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Improving Safe Bicycling Behavior Among Children: The Evaluation of an Instrument for Evaluating Road Safety Education Courses

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Abstract

Road Safety Education (RSE) courses, aimed at improving children's safe bicycling behavior around trucks, need evaluation in order to ascertain their functionality. In the present study, a measuring instrument in the form of a computer game called "Risk Perception in Complex Situations Part A: Blind Spot" has been evaluated on its suitability for evaluating RSE courses concerning trucks in traffic. This was done by means of two studies. In study 1, scores on the game of 30 adults were compared to those of 324 children in the 8th grade of primary school. Findings suggest that the game can differentiate between bicyclists who tend to behave relatively safe (adults) and those who tend to behave relatively unsafe (children). Study 2 investigated whether the game could detect a change in safe bicycling behavior due to RSE. To this end, a pre- and a posttest with control group were performed among 66 children in total. The pre- and posttest consisted of playing the game, and RSE course "*Veilig op Weg*" formed the intervention for the experimental group. Findings suggest that the game is not capable of detecting a change in safe bicycling behavior due to an RSE course. Taken together, the results of both studies suggest that the game is in its present form not suitable for evaluating RSE courses. One of the most important suggestions made for further research is to identify bicyclist behaviors that lead to blind spot crashes.

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Introduction

Each year, many people die in traffic. Specifically, of all people around the world who died in 2015, as many as 2.4 % died of road injuries. For youngsters between 15 and 29 years of age, road injuries even were the prime cause of death (World Health Organization [WHO], 2016). When limiting our scope to the Netherlands alone, it is seen that a substantial part of deaths is caused by traffic incidents too. Of the 7241 people who died in the Netherlands due to an external cause in 2015, as many as 621 died in traffic (Statistics Netherlands [CBS], 2016).

One of the contributing factors to the number of road casualties is the presence of trucks in traffic. In 2015, trucks were accountable for 66 of the 621 traffic casualties in the Netherlands (CBS, 2016). Because of their size and weight, accidents with trucks often have serious consequences for the ones involved. Additionally, the shape of a truck makes that a victim is likely to end up underneath the tires, whereas a victim of an accident involving a passenger vehicle is more likely to end up on top of the hood (Fietsberaad, 2007).

As cyclists are very vulnerable in traffic, an accident between a truck and a cyclist can be fatal. One specific type of fatal crashes between cyclists and trucks is due to the blind spot areas around the truck (SWOV Institute for Road Safety Research [SWOV], 2015). Blind spot areas are areas surrounding trucks that are out of the sight of the truck driver. In the classic blind spot crash, a right-turning truck crashes into a cyclist who goes straight and who is in the blind spot area on the right-hand side of the truck, see Figure 1.

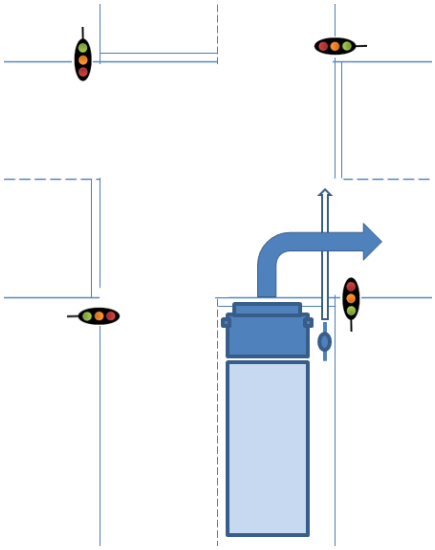

Figure 1. Representation of a classic blind spot crash. The cyclist, who is in the blind spot area of the truck, intents to go straight ahead. The truck driver, who has not seen the cyclist, runs over the cyclist with his truck as he turns right.

Since blind spot crashes often happen because cyclists are not aware of the limited field of view of truck drivers (Schoon, 2012; Räsänen & Summala, 1998; Wood, Lacherez, Marszalek, & King, 2009), or of the space needed for trucks to make a turn (Talbot, Reed, Barnes, Thomas, & Christie, 2014), one hypothesized way for reducing traffic casualties is to provide road safety education (RSE) (SWOV, 2007). The objective of RSE is to improve knowledge, insight, attitude, and skills of road users in order to change behavior in traffic (SWOV, 2013; Duperrex, Bunn, & Roberts, 2002). Since frequently performed behavior can turn into a habit, causing the

effect of intention on behavior to diminish (Triandis, 1980, in Webb, & Sheeran, 2006), RSE is most effective when given to people with little bicycling experience. In the Netherlands, children start participating in traffic on their own from as young as ten years of age. Therefore, it is crucial to start RSE in primary school, around the age from which children start participating in traffic.

RSE courses aimed at improving safe bicycling behavior of children around trucks already exist, but methods to evaluate those courses are lacking. Evaluation is necessary, because ineffective RSE courses may leave children with the same unsafe behavior as before (Twisk, 2014), or might give children a faulty sense of mastery, increasing the chance of incidents (Hatfield, 2012). When misinterpreted, RSE's might also be counterproductive, causing children to behave even less safe than before they participated in the course (Carlin, Taylor, & Nolan, 1998). Thus, in order to ascertain the presence of positive results and the absence of negative side effects, evaluation of RSE courses is crucial.

Whereas the objective of RSE is to reduce the number of traffic victims, this number is not a suitable measure to be used for evaluating RSE courses. That is, accidents do not occur often enough to aid the evaluation of RSE courses (Mesken, 2011; SWOV, 2013; Twisk, Vlakveld, Mesken, Shope, & Kok, 2013; CROW Kennisplatform Verkeer en Vervoer [CROW-KpVV], 2015). Additionally, accidents have multiple causes, so the level of safe bicycling behavior can not directly be measured by means of accidents statistics. Therefore, the effectiveness of RSE courses is best measured by the extent to which children make safe choices in traffic.

It is deemed unethical to examine children in real traffic situations. Therefore, SWOV Institute for Road Safety has, in 2016, developed a computer game called "Risk Perception in Complex Situations Part A: Blind Spot" that is meant to measure the extent to which children make safe choices around trucks. The game consists of six different scenes in which children must drive a virtual bicycle to indicate what they would do in traffic situations that involve trucks, whereby safe choices result in higher game scores. By means of this game, RSE courses concerning blind spots could be evaluated (Witvoet et al., 2016). The game, however, has not yet been evaluated on its suitability for evaluating these RSE courses.

Therefore, the objective of the present study is to provide insight into the suitability of the game for evaluating RSE courses concerning trucks in traffic. The evaluation of educational programs can be done by measuring their effect (Cook, 2010). In the case of RSE courses, the objective is to teach skills to improve safe bicycling behavior (Thomson, Tolmie, Foot, & McLaren, 1996; Twisk, Vlakveld, & Commandeur, 2007). Thus, to be a proper evaluation instrument, the game must be able to measure the effect of RSE courses concerning trucks in traffic, i.e., to detect a difference in safe bicycling behavior after having followed an RSE course.

First will be examined whether the game is capable to differentiate between levels of safe bicycling behavior at all. To this end, game scores from bicyclists who tend to behave relatively safe will in study 1 be compared to game scores from bicyclists who tend to behave relatively unsafe. If results of study 1 indicate that the game can indeed differentiate between safe and unsafe behaving cyclists, study 2 will more specifically examine whether the game is also capable of detecting improvements in safe bicycling behavior due to an RSE course.

Differentiating Between Safe and Unsafe Behaving Bicyclists

In a search for a "safe" and an "unsafe" group to compare to one another in study 1, a distinction was found between adults (safe) and children (unsafe). This distinction was supported by findings in the literature, suggesting that children, compared to adults, tend to behave relatively unsafe in traffic for various reasons. First, as Hamann and Peek-Asa (2017) observed in their naturalistic bicycling study, children make more mistakes in handling their bicycles than adults do. Hamann and Peek-Asa (2017) explored 179 safety-relevant events, coded from a total of 261 bicycling trips from both adults and children. Although they also observed that adults made more traffic violations, children had the highest rate of crashes and near-crashes per mile.

Additionally, Hamann and Peek-Asa (2017) observed that children who had travelled more miles, made less bike-handling errors than children who had used their bicycle less. This might indicate that experience contributes to safe behavior, which is in line with the notion that practice facilitates skillfulness (Kelso & Norman, 1978; Anderson, 1982). Since Dutch adults typically have more bicycling experience than Dutch children, children are expected to participate less safe in traffic than adults.

Moreover, participating in traffic takes some perspective-taking skills. Specifically, as stated earlier, one cause of blind spot crashes is the inability of the bicyclist to understand whether the truck driver is able to see them (Schoon, 2012; Räsänen & Summala, 1998; Wood, Lacherez, Marszalek, & King, 2009). Since perspective taking develops in puberty (Choudhury, Blakemore, & Charman, 2006), these tasks form a problem for young children in traffic.

Furthermore, children and adolescents are more likely to perform risk-taking behaviors than they are as adults (Gardner & Steinberg, 2005; Miller & Byrnes, 1997). In their experimental study, Gardner and Steinberg asked 306 participants to complete three measures of risk orientation. Apart from the effect of age on risk taking, Gardner and Steinberg also found that the effect of the presence of peers on risk-taking behaviors was larger among children than among adults.

Even if they estimate the traffic situation correctly, children take longer to perform the chosen task than adults do (Plumert, Kearney, & Cremer, 2004). A proposed reason for this delay is that children reach an adult level of performance when it comes to estimating time in traffic around the age of 12 (Hoffmann, Payne, & Prescott, 1980). Another reason is that, when it comes to processing speed, children do not reach an adult level of performance until the age of 15 (Luna, Garver, Urban, Lazar, & Sweeney, 2004). Hence, even when the intention was correct, children still might perform unsafe behavior due to their lower processing speed.

In conclusion, for study 1, in which it is explored whether the game is able to distinguish safe behaving bicyclists from unsafe behaving bicyclists, a group of adults will be compared to a group of children. Based on aforementioned evidence of the differences in safe bicycling behavior between adults and children, adults are expected to perform better on the game than children. If they do, this could indicate that the game is indeed capable of making a distinction in bicycling experience.

Hypothesis 1: Adults perform better on the computer game than children in the 8th grade of primary school do.

Measuring a Change in Safe Bicycling Behavior Due to an RES Course

Provided that the game might indeed be capable of differentiating between safe and unsafe behavior, further evaluation can take place. As explained earlier, the game must be capable of detecting changes in safe bicycling behavior due to an RSE course, in order to be suitable for evaluating RSE courses (Cook, 2010; Thomson, Tolmie, Foot, & McLaren, 1996; Twisk, Vlakveld, & Commandeur, 2007). Whether the game is capable of detecting changes in safe bicycling skills will be examined in study 2.

An important subject to discuss here, is how skills are acquired. According to Bloom (1956), there are six levels of learning. The lowest level is knowledge, meaning that information is memorized and can be recalled; then comes comprehension, when the given information is also understood; after comprehension comes application, meaning that the given information can be used or applied; the fourth level is analysis, when patterns are seen to analyze problems; then comes synthesis, when information can be reorganized into new patterns; and last comes evaluation, which includes all of the above, plus the ability to make judgments about the value of given information. The objective of RSE, i.e., to teach skills to improve safe bicycling behavior, is not only that the children memorize and understand the information given in the RSE course, but also that they are capable of bringing the acquired knowledge into practice.

Whereas knowledge and comprehension can be assessed by means of questionnaires, measuring the application of safe bicycling skills demands a more practical approach. As stated before, since it is considered unethical to examine children in real traffic situations, the computer game was designed for assessing bicycling behavior. Games allow players to feel immersed in the virtual environment, especially when playing in first person perspective (Denisova & Cairns, 2015), as is the case with the present game. This immersion can cause players to behave as if the game environment is real (Slater & Wilbur, 1997). It can therefore be argued that the game designed by SWOV might be a suitable measure for assessing changes in safe bicycling skills due to an RSE course.

To examine whether children improve on the game due to an RSE course, game scores of children who have had an RSE course (experimental group) will be compared to game scores of children who have not had an RSE course (control group). To check for other possible differences between both groups that could cloud the data, a pretest will be conducted before the experimental group receives the RSE course. Since RSE courses are designed to improve safe bicycling behavior (Thomson, Tolmie, Foot, & McLaren, 1996; Twisk, Vlakveld, & Commandeur, 2007) and safe choices in the game result in higher scores, children who have had an RSE course are expected to show greater improvement on the game than children who have not had an RSE course.

Since the game is solely meant as an instrument for measuring behavior in traffic, game scores should remain constant with repeated testing. Study 2 will explore whether children have the same scores when they play the game for the second time. However, since practice facilitates skillfulness (Kelso & Norman, 1978; Anderson, 1982), it is expected that children have fewer errors and therefore obtain higher game scores when playing the game for the second time.

Hypothesis 2: Children who have had RSE after the pretest, will show greater improvement on the posttest than children in the control group.

Methods

Participants

Both for study 1 and for study 2, an email was sent to the selected schools to inform them about the study and to ask whether they would like to participate, see appendices A and B. Also, information for the parents of the children was sent by email, see appendix C. The parents were told that they could refuse participation of their child by sending an email to the school. Otherwise, passive consent was given. For both studies, approval was given by the ethics committee of SWOV.

Participants Study 1. Game scores for study 1 derived from an existing database of SWOV. These data had been collected from 324 children in the 8th grade from twelve different Dutch primary schools, and from 30 adults. Eight children who, in the dataset, had a score higher than 1 on scene 5 of the computer game, were removed from the dataset. This was done because that scene was supposed to be scored either 1 (correct) or 0 (false). How this could happen is unknown.

Participants Study 2. Data for study 2 were collected from 66 children in the 1st grade from the Dutch secondary school "De Meerwaarde". This is a school for children who are socially and mentally deprived, causing their learning levels to be similar to that of children who are in the 6th grade of primary school. After removing seventeen children from the dataset who had only been present in either the pre- or the posttest; and thirteen children who did not complete the game or had negative scores on scene 6 of the game, data from 36 children remained.

The experimental group of study 2 consisted of 18 children who were selected because they were scheduled for a "*Veilig op Weg*" course of VVN during the test period. The control group existed of 18 children who were scheduled for the "*Veilig op Weg*" course a week after the posttest. This group of children was selected based on their similarity to the experimental group, that is, their shared environment and developmental state.

Design

Design Study 1. In study 1, a study with a two-level between-subjects design has been conducted to determine whether the computer game distinguishes experienced from less experienced bicyclists. The independent variable was the level of experience, whereby the assumption was made that adults are experienced bicyclists, and children are less experienced bicyclists. The dependent variable was the obtained score on the game.

Design Study 2. In study 2, a mixed methods quasi-experimental study with a nonequivalent groups pretest-posttest design has been conducted to determine how well the computer game detects a change in bicycling competencies of children who have had RSE. The independent variable was the RSE course "*Veilig op Weg*", by VVN, which was the intervention for the experimental group. The control group received no RSE nor any other treatment, see Table 1. The dependent variables were the scores on a digital questionnaire and on a computer game, which were both used as pre- and posttests in this study.

Tabel 1
Overview of the Various Characteristics of Study 1 and Study 2

Characteristic	Study 1	Study 2
Dependent Variable	Game scores	Scores on the game and answers to the questionnaire on pre- and posttest (within-subject variables)
Independent Variable	Level of experience	Intervention: RSE "*Veilig op Weg*" versus no intervention (between-subjects variable)
Design	Two-level between-subjects design	Mixed methods quasi-experimental study with a nonequivalent groups pretest-posttest design
Data-Analysis	Independent T-test	Mixed ANOVA

Procedure

Procedure Study 1. The adults of study 1 were invited at SWOV for playing the game. All participating children were in their own classroom during the test. Their teachers remained present in the classroom, along with the researchers. The children whose parents did not consent to participation, did something quiet for themselves during the test.

Prior to the test, participants were given a laptop with headphones and a computer mouse to complete the test. The laptops, provided by SWOV, were equipped with the computer game and had an internet connection. The log on portal of FietsmeetlatBO was set ready on the laptops, and the participants were given instructions about the test and on how to operate the game. Participants of study 1 performed the test once.

All participants sat behind an individual laptop that was distributed by SWOV and prepared for the test by the researchers. It was explained to the participants that they were allowed to ask questions throughout the test, and that they could stop whenever they wanted to, without having to explain why.

After the test, all laptops were collected. As acknowledgement for their participation, the school got a gift card worth €80. The adults were thanked for their participation, but received no gift.

Procedure Study 2. Study 2 had a similar procedure, with two exceptions. That is, in contrast to the participants of study 1, the participants of study 2 performed the test twice: once in the pretest; and once again, with the same procedure, in the posttest. The pretest took place before the experimental group received RSE, and the posttest took place a week after the RSE. Furthermore, after having played the computer game "Risk Perception in Complex Situations Part A: Blind Spot", see appendix D, the participants were asked to fill out the questionnaire regarding blind spot understanding, see appendix E. The participants of study 1 only played the game.

Instruments

Computer Game. In order to measure the degree to which children behave safely around trucks, a computer game in which children have to safely operate a virtual bicycle was created using the program Unity. This computer game, "Risk Perception in Complex Situations Part A: Blind Spot", is part of the FietsmeetlatBO of project WEVER and was evaluated in this study. The game has been tested and adjusted twice to improve its

accuracy in measuring bicycling competencies (Buijs, Roelofs, & Witvoet, 2017). The version of the game that was used for this test is part of FietsmeetlatBO 3.0.

The game consists of six different scenes, each of which measures a separate aspect of the blind spot problem, see appendix D. A Principal Component Analysis performed by SWOV, RoyalHaskoningDHV, Cito, and CROW-KpVV (2017) revealed that the game can be divided into three factors, namely: “trucks and traffic lights”, consisting of scenes 1 and 2; “bicycling around a truck”, consisting of scenes 3, 4, and 5; and “recognizing blind spots”, consisting of scene 6.

Prior to each scene, brief instructions were given by means of an instruction video with both written and spoken information. The game started with a practice scene, allowing the player to practice operating the virtual bicycle. The operating could be done by clicking where you want the virtual bicycle to go to. For every scene the clicks were registered, allowing us to analyze whether the children had chosen safe routes.

Scenes 1 through 5 were scored dichotomously by the game itself: a safe choice was coded with a 1, an unsafe choice was coded with a 0, see Figures 2 and 3. Scene 6 existed of seven situations in which the player was asked whether the truck driver could see him or her. The player could answer either “yes” or “no”, so again each situation was scored dichotomously and the sum score was the score on scene 6. This means that participants could obtain a maximum score of seven on scene 6, and a maximum score of 12 on the entire game.

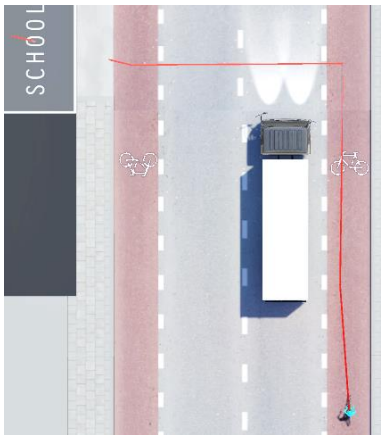

Figure 2. Example of a safe route on scene 1 of the game, thus coded with a 1. The red line indicates the chosen route.

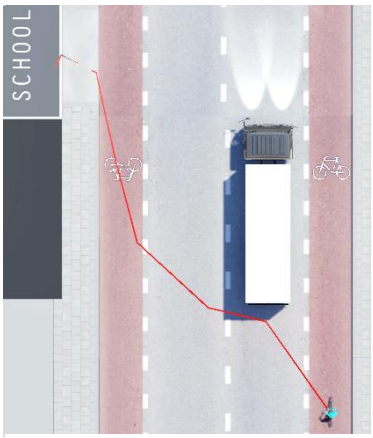

Figure 3. Example of an unsafe route on scene 1 of the game, thus coded with a 0. The red line indicates the chosen route.

Blind Spot Understanding. As stated earlier, children need to have an understanding of how visible they are for the truck driver, and of how much space is needed when a truck makes a turn, in order to reduce blind spot crashes (Talbot et al., 2014). Since the game only measures explicit behavior, a digital questionnaire was made to help gain insight into whether the performance on the game is related to aforementioned understandings.

All items on this questionnaire were asked qualitatively. An example of an item on this questionnaire is: “Why is it, that there are places around the truck where the truck driver cannot see you?”. Furthermore, the children were asked how they experienced the game, see appendix E. A pilot with six children was conducted to observe whether children understood the intention of the questions.

Veilig op Weg. The intervention used in the experimental group was the "*Veilig op Weg*" RSE course, which was designed and executed by VVN. The effectivity of this course has been examined in 2006 by means of a quasi-experimental study with a nonequivalent groups pretest-posttest design, using tabletop models whereupon the current version of computer game "Risk Perception in Complex Situations Part A: Blind Spot" of the FietsmeetlatBO is based (Twisk, Vlakveld, & Commandeur, 2007). This examination revealed that 41% of the children in the experimental group knew better what to do around trucks in traffic after having followed "*Veilig op Weg*", than before. This improvement was called to be a small effect. However, the researchers emphasized that the higher scores on the tabletop models are not necessarily generalizable to real life traffic situations, and that further examination was needed. In response to the examination in 2006, some alterations in "*Veilig op Weg*" were made. The effectivity of the current version is therefore unknown.

On the day of the course, children were first collectively educated about the concept of blind spots around large vehicles, such as trucks, busses, and tractors. Also, the VVN instructor asked the children about their experiences in traffic. Thereafter, a short movie started, which explained the dangers of large vehicles by means of several real-life examples. In the movie, two rules of thumb were proposed for safe behavior around trucks, namely: Stay on the right hand-side behind the truck and keep distance ("Blijf er rechts en ruim achter"); and: keep a distance of at least three meters between yourself and the truck ("Houd minstens drie meter afstand"). At the end of the movie, the children were given eight questions regarding large vehicles in traffic, the answers of which they had to write down on a sheet of paper. For example: "If I cross the street next to a truck, I keep a distance of five meters. That is…" A) Overdone; B) Safe; or C) Only necessary when the truck driver cannot see me. B was the right answer.

After this first part of the course, the group was split in half. One half stayed indoors to practice several traffic situations by means of a tabletop model, the other half went outside where a truck driver educated the children about the blind spot by means of a real truck. Finally, both groups changed place, so in the end both groups had been able to practice both with the tabletop model and with the truck. The entire "*Veilig op Weg*" course took about an hour and a half.

Data-Analysis

The data were anonymously saved without the names of the participants. Therefore, the data could not be traced back to individual participants. Every participant received a test number that was attached to both the questionnaire and the game. This way, the questionnaire could be linked to the corresponding game scores. Throughout the report, an alpha level of .05 is used to assess significance of a result.

Data-Analysis Study 1. In order to determine whether the game can make a distinction between experienced and less experienced bicyclists, game scores from the adults were compared to game scores from the children of study one. Since the Shapiro-Wilk test revealed that the dataset of the children was not normally distributed, a Mann-Whitney U test instead of an independent samples t-test was used for this comparison in the program IBM SPSS Statistics 24 (SPSS), see Table 1. Adults were expected to perform better on the game than children, since adults are assumed to have more bicycling experience than children and might therefore have better insight in the dangers around trucks.

Data-Analysis Study 2.

Game Scores. In order to determine whether the game is capable of detecting changes in bicycling competencies due to RSE, game scores from the pre- and posttest of either group were compared with each other by means of a mixed ANVOVA in SPSS, see Table 1. Since only two groups were analyzed, no test for sphericity was needed (Field, 2013, pp. 561). Furthermore, although the Shapiro-Wilk test indicated that the assumption of normality was violated, this was not a problem since the group sizes were equal (Field, 2013, pp. 444). Children in the experimental group were expected to show greater improvement on the game than children in the control group.

Questionnaire. In order to indicate whether the game scores reflected the children's knowledge and insights, understanding of blind spots was qualitatively examined by means of aforementioned questionnaire. Answers were scored as being either right or wrong, based on the author's expert view. For example, a right answer to the question "What is a blind spot?", was: "Somewhere the truck driver cannot see me", whereas for example "I don't know" and "A dead-end street" were wrong. that Also, children's opinions regarding the test were collected, as well as their suggestions concerning further development of the game.

Results

Differentiating Between Safe and Unsafe Behaving Bicyclists

The expectation in study 1 was that adults would perform better in the game than children in the 8th grade of primary school would. According to the Shapiro-Wilk test, the dataset of the children was not normally distributed (W = .94, $p < .001$). Therefore, a Mann-Whitney U test was performed to compare the scores of adults with the scores of children, which revealed that adults obtained significantly more points on the game (*Mdn* = 8.00) than children (*Mdn* = 6.00), with $U = 1968$, $Z = -5.37$, $p < .001$. This is in line with the hypothesis.

It was further explored whether adults and children differed in their scores on the various factors and scenes. Only in scene 6, factor "recognizing blind spots", there was a significant difference between adults and children. Adults achieved a significantly higher score in scene 6 of the game (*Mdn* = 5.00) than children (*Mdn* = 4.00), with $U = 1271$, $Z = -6.86$, $p < .001$. There were no significant differences between the groups on other factors or separate scenes of the game, nor on the sum scores of scenes 1 through 5. This suggests that the hypothesis is mainly supported because of the ability of scene 6 to differentiate between children and adults.

Measuring a Change in Safe Bicycling Behavior Due to an RES Course

Game scores for either group of children, on either test, will be discussed first. Then, a comparison between findings on game scores and answers on the questionnaires will be drawn. The latter includes opinions and remarks of the children regarding the test.

Game Scores. The expectation in study 2 was that children would show greater improvement on the game after having followed the RSE course "*Veilig op Weg*" (the experimental group) than children who did not follow the aforementioned RES course (the control group). First, it was explored whether both groups differed in game scores from one another in the pretest. According to the Shapiro-Wilk test, the dataset of the control group was not normally distributed (W = .92, $p = .033$). Therefore, a Mann-Whitney U test was performed,

which pointed out that in the pretest children from the experimental group (*Mdn* = 30.60) did not significantly differ from the control group (*Mdn* = 24.63), with $U = 283.50$, $Z = -1.42$, $p = .156$.

Furthermore, a mixed ANOVA was performed to compare game scores from the pre- and posttest of either group. As stated before, since the group sizes were equal, it was not a problem that the data were not normally distributed (Field, 2013). Also, since only two groups were analyzed, assumptions of sphericity did not apply (Field, 2013). Furthermore, Levene's test pointed out that the assumption of homogeneity had not been violated for any of the following analyses.

A significant main effect of pre- and posttest was found, $F(1,34) = 16.39$, $p < .001$, partial $\eta^2 = .325$, see Table 2. Contrasts revealed that children scored significantly higher on the pretest than on the posttest, see Table 3 for the mean game scores and standard deviations. This contradicts the hypothesis, which expected an inverse effect . However, no significant interaction effects were found between pre- and posttest on the one hand, and experimental and control group on the other hand, $F(1,34) = .14$, $p = .715$, partial $\eta^2 = .004$, see Table 2.

Table 2

Effects Found on Game Scores

Variables	***F***	***p***	**Partial η^2**
Pre- and Posttest Total	16.39	.000	.325
Pre- and Posttest * Experimental and Control Group Total	.14	.715	.004
Pre- and Posttest Scene 2	4.23	.047	.111
Pre- and Posttest * Experimental and Control Group Scene 2	2.16	.151	.060
Pre- and Posttest Scene 6	11.25	.002	.249
Pre- and Posttest * Experimental and Control Group Scene 6	.01	.928	.000

Additionally, both for scenes 2 and 6 of the game, children scored significantly higher on the posttest than on the pretest ($F(1,34) = 4.23$, $p = .047$, partial $\eta^2 = .111$, and $F(1,34) = 11.25$, $p = .002$, partial $\eta^2 = .249$, respectively). However, in neither one of the scenes an interaction effect was found ($F(1,34) = 2.16$, $p = .151$, partial $\eta^2 = .060$ and $F(1,34) = .01$, $p = .928$, partial $\eta^2 = .000$, respectively, see Table 2 and Table 3). Together, these findings do not support the hypothesis that children in the experimental group would show greater improvement on the game than children in the control group do.

Table 3

Mean Game Scores and Standard Deviations for Scenes in Which a Significant Effect was Found

Test moment	**Group**	***M***	***SD***
Pretest All Scenes	Experimental Group	6.78	1.70
	Control Group	6.06	1.73
	Total	6.42	1.73
Posttest All Scenes	Experimental Group	5.11	1.71
	Control Group	4.67	1.85
	Total	4.89	1.77
Pretest Scene 2	Experimental Group	.11	.32
	Control Group	.17	.38
	Total	.14	.35
Posttest Scene 2	Experimental Group	.44	.51
	Control Group	.22	.43
	Total	.33	.48
Pretest Scene 6	Experimental Group	2.94	1.63
	Control Group	2.94	1.55
	Total	2.94	1.57
Posttest Scene 6	Experimental Group	4.00	1.24
	Control Group	3.94	1.06
	Total	3.97	1.13

In the posttest, a question was added to the questionnaire regarding RSE in primary school. Fifteen of the 36 children indicated to have had an RSE course concerning blind spots of trucks in primary school. After repeating the ANOVA without these 15 children, similar results were found. That is, a significant main effect of pre- and posttest was found, $F(1,19) = 6.04$, $p = .024$, see Table 4. Contrasts revealed that children scored significantly higher on the pretest than on the posttest $F(1,19) = 6.04$, $p = .024$, partial $\eta^2 = .241$. However, no significant interaction effects were found between the pre- and posttest on the one hand, and experimental and control group on the other hand, $F(1,19) = .01$, $p = .923$, partial $\eta^2 = .001$. The 15 children who had had an RSE course before the current RSE course did not significantly differ on game scores from the other children on the game. This was true for both the pretest and the posttest.

Table 4

Effects Found on Game Scores, After Excluding Children Who Have Had RSE Concerning Blind Sport of Trucks on Primary School

Variables	***F***	***p***	**Partial η^2**
Pre- and Posttest	6.04	.024	.241
Pre- and Posttest * Experimental and Control Group	.01	.923	.001

Questionnaires. Participants in study 2 were also given a questionnaire regarding blind spot understanding. Note that either group consisted of 18 children. In the pretest, 12 children in the experimental group and 10 children in the control group could correctly indicate what a blind spot is, as opposed to 15 from

the experimental group and 14 from the control group in the posttest. Meaning that either group improved on this question. Furthermore, in the pretest, 16 children in the experimental group and 11 children in the control group correctly indicated why there are places around the truck where the truck driver cannot see you, as opposed to 13 from the experimental group and 15 from the control group in the posttest. This means that the experimental group worsened on the posttest, while the control group improved on the posttest. This is remarkable, since the experimental group was expected to show greater improvement on the posttest than the control group.

Another remarkable finding is that the child with the second highest score on the game in the pretest, incorrectly indicated on the questionnaire that a blind spot is a place where you cannot drive further. Furthermore, the child who scored the lowest on the game in the posttest, correctly explained what a blind spot is and why a truck driver is not able to see what is in the blind spot. Figure 4 and 5 display the game scores of the children who did not give a correct answer to the question: “What is a blind spot?” or: “Why is it that there are places around the truck where the truck driver cannot see you?”.

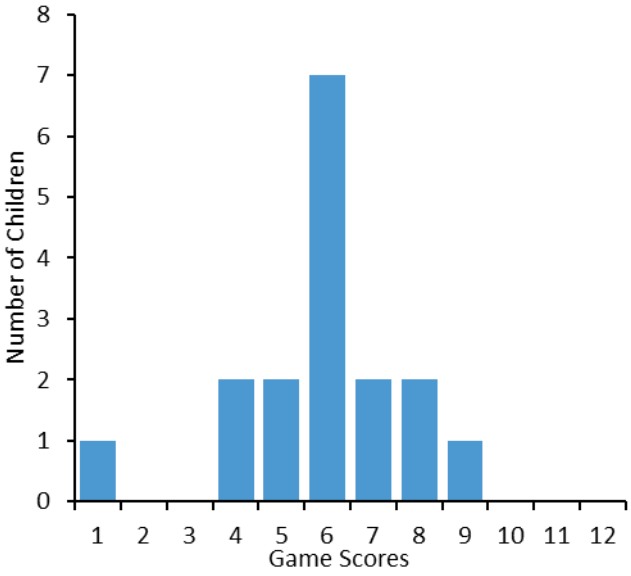

Figure 4. Game scores on the pretest of children who did not give a correct answer to the question: “What is a blind spot?” or: “Why is it that there are places around the truck where the truck driver cannot see you?”.

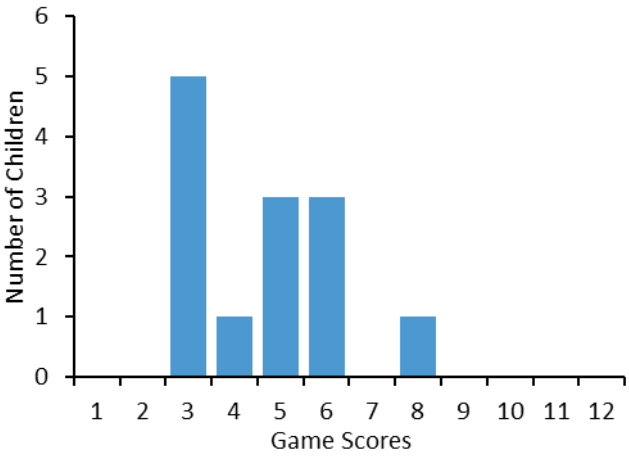

Figure 5. Game scores on the posttest of children who did not give a correct answer to the question: “What is a blind spot?” or: “Why is it that there are places around the truck where the truck driver cannot see you?”.

How the children thought about the game can be seen in Figure 6. Apart from this, three children indicated in the questionnaire that the game was too easy for them, and five other children thought of the game as boring. One child said that the instruction videos were too long, although they were clear. Four children suggested the addition of moving trucks in the game, instead of only stationary trucks, and two children suggested an option for operating the game by means of a controller or by using the arrow buttons. Overall, the test was rated with an average score of 7.42 (*SD* = 1.76) on a scale from 1 to 10.

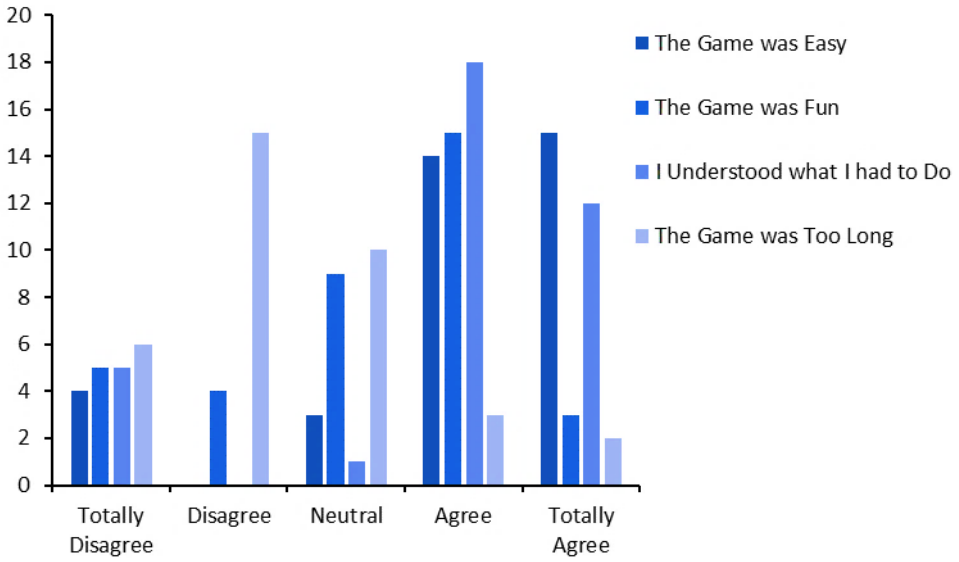

Figure 6. Answers on the questionnaire regarding how the test was perceived.

Lastly, the children were asked to indicate whether, in real life, they handle trucks in traffic safer, less safe, or just as safe as they did in the game. As shown in Table 5, two children indicated to behave safer around real trucks than they did in the game; eight children behave less safe around real trucks; 20 children behave just as safe as in the game; and four children did not know how safe they behave around real trucks as opposed to how they behaved in the game. The other two children answered this question with the remark that the game felt fake.

Table 5
Number of Children who Handle Trucks Safer, Less Safe, or Just as Safe in Real Life Traffic Than They did on the Game

Handling Trucks in Real Traffic as Opposed to Handling Trucks In the Game	**Number of Children**
Safer	2
Less Safe	8
Just as Safe	20
I Don't Know	4

Discussion

The objective of the present study was to provide insight into whether the game "Risk Perception in Complex Situations Part A: Blind Spot", which is part of the FietsmeetlatBO of project WEVER, is suitable for evaluating Road Safety Education (RSE) courses concerning trucks in traffic. This was done in two steps. Study 1 examined whether the game distinguishes relatively safe behaving bicyclists from relatively unsafe behaving bicyclists, by comparing game scores of adults to game scores of children in the 8th grade of primary school. As expected in

hypothesis 1, adults performed better in the game than children. These findings are consistent with earlier findings from Hamann and Peek-Asa (2017) that adults behave safer in traffic than children. Study 2 examined whether the game is capable of detecting improvements in safe bicycling behavior, by comparing game scores of children who had received RSE course "*Veilig op Weg*" of VVN, to game scores of children who had not received an RSE course. Contrary to what was expected in hypothesis 2, children of either group showed a decline in game scores. This is a remarkable finding, since children were expected to improve after becoming familiar with operating the game (Kelso & Norman, 1978; Anderson, 1982). No difference was found between the children who had and the children who had not received the RSE course. This was also unexpected, since RSE courses are meant to improve safe bicycling behavior (Thomson, Tolmie, Foot, & McLaren, 1996; Twisk, Vlakveld, & Commandeur, 2007). The results suggest that the game is not capable of detecting improvements in safe bicycling behavior, and is therefore in its present form not suitable for evaluating RSE courses concerning trucks in traffic.

Differences Between Children and Adults

Some aspects regarding children must be taken into consideration in the present study. Children might differ from adults on more aspects that might influence game scores than safe bicycling behavior alone. For instance, adults have more experience with reading, thanks to which they might have better understood the instructions of the game in comparison to the children.

Children are also more prone to risk-taking behaviors than adults are, especially in the presence of peers (Gardner & Steinberg, 2005; Miller & Byrnes, 1997). Since the game was played individually, children might have shown safer behavior in the game than they would have in reality. However, when asked how safe they behave in reality as opposed to the game, 20 of the 36 children indicated to believe that they behave just as safe in reality as they did in the game.

Another relevant aspect regarding children is that certain skills regarding safe bicycling behavior need to develop over time. For instance, perspective-taking develops in puberty (Choudhury, Blakemore, & Charman, 2006), and when it comes to processing speed, children do not reach an adult level of performance until the age of 15 (Luna, Garver, Urban, Lazar, & Sweeney, 2004). It can therefore be argued that, for instance, infrastructural interventions such as separating trucks from bicycle lanes, rather than RSE can be successful at reducing the number of road casualties among children.

Additionally, more patience when playing the game was observed by the researchers among adults than among children. Some children tried to finish the game as fast as possible to have some spare time. This is a serious point of concern, since this problem might occur in future situations whenever the game is played by children. Children got even more bored and annoyed when they played the game for the second time, which might explain the decline in game scores in the posttest of study 2. Children indicated that the instruction videos were long and boring, since they had seen them before. This might have caused them to lose their patience, thus becoming sloppy and less serious when playing the game, see Figure 7. Situations 1-7 of scene 6 are collectively explained by means of one instruction video. Therefore, boredom might have applied to scene 6 to a lesser extent than to the others, explaining why in study 2 the game scores of scene 6 did not decline. It is suggested to examine why some children do not take the game seriously, and how to counteract this.

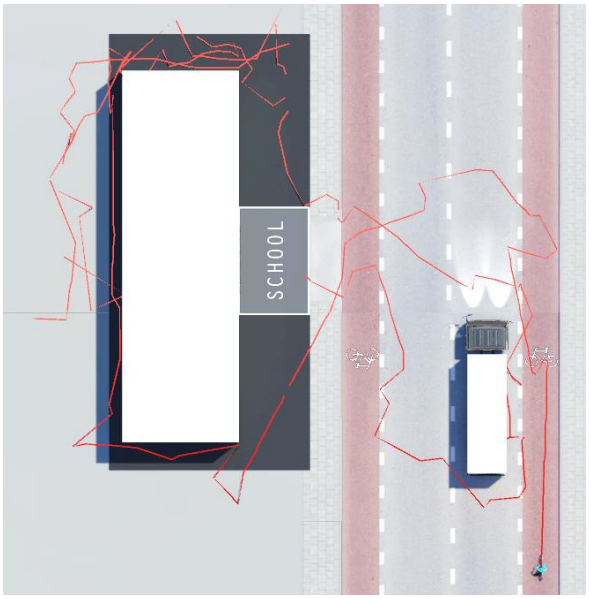

Figure 7. Example of a route chosen by a child who did not take the game seriously. The red line indicates the chosen route.

Resolution of the Scenes

A remarkable finding is that, in study 1, only in scene 6 of the game a difference was found between game scores of adults and game scores of children, where adults achieved higher scores than children did. This suggests that only scene 6 of the game is capable of differentiating between relatively safe and relatively unsafe behaving bicyclists. In study 2, significant results were found only for scenes 2 and 6, with the results of scene 6 being more significant than those of scene 2.

A possible explanation for these findings can be found when taking into consideration the several factors into which the game can be divided. Namely: scenes 1 and 2 together constitute factor “trucks and traffic lights”; scenes 3, 4, and 5 together constitute factor “bicycling around a truck”; and scene 6, consisting of seven different situations, constitutes factor “recognizing blind spots” (SWOV, Royal HaskoningDHV, Cito, & CROW-KpVV, 2017). As only the factor “recognizing blind spots” showed significant results, the other factors might not have existed of a sufficient number of items, i.e., might not have a sufficient resolution to be able to provide significant results.

Contributing to the poor resolution of scenes 1 through 5, is the way in which chosen routes are scored as being right or wrong by the game. For example, one unintended click with the mouse in an unsafe area, irrevocably results in an unsafe score on the concerning scene. In addition, when looking at the chosen paths, the difference between safe and unsafe can be rather ambiguous. The game, however, scores a path to be either safe or unsafe, dismissing all nuances. For example, Figure 8 shows a route that was coded as “safe”, and Figure 9 shows a route that was coded as “unsafe”.

The poor resolution of scenes 1 through 5 of the game might be an explanation for the finding that children who had received RSE did not show greater improvement on the game than children who had not received RSE. The poor resolution might have caused the game to not be sensitive enough for detecting changes in safe bicycling behavior due to RSE. It is therefore suggested to add scenes to factors “trucks and traffic lights” and “bicycling around a truck”, and to carefully re-examine the scoring of the chosen routes in scenes 1 through 5.

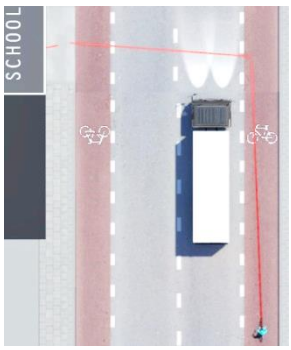

Figure 8. A chosen route in scene 1, that was coded as a safe choice.

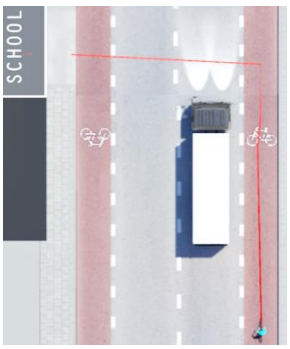

Figure 9. A chosen route in scene 1, that was coded as an unsafe choice.

Levels of Learning

Although the game scores of the children in either group declined in study 2, more children were able to correctly recall what a blind spot is in the posttest than they were in the pretest. This suggests that the children did learn something during the RSE course, although they were not able to display better skills in the game. A possible explanation for this finding is that the game measures a higher level of learning (application) than is acquired during RSE (knowledge). Another possible explanation is that they were not able to exhibit their acquired skills in the game, either because the RSE course does not teach the skills that need to be taught to improve safe bicycling behavior , or because the game does not measure the skills that should be measured. The latter can be supported by the finding that the child with the second highest score incorrectly indicated on the questionnaire that a blind spot is a place where you cannot drive further, and that the child who scored the lowest correctly explained both what a blind spot is and why a truck driver is not able to see what is in the blind spot.

As mentioned before, children of both groups showed a decline in game scores. A possible explanation for the similarity in game scores on the posttest between both groups, is that children who received an RSE course discussed their new knowledge with the children of the control group. Since the children of both groups attend the same school, this is far from unimaginable. To exclude this possibility in future studies, it must either be asked to the children whether they discussed the RSE with their peers, or it must be ascertained that the groups are unacquainted with one another.

Findings on the question “Why is it that there are places around the truck where the truck driver cannot see you?” indicate that children who had received an RSE course had more difficulty explaining why blind spots exist than before they received the RSE course, whereas children who had not received the RSE course improved on this question in the posttest. This suggests that, although children gained knowledge, they lost comprehension and worsened on skills due to the RSE course. A possible explanation is that the RSE course is ineffective or misinterpreted by the children. This could have given the children a faulty sense of mastery, causing them to be less cautious while showing unsafe behavior (Hatfield, 2012; Carlin, Taylor, & Nolan, 1998).

The Effectiveness of RSE Course “*Veilig op Weg*”

In study 2, children of either group showed a decline in game scores instead of an improvement, and no difference between the groups was found. As stated earlier, this might either indicate that the game does not measure the skills that should be measured, or that the RSE course does not teach the skills that need to be

taught to improve safe bicycling behavior. This would mean that RSE course "*Veilig op Weg*" has no effect on safe bicycling behavior. Since no other instrument for evaluating RSE courses exists, RSE course "*Veilig op Weg*" has not yet been evaluated on its effectiveness in its present form. Therefore, there is no way of telling whether the results indicate that the game is not a suitable instrument, or that RSE course "*Veilig op Weg*" did not generate the intended results. An observational study is proposed, having children perform the tasks from the scenes of the game in a simulated traffic situation. This way it could be identified whether children behave in reality as they do in the game.

Furthermore, although research has been done as to why blind spot crashes happen from the drivers' point of view, to date no study has yet been conducted to identify which bicyclists' behaviors lead to blind spot crashes. Therefore, it cannot be specified whether RSE courses address the correct skills in order to reduce blind spot crashes, nor whether the game measures these skills. Additionally, for the same reason the scenes of the game were not based on scientific evidence.

Thus, before any other steps regarding the evaluation of RSE courses concerning trucks, or regarding the evaluation of the game can take place, an extensive observational study is needed to identify which bicyclists' behaviors lead to blind spot crashes. Additionally, surviving victims of blind spot crashes could be interviewed regarding their perception of the run-up to the crash. That way, bicyclists' errors in both behavior and cognition can be identified.

Conclusion

In conclusion, findings from the present study indicate that the game in its present form is not suitable for evaluating RSE courses concerning trucks in traffic. Specifically, how game scores relate either to safe bicycling behavior or to skills taught in the RSE course is unknown. One of the most important suggestions for further research is to identify bicyclist behaviors that lead to blind spot crashes.

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Appendix A

Geachte heer/mevrouw <NAAM>,

Voor een onderzoek gericht op het verbeteren van de verkeersveiligheid van jonge fietsers, zijn Cito, Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV en RoyalHaskoningDHV op zoek naar scholen waar wij een toets kunnen afnemen om de verkeersvaardigheden van jonge fietsers in kaart te brengen. Deze toets zal twee keer worden afgenomen tussen 15 mei 2017 en 22 mei 2017.

Aan u de vraag of wij deze toets mogen afnemen op uw school bij de leerlingen van klas 1. Uit een eerdere afname bij diverse scholen is gebleken dat kinderen het leuk vinden om de toets te maken. Bovendien helpt u mee om ervoor te zorgen dat kinderen uiteindelijk veiliger kunnen deelnemen aan het verkeer. Als dank voor uw deelname ontvangt uw klas die deelneemt aan het onderzoek een VVV-bon van 50 euro. In de bijgesloten brief kunt u meer lezen over wat het onderzoek inhoudt.

Contact
Wij zouden het op prijs stellen als u wilt bijdragen aan ons onderzoek. U kunt in een antwoord op deze e-mail aan ons laten weten dat u mee wilt doen. Wilt u hierbij uw telefoonnummer vermelden waarop wij telefonisch contact met u op kunnen nemen? Wij stemmen dan een datum met u af en u kunt vragen over het onderzoek aan ons stellen.

Mocht u nog verdere vragen hebben of meer informatie willen over het onderzoek, neemt u dan gerust contact met ons op.

Nathalie Korbee (Proefleider SWOV) nathalie.korbee@swov.nl
Divera Twisk (Projectleider SWOV) divera.twisk@swov.nl

Appendix B

Uitnodiging deelname onderzoek

WEVER: op weg naar effectieve verkeerseducatie

Voor een onderzoek over het verbeteren van de verkeersveiligheid van jonge fietsers, zijn Cito, Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV en RoyalHaskoningDHV op zoek naar scholen waar wij een toets kunnen afnemen om de verkeersvaardigheden van jonge fietsers rondom vrachtwagens in kaart te brengen. Door mee te helpen aan dit onderzoek zullen kinderen uiteindelijk veiliger kunnen deelnemen aan het verkeer. In deze brief en de bijlage kunt u meer lezen over wat het onderzoek inhoudt.

Wat wordt er van u verwacht?

Het onderzoek bestaat uit een computertaak en vragenlijst waarmee verkeersvaardigheden van jonge fietsers worden gemeten. Aangezien wij beseffen dat tijd een kostbaar goed is, streven wij ernaar dat u als school zo min mogelijk hoeft te doen om aan het onderzoek deel te nemen.

Deelnemen aan het onderzoek betekent het volgende:

- Voor de computertoets gebruiken we graag een ruimte op uw school. Laptops worden georganiseerd door ons.
- De toets duurt een half uur per groep en wordt deels online afgenomen. Een voorwaarde voor deelname is dan ook toegang tot internet.
- Na ongeveer een week nemen wij de toets nogmaals af.
- Om ouders in te lichten over het onderzoek willen wij u vragen leerlingen een informatiebrief mee naar huis te laten nemen. Graag informeren we ouders daarnaast via een eventuele nieuwsbrief of uw website. Hier leveren wij een tekst voor aan die u voor dit doel kunt gebruiken.
- Op de dag van de afname zijn twee proefleiders aanwezig. Zij zetten alles klaar voor het onderzoek, en kunnen vragen van kinderen beantwoorden.

Wanneer vindt het onderzoek plaats?

Het onderzoek vindt plaats op 15 mei 2017 en wordt herhaald op 22 mei 2017.

Voordelen

- Deelname aan het onderzoek zal helpen om de verkeersveiligheid van kinderen te verbeteren, waardoor kinderen veiliger kunnen deelnemen aan het verkeer.
- Uit de vorige afname is gebleken dat kinderen het maken van de toets leuk vinden.
- Als dank voor uw deelname ontvangt uw school een **VVV-bon van 80 euro**.
- Indien u het op prijs stelt dan houden wij u graag op de hoogte van de resultaten van het onderzoek.

Contact

Mocht u nog verdere vragen hebben of meer informatie willen over dit onderzoek, neemt u dan gerust contact met ons op.

Nathalie Korbee (Proefleider SWOV) nathalie.korbee@swov.nl
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Bijlage 1. Meer informatie over het onderzoek

Wat is het doel van het onderzoek?

Dit onderzoek maakt deel uit van een groter onderzoeksproject: het WEVER-project. Momenteel wordt door Cito, Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV en Royal HaskoningDHV gewerkt aan het maken van een fietstoets voor leerlingen aan het einde van de basisschool. Deze toets is bedoeld om de verkeersvaardigheden van jonge fietsers in kaart te brengen. Uiteindelijk zal de toets dienen als meetlat om de effectiviteit van verschillende verkeerseducatie programma's te evalueren. Effectieve verkeerseducatie is immers een belangrijke stap in het vergroten van de verkeersveiligheid van jonge fietsers. In deze fase van het onderzoeksproject willen we de het onderdeel van de fietstoets dat gaat over de verkeersvaardigheden van jonge fietsers rondom vrachtwagens graag twee maal afnemen om een effectmeting te kunnen doen.

Wat houdt het onderzoek in?

Leerlingen die meedoen aan het onderzoek zullen eerst een computertoets maken. De computertoets meet in hoeverre jonge fietsers in staat zijn de meest veilige beslissing te nemen in verkeerssituaties met vrachtwagens. Leerlingen krijgen animaties te zien en moeten aangeven wat zij in die situatie zouden doen. Gekeken wordt of zij veilig kunnen omgaan met de dode hoek van de vrachtwagen. Na de computertoets wordt aan leerlingen gevraagd aan te geven hoe goed zij denken het onderdeel gemaakt te hebben. Ook zullen leerlingen een korte vragenlijst invullen met vragen met betrekking tot hun inzicht in dode hoeken. Na ongeveer een week wordt het onderzoek nogmaals afgenomen om te zien of er verschil is tussen de metingen.

Appendix C

Geachte ouder(s)/verzorger(s),

U ontvangt deze brief omdat wij binnenkort een onderzoek uitvoeren op de school van uw kind. Met het onderzoek willen wij meer inzicht krijgen in de verkeersvaardigheden van jonge fietsers. Deze inzichten zullen uiteindelijk helpen om kinderen veiliger aan het verkeer te laten deelnemen.

De school van uw kind verleent medewerking aan dit onderzoek en wij zouden het heel fijn vinden als uw kind mee mag doen aan dit onderzoek. Het onderzoek wordt uitgevoerd door onderzoekers van Cito, Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV en Royal HaskoningDHV.

Wat houdt het onderzoek in?
Het onderzoek bestaat uit een computertoets met filmpjes en animaties en een vragenlijst die ook op de computer wordt afgenomen. De computertoets richt zich op verkeerssituaties rondom vrachtwagens die lastig zijn voor jonge fietsers. De korte vragenlijsten gaan over wat kinderen begrijpen van dode hoeken van vrachtwagens. Elk kind maakt de toets en vult de vragenlijsten in op een door ons verstrekte laptop. Het onderzoek duurt in totaal ongeveer een half uur en vindt klassikaal plaats. Het onderzoek wordt begeleid door twee proefleiders van SWOV en zal twee keer binnen twee weken plaatsvinden in de klas van uw kind. Gedurende het onderzoek zal de leerkracht van de betreffende klas in de klas aanwezig zijn.

Bezwaar deelname onderzoek
Indien u bezwaar heeft tegen deelname van uw kind aan dit onderzoek, vragen wij u dit **voor maandag 15 mei** te laten weten aan de school van uw kind. Dit kunt u doen door via een e-mail aan de school aan te geven dat u bezwaar maakt voor deelname van uw kind aan het onderzoek en hierbij de naam en geboortedatum van uw kind te vermelden. Als u niet reageert, gaat u automatisch akkoord met de deelname van uw kind aan het onderzoek.

Vrijwilligheid
Deelname aan dit onderzoek is volledig vrijwillig. We leggen uw kind duidelijk uit dat het geen probleem is als hij/zij niet aan het onderzoek wil meedoen, of gaandeweg besluit te stoppen. Mocht uw kind aangeven te willen stoppen met het onderzoek, of mocht u binnen 24 uur uw toestemming alsnog intrekken, dan verwijderen wij de gegevens van uw kind uit onze bestanden.

Vertrouwelijkheid van onderzoeksgegevens
De gegevens van uw kind worden alleen gebruikt tijdens het onderzoek en worden vervolgens volledig anoniem verwerkt. Het is daardoor niet meer mogelijk op te maken wie aan het onderzoek hebben deelgenomen.

Contact
Mocht u nog verdere vragen hebben of meer informatie willen over dit onderzoek, dan kunt u altijd contact opnemen met één van ondergetekenden. Als u niet wilt dat uw kind deelneemt aan het onderzoek dan kunt u dit per e-mail doorgeven aan de school van uw kind.

Hopende u hiermee voldoende te hebben geïnformeerd.

Met vriendelijke groet,

Namens het onderzoeksteam,

Divera Twisk

Projectleider SWOV

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Appendix D

<table>
<tr><td colspan="2">The black cross is the cursor. In each scene, the player of the game can look around by moving the cursor. In scene 1-5, the player can drive the bicycle by clicking on the road. The chosen path can later be recalled, and is saved by the game as either safe (1) or unsafe (0).</td></tr>
<tr><td>Scene 1
  </td><td>On the other side of the road, behind the standing truck, is the school building. The goal of scene 1 is to go to school.

The safe route is to first pass the truck on its right-hand side, and then cross the street while keeping a distance from the truck.</td></tr>
<tr><td>Scene 2
  </td><td>This task is similar to the task in scene 1, with the exception that there is a cross-walk in front of the truck.

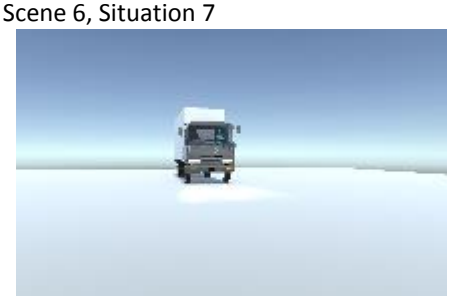
The safe route is to first pass the truck on its right-hand side, and then cross the street using the crosswalk while keeping a distance from the truck.</td></tr>
<tr><td>Scene 3
  </td><td>The goal is to click where you would wait before crossing the street.

The safe place is close to the road markings.</td></tr>
<tr><td>Scene 4
  </td><td>You are at a junction, where a truck is waiting to turn right. The goal is to indicate where you would wait for green light.

The safe place is well behind the truck, on its right-hand side.</td></tr>
<tr><td>Scene 5
  </td><td>This task is similar to the task of scene 5, with the exception that there is someone waiting next to the truck.

The safe place to wait is the safe as in scene 4.</td></tr>
</table>

Scene 6, Situation 1 	Scene 6 exists of seven different situations, all in which the player needs to indicate whether the truck driver is able to see them. The player needs to respond by pressing the “J”-key (yes) or the “N”-key (no). The correct response in situation 1 is “no”.
Scene 6, Situation 2 	The correct response in situation 2 is “yes”.
Scene 6, Situation 3 	The correct response in situation 2 is “no”.
Scene 6, Situation 4 	The correct response in situation 2 is “no”.
Scene 6, Situation 5 	The correct response in situation 2 is “yes”.

Scene 6, Situation 6 	The correct response in situation 2 is “yes”.
Scene 6, Situation 7 	The correct response in situation 2 is “yes”.

Appendix E

Eindvragenlijst

Evaluatie

* Vul hieronder je toetsnummer in.

*
Wat vond je van de toets? Klik hieronder je antwoorden aan.

	Helemaal mee oneens	Oneens	Niet eens, niet oneens	Eens	Helemaal mee eens
Ik vond het makkelijk	○	○	○	○	○
Ik vond het leuk	○	○	○	○	○
Ik snapte wat ik moest doen	○	○	○	○	○
De toets was te lang	○	○	○	○	○

* Welk cijfer zou jij de toets geven?

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

* Wat is een "dode hoek"? Probeer het zo goed mogelijk uit te leggen.

Dit is een verplichte vraag

* Hoe komt het dat er rondom de vrachtwagen plaatsen zijn waarbinnen de chauffeur jou niet kan zien?

Dit is een verplichte vraag

* Denk je dat je in het echt net zo veilig fietst als in het spel? Of denk je dat je in het echt veiliger of minder veilig omgaat met vrachtwagens in het verkeer? Leg uit waarom!

Dit is een verplichte vraag

* Wil je nog dingen zeggen over het spel dat je hebt gespeeld?

Dit is een verplichte vraag

*
Je hebt vorige week les gehad over de dode hoek, of je krijgt deze les volgende week.
Heb je daarvoor weleens les gehad over dode hoeken van vrachtwagens?

Dit is een verplichte vraag

Indien u 'Anders' kiest, licht deze keuze dan toe in het bijbehorende tekstvak.

- ◯ Nee
- ◯ Ja, op de basisschool
- ◯ Anders