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Traffic hazard perception among children

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ABSTRACT

Most studies comparing hazard perception skills between young and middle-aged drivers show that increasing age is associated with decreased reaction time to traffic hazards, although some studies failed to find this relationship. Studies on young people's hazard perception demonstrate that younger children have a more idiosyncratic perspective on the road environment and thus might have difficulty in understanding non-obvious dangers, such as dangers caused by lack of sight. This study's purpose is to examine the relationship between age and hazard perception when comparing children, teenagers, and adults. It demonstrates that children under 13 years of age have significantly longer hazard perception latencies and lower response rates to some traffic hazards than teenagers or adults. This effect is larger for hazards not involving "threatening" vehicles, such as hazards caused by standing or slowly moving road users on the side of the street with the ability to cause dangerous situations by behaving unexpectedly. The results indicate types of hazards to be emphasized in traffic safety education for children.

1. Introduction

Road users' awareness of potential hazards is an important factor in many accidents. Vigilant road users can both avoid triggering accidents due to own traffic behavior and prevent accidents caused by reckless behavior by others. Previous research has shown that hazard perception skills among motorists improve with driving experience (Borowsky, Oron-Gilad, Meir, & Parmet, 2012; Borowsky, Shinar, & Oron-Gilad, 2010; Liu, Hosking, & Lenne, 2009; Sagberg, 2009; Sagberg & Bjørnskau, 2003; Underwood, Crundall, & Chapman, 2011). Although most studies seem to find that hazard perception skills of car drivers tend to increase with age and/or driving experience, some studies did not find any difference in reaction times (Chapman & Underwood, 1998; Crundall, Underwood, & Chapman, 2002).

The purpose of the present study is to extend the age range of hazard perception testing to include the population that do not yet have access to a driving license, i.e., children and youth below the age of 18 years.

Children and youth constitute an important share of the road users, and even if they are not allowed to drive motorized vehicles themselves and therefore seldom hurt other road users, their ability to anticipate hazards can protect them from being hit by others, such as when crossing the road. Their ability to perceive hazards can also reduce the likelihood that they will end up in accidents while riding a bicycle.

"Hazard perception" can be defined as the ability to anticipate dangerous situations on the basis of perceptual evidence; that is, the creation of accurate expectations about what can happen (Groeger & Chapman, 1996). Hazard perception

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depends on cognitive abilities, which are not fully developed in young children. Previous studies show that children from 7 years old start reading the traffic and are able to adapt their behavior according to the situation (Glad & Midtland, 2000), but it is only from 11 to 12 years that the perception of complex scenes is both effective and complete (Pettit & Janks, 1996). Several studies have compared hazard perception test results among younger and older children and demonstrated that that older children tend to score higher than younger children (Hill, Lewis, & Dunbar, 2000; Renge, 2001; Sarkar et al., 2003). Furthermore, Oron-Gilad, Meir, Tapiro, and Borowsky (2011) has compared adults with children of age 7–9 years and 10–13 years and showed that experienced adult-pedestrians were more sensitive to potential hazardousness.

Younger children have a more personal and idiosyncratic perspective compared to older children. They base their hazard perception on the presence of specific objects (such as a saw, match, or a large vehicle) while ignoring the environment the object is part of Hill et al. (2000), Underwood, Dillon, Farnsworth, and Twiner (2007). They can, for instance, perceive a parked car as more dangerous than the lack of visual sight (Hill et al., 2000), while older children show greater understanding of other road users' perspective (Underwood et al., 2007). Children tend, furthermore, to ignore potential hazards when no-one had cued them to danger and probably are more easily distracted by other features (Hill et al., 2000). Training has been shown to improve children's traffic behavior (Fyhri, Bjørnskau, & Ulleberg, 2004; Glad & Midtland, 2000), but the children had particular difficulty in understanding that lack of sightlines could represent a danger (Glad & Midtland, 2000).

Although there has been some research on the qualitative aspects of hazard perception among children, we have not found any studies including measurement of reaction times or response rates to traffic hazards.

1.1. The TØI hazard perception test

The Institute of Transport Economics (TØI) has developed a video-based test to measure the reactions of potential hazards in traffic (Sagberg & Bjørnskau, 2003, 2006). According to Sagberg (2009), the test was based on similar tests developed in England (see, for example, McKenna & Crick, 1997), tests which today are part of the UK driving test. The subject is looking at video recordings made from the approximate eye position of a car driver, showing the traffic almost as it looks when driving (except for the lack of view to the sides). The subject is told to press a button each time he or she notices a traffic situation that could develop into a hazard which may require braking or evasive action. A computer records the reaction time for each situation from the time it is possible to recognize the hazardous event or object. For sample video frames from the present test, see Dukic, Eriksson, and Sagberg (2012).

The first study using the TØI video test (Sagberg & Bjørnskau, 2003, 2006) examined the relationship between driving experience and hazard perception among novice drivers. Test subjects were shown two videotapes with a total of approximately 20 min duration, which contained 33 different predefined hazards. The video was shown on a big screen for groups of drivers, each person sitting with a push button in the hand.

Later, TØI developed a DVD version for use on individual PCs (Sagberg, 2005). The DVD version, comprising 13 traffic situations, has been used in two subsequent studies of age and hazard perception, one comparing older drivers (over 65 years) with drivers between 35 and 55 years old (Levin, Dukic, Henriksson, Mårdh, & Sagberg, 2009), and one comparing the mentioned age groups with a group of learner drivers in the first phase of driver education (Sagberg, 2009). Fig. 1 shows screen-shots from one traffic situation where a car comes from the left and does not observe duty to yield to camera car at intersection (situation 1 in Table 1).

In a subsequent analysis of data from the study of Levin et al. (2009), the situations were classified into four different types of hazards (Dukic et al., 2012; Thörnell, 2010), partly based on criteria developed by other researchers (Crundall, Chapman, Trawley, & Underwood 2008; Renge et al., 2005; Vlakveld & Twisk, 2008). The first class of hazards are *context hazards*, which is defined as stationary or slowly moving road users on the side of the street which may cause dangerous

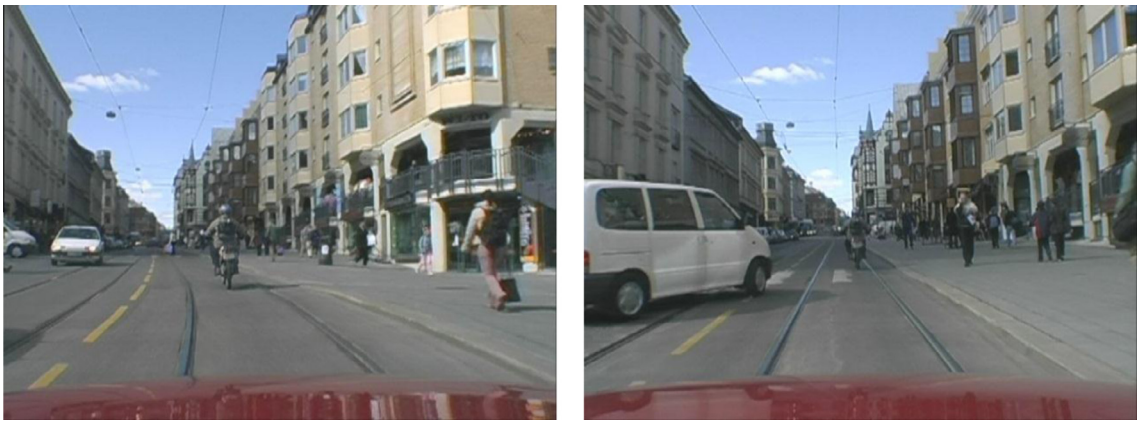

Fig. 1. Car from left does not observe duty to yield to camera car at intersection (situation 1 in Table 1).