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Fear and danger appraisals of a road-crossing scenario: A developmental perspective

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ABSTRACT

Children's actual performance of visual timing task is possibly deficient, and road-crossing training programs focusing on visual timing elements result in questionable improvement in performance. The present study focused on conceptual, rather than perceptual, examination of the visual timing elements of distance and speed, as integrated into appraisals of risks related to a traffic scenario. Preschool children, third-grade children and adults appraised pedestrian fear and danger associated with four scenarios conceptually depicted using a table-top model. Each scenario described either a child or an adult pedestrian approached by a vehicle at various distances (near/far) and speeds (slow/fast). Results suggest that whereas the adult subjects integrated the danger and fear appraisals by giving separate weights to both distance and speed concepts, preschoolers failed to properly realize the danger associated with speed, and third-graders failed to integrate both concepts in their appraisals. In addition, children seem to be unaware of their underprivileged pedestrian status compared to adult pedestrians, as evidenced by similar appraisal patterns for both pedestrian age groups. The safety implications of these findings are discussed.

Visual timing is considered one of the most important skills involved in road crossing, requiring pedestrians to evaluate an approaching vehicle's time-on-arrival, compare it to their own crossing time, and finally decide whether it is safe to cross (Thomson et al., 1996). While adults usually identify safe traffic gaps, children perform poorly on this visual timing task (Lee et al., 1984; Routledge et al., 1976), as evident by their delayed crossings even on suitable gaps, missed crossed opportunities, and tight crossing fits (Thomson et al., 2005; Tolmie et al., 1998).

There has been some debate as to whether estimates of time-on-arrival are generated top-down, by computing the speed and distance relations of an approaching objects (Connelly et al., 1996, 1998), or are they perceived directly, bottom-up, as the approaching object's retinal image increases (Lee, 1980). Supporting the first view, studies indicate children's time-on-arrival judgments (for both traffic related and neutral scenarios) rely heavily on the distance factor (Connelly et al., 1996, 1998; Matsuda, 1996; Siegler and Richards, 1979). Proponents of this position generally attributed this deficiency to inferior physical and motor skills (Briem and Bengtsson, 2000), and to perceptual development (Hoffrage et al., 2003; Plumert et al., 2004). Thus it has been suggested training programs better focus on non-kinematical road-crossing aspects, less subjected to developmental maturation.

In contrast, results from several training programs indicated visual timing improvement is attainable even with young children. Training programs using the pretend road paradigm (Lee et al., 1984) indicated a decrease in missed crossing opportunities, crossing delay, and accepted gap size, for children as young as 5 (Demetre et al., 1993; Young and Lee, 1987). However, after 3 months the effects of the pretend road training program disappeared, resulting in similar behavioral patterns for both program participants and controls. More recently, a similar training program replicated 5–8-year-olds' improvement in crossing delay and accepted gap size, but found no missed opportunities decrease (Barton et al., 2006). The lack of finding regarding missed opportunities is especially interesting, as these results included statistical compensation for this measure's positive skew, and furthermore, as design limitations allowed for an extensive practice prior to the actual task performance. An alternative method, using a virtual reality training program, also resulted in gap size, initial crossing delay, and missed opportunities decreases (Thomson et al., 2005). Still, improvement in gap size was evident only 8 months after the program's completion, which might indicate some element of maturation was involved. Furthermore, the criterion defining a missed opportunity was twice the actual crossing time, whereas

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all the above-mentioned pretend road studies used a stricter criterion—1.5 × actual crossing time.

In view of these inconclusive findings, the effectiveness of such behavioral methods as the pretend road is still debatable. Although alternative methods were considered ineffective substitutes with regards to visual timing training (Thomson et al., 1996), Foot et al. (2006) suggested it is possible to train even 7-year-olds to attend speed-related traffic cues such as braking lights, thus avoiding the perceptual aspect of direct speed assessment. Unfortunately, their findings were limited to the computer simulation task and missing from roadside test.

Even if children's failure to improve their visual timing skills is related to the maturation of top-down processes, they might still be able to conceptualize task-related factors (speed, distance and time) without actually perceiving them correctly. That is not to say children's performance on a perceptuo-motor level is dependent of or even follows their conceptualizations of kinematics (Thomson et al., 1996). However, road-crossing visual timing training programs usually rely on verbally focusing children's attention to elements of speed, distance and time, and therefore relate to these elements' conceptualizations. Thus, although conceptual aspects need not be directly linked to a successful road-crossing performance, instilling performance by way of teaching is.

By their very nature, road-crossing training programs deal not only with the correct procedure for safe crossing, but also with the risks of refraining from following it, i.e. traffic accidents. Fear of the danger associated with traffic accident can be targeted when devising an effective safety intervention, as emotions are conductive in generating stable cognitive appraisals (Lerner and Keltner, 2001). The behavioral rationale is simple: danger elicited by the consequences of an inappropriate crossing, induces fear of the aversive outcome, and causes children to avoid such behavior. Thus, a direct measure of children's awareness of the importance of visual timing elements in a road-crossing task would be to evaluate the fear and danger children associate with traffic accidents.

In general, traffic accidents are rated as 1 of the 10 most common fears children report on the Fear Survey Schedule for Children (Gullone and King, 1992; Ollendick, 1983; Scherer and Nakamura, 1968). In contrast, McCathie and Spence (1991) suggested children do not experience any frequent fear on a regular basis with any of the 10 most common fears, nor do they take action to prevent them from occurring. Rather, children are biased by the low-probability[1]/extreme-fear-inducing items, leading them to treat the survey items as concrete, present dangers. Muris et al. (2002) found the prevalence of fear of traffic accidents in 8–12-year-olds reports of daily fears was considerably lower in frequency, duration, and intensity, than when measured with the FSSC-R. Similarly, Dunbar et al. (1999) found that 4–10-year-olds failed to identify dangerous situations unless prompted to look for danger, in which case they tended to view safe situations as potentially dangerous. Experience, as well as maturation, seems to improve children awareness of danger, as exposure to traffic-related situations increased the likelihood of identifying these as dangerous situations at a younger age.

Direct measurement of the perceived road-crossing danger using a table-top model revealed younger children were less proficient in their identification of safe and dangerous crossing sites, relying more on the presence or absence of cars on the road (Ampofo-Boateng and Thomson, 1991). Other critical factors, such as road visibility, were completely ignored. Likewise, while children's knowledge of traffic-related dangers increased following a traffic training program, their performances failed to improve (Zeedyk et al., 2001; Zeedyk and Wallace, 2003).

Although children can conceive of situational dangers, it seems they do not estimate the plausibility of the dangerous element in the specific situation: they do not consider danger to be a primary feature of some dangerous situations, while finding danger even on safe situations. When the danger of traffic accidents is made salient (either through task requirement, training, or experience), children readily identified situational dangers and easily associated them with fears. However, children apparently do not view traffic accidents as eminent, probable dangers and therefore neither worry about them nor take any preemptive measures to avoid them (Demetre and Gaffin, 1994; Hill et al., 2000).

These issues present a double-tiered hurdle for children visual timing training programs to overcome: first to improve children's detection of visual timing factors, and then to make them identify the risks these factors present. In view of possible gaps between knowledge and its actual implementation (Miller et al., 2004; Zeedyk et al., 2001; Zeedyk and Wallace, 2003), the current study avoided direct evaluations of speed and distance (and naturally, direct risks), instead focusing on their representations in children's mind as concepts rather than precepts.

Considering many road safety programs highlight the element of danger involved in pedestrian crossing, coupled with many children's abundant experience in actual road crossing, results in a rather bleak picture of children's awareness to the dangers of traffic. Worse even, if children's perception of speed and distance is impaired, and if their sensation of fear and danger elicited by road-crossing situations is conceptual and abstract rather than actual and concrete, prospects of teaching children correct behavior are exceptionally poor. However, children's knowledge of a phenomenon often precedes their ability to correctly identify its actual properties, undergoing an abstract-to-concrete shift. Concurrent evaluation of a wide range of components and differing visual perspectives related to road-crossing tasks suggests these also develop and improve with age (Demetre and Gaffin, 1994; Foot et al., 1999). At the age of 7, children started predicting future traffic scenarios rather than relying on simple sampling of the traffic situation (Whitebread and Neilson, 1999, 2000), while at 10 children were capable of exercising accurate judgment at identifying safe cross-road passage (Demetre and Gaffin, 1994).

By alerting children to their perceptual inadequacies, training programs could induce children's association of fear and danger with their concepts of speed and distance. However, for children to understand the gap between their concept of the world and the actual phenomena, and consequently that this gap is inexistent in adults, is dependant of the child's development of Theory of Mind (Andrews et al., 2003; Leslie, 1994). Whether innate or socially acquired, this ability undergoes significant changes between the ages 6 and 10 (Wellman and Hickling, 1994). Thus, if success of training programs is dependent on children's internalization of their own limitations, this ability in turn relies on sufficient theory of mind levels to be reached.

With these considerations in view, a different experimental approach was used in the present study. Following Ampofo-Boateng and Thomson's (1991) procedure we presented a road-crossing scenario on a table-top model, and examined whether participants, especially children, consider the arriving traffic's speed and distance as possible causes of fear and danger. We avoided the cognitive and developmental limitations hindering direct evaluation of kinematical elements, by providing participants with general verbal terms of values for speed and distance, hopefully tapping concepts rather the precepts. Assuming both perceptual and conceptual abilities improve through the course of development, we expected older children to associate higher lev-

[1] Low probability from the child's point-of-view.