Accident Analysis and Prevention 102 (2017) 81–92

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

The importance of spatial orientation and knowledge of traffic signs for children's traffic safety

Aleksandar Trifunović*, Dalibor Pešić, Svetlana Čičević, Boris Antić

University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, 11000 Belgrade, Serbia

ARTICLE INFO

Article history:
Received 28 September 2016
Received in revised form 18 January 2017
Accepted 21 February 2017

Keywords:
Children traffic safety
Color perception
Spatial orientation
Traffic signs
Non-verbal tests

ABSTRACT

Pre-school children, as well as children from lower grades in primary school, who although rarely, completely independently participate in traffic, represent a vulnerable population from the standpoint of traffic safety. The greatest number of children were injured or killed in road traffic crashes on their way from home to kindergarten or school. Mostly due to lack of experience, children's behavior is confusing and often reckless and hasty. Safe behavior in the traffic environment demands certain cognitive skills. Unlike adults, children have less than fully developed peripheral vision. Also, changes occur in color perception, i.e. discrimination. All this leads to the conclusion that the stage of physical and mental development of the child is very important for safe participation in traffic. So, to estimate if they are sufficiently equipped to participate safely in traffic, a sensitive test for young children that may be suitable for their level of cognitive development is required. Accordingly, road safety education should be arranged in such a way that considers the child's level of development, as has been shown to be more effective when started at younger ages. Play is the most natural and easiest way of learning because it is the lens through which children experience their world, and the world of others. Having this in mind, if we want to measure the abilities of a child, and their preparedness for safety participation in traffic, unavoidable is to use non-verbal tests. The purpose of this study is to explore primary schooler's spatial, and abilities of color perception and memorization, as well as their performances in interpreting the meaning of traffic signs. In addition, neighborhood environmental correlates (rural–urban) and possible individual differences influences on the relationship among these abilities was examined. Knowledge about these factors affecting children's safety can be applied to improve relevant intervention measures for promoting safe participation of young children in traffic. It may constitute the basis for effective classroom work which implies the creation of individualized educational plans and programs, through which road safety skills could be acquired and adopted through play.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

A modern traffic setting poses complex and high requirements to all its participants, and among them, particularly to children. At the ages when they are acting as independent road users, they participate in traffic, mainly as pedestrians or cyclists. Without doubt, travel of children to and from school is a complex and sensitive issue. Each travel mode has its attendant risks, which vary from community to community and school to school, and any shifts from one mode to another can have a marked effect on the overall safety of school travel (National Research Council, 2002). A study in the United States showed that children aged 5–13 years who walk or cycle to school are at greater risk of injury than those who are driven by car (Lavoie et al., 2014). There are multiple risk factors that together create an increased risk for child injury. First of all, children observe a roadway environment from a different perspective than adults due to their smaller stature which makes them harder to see oncoming traffic. They are at a physical disadvantage because of their height which makes it difficult for drivers to detect them, and at close proximity they may be invisible below the height of a vehicle (Agran et al., 1994; Mohamed et al., 2011; Ivarsson et al., 2006; Kaufer Christoffel et al., 2002). Also, the ability to coordinate eyesight and hearing is limited, which can lead to their missing danger signals, thereby increasing their risk of road traffic injuries (Olofsson, 2014).

Interacting with traffic is complex, and the necessary abilities are not fully developed in children until age 11–12 years

* Corresponding author.
E-mail addresses: a.trifunovic@sf.bg.ac.rs (A. Trifunović), d.pesic@sf.bg.ac.rs (D. Pešić), s.cicevic@sf.bg.ac.rs (S. Čičević), b.antic@sf.bg.ac.rs (B. Antić).

http://dx.doi.org/10.1016/j.aap.2017.02.019
0001-4575/© 2017 Elsevier Ltd. All rights reserved.

(Schieber and Thompson, 1996; Sandels, 1995; Vinje, 1981). Furthermore, a wide range of environmental (including traffic speed and volume) and behavioral factors contribute to child injury risk. Prominent among them is children's development, while developmental psychology research suggests several functions required for safe pedestrian ability develop through early and middle childhood. One major reason children have increased pedestrian injury risk is because crossing a street requires sophisticated cognitive and perceptual processing, skills that are age dependent, too. It is the combined development of a number of different cognitive processes that are linked to safe pedestrian behavior. Those processes also overlap with other developing skills, such as perception of relevant spatial and situational attributes, attentional, memory and information-processing capacity, decision-making as well as motor abilities, which are fairly limited, but increases with age and begins to approach adult level in the early teens. Above all, children are also lacking fully developed ability to evaluate a complex and potentially hazardous situation involving assessments of speed, distance, time and detecting movement. So, in making roadside crossing decisions young children suffer from poor pedestrian skills.

Pedestrian-oriented educational measures may change children's behavior when crossing the street, but it is still unknown whether they effectively reduce the risks of motor vehicle–pedestrian collisions. Thoughtful and age-appropriate road safety instructions within the context of family, school and community is required. An early, presentation of road safety will also influence the belief system and mind-set of current and future road users and their attitude toward road safety. Educators can create an environment in which children are eager to explore and learn about traffic safety.

Each phase within childhood is characterized, and consequently defined, by distinctive levels of physical and psychological skill. Children as road users cannot, therefore, be considered a homogenous group as their abilities differ considerably (DaCoTA, 2012). Among others, spatial orientation has a very important role for safe participation in traffic. Spatial orientation is related to the differentiation of the spatial relationships of child's own body (right hand, left hand, among others). A large role in developing the perception of spatial relationships plays inclusion of words in the process of perception, especially in the perception of spatial relationships between objects. Real focusing of attention on relevant information and ignoring irrelevant information appears only after the age of 11 years. When the children are 36–72 months old, they are able, in the field of perceptual-practical thinking, to classify objects by shape, color or function, and they began to logically classify cases by combining two properties (Ong and McLean, 2011). Besides the undeniable development of sensory characteristics, psychomotor and cognitive abilities of children of younger preschool age, numerous studies provide convincing data that different components of executive functions mature at different times. Differences in the hereditary potentials and environmental support systems of the individual leading to individual differences in the developmental patterns. So, children reach the same point in physical, cognitive and concept development at various ages. An important element for understanding the interactions of children with the surroundings, especially when it comes to participation in traffic, is to examine how they perceive it. The basis for spatial processing is localizing the stimulus; this is followed by spatial memory, inferential abilities and the use of symbolic representations. At this higher level of mental representation there are also cognitive maps. These preserve spatial properties such as landmarks, paths, directions, distances and the general relationships between the elements, regardless of the person's position or direction from which they are approaching (Long and Giudice, 2010; Millar and Al-Attar, 2004).

Different spatial perspectives have influence on the representation of the spatial characteristics of a described environment. Two types of spatial perspectives or their combination are often used for categorical and metric distance information extraction. According to the Category-Adjustment (CA) model originally proposed by Huttenlocher et al. (1991), retrieval of locations from memory involves the use of both fine-grained and categorical information. When trying to remember a previously learned location, children and adults make estimates based on their memory of fine-grained, metric information, such as distance and direction from an edge. Recent empirical tests of the CA model support the notion that children and adults combine memory for fine-grained and categorical information to estimate location (Recker and Plumert, 2009; Plumert, 2008; Plumert and Spencer, 2007).

Route and survey descriptions have specific characteristics that have their origins in the different reference frames they employ. Route descriptions take the addressee into the environment and give information on position of landmarks and objects relative to the changing position of the addressee. The relative spatial information is conveyed by locative prepositions such as "to the left" and "to the right". In contrast, survey descriptions adopt a bird's-eye view and describe objects with respect to one another in terms of "north", "south", "east", and "west" (Noordzij and Postma, 2005). Mental spatial perception has its own structure i.e. metric characteristics. It turned out that the physical characteristics of objects (color and shape) have a pronounced effect on tracking performances of moving objects, although spatial and temporal (location and direction of travel) components may be controlled by different cerebral subsystems, which adapt separately to perturbations like changes in muscle proprioception, or in vestibular and visual information (Čičević and Trifunović, 2013).

There is a large body of literature on important processes underlying human perception, whether of adults or of children. However, the data upon perception of symbols on traffic signs by the preschool, and early school aged children are very scarce. Regardless of that fact, it is clear that children do not perceive, neither traffic sings, nor the overall reality, in the same way as adults. For children, it is much easier to express themselves as well as to acquire knowledge through graphic symbols (Waterson and Monk, 2014; DeKlerk et al., 2014; Eisenbach et al., 2015; Hiniker et al., 2016). For the sake of their safety in traffic, it is very important that children develop competencies in a range of primary perceptual-motor and cognitive skills. In attempt to offer a simple answer to the complex question: "What do children need to know in order to become traffic-safe participant?", the experiment was arranged and conducted aiming at measurement children's spatial orientation, spatial relationships, color perception and discrimination, understanding the meaning of traffic signs, as well as graphomotoric skills. On the basis of the testing results, child's preparedness for safety participation in traffic can be estimated.

2. Methodology

The experiment consisted of two testing sessions. The first test is used to explore children's spatial orientation ability, the contribution of color to their wayfinding ability in school environments, to examine the differences between different colors in terms of their remembrance and usability in route learning process, as well as for evaluation of their graphomotoric skills. Test II consisted of tasks measuring the knowledge of the meaning of several traffic signs.

For the purposes of Test I four identical boxes in shape and size are used, height 25 cm, 36 cm in length and 26 cm in width (Fig. 1). Although the exact colors used for traffic signs generally depend on the country, red, green, yellow and blue are usually included, and that is why they were chosen. Red color usually refers to prohibited

Download English Version:

https://daneshyari.com/en/article/4978594

Download Persian Version:

https://daneshyari.com/article/4978594

Daneshyari.com