1 **TOWARDS SAFER ROADSIDE BEHAVIOR ON THE SCHOOL**
2 **JOURNEY THROUGH INTERACTIVE VIDEO TRAINING**
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1   **ABSTRACT**

2   Active travel in the form of walking can contribute to recommended levels of daily exercise and
3   is linked to increased health and wellbeing. Promoting active modes for school travel, such as
4   walking, has become commonplace in recent years. In the United Kingdom, Safe Routes to
5   Schools programs demonstrate one method of promoting walking, whilst attempting to ensure
6   the safety of children during their school journey through interventions which include child
7   pedestrian training. The quality of child pedestrian training programs in the United Kingdom has
8   suffered in recent years due to austerity measures and time pressures forcing local authorities to
9   reduce the amount of practical training and increase the amount of less effective, but cheaper,
10   paper-based classroom activities. This paper considers the effectiveness of an interactive video
11   which has been developed as an alternative to these paper-based activities designed to target and
12   improve the crossing behavior of children between parked cars. In an exploratory study targeted
13   at elementary school aged children, significant improvements in certain crossing behaviors were
14   demonstrated as a result of training with the interactive video, indicating its potential to
15   significantly improve the range of resources currently available for use by road safety training
16   professionals.

17   **Key words:** Pedestrian training, interactive video, road safety, active modes, safe routes, school
18   travel.

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INTRODUCTION

Regular exercise is linked with reduced risk of heart disease, stroke, diabetes and osteoporosis in later life *(1, 2)* and yet a substantial proportion of children in the United Kingdom (UK) are active for less than one hour per day and alongside this there has been a decline in walking to school and a corresponding rise in childhood obesity *(1)*. The United States (US) faces similar issues caused by increased automobile use and a decrease in walking and cycling *(3)*. Encouraging walking to and from school is seen as one way of increasing the amount of exercise a child takes, increasing general health and wellbeing and preventing obesity*(1, 3, 4)*. With average trip distance to elementary schools in the UK being 1.5 miles *(5)* and with 22 per cent of children aged 6-12 in the US living within one mile *(6)*, walking at a moderate pace to and from school could contribute to current expert advice that children should be exercising for a minimum of one hour per day *(7)*. As well as improving well-being, many governments and authorities are advocating that more children should walk to and from school to help foster more sustainable attitudes to transportation.

This advice is paradoxical; if we are to encourage active modes such as walking to school to improve health and wellbeing, we are also increasing the exposure of young and vulnerable pedestrians to a potentially dangerous environment where there is a risk of becoming involved in a road traffic accident. Evidentially, concerns for personal safety have contributed to a decline in the numbers of children walking to school, both in the United Kingdom and the United States *(8, 9)*. With over 2000, 5-15 year old UK pedestrians reported to be involved in a traffic related injury when walking to school in 2010 *(10)* it is clear that injury prevention measures must come hand in hand with the promotion of active lifestyles in order to minimize the risks involved *(11)*. Reducing the risks when walking to school is likely to increase parental confidence in their children's capability and levels of safety on the school journey, making them more likely to allow their children to walk independently.

A variety of programs operate in order to minimize risks experienced during school travel and encourage cycling and walking as healthier, more sustainable forms of school transport. Safe Routes to Schools programs aim to enhance child pedestrian and cyclist safety during the school trip *(12)* and broadly cover ten countermeasures; sidewalks, bicycle lanes, traffic-calming, crosswalks, median refuges, active police enforcement, school zone signs / flashers and speed limit reductions, crossing guards, motorist education programs and child pedestrian education programs *(12)*. Safe Routes to Schools programs are used (or the fundamental principles applied) in a number of countries worldwide including the United Kingdom and the United States *(13)*.

One element of Safe Routes to Schools programs are child pedestrian education interventions which, in the United Kingdom, have become commonplace *(14)*. One cause for concern however is the cost of pedestrian training schemes given current UK austerity measures and a drive to cut costs while still retaining the value of public services. One method used by local authorities (who have the responsibility of administering the majority of road safety interventions in the UK) has been to reduce the amount of on-street practical training, replacing with classroom oriented, paper-based activities which have been shown to be less effective in improving on-street skills as they target knowledge acquisition only *(14, 15)*. This is clearly an unsatisfactory solution and more effective in-class activities, which directly target roadside behavior, such as virtual reality, interactive video and online multimedia should be considered.

This paper considers how interactive video can be used to complement the current range of material available to road safety trainers and enhance the education of child pedestrians. We discuss the development of an interactive video designed to teach young children road crossing

1 skills and find through a trial implementation that it has the potential to improve their crossing
2 skills after a short amount of exposure.

3 **PEDESTRIAN TRAINING IN THE UNITED KINGDOM**
4
5 Pedestrian training is seen as one of the essential interventions required alongside the promotion
6 of walking to school to ensure children are safe on their school journey. The government
7 recommends that local authorities implement the 'Kerbcraft' pedestrian training scheme in
8 elementary schools *(16)*.
9   Kerbcraft offers children training in three pedestrian skills; finding safe places and routes,
10 crossing safely between parked cars and crossing safely at junctions. Twelve roadside sessions of
11 approximately thirty minutes are delivered to children aged from five through seven over the
12 course of one academic year. The course is practical, taking place at the roadside with no
13 classroom-based elements and during a national evaluation was shown to demonstrate "strong
14 statistical evidence of the positive impact of training in all three Kerbcraft skills" *(17)*.
15   A recent survey of local authorities in the United Kingdom indicated that large numbers,
16 originally delivering Kerbcraft in schools had subsequently reduced the amount of practical
17 training on offer and over 50% had introduced classroom-based activities, despite research
18 indicating that it is far less effective compared to practical training *(14, 15)*. Many also indicated
19 that financial pressures were the main threat to the training on offer with on-street activities
20 being hardest hit in the drive to reduce costs. Under these circumstances, there is a need to
21 ensure that classroom-based activities increase the level of skill demonstrated by children at the
22 roadside, and not merely their knowledge. Interactive computer based activities may be a viable
23 method for improving child pedestrian training to realize this positive practical application on-
24 street.

25 **The Scope for Interactive Video in Pedestrian Safety Training**
26 Various forms of Interactive Media, (a combination of sounds, images, video and text in a
27 structured interactive computer-based environment that a user interacts with in order to directly
28 affect their experience or outcomes *(18, 19)*), exist in the realm of road safety education, training
29 and publicity activities. Regarding the training of pedestrian skills, several forms of interactive
30 media have been considered; i) *Virtual Reality* environments where a user controls an animated
31 avatar in a simulated roadside environment, allowing them to explore roadside environments and
32 experience risk in a safe setting ii) *Animated Games* where a user will interact with an animated
33 game; often focused on specific road safety learning outcomes iii) *Interactive Videos* where a
34 user interacts with a video of real roadside environments to influence the outcome of the activity.
35   Animated games are perhaps the most common form of interactive media available on
36 road safety websites, covering a considerable range of scenarios and road safety material. While
37 widespread, the majority of these games are focused on knowledge acquisition *(15)* and not
38 behavior change so add little value to pedestrian training schemes where the required outcome is
39 improved skills and awareness.
40   Virtual reality environments have been shown to make some improvements in road safety
41 knowledge and behavior of pedestrians at the roadside *(20-23)*, however young children have
42 difficulty transferring knowledge acquired in a realistic simulation on a computer into safe
43 behavior at the roadside *(24)*. This lack of transfer may be because the cognitive skills in young
44 children limit their ability to think from a different perspective *(25)*, making it difficult for them
45 to associate simulated with real roadside environments. The majority of virtual reality training

1 demonstrations also rely on relatively expensive computer peripherals (such as multiple screens),
2 which would contribute to, and not reduce the cost of current training schemes on offer.
3   Interactive video creates a multi-sensory learning environment *(26)* and has been shown
4 to increase an individual's ability to transfer information from the short-term to long-term
5 memory *(27)*. It may offer a cheap and yet effective alternative to virtual reality environments
6 and can be defined as 'the use of computer systems to allow proactive and random access to
7 video content based on queries or search targets' *(26)*. Modern technologies allow interactive
8 video to be used alongside other multimedia such as graphics, simulations and even other videos
9 in order to attract a users' attention to a specific issue.
10   The use of interactive video in road safety education was considered as early as the 1980s
11 with the development of interactive videos by a prominent insurance company for a road safety
12 campaign in the UK *(28, 29)*. These older systems relied on dedicated interactive video
13 machines to read the videos from special discs *(28)*. Recent studies have shown interactive video
14 to be effective in improving roadside hazard awareness skills in kindergarten to third grade
15 students *(30)* and has also been used in the development of a European best-practice teaching
16 tool, "B-Game", targeting school-aged cyclists *(31)*. Alongside applications in road safety,
17 Interactive Video has also been successfully used by Cherrett et al (33) in health and safety, and
18 Dror et al in medical training *(32, 33)* and demonstrates the potential to train users in 'hard'
19 procedural skills *(33)*, making the medium applicable to road safety training in which step-by-
20 step 'hard' procedures are taught. Critically, interactive video studies have seldom tested their
21 effectiveness in changing actual behavior on-street in live roadside situations, and because each
22 video contains footage of real, rather than simulated environments, the transfer of information to
23 behavior will be aided by the fact that children will not have to 'translate' from a simulated to a
24 real environment.
25   The interactive videos developed by both Cherrett et al *(33)* and Dror et al *(32)*, were
26 based on the same principal; asking players to identify hazardous behaviors by clicking directly
27 on 'hot-spotted' elements as it played. Correct identifications would pause the video and require
28 further input from the player before continuing. In both demonstrations, the interactive video was
29 split into two sections; one in which undesirable behavior was shown and where hazards
30 correctly identified would result in a hazard perception score and another where desirable 'best
31 practice' behavior was demonstrated.
32   "B-Game" followed similar principals in the domain of cycle safety. The users viewed
33 footage taken from a cyclist's perspective, covering a variety of dangerous scenarios. They were
34 required to complete various journeys safely, using a variety of on-screen and keyboard controls
35 such as hand indications and stopping. If the player carried out the correct 'maneuvers', they
36 would progress to the next level. Players would receive a score at the end of each level and
37 following completion of the game, a diploma would be sent to parents outlining the child's
38 performance.
39   It is important to note that interactive video as a tool to aid learning will not be effective
40 unless it is carefully designed to enable the information to be retained in long-term memory. One
41 must also be careful not to overload and distract the player from the actual learning materials,
42 which is particularly important when dealing with children and learning through the process of
43 experiencing failure *(34)* has great potential for fostering 'deeper learning' *(35)*.
44   For interactive video to be effective, it must incorporate control, challenge, and
45 commitment *(36)* as when the player has control over their learning, they become more involved
46 and participate in the learning process which is critical to maximizing engagement. When players

1 are challenged and are committed to the learning process, the cognitive system is utilized
2 properly and learning is most effective.

3 **METHODOLOGY**
4
5 An interactive video was developed, designed to teach 6-7 year old children the skills required to
6 cross safely between parked cars. In the United Kingdom there is no concept of 'jay-walking'
7 and while safer crossing locations and skills are advocated as a first-resort, this is not always
8 possible and crossing between parked cars is, therefore, considered to be a social norm. The on-
9 street parking situation, where cars are able to park at the side of the road means that children
10 can be forced to cross the road between parked cars outside schools and on residential streets.
11 The interactive video was based on a combination of the hazard perception principals
12 demonstrated to be engaging and effective by Cherrett et al. *(33)*, Dror et al. *(37)* and Melson
13 *(31)*, and using a video of carefully staged, undesirable on-street crossing behavior. In this
14 context, interactive video is defined as footage taken of actual activity which is subsequently hot
15 spotted using multimedia authoring software to allow players to engage in the scene at specific
16 points via the computer mouse. An exploratory study was then carried out to determine the
17 impact of the video on children's' on-street crossing skills using a quasi-experimental pre-and-
18 post assessment design with experimental (interactive video trained) and control groups (non-
19 trained) from an elementary school in Southampton UK.
20   The methodology encompassed two key areas; i) developing an interactive road safety
21 video and ii) assessing its effectiveness using an on-street skills assessment looking for changes
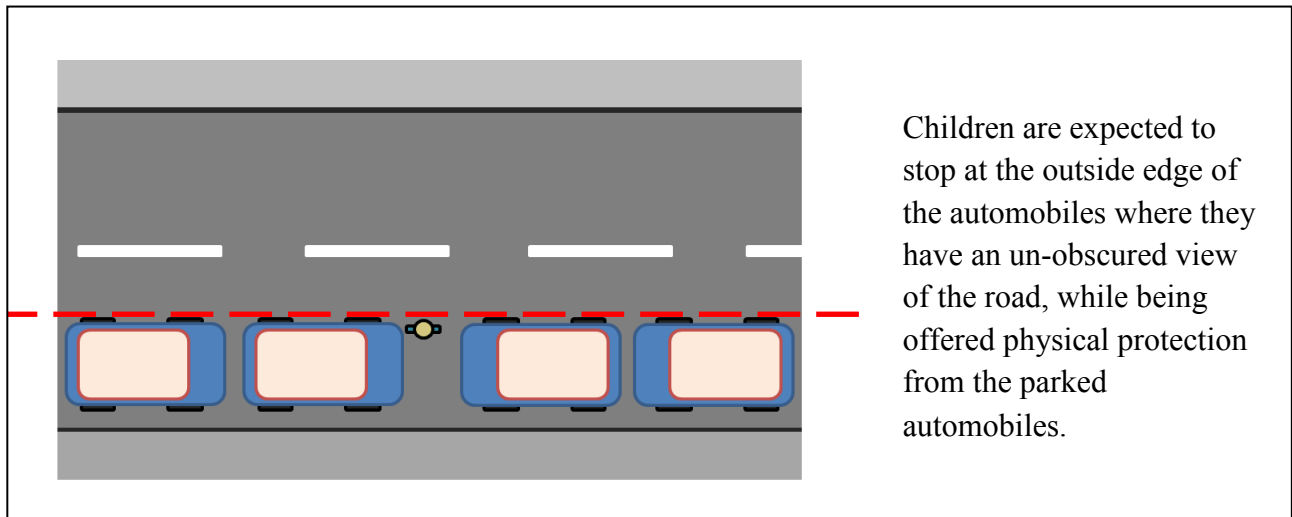22 in crossing behavior as a result of playing the video.
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24 **Interactive Video Development**
25
26 *Filming the Video*
27 The subject matter of the video was based around two young children making an independent
28 journey to a local amenity which involved crossing between parked cars where no safer crossing
29 location was available. Two scenarios were developed; 1) Sidewalk use and a road crossing
30 demonstrating safe practice and 2) Sidewalk use and a road crossing demonstrating dangerous
31 practice. The scenarios were professionally filmed on a busy residential road lined with parked
32 cars on each side, representing a typical location where the children may be forced to cross
33 between parked cars. In the safe practice, the children walked along the sidewalk and crossed
34 safely between parked cars using UK government crossing advice *(38)*:
35
36   1) Find a gap between two cars with easy access to the pavement on the other side of the
37   road.
38   2) Check the cars are not going to move; check the automobiles are empty or look for a
39   driver, engine noise or lights.
40   3) Walk between the cars and stop at their outside edge (Figure 1).
41   4) Look and listen all around to check there is no traffic coming.
42   5) When there is no traffic and the road is clear, cross the road whilst remaining aware
43   and looking and listening for traffic whilst crossing.

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2   Crossing between parked cars was selected as the demonstration skill, over and above
3   finding safe places to cross and crossing at junctions due to its procedural nature making the task
4   of assessing crossing skills more straightforward.

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8   Children are expected to
                                                                         stop at the outside edge of
9   the automobiles where they
10   have an un-obscured view
                                                                         of the road, while being
11   offered physical protection
12   from the parked
                                                                         automobiles.
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16   **FIGURE 1 Stopping at the outside edge of the cars.**

17   In the unsafe practice, the children were running on the sidewalk bouncing a ball, failing
18   to look in gateways and crossing between two parked cars without looking for on-coming
19   vehicles, or stopping at the edge first.
20   Scenes were planned so that both the safe and unsafe procedures could be filmed without
21   putting the subjects at any risk and the whole experiment was passed by the University of
22   Southampton's research ethics committee. Each scene was filmed using widescreen digital video
23   in multiple takes, generating approximately 30 minutes of raw footage which was edited into
24   several continuous sequences. One sequence lasting 1.5 minutes demonstrated unsafe behavior
25   and the unsafe crossing practice while the other sequence lasting 2 minutes demonstrated safe
26   behavior and practice (Figure 2). A voice-over featuring an 11 year old child explaining safe
27   roadside behavior and the correct crossing practice was recorded and integrated into the safe
28   behavior video. The sequence demonstrating the safe crossing procedure was also cut into
29   several individual clips to explain the individual procedural steps required to cross safely
30   between parked cars.
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FIGURE 2 A frame from the video. The children have been forced to cross between parked cars on a busy residential road, in this case safely as part of Scenario 1.

Making the Video Interactive
The edited video clips were imported into an animation and multimedia authoring environment which allows interactive elements to be integrated into the video using custom scripts and built-in features of the software. The model video originally developed by Cherrett et al *(33)* was used as a foundation and was then altered, following advice from road safety professionals, elementary school teachers and cognitive learning experts, to ensure the user interface and functionality was suitable for young children. Key features targeting the young audience include; i) an engaging color scheme; ii) accompaniment of text with voice-over to aid children who have reading difficulties; iii) accompaniment of percentage scores with a star-rating system to ensure children with a range of numerical ability can understand the significance of their performance; iv) the introduction of a 'hints' system to aid hazard perception. The elements of the new video, which was played chronologically were:

    1) An introduction which explains the background to the video and the task that the children will be given.
    2) A tutorial which demonstrates how to interact with the video and identify and select hazards.
    3) The interactive video segment where the player was expected to highlight any unsafe roadside and crossing behavior by clicking on the hot spotted activity in the video itself (Figure 3).
    4) An explanation segment where each hazard is displayed individually, irrespective of whether or not the user managed to highlight it, alongside an explanation of the safe behavior expected.
    5) A reinforcement segment where the entire safe crossing practice sequence was played so that the player could see how the behaviors fit together into a crossing sequence.

    All hazards were hot spotted manually in the multimedia authoring environment. A hot spot is a defined interactive area of a video which when clicked on allows a specific action (in this case the generation of a pop-up window) to occur. Hot spots are not static and in fact move and change size as the video develops to ensure hazardous activity can be selected with a mouse.

1   The player is forced to watch the introduction, tutorial and explanation sections in full
2   before progressing. In the hot-spotted segment, the user can pause and rewind the video as many
3   times as they choose so that they can explore hazards in their own time. Visual hints are provided
4   to the player to help them identify hazards; 1) the mouse cursor would change from an arrow to a
5   large hand; 2) an exclamation mark would appear next to the mouse cursor to draw the players'
6   attention to the hazard (Figure 3). When a player clicks on a hazard, a pop-up box notifies them
7   that they have scored a point which is displayed on a scoreboard. The player simultaneously
8   hears a loud brake-screeching sound-effect accompanied by on-screen text saying what the
9   children should not have been doing. The player is then shown the corresponding video clip
10   demonstrating the correct behavior required for the individual part of the procedure in question.
11   When the player has viewed the video once, they are given their intermediate score and if this is
12   less than 100% are asked to play the video again to identify more hazards. On reaching the
13   conclusion of the video for a second time, a final score is given before the player proceeds to the
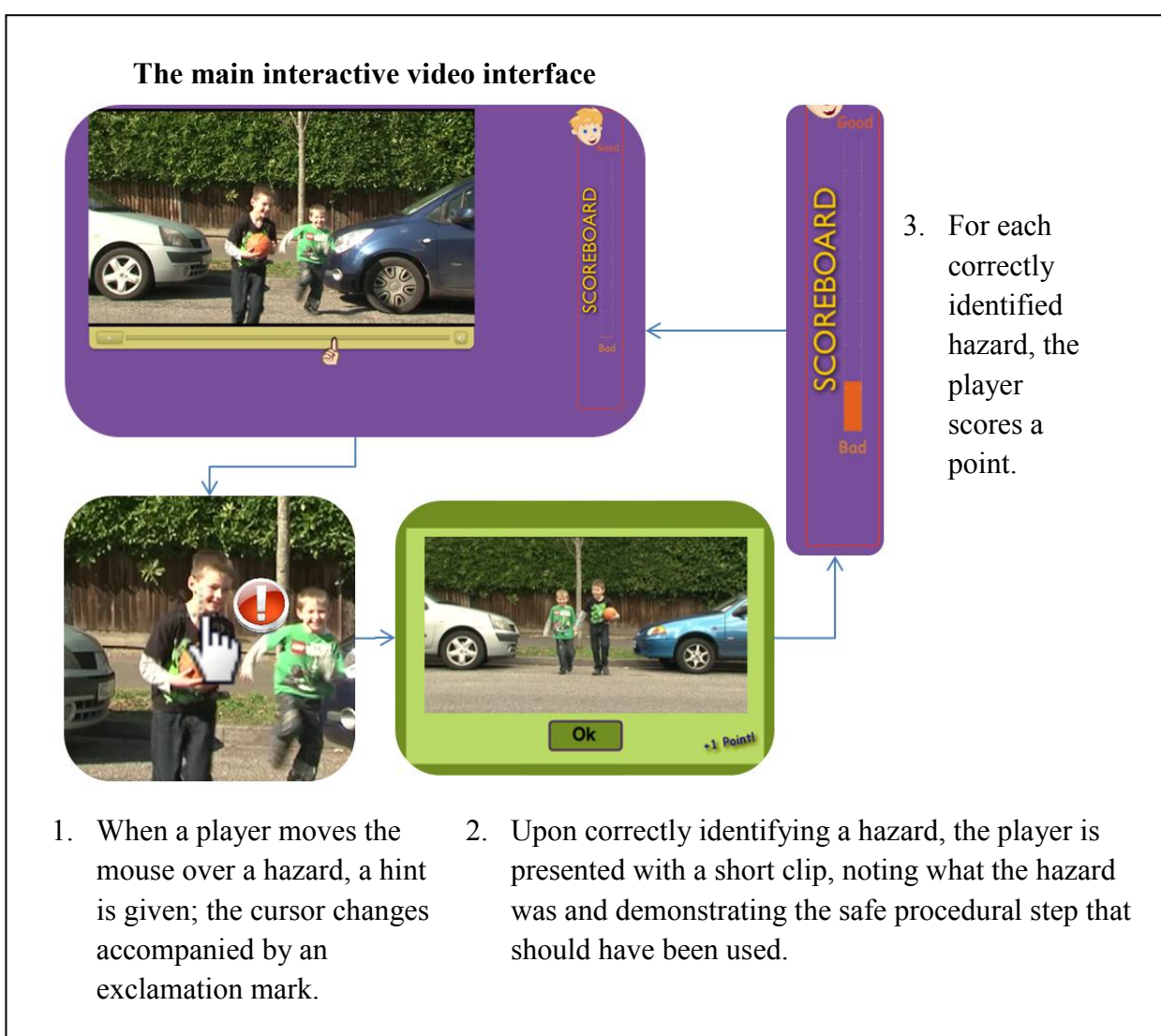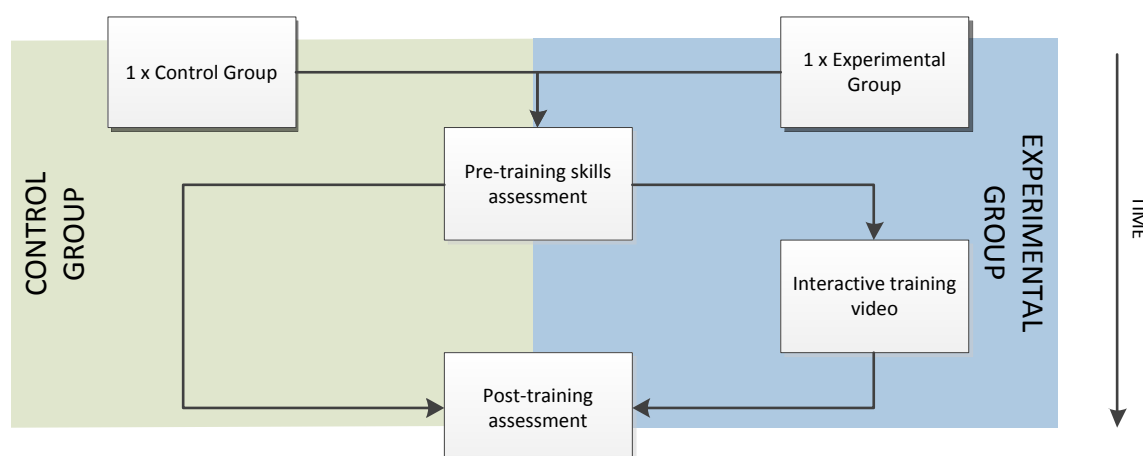14   explanation and reinforcement segments.

The main interactive video interface

3. For each correctly identified hazard, the player scores a point.

1. When a player moves the mouse over a hazard, a hint is given; the cursor changes accompanied by an exclamation mark.

2. Upon correctly identifying a hazard, the player is presented with a short clip, noting what the hazard was and demonstrating the safe procedural step that should have been used.

FIGURE 3 The hazard identification procedure used in the interactive video.

1   **On-Street Skills Assessment**
2   Two classes of 6-7 year old children were selected by the local elementary school to take part in
3   an evaluation of the interactive video to assess its impact on roadside skills acquisition. While
4   young, this is the age at which practical training is usually administered in the UK as it allows
5   the 'seeds' of good roadside behavior to be 'planted' at an early stage and with over 500, 5-10
6   year old child pedestrians reported to be injured during the school journey in 2010 *(10)*, it is wise
7   to be supporting children with road safety education at this age. One class was designated as the
8   control group, and the other the experimental group, in a quasi-experimental study design
9   (Figure 4).
10   Each group took part in a pre-training skills assessment where they were taken in groups
11   of three to a quiet cul-de-sac (dead-end) street used as a roadside parking area by local residents.
12   Upon reaching the street, one child at a time was asked to lead an assessor (who feigned an
13   inability to cross roads) across the road safely. This assessor was only present to stop the child
14   should a potentially life-threatening situation arise and while they were holding the hand of the
15   child; they were not tasked with leading or advising. During the crossing, the other assessor
16   observed the child's behavior and noted the presence or lack of key skills on a three point scale
17   (good, satisfactory, poor) using an assessment record sheet; i) stopping at the curb; ii) checking
18   the parked cars are not about to move; iii) stopping at a safe location at the outside edge of the
19   cars; iv) looking all around for traffic; v) crossing sensibly; vi) remaining aware while crossing.
20   The remaining two waiting children were positioned such that their view of two parked cars was
21   obscured to remove the chance of them replicating a preceding child's behavior.
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24   **FIGURE 4 The study design.**

25   Following the pre-training skills assessment, the experimental group of children were
26   asked to play the interactive video back in the class room. Interactive video 'training' sessions
27   were conducted in groups of eight under the supervision of a researcher. Children were each
28   assigned a laptop computer, positioned in a semi-circle taking advantage of the viewing angle of
29   the screens to minimize the chances of children being distracted by other laptop screens. The
30   researcher gave a brief introduction to the session expectations and how to use the mouse to click
31   on an object. The children were then asked to put on headphones and follow the game
32   instructions in order to progress through the interactive video. Children were asked to raise their
33   hand with any technical and usability issues which were then addressed immediately by the

1   assessor. Technical issues included increasing the volume of the audio (often because children
2   inadvertently decreased the volume on the headphone in-line remote). Usability issues, which
3   occurred rarely, related to either progressing through the video e.g. the player not clicking "next"
4   to progress through scenarios, or issues concerning clicking on hazards e.g. the player clicking
5   on the screen when they saw a hazard, but not on the actual hazard itself. In either case, the
6   researcher would encourage the child to solve the issue themselves e.g. "what do you think you
7   should click on?", rather than telling the child what to do. Children generally finished the game
8   within 20-30 minutes depending on how long it took to progress through the interactive video
9   stage of the game.
10   The day following the interactive video training session, the experimental and control
11   groups were re-assessed in a post-training assessment at the same roadside location and using the
12   same methodology. Immediately following this assessment, the children (in groups of three)
13   were shown the correct crossing sequence, highlighting general mistakes made by the group and
14   also told that they should always have an adult with them at the roadside until they are ready for
15   independent school travel.
16   Pre and post-test assessment score records, detailing which sample was cross-verified by
17   the second assessor, were coded following the completion of the roadside study. Perfect behavior
18   was awarded two points, satisfactory behavior was awarded one point and hazardous behavior
19   was awarded zero points.
20   In total 43 children aged between six and seven years were involved in the study. In order
21   to minimize school disruption, one class (N=21, 9 females, 12 males) was randomly assigned the
22   control condition and the other (N=22, 14 females, 8 males) was assigned the experimental
23   condition. Groups were matched for age and participant background.

24   **RESULTS**

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26   The crossing proficiency of all participants improved to some extent between the pre and post-
27   training assessments, with a number of skills demonstrating a statistically significant
28   improvement at the 5% significance level (Table 1). The baseline performance of 'Walking
29   safely across the road' was high and therefore excluded from the analysis. Moving forward to a
30   safe location at the line of sight was also excluded as there was a possibility that the presence of
31   an assessor on one or other side of a child would have influenced the stopping location a child
32   selected. Females and males were considered separately to identify gender differences and due to
33   the small range of ages, the effect of age on training outcomes was not considered.

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1	**TABLE 1 On-street Assessment Scores**

Mean on-street assessment scores (and standard deviation) for male and female participants during pre and post-training assessments.							
Assessed crossing procedure	Pre-Training Assessment				Post-Training Assessment			
	Control		Experimental		Control		Experimental	
	Female	Male	Female	Male	Female	Male	Female	Male
i) Stopping at the curb	0.7 (0.87)	0.5 (0.67)	1.4 (0.93)	0.6 (0.92)	1 (1.0)	1.1 (1.0)	2* (0)	1.4 (0.92)
ii) Checking the parked cars are not going to move	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.25 (0.45)	0.9* (0.95)	0.9* (0.99)
iii) Stopping at the line of sight	1.1 (0.93)	0.7 (0.49)	0.9 (0.92)	1.4 (0.92)	1.5 (0.53)	1.8* (0.39)	1.6* (0.76)	1.5 (0.53)
iv) Looking all around before crossing	1.8 (0.67)	1.3 (0.98)	1.1 (1.0)	1.8 (0.71)	2 (0)	2* (0)	2* (0)	2 (0)
v) Remaining aware during crossing	1.2 (0.83)	0.3 (0.49)	0.9 (0.66)	1.3 (0.71)	1.3 (0)	1.3* (0.87)	1.9* (0.36)	1.7 (0.52)
* Indicates significant T-Test (paired, 2-tailed) result at the 95% confidence level								

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3	*i) Stopping At The Curb*
4	Mean scores in all groups increased in the post-training assessment with a statistically significant
5	improvement in crossing behavior in trained females.

6
7	*ii) Checking The Parked Cars Are Not Going To Move*
8	During the pre-training assessment no children in either the control or experimental groups
9	checked the cars before stepping out into the road. Following training, the control group showed
10	no significant improvement, however the trained experimental group consistently checked the
11	cars and demonstrated a statistically significant improvement in executing this skill; trained
12	females paired $T_{(13)}$ = -3.379, p=0.005, trained males paired $T_{(7)}$ = -2.497, p=0.041. Given that
13	the control group did not demonstrate any statistically significant improvement, the results
14	suggest that interactive video training does have an effect on this skill in both trained males and
15	females. Further research is required to identify what specific parts of the video impacted on the
16	children's cognition and what wider lessons can be learnt in terms of scene design and
17	interaction methods.

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19	*iii) Stopping At The Line Of Sight*
20	Significant improvements in skill demonstration were observed in the control male and
21	experimental female groups during the post-training assessment, suggesting other factors may
22	have led to this improvement.

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iv) Looking All Around Before Crossing

The baseline level in this skill was surprisingly high, with many children checking it was safe to cross before stepping into the open road, nonetheless significant improvements in skill demonstration was seen in the control male and experimental female groups.

v) Remaining Aware During Crossing

Participants were expected to remain aware by continuing to look (and listen) for traffic when on the road. During the pre-training assessment many children assumed it would remain safe once the crossing had been instigated. Following training, significant improvements were seen in the male control and female experimental groups; however a number of children still demonstrated a complete absence of this behavior.

Where statistically significant improvements in desired behavior were observed in both control and experimental groups, other factors, and not solely the interactive video are considered to have contributed. In order to get to the assessment site, located approximately 200 yards from the school entrance, the participants were safely taken across two roads. While safe crossing skills were not explicitly demonstrated, children were aware that they were involved in a road safety research project and that the researchers would be obliged to use safe crossing skills when in loco parentis. A possible contributor to the significant increases in skill demonstrated by participants for the stopping at line of sight, looking around and remaining aware skills is therefore replication of this demonstrated behavior in a similar learning mechanism used in practical training. An alternative explanation could be presence of a type of acquiescence bias where children are deliberately trying to exhibit 'desired' behaviors in order to get praised. Future studies could control for either effect by i) driving children from school to the test site, even over a very short distance or ii) setting up a mock street scene with parked cars within school grounds; in either case so the children are not demonstrated 'correct' road crossing behavior, other than in the interactive video.

Checking that cars are not about to move was a skill only shown in the interactive video as it was not necessary to cross between any parked cars to get to the assessment site. With a statistically significant improvement in the number of male and female children in the experimental condition that checked the cars, it is likely that this skill was acquired through the use of the interactive video alone. This finding is of interest as it suggests that just a single, self-directed and short interactive video training session can have an impact on the skills demonstrated by children at the roadside. Importantly, if interactive video sessions were to replace less effective paper-based classroom activities, they could enhance the quality of pedestrian training programs delivered to children.

CONCLUSIONS

Interactive video elements could become an important component in education interventions in Safe Routes to School programs. While we have demonstrated the potential for interactive video to enhance pedestrian training, similar videos could be produced to enhance cycle and general road safety education as part of Safe Routes to Schools interventions, allowing children to experience real hazards from real roadside environments whilst in safe surroundings.

1   This exploratory study has demonstrated the potential for interactive video to be used as a
2 tool to increase the skill of young pedestrians at the roadside, which if executed during a school
3 run may reduce the risks involved when walking to school. When used alongside pedestrian
4 training, interactive video will not only support, but also enhance training allowing classroom
5 elements to be introduced, without detriment to the quality of training delivered. The findings of
6 this study may also have wider implications in that any procedural skills in which safety is a
7 factor of success, may be able to benefit from interactive video training.
8   Further research using a larger sample and refined experimental procedure is required
9 before specific training recommendations can be made.

10 **ACKNOWLEDGEMENTS**
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