedestrians and cyclists use headphones when crossing the road, whether they are talking on the phone or writing SMS. The results of the research indicate that currently in Gdańsk about 10% of unprotected traffic users use a telephone and 5% use headphones at pedestrian crossings. Most of them are young people, 70–90% of all users. Women prefer using headphones more than men. Pedestrians exhibited dangerous behaviour involving entering the road at a red light regardless of the use of telephones and

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headphones. Therefore, as part of the studies described, it cannot be clearly stated whether the use of telephones and headphones increases the risk of being the victim of an accident. Due to the lack of separate statistics with accidents involving mobile phones and headsets, it was not possible to analyse statistical data in this respect. At the same time, research confirmed traffic disruptions at the crossings, caused by telephone users, as indicated in literature.

Keywords: headphones, mobile phones, road safety, vulnerable users.

Introduction

Pedestrians represent a significant group of road users, furthermore, they are one of the most vulnerable groups (WHO, 2018). They account for a large proportion of road traffic casualties. Pedestrian crossing was conceived as a safe place for pedestrians, unfortunately it appears to be location of most accidents involving pedestrians. Complex characteristics of pedestrian crossing behaviour are addressed in the research in the field of transportation, psychology, and sociology. In the last 20 years, the use of mobile devices such as mobile phones and headphones has grown extensively worldwide. According to world mobile phones market analysis conducted by IDC Analyze The Future, 342 million of mobile phones were sold worldwide in the second quarter of the year 2018 (Wirtualnemedia, n. d.). Mobile phones used as the multimedia gadgets could distract phones users. People typing messages on phones while walking along the street do not notice other road users and their trajectory. Such situations are very dangerous at pedestrian crossings, where vulnerable users are exposed to collision with vehicles. Use of headphones isolates road users from environmental sounds and impedes hearing, for example, ambulance approaching a pedestrian crossing. Very dangerous situations may occur when a road user isolates oneself from visual and aural environment factors. According to literature on the subject, mobile phone use related road accidents occur most often among people younger than 31 (Nasar and Troyer, 2013). As the previous research revealed, operating mobile phones during walking makes people walk slower (Haga *et al*., 2015; Hatfield and Murphy, 2007; Jiang *et al*., 2018) and slows down the response time (Tapiro *et al*., 2016; Zhou *et al*., 2019). In India, the effect of using cell phones while crossing pedestrian crossings on pedestrian speed was investigated and this factor proved to be insignificant (Kadali and Vedagiri, 2019). Nasar (Nasar, Hecht, & Wener, 2008) pointed at the problem of pedestrian using mobile phones, because they behave in a strange way close to pedestrian crossings. They walked out in front of approaching vehicles and stopped when the cars stopped. Neider *et al*. (Neider *et al*., 2010; Stavrinos, Byington, & Schwebel, 2011) indicated that people talking on the phone are more

exposed to risk during crossing the street than people listening to music or not using any devices at all. Dalibor (Antic, Milenkovic, & Pešic, 2016) and Schwebel (Schwebel *et al*., 2012) stated that people texting are exposed to higher risk during crossing the street than those talking on the phone or listening to music. The type of task performed on the cell phone had an impact on distraction. Texting engages a person and makes a person ignore the surroundings (Lin and Huang, 2017). In other research it was argued that using personal music devices did not lead to higher risk of road accidents (Walker *et al*., 2012). According to surveys conducted in Australia, up to 40% of pedestrians may be distracted by mobile phones when crossing the road. Texting and internet access while crossing is widespread among 18–30 year olds (Lennon *et al*., 2016). In Poland, in 2018 over 65% of population admitted listening to music daily. The highest usage of mobile phones for music listening is observed among the people at the age of 18–44 (72–32%) (Felisiak, 2018; "Statistics Poland," n. d.). Furthermore, gender analyses show that young men use mobile phones more often than women (Zhou *et al*., 2019). Some research indicates that pedestrians using cell phones at the crossing often interfere with pedestrian traffic by entering the crossing too late or sneaking (Zhou *et al*., 2019). Press articles in Poland reveal cases of road accidents resulting from pedestrian use of cell phones or headsets. In January 2019, in Krakow, a pedestrian using headphones did not hear the warning signal and was hit by a tram. He was hospitalised because of serious head injuries (Wyborcza, n. d.). The same situation occurred with a 25 years old man in Wrocław (Wrocławska_Newspapaer, n. d.). In another city, a young woman focused on her cell phone entered pedestrian crossing just in front of an approaching car (Motofakty, n. d.). Video monitoring in several places recorded some near collision situations, where pedestrians invaded the road whilst focused on the cell phone or music from headphones (TVN24, n. d.; TVP, n. d.). The human factor is the weakest link in safety management and the vast majority of road accidents are due to a driver or pedestrian error (Cunningham, 2018; Plankermann, 2013). The scientific foundation of Vision Zero shows that different road and vehicle design, which improves protection of human beings against external violence, would mean that up to 63% of all deaths could be avoided (Kristianssen *et al*., 2018). Vulnerable road users by their risky behaviour may impede reduction of the number of fatalities. Because of that risky behaviour surveys are essential, especially in the new technology era. This article presents the results of studies on the use of mobile phones and listening to music on headphones while passing through pedestrian crossings with traffic lights. The magnitude of this phenomenon and potential threats that could result from such behaviour were identified.

Vulnerable road user safety in Poland in general and Gdańsk in particular

In Poland, road fatalities among pedestrians represent about 30% of all road fatalities. Despite the ongoing efforts to improve this situation, it changes too slowly and ineffectively. Pedestrian crossings are being modernized to make them safer. Monitoring of vehicle speed is increased to reduce the likelihood of fatalities in the event of a collision with a vehicle. However, this does not lead to a decrease in the number of pedestrians killed on Polish roads. In 2018, over 800 pedestrians and over 120 cyclists were killed on Polish roads and over 2600 pedestrians and almost 300 cyclists were heavily injured. It should be noted that the number of cyclist casualties has started to grow since 2017 and this group of vulnerable road users should be focused on.

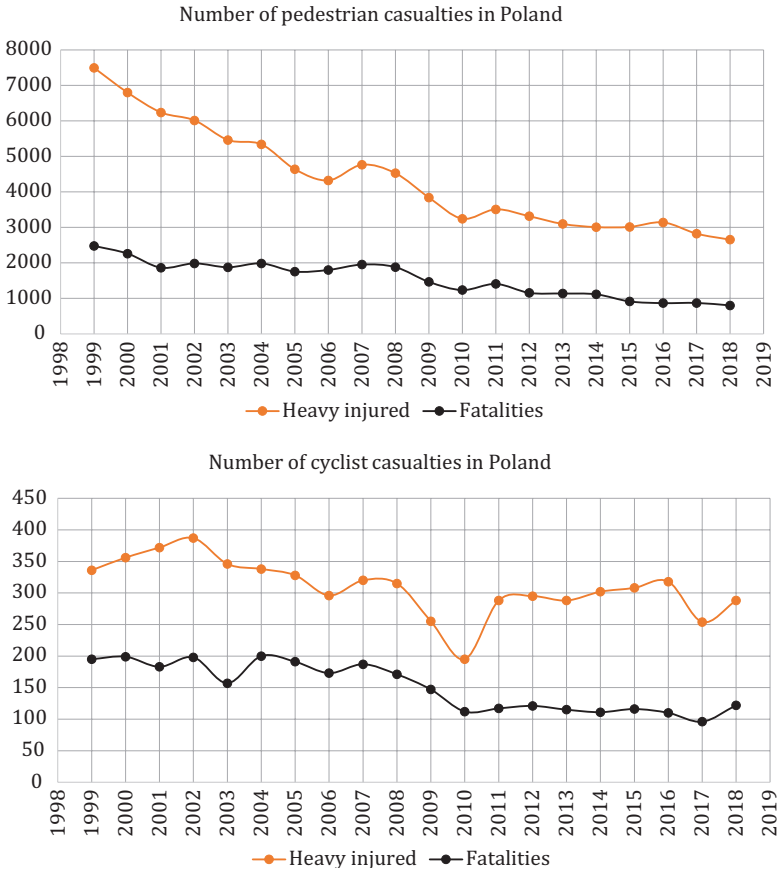

Figure 1. Number of pedestrians and cyclists heavily injured and killed in Poland in 2000–2018

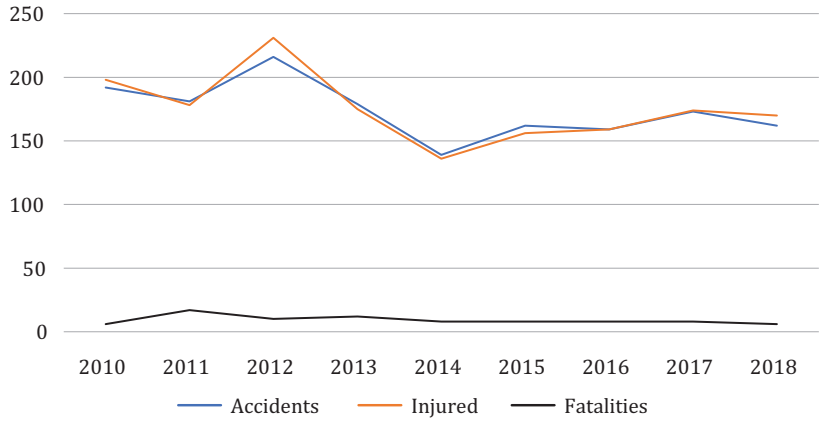

Figure 2. Number of accidents with pedestrians, pedestrians injured and killed in Gdansk in 2000–2018

Gdańsk is one of the major Polish cities. Its population is growing dynamically and in 2018 amounted to over 570 thousand residents. In the years 2000–2018, over 1.5 thousand road accidents with pedestrians were recorded in Gdańsk, in which almost 90 people were killed and almost 160 were injured.

Unfortunately, the dynamic decline in the number of pedestrian accidents recorded in 2012–2014 stopped. Since then the number of fatalities has been fluctuating between 6–8 people a year and injured – about 160–170 a year. Figure 2 presents the changes in the number of accidents with pedestrians, pedestrians injured and killed in Gdansk in the last 9 years.

The cited literature pointed to the growing problem of pedestrian distraction due to the use of cell phones. As part of the field tests, it was decided to check whether in Gdańsk pedestrian use of cell phones while passing through the crossing may increases the risk of accidents. For this purpose, three pedestrian crossings with high pedestrian and car traffic were selected. Bicycle traffic is also present at these crossings and thus it was possible to observe cyclist behaviour as well.

1. Methodology

The research involved video recording of the area of the three selected pedestrian crossings with traffic lights and was conducted in year 2018. Video recording was performed continuously for 12 hours during the day. The pedestrian crossings were located along one of the

Figure 3. Location of the researched pedestrian crossings (source: google.maps.com)

main arterial roads in Gdańsk at a distance of about 700 m (Figure 3). All of them are characterised by very high traffic volume of pedestrians, cyclists and cars. Additionally, each of them goes through the tram track, which further increases the risk for pedestrians. A general view of each pedestrian crossing (A, B, C) is shown in Figure 4.

Every day a different pedestrian crossing was recorded. Video recording was conducted using two GoPro Hero 4 cameras over 12 hours from about 7 a.m. till 7 p.m. Due to high resolution full HD, the image quality is very high. Cameras should have been located fairly close to pedestrian crossings to record everything accurately and at the right height so that they would not have been stolen or damaged. According to 2017 police statistics, the highest number of accidents (10.1% of all accidents that year) occurred in October, therefore the described surveys were conducted in October as well. Pedestrian and cyclist safety

Figure 4. Photos of the traffic environment at the analysed sites A, B, and C (Figure 3)

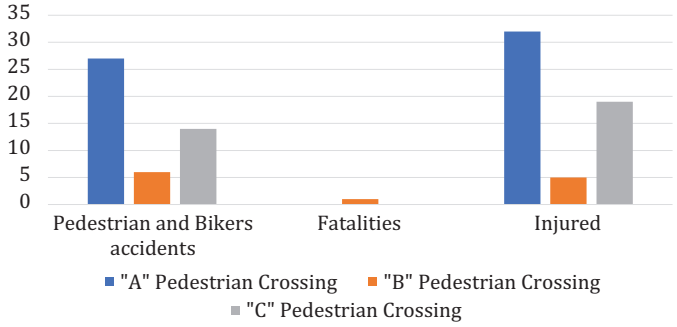

Figure 5. The number of accidents with pedestrians, pedestrians injured and killed at selected pedestrian crossings in 2000–2018

analyses at the selected pedestrian crossings in 2010–2018 indicate that the majority of accidents reported by the police took place at crossing "A", where there were 27 accidents, at crossing "B" there were 6 accidents and at passage "C" – 14. As a result of these events, 1 person was killed and 56 were injured. The most common cause of accidents was not giving priority to pedestrians or cyclists, but the percentage of vulnerable road users entry at a red light ranged from about 18% to about 50% of accidents.

During the analysis of the resulting recordings, particular focus was made on such factors as the volume of pedestrian and cyclist traffic in each analysed hour, number of people using mobile phones, number of people using headphones. The sex of people using phones and handsets was specified, and they were divided into two age groups: up to 30 years and over 30 years. In addition to calculating the number of people using mobile phones or headsets, analysis of conflicts between all road users and dangerous situations was conducted. The results of the research are presented below.

2. Results

2.1. Pedestrian crossing A

During the research, almost 22 000 pedestrians were recorded at the pedestrian crossing. The peak hours occurred from 3 p.m. to 6 p.m., when over 2500 P/h were counted. It was found that 3.5% of pedestrians

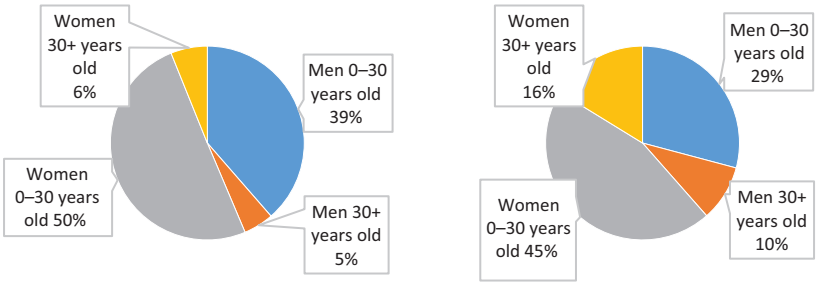

Figure 6. Distribution by age and gender among people using headphones (on the left) and mobile phones (on the right) at pedestrian crossing A

used headphones while crossing the road. Women under 30 years of age (50%) were the predominant group, followed by men in the same age group (39%). People over 30 years old constituted 11% of headphone users. Mobile phone usage concerned 8% (1688) of pedestrians. 74% of them were under 30 years of age. Women also prevailed here (61% of the total number of phone users at the crossing).

People looking at the phone walk slower and do not observe the environment. As a consequence of such behaviour they collide with passers-by. An example of this situation is shown in Figure 6.

Figure 7. An example of pedestrian collision due to focus on the mobile phone

2.2. Pedestrian crossing B

During the research, over 15 000 pedestrians were recorded at the pedestrian crossing. The peak hours occurred from 2 p.m. to 5 p.m., when about 1500 P/h were counted. It was found that 4.4% of pedestrians used headphones while crossing the road. Similarly to the previous pedestrian crossing, women under 30 years of age (55%) were the predominant group, followed by men in the same age group (38%). People over 30 years old constituted 7% of headphone users. Mobile phone usage concerned almost 10.5% (1591) of pedestrians. 79% of them were under 30 years of age. Women also prevailed here (54% of the total number of phone users at the crossing).

In addition, cyclists were using cell phones and headphones while crossing the street as well. An example of this situation is shown in Figure 9.

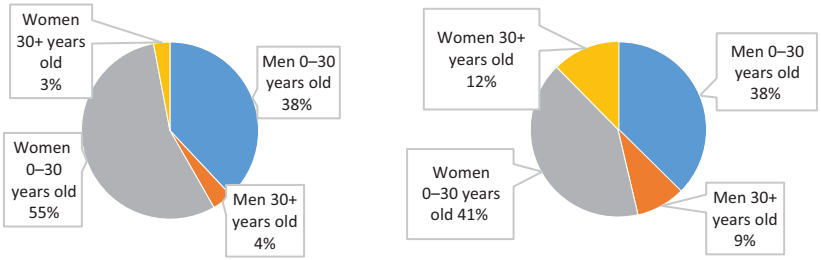

Figure 8. Distribution by age and gender among people using headphones (on the left) and mobile phones (on the right) at pedestrian crossing B

Figure 9. An example of cell phone use by a cyclist crossing a road

2.3. Pedestrian crossing C

About 11 000 pedestrians were recorded on pedestrian crossing. The peak hours occurred from 3 p.m. to 5 p.m., when about 1500 P/h were counted. It was found that 5.3% of pedestrians used headphones while crossing the road. Similarly to the previous two pedestrian crossings, women under 30 years of age (48%) were the predominant group, followed by men in the same age group (38%). People over 30 years old constituted 14% of headphone users. Mobile phone usage concerned almost 10% (1130) of pedestrians. 76% of them were under 30 years of age. Women also prevailed here (48% of the total number of phone users at the crossing). For all crossings, it was also observed that some people hide the phone just before entering the road.

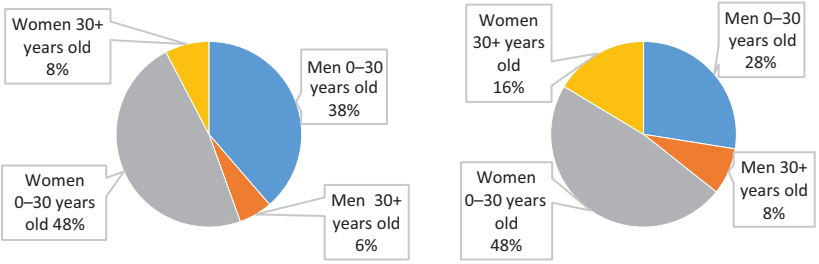

Figure 10. Distribution by age and gender among people using headphones (on the left) and mobile phones (on the right) at pedestrian crossing C

3. Discussion

Although the research presented in the article is a pilot survey, it allowed stating the problem of using headphones and cell phones by vulnerable users at pedestrian crossings. The results confirm that new technologies are mainly used by young pedestrians at pedestrian crossings (Lennon *et al.*, 2016). They constituted from about 70–90% of the total users. In this study, the use of headphones was also analysed. To the best of our knowledge, this issue has not been studied before. Results indicate that in the entire population almost 5% of people walk in the streets wearing headphones. Regarding mobile phones usage, this percentage fluctuated around 10% of all people using pedestrian crossings. In comparison to Australia, the proportion was lower (Lennon *et al.*, 2016). However, this phenomenon may become more pronounced in the next few years. Contrary to Chinese studies (Zhou *et al.*, 2019), women appeared to be the predominant group using headphones. During

the research, pedestrians using cell phones moved more slowly through the passage, which is consistent with the conclusions from the literature (Haga *et al*., 2015; Zhou *et al*., 2019). In addition, they disrupted other pedestrian traffic by bumping into them, which was also observed in China (Lin and Huang, 2017; Zhou *et al*., 2019). During research in Gdańsk, pedestrians looking at the screen of cell phones more often collided with other pedestrians than those talking on the cell phone or listening to music. This is because they watched what was happening around them. These results were similar to those presented in the cited studies (Antic *et al*., 2016; Schwebel *et al*., 2012).

Conclusion

The studies described above were of a pilot nature and cannot be used to draw conclusions with regard to the entire population of Poland. However, it should be emphasized that research on this type of behaviour was performed in Poland for the first time. Comparison of the results obtained with those presented in the literature was interesting as well. It appears that in Poland, compared with other countries where similar research was performed, the problem is considerably smaller. Additionally, women are at the forefront in using mobile electronic devices at pedestrian crossings. For now, there is no annotation in the Polish statistics in the event an accident results from pedestrian looking at the cell phone while crossing the street or listening to music on the headphones, so such data cannot be analysed. All that remains is to study behaviour and possible conflicts, which is arduous and time-consuming work. The consequences of such behaviour at the pedestrian crossing without traffic lights can be much more serious. Further research on pedestrian use of cell phones at crossings will be followed by studies of pedestrian behaviour at pedestrian crossings without traffic lights. Subsequently, pedestrian crossings without traffic lights were selected, and all user behaviour was recorded. The purpose of research is checking if pedestrians are careful when crossing the street and finish the tasks performed on the phone before entering the road, making sure that they can enter the crossing safely and also if there are dangerous situations at the crossing. The conclusions of such studies could be used to substantiate prohibition of the use of telephones by all users within the pedestrian crossing and the possibility of punishing such behaviour by the police just like in cases when pedestrians cross the road at the red light.

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