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# Inexperience and risky decisions of young adolescents, as pedestrians and cyclists, in interactions with lorries, and the effects of competency versus awareness education

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ABSTRACT

*Background:* Road injuries are a prime cause of death in early adolescence. Often road safety education (RSE) is used to target risky road behaviour in this age group. These RSE programmes are frequently based on the assumption that deliberate risk taking rather than lack of competency underlies risk behaviour. This study tested the competency of 10–13 year olds, by examining their decisions – as pedestrians and cyclists – in dealing with blind spot areas around lorries. Also, the effects of an awareness programme and a competency programme on these decisions were evaluated.
*Method:* Table-top models were used, representing seven scenarios that differed in complexity: one basic scenario to test the identification of blind spot areas, and 6 traffic scenarios to test behaviour in traffic situations of low or high task complexity. Using a quasi-experimental design (pre-test and post-test reference group design without randomization), the programme effects were assessed by requiring participants ($n = 62$) to show, for each table-top traffic scenario, how they would act if they were in that traffic situation.
*Results:* On the basic scenario, at pre-test 42% of the youngsters identified all blind spots correctly, but only 27% showed safe behaviour in simple scenarios and 5% in complex scenarios. The competency programme yielded improved performance on the basic scenario but not on the traffic scenarios, whereas the awareness programme did not result in any improvements. The correlation between improvements on the basic scenarios and the traffic scenarios was not significant.
*Conclusions:* Young adolescents have not yet mastered the necessary skills for safe performance in simple and complex traffic situations, thus underlining the need for effective prevention programmes. RSE may improve the understanding of blind spot areas but this does not 'automatically' transfer to performance in traffic situations. Implications for the design of RSE are discussed.
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## 1. Introduction

Road safety education (RSE) programmes are widely used with the goal of changing behaviour among young adolescents, so that injuries and fatalities are prevented. However, little is known regarding whether these programmes address the relevant determinants of risk behaviour, achieve their objectives, and actually change behaviour (Dragutinovic and Twisk, 2006; SUPREME, 2007; Williams, 2007). For example, blind spot programmes have become increasingly popular to educate and train young cyclists and pedestrians, now that the additional mirrors on lorries – compulsory in the EU since 2003 – and other technical systems that seek to improve lorry drivers' view, have only led to a temporary reduction in fatalities (Schoon et al., 2008). Of all fatal crashes between cyclists and lorries in the period 1997 and 2006, 45% happen because of cyclists being in the driver's blind spot. Of those blind spot fatal crashes, 28% involves a cyclist in the age category 0–17 (Schoon et al., 2008). To date little is known about the antecedents of these risky decisions. Is it that youngsters hold safety compromising attitudes and beliefs, resulting in 'carelessness' and deliberate ignoring of these risks? Or is it that these youngsters lack the necessary skills to deal with these potential risks, and just do not know what to do? Whereas education programmes for children are implicitly

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based on the assumption that they are still inexperienced road users, those for young adolescents tend to focus on attitudes and beliefs as the main determinants of risky behaviour (Dragutinovic and Twisk, 2006). The latter focus is supported by results from epidemiologic studies showing a strong rise in all sorts of risky behaviours in this age group, such as smoking, alcohol use, and petty crime (Dorsselaer et al., 2007; Ezinga et al., 2008; Junger et al., 2003; Kumpula and Paavola, 2008), and by results from studies on the psychological determinants suggesting that youngsters are well aware of risks (e.g., Reyna and Farley, 2006; Steinberg, 2008) but still behave in a risky manner because of strong desires for novel and exciting experiences, high desire for peer approval, and low impulse control (Dahl, 2004). In contrast, studies on expertise development, however, support the possible role of inexperience as a determinant of risk behaviour, pointing to the slow acquisition of new skills (Anderson, 1982) and the necessity of deliberate practice (Ericsson, 2005). Also, several behaviour models point to the importance of expertise, in that skills are a restricting factor for attitudes/beliefs to influence road behaviour (e.g., Fuller, 2008). That is, despite a positive safety motivation youngsters may still behave risky because of poor skills. Although this distinction between 'attitudes/beliefs' and 'inexperience' is of utmost importance for the design of RSE programmes (Bartholomew et al., 2006), until now this information has not been available. Therefore, the present study examined the initial proficiency of 10–13 year old adolescents in simple and complex blind spot situations, and evaluated and compared the effects of two types of blind spot education programmes: a programme aimed at raising proficiency and a programme aimed at increasing risk awareness. The study focussed on blind spot situations because of the complex psychological mechanisms involved, the high incidence of this type of situation in road traffic, and the serious consequences of such a crash.

With respect to the competency of young adolescents – before the intervention – the following hypotheses were formulated. Because blind spot scenarios require the recognition of situations in which lorry drivers can easily make errors, and the processing of information that may contain contradictory cues and distractors (Endsley, 1995; Fuller, 2008), road users need to possess abilities such as 'empathy', 'perspective-taking', and 'selective and focussed attention'. These abilities, however, are not yet fully developed in early adolescence, partly because of the immaturity of the adolescent brain (Blakemore and Choudhury, 2006; Keating, 2007). It is therefore expected that youngsters will frequently make risky decisions in blind spot situations (H1). The development of these skills may be accelerated by practice on the task (Crone and Dahl, 2012; Johnson et al., 2010; Keating, 2007), whereby the simple tasks require less practice than the more complex ones (Anderson, 1982; Ericsson, 2005; Shriffrin and Schneider, 1977). Young adolescents in the Netherlands have had little practical experience with these blind spot situations. It is therefore expected that risky decisions will be made more frequently in complex traffic situations containing contradictory cues and distractors than in simple ones (H2).

In the evaluation study, two blind spot programmes were assessed. The awareness programme addressed carelessness, not only in blind spot scenarios, but also in other traffic situations. The competency programme solely addressed blind spot hazards and used a condensed message of only four rules: (a) do not cross the street right in front or right behind a lorry; (b) at signalized intersections, always wait behind the stop line; (c) when approaching an intersection, stay behind the lorry; and (d) make sure the lorry driver sees you. Besides these differences, the programmes were very similar. Both were comprised of a half-day of instruction, whereby a real lorry was placed in the schoolyard. The limitations in the lorry driver's field of view were demonstrated and information on safe behaviour was provided. Participants could climb into the driver's seat and see for themselves where the blind spots were located. Blind spots were further illustrated through graphic representations and videos. Practical training in real-world situations was not included in either of the programmes. Both programmes visited schools on request, the costs were often covered by subsidies from local governments, and instructors were volunteers, frequently retired lorry drivers.

This study further tested the validity of the presumed didactic mechanisms. Both programmes implicitly assumed a successful 'far' transfer of learning (Barnett and Ceci, 2002), meaning that the mere provision of instruction and demonstration were expected to yield better performance in actual traffic situations. The present study hypothesized that if demonstrations of blind spots and instructions were sufficient for improving actual behaviour in traffic, improvements in the 'identification of blind zones' should be associated with improved performance in simple and complex traffic scenarios (H3).

The evaluation was conducted in a field setting in schools that already used the programmes on a regular basis. Performance was assessed by means of table-top models representing traffic situations. The field setting was chosen because of the study's aim to inform policy makers, teachers and educators about the 'net' effect of the programmes in use. The table-top model was used for two reasons: first, because exposing adolescents to real traffic situations would be too dangerous and second, because the evaluation study required rigorous control over task complexity.

Even though these RSE programmes were intended to improve road safety and thus reduce injury rates, the evaluation study only used 'road decisions' as a success criterion. Because crashes are rare, an evaluation study aiming to demonstrate effects on crashes and fatalities, would have required sample sizes of thousands of participants and extremely long observation periods (Hauer, 2008). Still, based on the assumptions that competency is a pre-condition for safe decisions and safe decisions reduce crash risk, this study uses 'change in the number of safe decisions' as an indicator of the potential impact these programmes may have on road safety.

## 2. Methods

### 2.1. Participants

Four primary schools in the Netherlands participated in the study: two intervention and two reference schools. The intervention schools were those that came first in the programme's 'tour scheme'. These schools were matched in terms of geographical location with two reference schools that used neither of the programmes. No other criteria were used for matching. All participants ($n = 63$) of the last two grades of these four primary schools participated in the study and completed both the pre- and the post-test as part of their regular school day. They were between 10 and 13 years of age. In the intervention group, 49% of the participants were boys. In the reference group, this proportion was 51%.

### 2.2. Design

A quasi-experimental approach with a non-equivalent control group design (Cook and Campbell, 1979) and a split plot factorial (SPF) design (Jones, 2009) was employed. Identical task scenarios were used for pre- and post-test. The pre-test was administered just before the programme and the post-test about 1 month later.

### 2.3. Task scenarios

Seven table-top models of traffic scenarios were employed to assess performance. These table- top models were approximately 1 by 2 m in size, each depicting a schematic road layout in 2D and

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