Altering pre-drivers' social norms, perceived risk and willingness for mobile phone usage whilst driving. Pilot evaluation.

Dan Campsall
Road Safety Analysis, Banbury, UK
Tanya Fosdick
Road Safety Analysis, Banbury, UK
Steve Ferris
Road Safety Analysis, Banbury, UK
George Ursachi
Road Safety Analysis, Banbury, UK

ABSTRACT

Purpose: The purpose of this paper is to propose a new way of altering social norms, perceived vulnerability and willingness in road safety interventions aimed at adolescents. Following trends in latest behavioural change research, the proposition of this paper is that positive and self-reflective behavioural change techniques can successfully alter social norms, perceived vulnerability and willingness in road safety or other health areas.

Design/methodology/approach: Special sessions (incorporating behavioural change techniques such as prompts/cues, action planning and problem solving via interactive games and group discussions) were specifically designed for the target groups and included in a pilot road safety intervention. Pre and post questionnaires were distributed and the results were compared and tested.

Findings: Major movement in the desired direction was reported for all three aspects investigated. Further, the level of engagement and satisfaction among participants was higher than previous or comparator 'traditional' interventions based on 'fear appeals'

Practical implications: Latest psychology and behaviour change research suggests social norms, perceived risk/vulnerability and willingness are key factors in determining or influencing young people's behaviour. Moreover, the traditional 'fear appeal' techniques are not proven to work and are more frequently contested. This paper opens new horizons by providing an example of analysis, design, implementation and evaluation of a behaviour change intervention.

Originality/value: Designed on the basis of new theories and incorporating a number of creative ways to use and evaluate behaviour changing techniques, this paper is a pioneer in road safety, providing a good practice example on both how to tailor interventions and how to evaluate them, whilst incorporating the evaluation and feedback into constantly improving the output.

1. INTRODUCTION

This paper presents a proposal for a new way of altering predictors of risky driving behaviour among novice young drivers using positive, self-reflective behavioural change techniques. The intervention and especially the sessions analysed and discussed in this paper were designed taking an evidence-based and theory-informed approach. The paper also provides background information about research on young drivers' risk-taking behaviours (such as mobile phone usage while driving) and behavioural change techniques (BCTs) and their usage in road safety interventions.

1.1. Young drivers

Young drivers present a higher risk of road traffic collisions and road traffic injuries because of their lack of experience and because of their greater propensity for adopting unsafe driving behaviours and disregarding the traffic regulations (Hanna, et al., 2010). Since the early 1980's, researchers concluded that traffic accidents were the single most common cause of death among young people in Canada and United States (Jonah, 1986). More recently, researchers conclude that world-wide, motor vehicle crashes are the leading cause of death and disability among adolescents, whose crash involvement rate is much higher than for older, more experienced drivers (Simons-Morton, et al., 2011) and that crash risk is highest early in licensure, declining rapidly for approximately 6 months and then slowly for years before reaching stable, adult rates (Mayhew, et al., 2003) (McCartt, et al., 2003) (Williams, 2003). In addition to experience deficits, unsafe behaviours also affect risk. In a recent Swedish cohort study, young unlicensed drivers displayed more risky driving practices than their licensed counterparts, at the time of the crash (Hanna, et al., 2010).

Although in recent years in Great Britain the number of young car drivers (aged 17-24) involved in reported road accidents has fallen significantly, from a high of nearly 90,000 in 1990 to 30,000 in 2013, young car drivers are still at a very high risk. They represent 18% of all car drivers involved in reported road collisions, which is considerably higher than the 5% of miles they account for (Department for Transport, UK, 2015). Per unit of travel, teenagers have an elevated fatal and non-fatal collision risk relative to adults in the USA, too (Durbin, et al., 2014).

Crash risk among young drivers is particularly high under complex driving circumstances such as late at night or driving while distracted (Williams, 2003). Learning basic vehicle management requires only a few hours of instruction and practice (Hall & West, 1996), but judgement consistent with safe driving is thought to develop only with substantial driving experience (Groeger, 2000). Distraction is one of several important measures of risky driving, along with speeding, close following, impairment, and elevated g-force events (Simons-Morton, et al., 2011). Mobile

phone usage while driving is one of the most dangerous and increasingly widespread distractions, especially among young drivers (Durbin, et al., 2014).

1.2. Mobile phone usage while driving

Using mobile phones can cause drivers to take their eyes off the road, their hands off the steering wheel, and their minds off the road and the surrounding situation. It is this type of cognitive distraction which appears to have the biggest impact on driving behaviour. There is a growing body of evidence showing that the distraction caused by mobile phones can impair performance in a number of ways, e.g. longer reaction times (notably braking reaction time, but also reaction to traffic signals); impaired ability to keep in the correct lane; shorter following distances; and an overall reduction in awareness of the driving situation (World Health Organization, 2011).

The evidence around mobile phones as a risk factor for road traffic injuries is in its infancy compared to other aspects of road safety, but the issue is likely to become a fast growing concern globally (World Health Organization, 2011). Although drivers have been the subject of targeted laws limiting mobile phone use and texting in many countries (Durbin, et al., 2014), the use of mobile phone devices while driving has increased, especially for the 17-24 age group (World Health Organization, 2011). A series of additional activities even more dangerous than talking and texting emerged, including activities such as taking photos or videos, or reading or posting on social media while driving (RAC , 2016). The self-reported prevalence of mobile phone use while driving has been rising for more than a decade, as shown in studies from USA, Canada or Australia and young drivers are particularly inclined to perform the behaviour (Asbridge, et al., 2013). In 2014, 1.6% of all drivers and 1.4% of car drivers in England and Scotland were observed using a hand-held phone whilst driving (Department for Transport, 2014).

The impact of using a mobile phone on collision risk is difficult to ascertain (World Health Organization, 2011), but there are several studies revealing some interesting conclusions: mobile phone conversations while driving increase collision risk by 4 to 6 times (Redelmeier & Tibshirani, 1997) (Strayer & Drews, 2004); text messaging while driving increases collision risk by 23 times (Lee, et al., 2013); whether it is hand-held or hands-free, the conversation is the distraction (Lee, et al., 2013). Furthermore, mobile phone conversations impair drivers' reactions to vehicles braking in front of them, their explicit recognition memory of roadside billboards and their implicit perceptual memory (Strayer, et al., 2003). The risk of a crash or near-crash among novice drivers increases with the performance of many secondary tasks, including texting and dialling mobile phones (Klauer, et al., 2013), and moreover, crash culpability was found to be significantly associated with mobile phone use by drivers; increasing the odds of a culpable crash by 70% compared with drivers who did not use a mobile phone (Asbridge, et al., 2013). This growing body of evidence, together with an obvious elevated social pressure to 'stay connected' among drivers (and young drivers in particular), urges road safety professionals to

treat mobile phone use while driving as a very important threat that needs to be approached rigorously and effectively in interventions.

1.3. Fear appeal

Public health widely uses threat and fear as an option for campaign approaches and there is a firm belief, especially in road safety, in the ability to 'scare people straight' (Hoekstra & Wegman, 2011). Road safety campaigns are particularly renowned for using physical threats in which drivers and passengers are often shown to be injured and killed as a result of unsafe and/or illegal behaviour (Lewis, et al., 2007). However, the prevalence of fear appeal doesn't necessarily mean that it works, and the inconsistencies in the literature make it difficult to advise practitioners on 'what works' when designing threat appeals or whether or not threat appeal should feature in road safety campaigns (Carey, et al., 2013).

Recent research into models of fear and persuasion revealed that the earliest conceptualisation of the fear-persuasion relationship was based on drive theories which posited that fear appeals would evoke fear arousal and that fear, in turn, would act as a driver to motivate action. A number of early studies provided support for a positive linear relationship such that higher levels of fear arousal were the most conducive to persuasive attempts, but other, also earlier studies provided evidence of a negative, linear relationship such that lower levels of fear resulted in more persuasion. Such findings highlight the particularly ambiguous nature of the fear-persuasion relationship (Lewis, et al., 2007). Moreover, recent analysis of experimental literature indicates that threat appeals can lead to increased fear arousal, but do not appear to have the desired impact on driving behaviour (Carey, et al., 2013) and that many threat-based campaigns may produce other emotions such as disgust or disapproval, which may have different behavioural impact (Lewis, et al., 2007).

1.4. From theory to intervention. Behaviour change techniques

Research suggests that interventions to change behaviour should draw from theories of behaviour change in their development, starting with a 'theory phase' followed by a 'modelling phase' and 'experimental phases'. At the same time, theory provides a helpful basis for designing intervention to change behaviour but offers little guidance on how to do this (Michie, et al., 2008). Interventions to change behaviour are typically complex, involving many interacting components, making them challenging to replicate in research, to implement in practical applications and to synthesize in systematic literature reviews (Michie, et al., 2013). Because of these reasons, a group of international researchers in behaviour change (Michie, et al., 2013) developed a BCT Taxonomy, formed of 93 BCTs clustered into 16 groups, aimed to help practitioners, on one hand, in using the most appropriate and proven to work techniques for their interventions and to help theoreticians, on the other hand, in having a common base of comparing, grouping, assessing, analysing and evaluating

techniques and theories. Starting from the evidence and inspired by theory, this paper uses and analyses a series of BCTs in order to affect elements identified in theory. The processes of intervention development, delivery, and evaluation, with references to the BCTs in use, are described in later chapters of the paper.
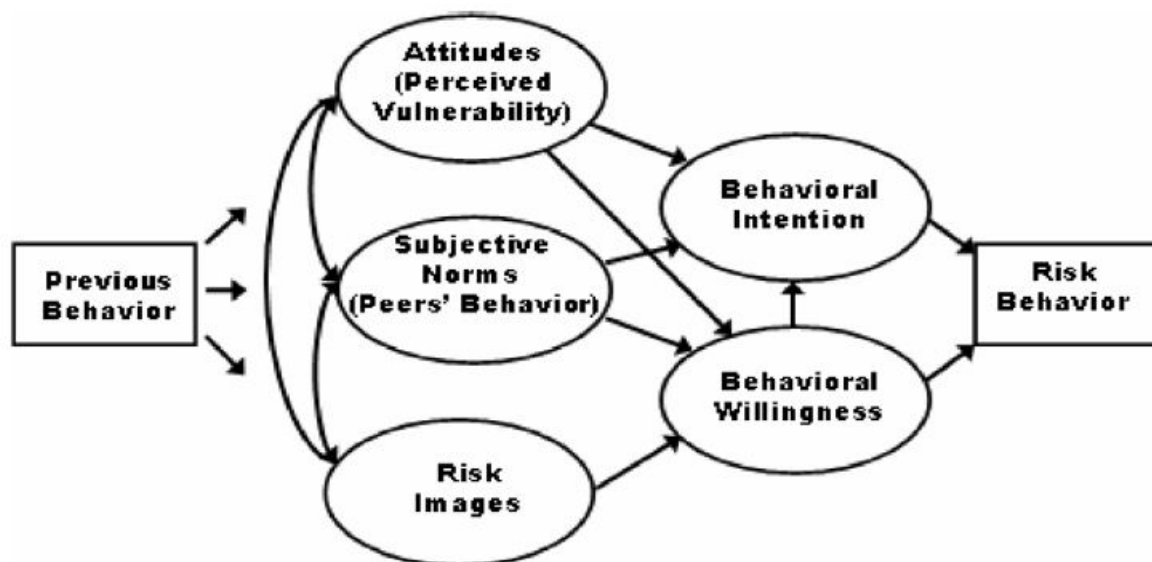
1.5.   The Prototype Willingness Model

There is a rich body of research and theories relating to behaviour change and, until recently, most researchers and most theoretical models have viewed risk behaviour in much the same way as any other type of behaviour: at least planned and reasoned, if not always rational (Gerrard, et al., 2008). Many behaviour change interventions are based on the Theory of Planned Behaviour (Ajzen, 1985) which presumes that decision making is a reasoned and deliberative process that involves consideration of behavioural options and anticipated outcomes. In these approaches to decision making, attitudes proceed behaviour through a single proximal antecedent, behavioural intentions, defined as 'goals' or 'goal states' that are formulated after some deliberation or reasoning (Gerrard, et al., 2008). When applied to adolescents and risky behaviour this seems to be somehow counter-intuitive. The 'prototype willingness model of adolescent risk behaviour' is related to other dual processing models based on an assumption that there are two types of decision making, two hypothesized paths to adolescent risk behaviour: a reasoned path, similar to that described in the theory of reasoned action, which involves more analytic processing; and a social reaction path that is image-based and involves more heuristic processing. This second path incorporates two new constructs: *risk prototypes*, which are images of people who engage in risk behaviours and *behavioural willingness* – an openness to engaging in risky behaviour (Gerrard, et al., 2008).

Refined especially for young people's risky behaviours, the Prototype Willingness Model (PWM) starts from the existence or absence of previous behaviour (for the adolescent, their peers or others). The existence or absence of the behaviour will influence three different elements (also inter-related): attitudes (perceived vulnerability), subjective norms (peer's behaviour), and risk images. These three elements will manifest influence in the formation on the behavioural willingness on one hand and, on the other hand, the attitudes, the norms, and the willingness will influence the behavioural intentions. Behavioural intentions and behavioural willingness will determine the state of engagement in the risky behaviour.

The PWM has two major assumptions. The first basic assumption is that adolescent health risk behaviour is usually volitional, but is often not planned or even intentional. When asked, most of them will say they do not intend to engage in risky behaviour in the future even if they have engaged in that behaviour in the past. The discrepancy between intentions and behaviour is a reflection of the nature of their risk behaviour and decision making involved – reactive and less premeditated or reasoned. The second major assumption is that children and adolescents have clear cognitive

representation or social images (prototypes) of the type of person their age who engages in specific risk behaviour. The more favourable that image is, the more willing they are to accept the social consequences associated with the behaviour (Gerrard, et al., 2008).

Fig 1. The prototype willingness model (Gerrard, et al., 2008)

After a very thorough and careful review and analysis of the theoretical models that focused on analytic and/or heuristic thinking, Gerrard et al. concluded that the dual-processing model specially designed to address the non-rational decision making of adolescent health risk behaviour, the PWM is not only beneficial for changing behaviour but it also helps theory and research to enhance our understanding of adolescent (and adult) decision making in a variety of ways. As a consequence, the model was selected for the development of this intervention (sessions) and also as a means of understanding the processes that lie behind the changes that the intervention is producing in young people's attitudes and willingness towards the risky behaviours.

2. METHODOLOGY

The literature reveals only a small amount of systematic operational guidance about how to develop interventions to reduce the gap between practice and evidence. Multi-step systematic methods for developing interventions designed to change behaviour, based on theoretical frameworks, have been illustrated and tested in the literature (French, et al., 2012). Whilst the case of developing an intervention from scratch is the optimal and desired one, in practice it is often a case of improving or modifying an existing intervention. Hence the need to develop a new systematic approach, tailored for the case. Nevertheless, the systematic approach used for this intervention is based on examples previously presented and tested in literature.

The method used for developing (redesigning) the intervention (sessions) consisted of five steps:

1. Evaluation of existing intervention (process evaluation and outcome evaluation) and identification of problems;
2. Assessment of problems;
3. Development of solutions to overcome problems – redesign intervention;
4. Implementation of solutions (Pilot);
5. Evaluation of the Pilot.

The following paragraphs will shortly summarise each of the steps, highlighting the essential findings and challenges.

Evaluation of existing intervention (process evaluation and outcome evaluation) and identification of problems

There are many types of evaluations, each suitable for specific purposes. For this case, process and outcome evaluations were considered to be the most appropriate and valuable.

Process evaluation

There were numerous issues identified in the process evaluation, the most important of which being:

- The aim and objectives of the existing intervention were vaguely stated, unrealistic and unrelated directly to the content of the intervention (objectives related to casualty reduction where the intervention has around twenty-five participants are unrealistic);
- There were no specific objectives nor indication of how success or failure (specific or overall) can be measured and assessed;
- There was no indication why (or how) the content can produce the achievement of the aim and objectives. There was no theory based, or at least intuitive, connection between the content and the desired results;
- There was little or no communication between the parties delivering different sessions, the only constant message being related to threat and fear arousal;
- The 'evaluation' of the intervention was based on assessing levels of satisfaction regarding the participation in the event.

Outcome evaluation

For assessing the outcome evaluation, the team used three main methods. First, for analysing attitudinal changes, the team asked the participants to describe four categories of drivers on a white board, using one or two words, at the beginning of the intervention and before the end of it. The categories of drivers were drink driver, distracted driver, speeding driver, and drivers that don't wear the seatbelt. The descriptions were then analysed and compared. The second technique used was

focus groups. The participants were split into four groups in order to participate in guided focus groups at different times during the day. The third technique was observation. The team, formed of four experienced professionals, observed the whole intervention, taking notes on content and delivery. After the intervention, the team met to discuss and analyse the findings.

Giving the fact that the aim and objectives were unrealistic, the team decided to evaluate the outcomes of three elements, identified in the literature as being key for behaviour change interventions aimed at young adults or adolescents, and which can be altered in an intervention of this type (one day classroom based intervention): attitudes toward risky behaviour (perceived risk or vulnerability); social norms (subjective norms); and behavioural willingness (stated)

- The participants came with very negative attitudes towards risky behaviour hence their intentions of engaging in the risky behaviours were very low. Whilst proceeding with various sessions, their attitudes towards the risky behaviours became less negative and they tended to accept a higher probability of engaging in such actions, even stating that, because of the way these actions were pitched, they had the feeling that is '*not that bad*', that '*anyone can make mistakes*', and '*there is nothing you can do about it*'. The risky behaviour has been normalised and made socially acceptable during the intervention;
- The behavioural willingness to perform the risky behaviours also followed a wrong trajectory during the intervention when the participants started to identify themselves or their peers with the characters engaging in the risky behaviour in the presented sessions. Again, risky behaviour became more socially accepted and therefore the participants indicated greater willingness to engage;
- For the subjective norms, the participants arrived at the intervention site with social (subjective) norms regarding the proportion of people performing risky behaviour already over inflated by various factors such as the media, and the intervention reinforced those norms through the persistent presence of the bad, risky behaviour portrayed;
- The most prevalent reaction to the highly violent, physical threatening images was disgust and denial of acceptance. The scenes were described as being '*too harsh*', '*disgusting*' or '*too much*'. Nevertheless, a paralysing '*it's nothing you can do, anyone can make mistakes*' fatalist attitude seemed to arise in participants' minds while these types of images were repeated.

Assessment of problems

These findings led the team to conclude that there was a risk of the intervention doing harm. The team considered that all the identified problems were critical and that some of the sessions should be redesigned and others should be replaced. This paper only broadly describes these measures. In the following chapters, further

details for the sessions and objectives are described as they relate to mobile phone use only.

Development of solutions to overcome problems – redesign intervention

In order to overcome the identified problems, several elements of the intervention were modified, eliminated or created:

New aims and SMART objectives were formulated. Evidence and theory was used to explain how the behaviours occur in young people and to inform the intervention and the objectives. One important issue that the team identified here is that the intervention was trying to change a behaviour that did not yet exist (the participants are pre-drivers). Hence, the new approach, as well as the aims and objectives, focused on altering those elements more susceptible to ***preventing future adoption of risky behaviour***.

The specific objectives regarding mobile phone usage while driving focused on three main aspects:

1) To significantly reduce the average norm among participants related to the proportion of people using the mobile phone while driving with 0.5 on a scale from 1 to 5 and/or statistically significant;
2) To significantly increase the average perceived risk (vulnerability) for the use of mobile phones while driving, with 0.5 on a scale from 1 to 5 and/or statistically significant;
3) To significantly decrease the average willingness to engage in using mobile phones while driving, with 0.5 on a scale from 1 to 5 and/or statistically significant.

The choice for '0.5 and/or statistically significant' formulation was used to allow for cases where an average is too high or too low and 0.5 increase or decrease is not possible, but significance can be achieved, given the distribution.

The theories underlying the relationships between the actions and the expected result were described and summaries of these theories are a part of the strategic documents behind the development of the new sessions.

An appropriate evaluation consisting of pre, post and three months after questionnaires was put in place to assess changes in different levels for willingness, attitudes, and social norms regarding the engagement in different risky behaviours. Success and failure were also defined.

Inspired by the latest research, all threatening and fear appeal (fear arousal) based sessions were eliminated and replaced with positive and self-reflective behavioural change techniques such as prompts/cues, action planning, group discussions and problem solving, incorporated in a number of creative and interactive game-like sessions. The BCTs were specified and coded (Michie, et al., 2013) in the

description of the pilot. Some of the most frequently used ones are enumerated below:

- 1.2. Problem solving;
- 1.4. Action planning;
- 7.1. Prompts/cues;
- 6.1. Demonstration of the behaviour;
- 5.2. Salience of consequences;
- 6.3. Information about others' approval;
- 5.3. Information about social and environmental consequences;
- 1.8. Behavioural contract;
- 3.1. Social support (unspecified);
- 10.5. Social incentive;
- 13.1. Identification of self as role model.

All parties involved in the delivery of the intervention (including those left from the existing format) received a briefing and an indication of the tone and purposes of the messages, with the team making sure that there is consistency between the different sessions of the intervention.

Implementation of solutions. Pilot intervention

The intervention was piloted at two consecutive events in the same location, with a total number of 39 participants. The pilot incorporated three short presentations and eight workshops, all containing interactive discussions, games, activities, and debates where every participant needed to engage. The overall tone of the intervention was positive and fun, making the experience enjoyable and enriching both for the participants and for the team.

Although the subject of distraction and specifically of mobile phone usage while driving is present in many discussions and presentations, the intervention includes a special workshop dedicated to distraction in general and to mobile phone usage while driving in particular. The session starts with a very short discussion about multitasking and about how the brain can't multitask processes and how it actually switches between tasks. Following that, the participants are engaged in a puzzle game. They need to complete a 30-piece puzzle while counting backwards. These two apparently very easy tasks, because they need to be carried out simultaneously, create significant difficulties among the participants. Open discussion is encouraged about how difficult simple tasks became when multitasking. After the game, a short talk follows to summarise the task, where everyone is encouraged to express an opinion about the difficulty of the game. The discussion is directed towards the use of mobile phones while driving.

The second game also consists of two simple activities. The participants need to direct a ball with a stick, through a track laid out on the floor with some coloured rope. The requirement is not to let the ball get out of the track and to keep the ball

moving forward at all times. At the same time, they need to text a specific message to their parents. After completing the task, they are required to do the task again but without texting. At the end of the game everyone is invited to compare the two experiences. Following this second game, participants collectively come up with different situations when the mobile phone would be needed in the car and also collectively and under guidance come up with coping mechanisms to avoid usage of mobile phones while driving. The session ends with a verbal contract that everyone will be a role model for their peers and that they commit to safe driving.

Some of the BCTs used in this session are:

-   6.1. Demonstration of the behaviour – demonstration of how mobile phone usage while concentrating on something else is distracting;
-   7.1. Salience of consequences – the consequence of using the mobile phone is losing focus on the other activity;
-   1.2. Problem solving – they collectively find solutions for situations when one can be tempted to use the mobile phone while driving;
-   1.4. Action planning – they are encouraged and guided to plan actions to reduce the need and likelihood of using their mobile phone while driving;
-   3.1. Social support (unspecified) – the rejection of engagement in the risky behaviour is socially supported by peers participating in the session and becomes more socially normative;
-   1.8. Behavioural contract – even if only verbal, a commitment to certain behaviour while surrounded by peers is a very powerful reminder.

Participants completed questionnaires at their arrival and before the end of the event, allowing the team to measure the short-term effects of the pilot on the targeted behavioural components. The post questionnaires were also a good opportunity for the participants to reflect on the things they did during the day and how that did or didn't change their beliefs and attitudes. The questionnaires were anonymous and matching was done based on date of birth and gender.

Three months' post questionnaires will be also administrated but are not a subject of this paper.

Evaluation of the pilot

The questionnaires were processed and matched and the differences were tested for statistical significance. The results were evaluated against the specific objectives. The results and the analysis will be presented in the following 'Results' section. For the social norms, available evidence from a comparison group, where the previous intervention ran, was also used.

The total number of participants was 39. For the social norms section, there were 39 valid answers. For the risk and willingness sections there were only 38 valid cases.

Social Norms - The question used to capture the norms related to the usage of mobile phone while driving was: 'How many drivers do you think get involved in activities such as texting or watching videos while driving?'. Five intervals were created to reflect five different levels for the proportion of drivers using mobile phones while driving: 'Less than 10%', 'Between 10%&25%', 'Between 26%&40%', 'Between 41%&60%' and 'More than 60%' to reflect 'Very low proportion', Low proportion', 'Neither low or high proportion', 'High proportion' and 'Very high proportion'. These intervals were pretested. After the data input, the levels were also recoded from 1 (the lowest proportion) to 5 (the highest proportion) to allow for evaluation against the objectives. For the original intervals, the median value of the interval was considered.

Perceived Risk (Vulnerability) - The question used to capture the participants' perceived risk of a crash occurring when one gets involved in a risky behaviour was: 'Thinking of the following behaviours, how likely do you think they will result in a crash?'. Five levels were created: Extremely likely (5), Likely (4), Unsure (3), Unlikely (2), and Extremely Unlikely (1). There were three behaviours related to mobile phone usage while driving amongst the enumerated behaviours in the question: Texting while driving; Watching videos while driving; and Talking on the mobile phone while driving.

Willingness - The question used to capture the participants' willingness to engage in risky behaviour while driving was: 'Think about your best mate as a driver. How willing do you think he/she would be to do the following things?'. Five levels were created for this question too: Very willing (5), Quite willing (4), Not sure (3), Not very willing (2), and Not at all willing (1). There are also three behaviours related to mobile phone usage while driving amongst the enumerated behaviours in the question: Text while driving; Watch videos while driving; and Talking on the mobile phone while driving.

3. RESULTS

Social Norms

Paired T-tests were conducted to assess the significance of the differences between the pre intervention and post intervention responses.

The analysis was done on both original intervals, with the median value considered, and on the recoded values.

In order to perform a paired T-test, the distribution of the differences between the paired samples should be similar to a normal distribution. Histograms were used to analyse the distribution of the differences between pre and post answers.

The histograms for the differences between pre and post answers for the mobile phone use social norms show distributions similar to the normal distribution, as can be seen in the following figures.
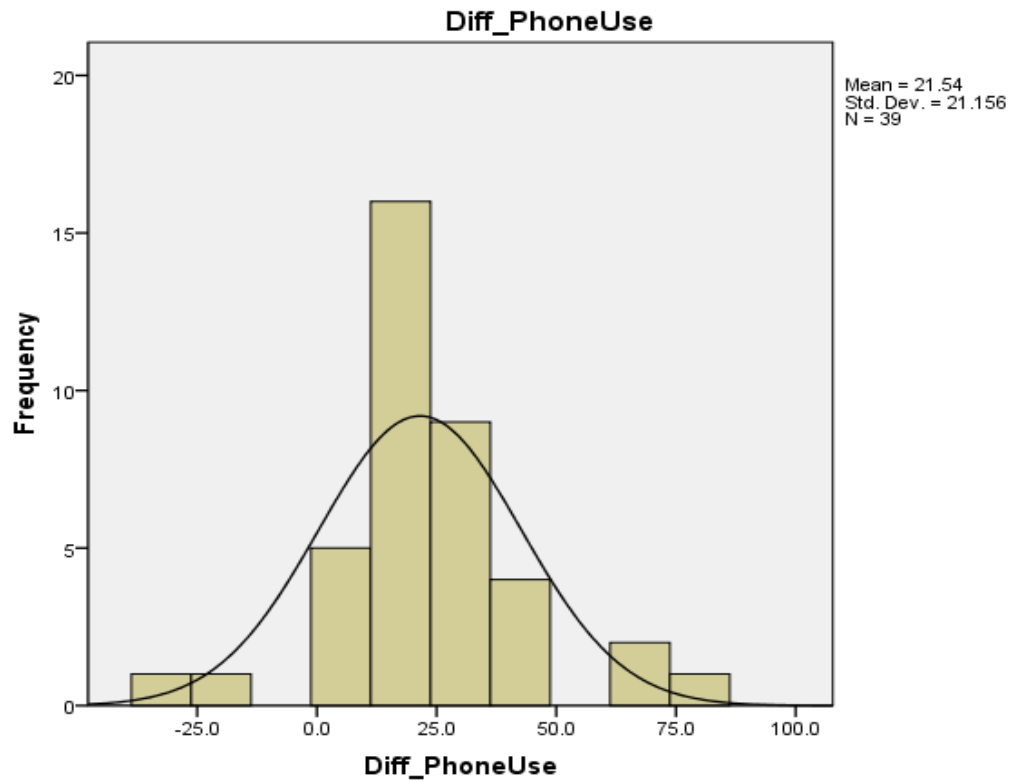
Figure 2. Histogram of difference between pre and post answers for mobile phone use (median)
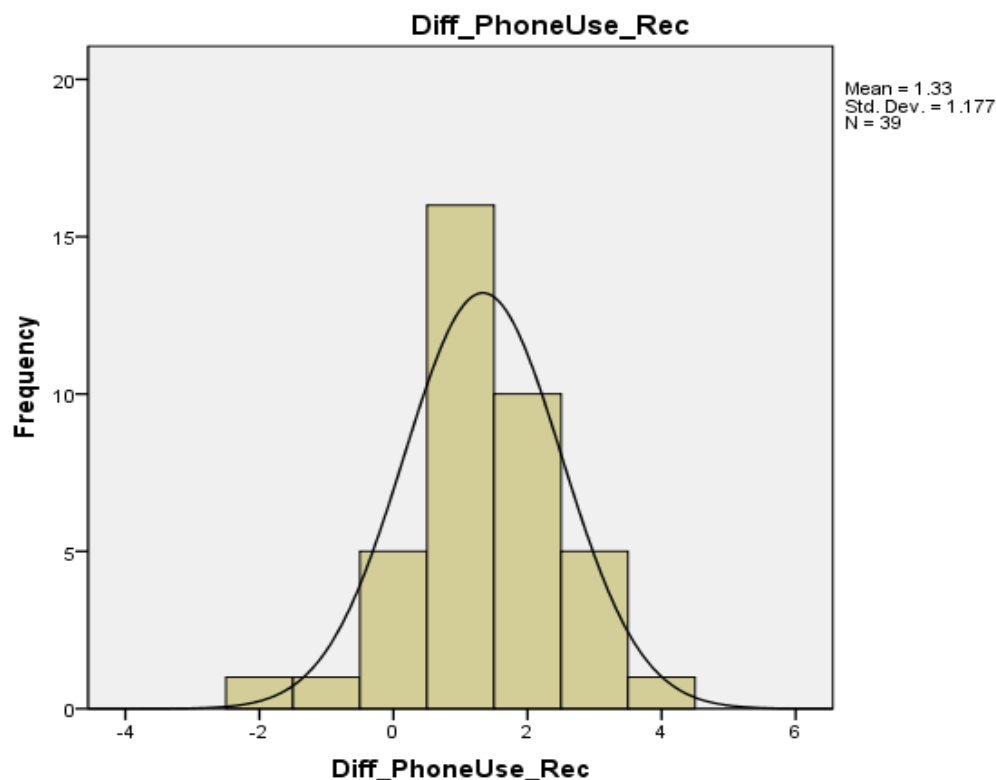
Figure 3. Histogram of difference between pre and post answers for mobile phone use (recoded)

Table 1. Paired samples statistics for mobile phone use norms (median values and recoded)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PhoneUse_pre	40.128	39	19.8261	3.1747
	PhoneUse_post	18.590	39	15.8197	2.5332
Pair 2	PhoneUse_preRec	3.31	39	1.004	.161
	PhoneUse_postRec	1.97	39	.986	.158

Table 2. Paired samples test for mobile phone use norms (median values and recoded)

| | | Paired Differences | | | | |
| | | 95% Confidence Interval of the Difference | | | | |
		Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	PhoneUse_pre - PhoneUse_post	14.6805	28.3964	6.358	38	.000
Pair 2	PhoneUse_preRec - PhoneUse_postRec	.952	1.715	7.073	38	.000

The difference between pre-intervention and post intervention answers for social norms is 21.54%: from the perceived average of 40.13% drivers using their mobile phone while driving, before the intervention to a perceived average of 18.59% drivers using their mobile phone while driving, after the intervention. The paired test reveals a Sig. (2-tailed) of .000 (<.05), which indicate that there is a significant difference between the two sets of answers.

In recoded levels, the perceived norm of drivers using their mobile phone while driving changes from 3.31 (high proportion) to 1.97 (low proportion). The test also reveals a Sig. (2-tailed) of .000 (<.05), meaning that there is a significant difference between the two sets of answers.

Perceived Risk (Vulnerability)

The perceived risk represented by three different activities was investigated for this section: texting while driving, watching videos while driving, and talking on the mobile phone while driving. Paired T-tests were conducted to assess the significance of the differences between the pre-intervention and post intervention responses.

The histograms for the differences between pre-intervention and post intervention answers show distribution close to the normal distribution for all three variables.
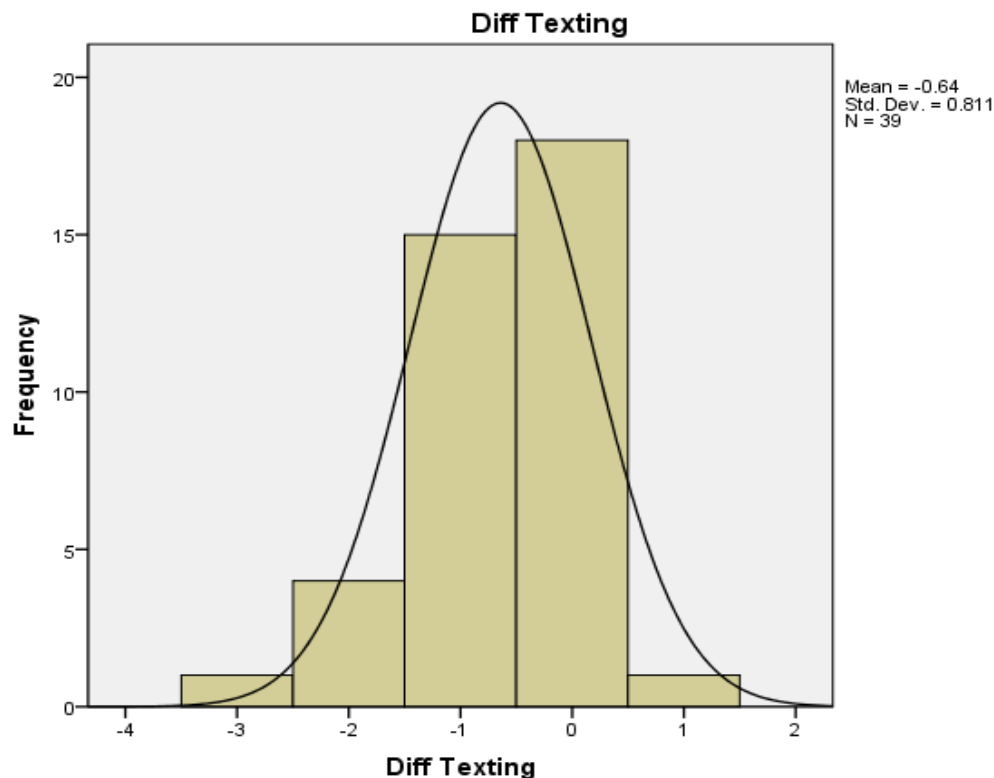
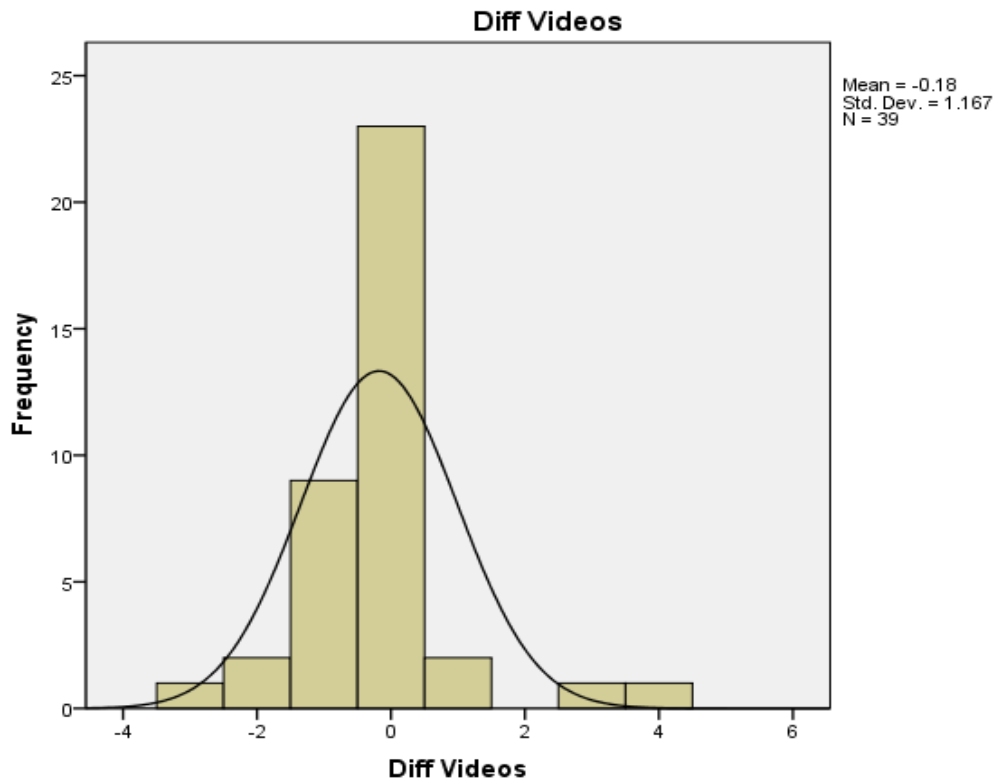**Figure 4**. Histogram of difference between pre and post answers for texting

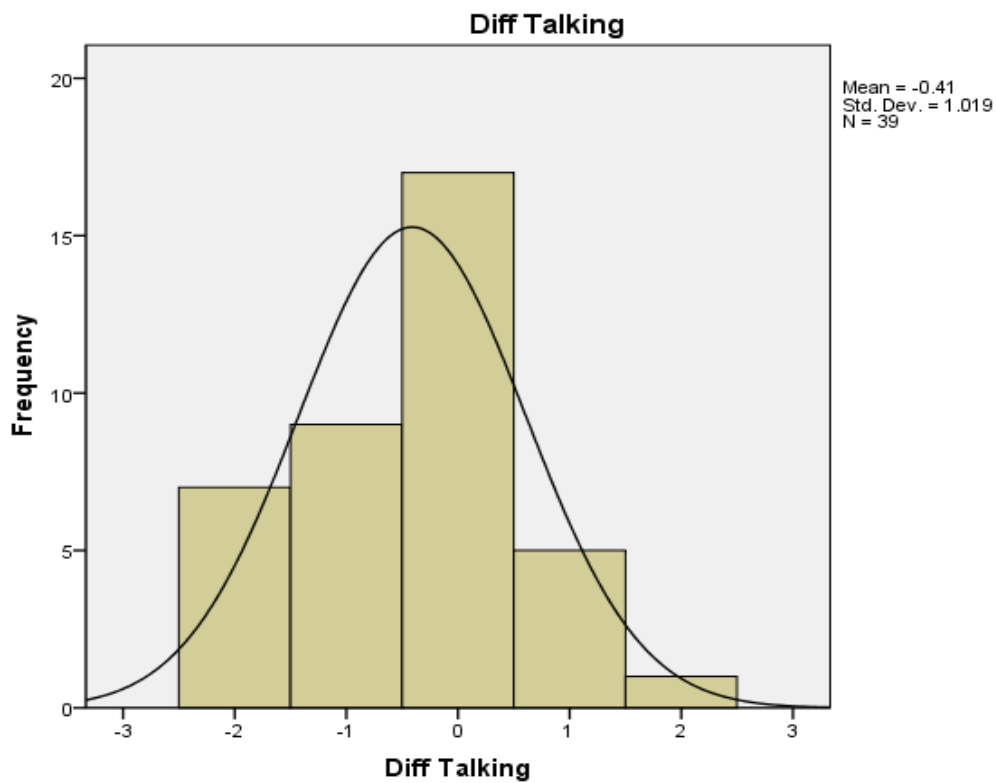**Figure 5**. Histogram of difference between pre and post answers for videos

Figure 6. Histogram of difference between pre and post answers for talking on the phone

Table 3. Paired samples statistics for mobile phone use risk (vulnerability)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Texting Pre	3.84	38	.789	.128
	Texting Post	4.50	38	.647	.105
Pair 2	Videos Pre	4.26	38	.760	.123
	Videos Post	4.45	38	.891	.145
Pair 3	Talking Pre	3.66	38	.909	.147
	Talking Post	4.08	38	.784	.127

Table 4. Paired samples test for mobile phone use risk (vulnerability)

		Paired Differences				
		95% Confidence Interval of the Difference				
		Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Texting Pre - Texting Post	-.926	-.390	-4.979	37	.000
Pair 2	Videos Pre - Videos Post	-.573	.204	-.961	37	.343
Pair 3	Talking Pre - Talking Post	-.760	-.082	-2.520	37	.016

For texting while driving, the average perceived risk was 3.84 before intervention and 4.50 after the intervention on a scale from 1 to 5 where 1 means that the behaviour is extremely unlikely to result in a crash and 5 means that the behaviour is extremely likely to result in a crash. Although the behaviour was perceived to be likely to result in a crash before the intervention, the answers post interventions are significantly different (Sig. (2-tailed) = .000 < .05) moving the average to extremely likely.

Similarly, for talking on the mobile phone while driving, the average perceived risk was 3.66 before the intervention and 4.08 after the intervention, moving the perceived risk towards extreme likelihood that the behaviour will result in a crash. The difference between the two sets of answers is also statistically significant (Sig. (2-tailed) = .016 < .05).

For the behaviour of watching videos while driving, the likelihood of resulting in a crash also increased but, because the likelihood of resulting in a crash was perceived to be very high before the intervention, the difference between the two sets of answers is not statistically significant (Sig. (2-tailed) = .343 > .05).

Willingness

The willingness to engage in the same three different risky activities was investigated for this section: texting while driving, watching videos while driving, and talking on the mobile phone while driving. Paired T-tests were also conducted to assess the

significance of the differences between the pre-intervention and post intervention responses.

The histograms for the differences between pre-intervention and post intervention answers show distribution close to the normal distribution for all three variables.
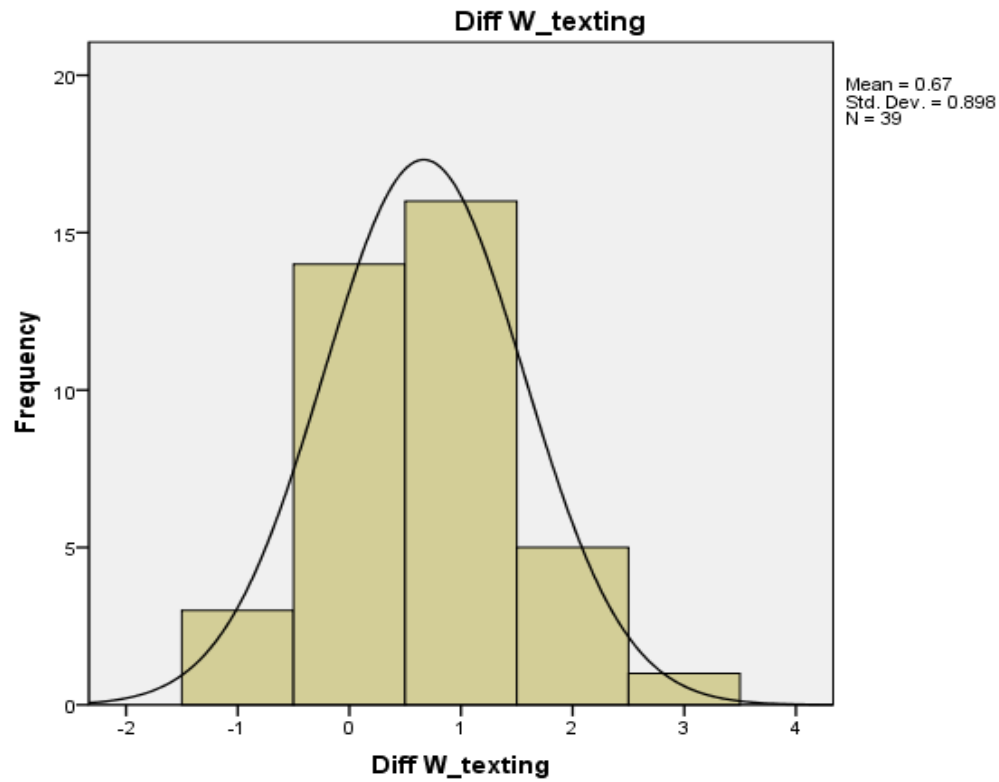
Figure 7. Histogram of difference between pre and post answers for willingness for texting
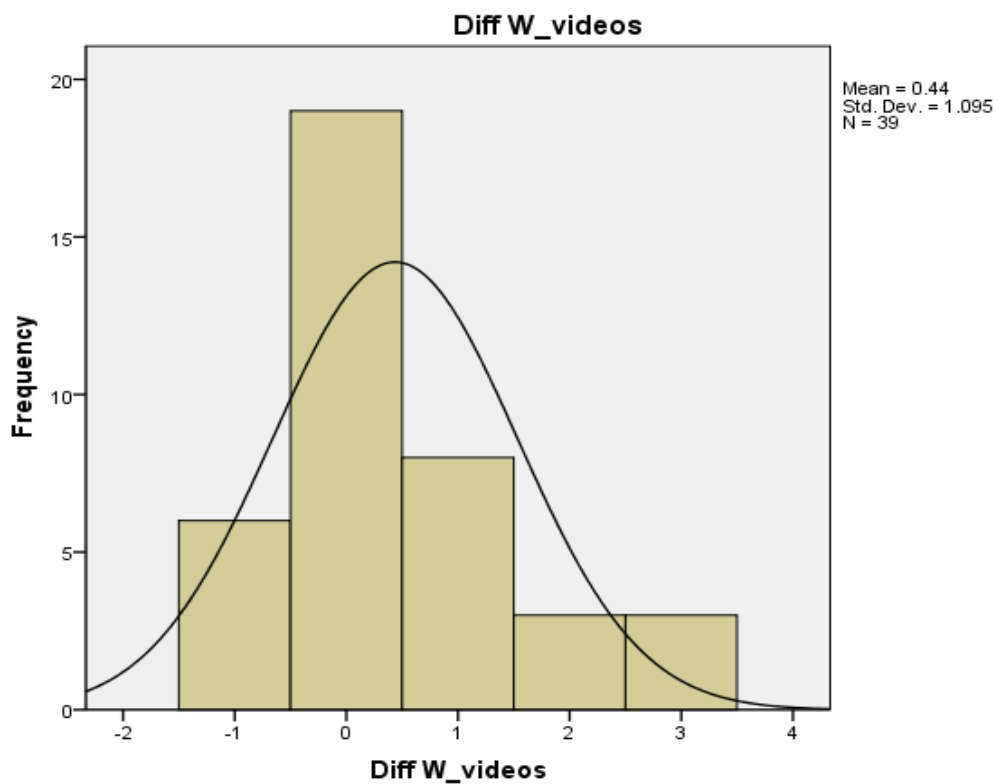
Figure 8. Histogram of difference between pre and post answers for willingness for videos
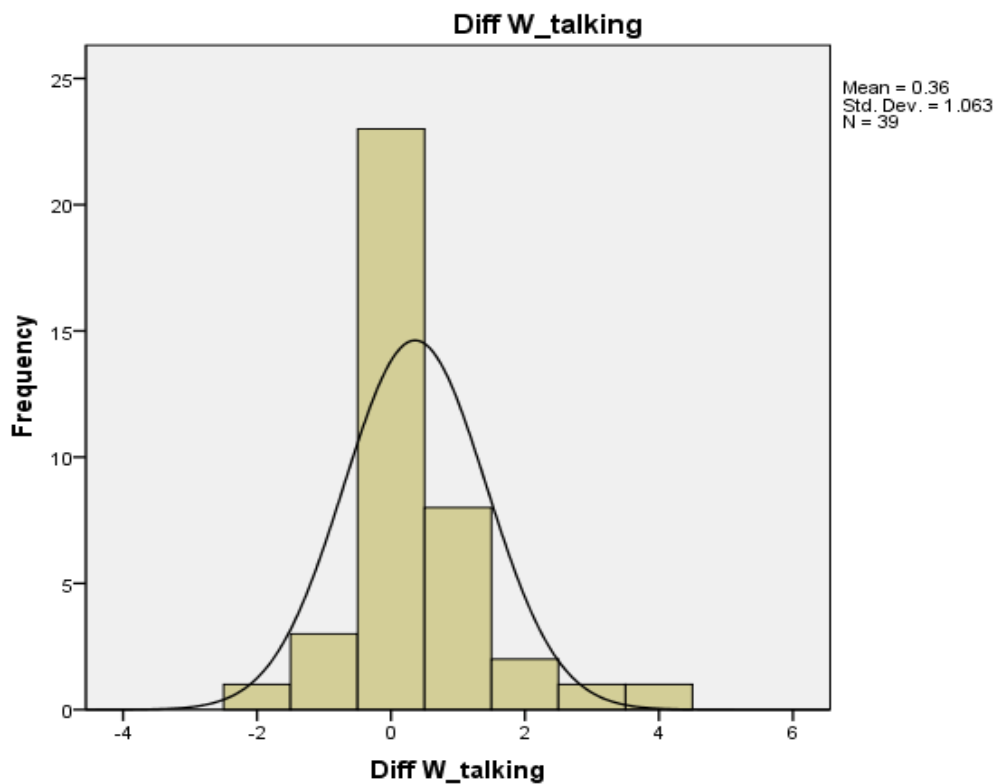

Figure 9. Histogram of difference between pre and post answers for willingness for talking on the mobile phone

Table 5. Paired samples statistics for mobile phone use willingness

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	W_Texting Pre	3.00	38	1.139	.185
	W_Texting Post	2.32	38	.989	.160
Pair 2	W_Videos Pre	2.08	38	1.171	.190
	W_Videos Post	1.63	38	.913	.148
Pair 3	W_Talking Pre	2.71	38	1.393	.226
	W_Talking Post	2.34	38	1.146	.186

Table 6. Paired samples test for mobile phone use willingness

		Paired Differences				
		95% Confidence Interval of the Difference				
		Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	W_Texting Pre – W_Texting Post	.387	.981	4.668	37	.000
Pair 2	W_Videos Pre – W_Videos Post	.083	.811	2.490	37	.017
Pair 3	W_Talking Pre – W_Talking Post	.015	.722	2.111	37	.042

For texting while driving, the average willingness to engage in the behaviour was 3.00 before intervention and 2.32 after the intervention on a scale from 1 to 5 where 1 means not at all willing to engage in the behaviour and 5 means very willing to engage in the behaviour. If before the intervention, the participants were not sure about their willingness to engage in the behaviour, after the intervention they became unwilling to engage in the behaviour. The two sets of answers are also significantly different (Sig. (2-tailed) = .000 < .05).

For talking on the mobile phone while driving, the average willingness to engage in the behaviour was 2.08 before intervention and 1.63 after the intervention, moving the willingness towards not at all willing to engage in the behaviour. The difference between the two sets of answers is also statistically significant (Sig. (2-tailed) = .017 < .05).

For watching videos while driving, the average willingness to engage in the behaviour was 2.71 before intervention and 2.34 after the intervention moving the average willingness towards unwilling to engage in the behaviour. The difference between the two sets of answers is also statistically significant (Sig. (2-tailed) = .0.42 < .05).

Comparison group results

Previously collected evidence from an intervention using the original format was available, giving the opportunity to conduct an analysis. Social norms were the only element where the evidence collected was comparable to the pilot, giving the opportunity for a similar analysis.

The question used for the comparison intervention questionnaire was identical to the one used in the questionnaire developed for the pilot evaluation.
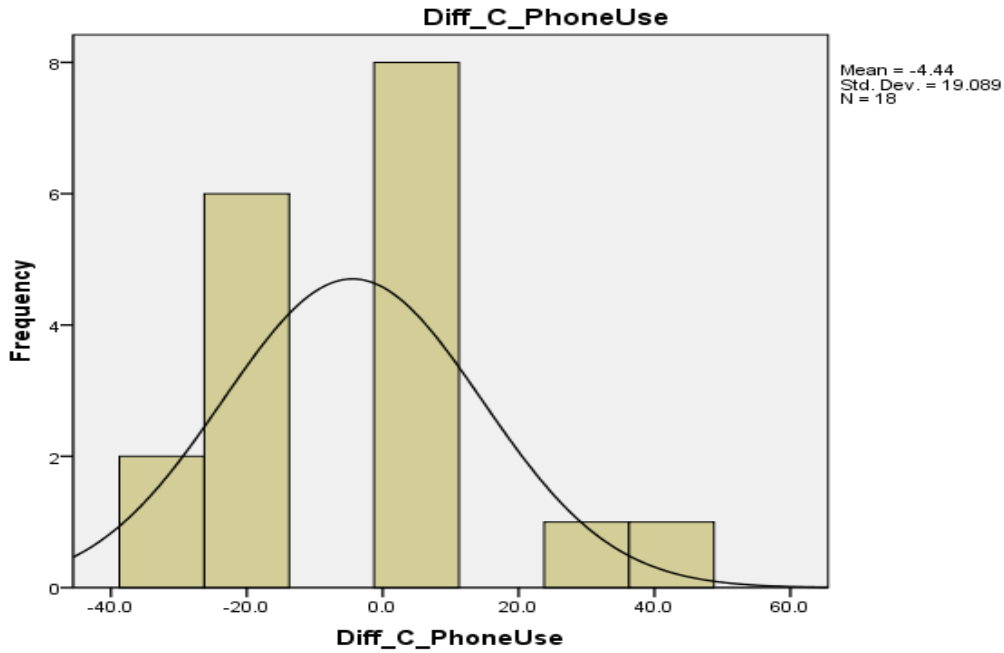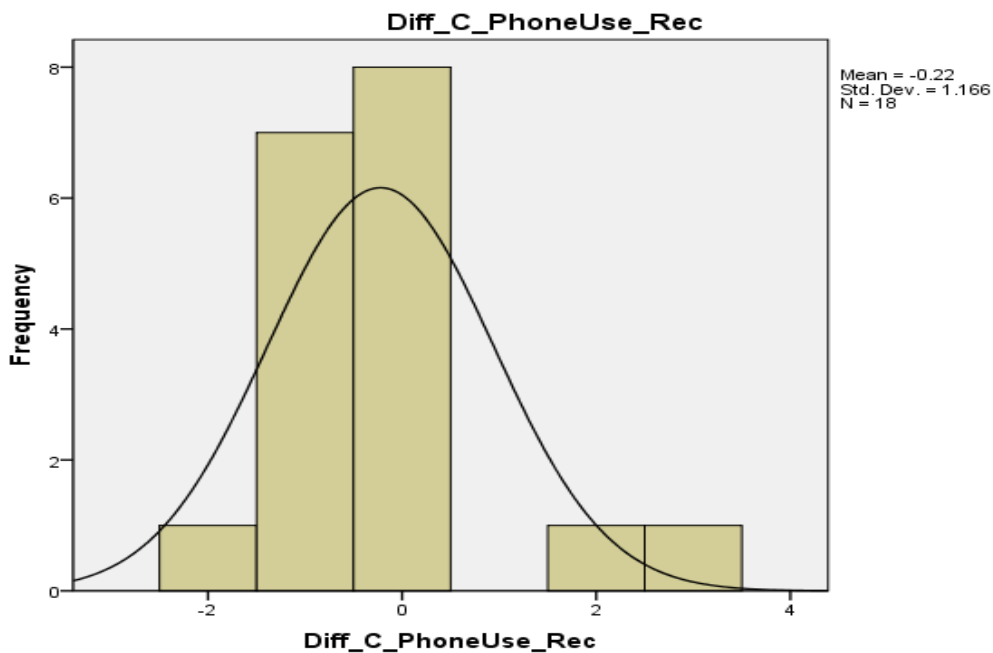

Figure 10. Histogram of difference between pre and post answers for mobile phone use (median) - comparison

Figure 11. Histogram of difference between pre and post answers for mobile phone use (recoded) - comparison

Table 7. Paired samples statistics for mobile phone use norms (median values and recoded) – comp.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	C_PhoneUse_pre	34.167	18	17.2993	4.0775
	C_PhoneUse_post	29.722	18	13.0296	3.0711
Pair 2	C_PhoneUse_preRec	3.00	18	.970	.229
	C_PhoneUse_postRec	2.78	18	.986	.191

Table 8. Paired samples test for mobile phone use norms (median values and recoded) – comp.

		Paired Differences				Sig. (2-tailed)
		95% Confidence Interval of the Difference		t	df	
		Lower	Upper			
Pair 1	C_PhoneUse_pre – C_PhoneUse_post	-5.0482	13.9370	.988	17	.337
Pair 2	C_PhoneUse_preRec – C_PhoneUse_postRec	-.358	.802	.809	17	.430

The difference between pre-intervention and post intervention answers is 4.44%: from the perceived average of 34.17% drivers using their mobile phone while driving, before the intervention to a perceived average of 29.72% drivers using their mobile phone while driving, after the intervention. The paired test reveals a Sig. (2-tailed) of .337 (>.05), which indicate that there is no significant difference between the two sets of answers.

In recoded levels, the perceived norm of drivers using their mobile phone while driving changes from 3.00 to 2.78. The test also reveals a Sig. (2-tailed) of .430 (>.05), meaning that there is no significant difference between the two sets of answers.

Table 9. Wilcoxon Signed Ranks Test

	C_PhoneUse_post - C_PhoneUse_pre	C_PhoneUse_postRec - C_PhoneUse_postRec
Z	-.925[a]	-.953[a]
Asymp. Sig. (2-tailed)	.355	.340

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

A nonparametric test was also undertaken, the Wilcoxon Signed Rank Test (See Table 9.) which is the nonparametric equivalent for Paired sample parametric test.

This test was performed to strengthen the findings (being a small sample one can argue that a parametric test is less appropriate). The nonparametric test revealed the same findings as the parametric paired sample test, that there is no significant difference between the two sets of answers or recoded answers (Sig. (2-tailed) of .355 (>.05) and Sig. (2-tailed) of .340 (>.05) respectively).

4. DISCUSSION AND CONCLUSIONS

Among behavioural scientists, health professionals and practitioners, the concern associated with the frequent use (and preference) of strong physical threats to target young people is more often criticised and exploration of alternative, non-threat-based, approaches is encouraged (Lewis, et al., 2007). At the same time, there is increasing recognition that interventions to change behaviour should draw, in their development, on theories of behaviour and behaviour change (Michie, et al., 2008), and evidence and practical issues (French, et al., 2012). Theory can be used to understand the behaviour; evidence can inform which behaviours can be changed; and the practical issues can determine which BCTs are feasible with the available resources (French, et al., 2012). Also, using theory in designing the interventions provides at least three important advantages: interventions are likely to be more effective because the mechanisms and the determinants of change are understood; theories can be tested and developed further; and theory-based interventions facilitate an understanding of what works and are a basis for developing better theories (Michie, et al., 2008).

The intervention presented in this paper is theory informed and evidence based. It starts from the evidence which informs about the behaviours that need to be changed. The theory is then used to explain the mechanisms of behaviour creation. Finally, the theory provides indications for intervention development and design in order to affect those elements of behaviour more likely to induce the desired behaviour change.

The first step in developing the intervention was to look at the evidence. The evidence, also backed by a growing body of research suggests that distracted driving and especially distracted driving among novice drivers is an increasing issue in road safety (Klauer, et al., 2013) (Durbin, et al., 2014). As one of the most dangerous distractions among young drivers, mobile phone use is a growing problem both in terms of proportion and in terms of the ways to be distracted with the help of the mobile phone while driving (World Health Organization, 2011) (Asbridge, et al., 2013) (Strayer & Drews, 2004) (Lee, et al., 2013).

The second step was to search for the newest theoretical frameworks in an attempt to understand how behavioural processes work and how behaviour can be changed or influenced. For this particular age group, the Prototype Willingness Model (Gerrard, et al., 2008) was considered to be the most appropriate framework from at least two perspectives: Firstly the PWM gives special consideration to the

characteristics the target age group manifest when engaging in a behaviour; behaviours which are less planned and intended and more socially determined; and secondly the PWM offers indications about the behavioural elements and the way they should be affected in order to change or influence risky behaviour in the target age group. More precisely for this intervention, the theory suggests that (1) social norms that mirror high proportions of peers engaging in the behaviour will elevate the willingness to engage in the behaviour and (2) low levels of perceived vulnerability or personal risk related to the engagement in a behaviour will also elevate the willingness to engage in the behaviour. Thus, decreasing the perceived social norms level and increasing the level of perceived vulnerability will result in lower levels of willingness to engage in the behaviour.

Using positive, self-reflective behaviour change techniques incorporated in innovative game-like and group activities, the intervention had a focus on decreasing social norms and increasing perceived vulnerability for dangerous behaviours among novice drivers. Most of the participants being pre-drivers, the intervention aimed to prevent the future adoption of the behaviour where it is not yet present. For the use of mobile phones while driving, the objectives of lowering the social norms levels and increasing the perceived vulnerability were fulfilled, and that resulted in a significant decrease in willingness to engage. Notable here is that, even if for one of the analysed actions (watching videos while driving) the perceived risk did not significantly increase (because of a very high initial level), the synergy between the increased vulnerability and the decreased social norms determined a significant decrease in willingness to engage in the behaviour.

The intervention not only successfully fulfilled its objectives, it also reinforced and practically tested a part of the PWM framework. Giving the resources and the size of the samples that currently can be affected, evaluating the actual behavioural change is unrealistic. That is a future step that will require more resources and larger samples.

Conclusion

The primary aim of this paper was to propose a new way of altering social norms, perceived vulnerability and willingness in road safety interventions aimed at adolescents. The paper presents an alternative to the over-used and not proven to work fear- arousal techniques that feature as default options for road safety interventions. Based on latest research and theory and developed following a robust methodology, the pilot intervention showed better results than previous or comparator interventions, fulfilling its specific objectives and delivering change for the targeted behavioural elements, reinforcing in the same time a part of the PWM framework. The pilot intervention showed that positive and self-reflective BCTs are efficient in altering social norms, perceived vulnerability, and as a consequence the willingness for young drivers or for pre-drivers to engage in risky behaviours.

References

Ajzen, I., 1985. From intentions to actions: A theory of planned behavior. *Action Control. From Cognition to Behaviour,* pp. 11-39.

Asbridge, M., Brubacher, J. & Chan, H., 2013. Cell phone use and traffic crash risk: a culpability analysis. *International Journal of Epidemiology,* Volume 42, pp. 259-267.

Carey, R., McDermott, D. & Sarma, K., 2013. The Impact of Threat Appeals on Fear Arousal and Driver Behaviour: A meta-Analysis of Experimental Research 1990-2011. *PLoS ONE,* 8(5).

Department for Transport, UK, 2015. *Facts on Young Car Drivers,* s.l.: s.n.

Department for Transport, 2014. *Seat belt and mobile phone use surveys: England and Scotland,* s.l.: s.n.

Durbin, D., McGehee, D., Fisher, D. & McCartt, A., 2014. Special Consideration in Distracted driving with Teens.

French, S. et al., 2012. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. *Implementation Science,* Volume 7.

Gerrard, M. et al., 2008. A dual-process approach to health risk decision making: The prototype willingness model. *Develomental Review,* Volume 28, pp. 29-61.

Groeger, J., 2000. Understanding Driving: Applying Cognitive Psychology to a Complex Everyday Task. *Hove.*

Hall, J. & West, R., 1996. Role of formal instruction and informal practice in learning to drive. *Ergonomics,* 39(4), pp. 693-706.

Hanna, C., Hasselberg, M., Laflamme, L. & Moller, J., 2010. Road traffic crash circumstances and consequences among young unlicensed drivers: A Swedish cohort study on socioeconomic disparities. 10(14).

Hoekstra, T. & Wegman, F., 2011. Improving the effectiveness of road safety campaigns: Current and new practices. *International Association of Traffic and Safety Sciences,* Volume 34, pp. 80-86.

Jonah, B., 1986. Accident risk and risk-taking behaviour among young drivers. *Accident, Analysis & Prevention,* 18(4).

Klauer, S. et al., 2013. Distracted Driving and Risk of Road Crashe among Novice and Experienced Drivers. *The New England Journal of Medicine,* Volume 370, pp. 54-59.

Lee, V., Champagne, C. & Francescutti, L., 2013. Fatal Distraction. Cell phone use while driving. *Canadian Family Physician,* Volume 59.

Lewis, I., Watson, B., Tay, R. & White, K., 2007. The Role Of Fear Appeals in Improving Driver Safety: A review of the Effectiveness of Fear-arousing (threat) Appeals in Road Safety Advertising. *International Journal of Behavioral Consultation and Therapy,* 3(2).

Mayhew, D., H.M., S. & Pak, A., 2003. Changes in collision rates among novice drivers during the first months of driving. *Accident, Analysis & Prevention,* 35(3), pp. 683-691.

McCartt, A., Shabanova, V. & Leaf, W., 2003. Driving experience, crashes and traffic citations of teenage beginning drivers. *Accident, Analysis & Prevention,* 35(3), pp. 311-320.

Michie, S. et al., 2008. From Theory to Intervention: Mapping Theoretically Derived Behavioural Determinants to Behaviour Change Techniques. *The International Association of Applied Psychology,* 57(4), pp. 660-680.

Michie, S. et al., 2013. The Behaviour Change Technique Taxonomy (v1) of 93 Hierarhically Clustered Techniques: Building an International Consensus for the Reporting of Behaviour Change Interventions. *Annals of Behavioural Medicine,* Volume 46, pp. 81-95.

RAC , 2016. *Report on Motoring,* UK: s.n.

Redelmeier, D. & Tibshirani, R., 1997. Association between cellular-telephone calls and motor vehicle collisions. *The New England Journal of Medicine,* 336(7).

Simons-Morton, B. et al., 2011. Crash and Risky Driving Involvement Among Novice Adolescent Driver and Their Parents. *American Journal of Public Health,* 101(12).

Strayer, D. & Drews, F., 2004. Profiles in driver distraction: effects of cell phone conversation on younger and older drivers. *Human Factors,* 46(4).

Strayer, D., Drews, F. & Johnston, W., 2003. Cell Phone-Induced Failures of Visual Attention During Simulated Driving. *Journal of Experimental Psychology,* 9(1), pp. 23-32.

Williams, A., 2003. Teenage drivers: patterns of risk. *Journal of Safety Research,* Volume 34, pp. 5-15.

World Health Organization, 2011. *Mobile Phon Use: A growing problem of driver distraction,* s.l.: s.n.