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Usage of Social Media To Engage With Malaysian Youths Concerning Road Safety Awareness

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Abstract
Researchers and policymakers are intrigued by the challenge of promoting safer driving behaviours among road users. Behavioural economics contends that human decisions often rely on heuristics rather than strict rationality. Nudging theory acknowledges the prevalence of heuristic thinking and suggests that desired behaviour changes can be prompted with minimal visual and linguistic cues. This study therefore aimed to identify specific types of nudges that can increase the salience and value of safe driving behaviour among young citizens in Malaysia aged 17 to 25. This study employed a mixedmethods research design, which involved two distinct phases. The first phase, referred to as Study I, utilised qualitative research methods. Specifically, focus group discussions were conducted with students to gain insights into their perspectives and lived experiences concerning road safety. The primary aim of this phase was to identify and elucidate key themes related to road safety. In the second phase, denoted as Study II, quantitative research methods were utilised, where an online experiment was conducted. This experiment intended to evaluate the effectiveness of various campaign messages in motivating young individuals to embrace safe driving behaviours. Focus group discussions resulted in four main themes. Based on the four themes, relevant visual stimuli were created and tested in an online Facebook group experiment with 337 participants (N=337) in a pre-post-test design. Participants were asked to complete a safe driving attitude test at baseline and after three weeks. During this time, the three experimental groups were exposed to the visual stimuli via a Facebook discussion. Results showed that concern for family was most significant, followed by overconfidence. Reframing was not significant. The results provide important information that can be used to prepare road safety campaigns that could produce positive behavioural changes related to safe driving.

Keywords
Road safety; Nudging; Young citizen; Risk perception; Facebook

Introduction

Changing the behaviour of road users toward safer behaviour is a topic of great interest to researchers, practitioners, and policy makers. It is fair to say that the major considerations in this area are heavily influenced by assumptions about rational behaviour. Policy makers, however, have embraced the idea that a better understanding of the behaviour of individual actors will enable

more effective policy through "nudging" (Lodge & Wegrich., 2016). One of the key implications of behavioural research is that it is possible to apply the insights of bounded rationality theory to correct the inconsistencies in citizens' behaviour and bridge the gap between their intentions to drive safely and their actual unsafe driving behaviour.

The Malaysian Institute of Road Safety Research reported 521,466 road accidents in 2016, including 7152 fatal accidents (Malaysian Institute of Road Safety Research [MIROS], 2019). This represents an increase of 31,860 road accidents compared to 2015 and is part of a longer trend, as statistics show a 241% increase in accidents between 1997 (215,632) and 2016 (521,466) (MIROS, 2019). Globally, about 3.1 Million people dies in road accidents every year even though authorities take initiatives to create driving safety awareness among road users (WHO, 20 June 2022).

Statistics from the World Health Organisation (WHO) also show that Malaysia has the third highest rate of traffic accidents in the world and that 7000-8000 people die in traffic accidents each year (WHO, 2017). According to the Malaysian Minister of Transport, road safety is a priority for the government because, in addition to the personal tragedy and impact on those directly involved, it also represents a great loss to the country, both in terms of human capital and economic costs. In 2017, the Malaysian Road Safety Research Institute (MIROS) reported that road traffic accidents imposed a significant economic burden of approximately RM9.28 billion on the nation's economy (MIROS, 2019).

Research findings suggest that human error in driving is the main contributing factor to road accidents in Malaysia (Ismail, 2017). Suraji and Tjahjono (2012), mentioned that 80-90 percent of traffic accidents are due to human behaviour. Similarly, a study by Idris et al. (2019) found that human behaviour is the leading cause of traffic accidents in Malaysian. Research also shows that there are two other factors, namely the vehicle and road conditions, that contribute to traffic accidents (Darma et al., 2017; Harith & Mahmud, 2018).

In addition to these general trends, accident rates in Malaysia are much higher on festive days such as "Hari Raya Aidilfitri (Eid al-Fitr)," "Chinese New Year," and "Deepavali (Diwali)" compared

to normal days. Most of the fatal traffic accidents occur during the festive season (Shaadan et al., 2021). For example, in the first six months of 2019, approximately 281,527 traffic accidents were recorded in Malaysia (Malay Mail., 17 July 2019). During the same period in 2018, a total of 274,556 traffic accidents were recorded, which was a 2.5% increase in the number of accidents in comparison (Malay Mail, 17 July 2019). Government agencies and non-governmental organisations in Malaysia have conducted various activities and campaigns to increase road safety among the Malaysian population (Darma et al., 2017). However, despite the good intentions of the campaigns, the number of traffic accidents has not decreased to date. Thus, it is necessary to investigate what kind of messages can persuade road users to change their behaviours toward safe driving. This study therefore has two objectives: (1) to investigate Malaysian youths' road safety concerns and driving practices, and (2) to develop nudges based on key road safety issues and test their effectiveness among Malaysian youths.

Literature Review

Redhwan and Karim (2010) examined the knowledge and attitudes toward traffic safety of 109 university students with a mean age of 20.94 years, 36% of whom had already suffered one or two accidents. Regression analysis showed that age and attitude were significantly correlated with traffic accidents. Malaysian students have moderate knowledge of road safety rules and regulations and also believe that traffic accidents are caused by lack of awareness of traffic rules (Redhwan & Karim, 2010). Sultan et al. (2016) showed among university students that human error behaviours such as impatience, carelessness, selfishness and dangerous driving contribute most to traffic accidents. Abdelfatah (2016) also argues that human factors such as careless exiting, negligent signalling, careless driving, dangerous turning and overtaking, tailgating, and excessive speed contribute to traffic accidents.

Road safety campaigns in Malaysia generally use traditional, linear media such as radio and television. No social media campaigns have yet been conducted using nudging theory. Social media is very popular among young people. Therefore, we believe that social media could be successfully used to increase awareness of road safety. Hence, in this study, social media was used to raise young people's awareness of road safety, and the effectiveness of different types of

messages was measured.

Behavioural economics is a new branch of research that seeks to understand behaviours that deviate from the predictions of rational choice models by incorporating insights from behavioural sciences, cognitive psychology, and social psychology into economics and giving more weight to motives and behaviours that are sometimes called "irrational" (Avineri & Goodwin, 2010). Research in the behavioural sciences, particularly in cognitive psychology, shows that individuals' decisions deviate from the predictions of rational behaviour in a variety of contexts. Some of these deviations are systematic, consistent, robust, and largely predictable (Tversky & Kahneman, 1974; Kahneman & Tversky, 1979). Herbert Simon emphasised the importance of emotions as a determinant of behaviour and decisions, considered intuition and heuristics in decision processes, and coined the term "bounded rationality." Simon (1956) questions the use of economic theories of rational behaviour as a basis for explaining the characteristics of human rationality. He argues that a person's behaviour should be understood in relation to his or her environment.

Recent research in the behavioural sciences suggests that individuals' decisions in a variety of contexts deviate from the predictions of the rational-person paradigm-which has inspired research on the bounded rationality of travellers (see, e.g., the special issue of Avineri & Chorus, 2010), with less evidence for direct application to the behaviour of road users. Laibson and Zeckhauser (1998) see behavioural economics as a field that is "sceptical of perfect rationality, emphasises validation of modelling assumptions, integration of microdata into decisions (including experimental data), and adoption of lessons from psychology. "Since one of the goals of the social sciences is to provide explanations and predictions of human behaviour, behavioural economics aims to "increase the exploratory and predictive power of economic theory by giving it a more psychologically plausible foundation" (Camerer, 1999). A second picture of human decision making has emerged: In this framework, it is assumed that there are forms of forbidden irrationality and that our brains formulate judgments and evaluations (e.g., in the face of uncertainty) through mental shortcuts that even help us make decisions.

According to this model, we make our decisions largely on the basis of what psychologists call

"System 1" or fast thinking, using mental shortcuts that may be due to emotion, rather than relying on "System 2" or slow thinking. We should not think of systems 1 and 2 as two separate parts of our brain, but rather as two different modes of functioning (Kahneman, 2011). This division into two modes of thinking, "slow" and "fast" thinking, attempts to account for the fact that people sometimes make weighted decisions by using only a fraction of the available information and relying on a quick but inaccurate assessment.

Methodology

A mixedmethods approach was used in this study. The mixedmethods approach has proven to be extremely beneficial in developing novel and improved interventions for road safety awareness campaigns (von Beesten & Bresges., 2022; Peden at al., 2004). In addition, the mixedmethods approach allows studies to focus on culturally identified community problems within socio-ecological and socio-cultural frameworks (Landsverk et al., 2012). Thus, integrating mixedmethods into road safety campaign research offers distinct advantages. By simultaneously applying quantitative and qualitative approaches, researchers can comprehensively explore the multiple factors that influence road safety behaviours and awareness in a given community (von Beesten & Bresges., 2022). Therefore, this study was conducted in two phases: Study I: A qualitative study that used focus groups with students to understand their views and experiences related to road safety and to identify key themes. Study II: An online experiment that tested different types of campaign messages to encourage youths to adopt safe driving behaviours.

Approval for this study's ethical considerations was granted by the Institutional Review Board of both Universiti Tunku Abdul Rahman, Malaysia and the University of Leicester, United Kingdom. Prior to participation, all participants were thoroughly informed about the study's objectives and methodologies. Each participant willingly engaged in the study by signing an informed consent form, signifying their understanding of the study's nature and their voluntary involvement. This process ensured that ethical guidelines were strictly adhered to and that participants' rights and well-being were safeguarded throughout the research process.

Study I: A qualitative investigation of Malaysian youths' road safety concerns and driving practices

Qualitative data were collected through focus group discussions. Three focus group discussions were conducted with 6, 8, and 9 members per group. The focus group members were from Universiti Tunku Abdul Rahman, Malaysia and undergraduates from programs such as Corporate Communications, Journalism, Game Development, Media and Creative Studies, Digital Animation, and Broadcasting. The strategy of purposive convenience sampling was used to identify the samples for the study.

This study was designed to examine the road safety concerns and driving experience among young people, particularly those aged 17 to 25 years, using a descriptive narrative design. The duration of the focus group discussion ranged from 45 to 60 minutes. The focus group discussions were recorded with the informed consent of the participants. A thematic analysis approach was used to analyse the data from the focus groups.

The purpose of the focus groups was to gather contextual social and cultural information about driving practices in Malaysia, including whether unsafe driving practices were associated with particular social groups, which actors were involved in providing information about safe driving: Police, NGOs, etc., and what their experiences with unsafe driving had been. The goal of the focus groups was also closely related to the second phase of the study's empirical research: the online experiment. Specifically, the goal was to analyse key themes and prepare interventions for the experiments.

Focus group discussions were prompted on scenarios such as social proof, overconfidence, and availability. Social proof refers to the positive influence that occurs when someone learns that others are doing something. Respondents were asked to discuss how many of their peers they thought took safety measures when driving, such as wearing a seatbelt, keeping a safe distance, etc. Overconfidence is defined as an estimate of the risk involved in driving. For example, respondents may be asked about how many meters it took them to stop their car at a speed of 50

km/h. The appropriate answer is 24 meters. Different scenarios could be created to trigger a discussion about risk assessment. Availability heuristic is an examination of how respondents determine the locus of responsibility for the lack of safety on the road: What reasons came to mind first? Who or what do they thought was the main cause?

Study II: Online experiment- A test the effectiveness of campaign messages in nudging Malaysian youths toward safe driving

Online experimentation has gained considerable traction as a recommended research approach and offers a variety of benefits that researchers are increasingly recognizing (Veltri, 2023; Veltri, 2019). A primary advantage of online experiments is the accessibility and diversity of participants (Van Quaquebeke et al., 2022). The digital landscape removes geographic boundaries and allows researchers to engage with a larger and more diverse pool of participants, resulting in more representative samples (Gosling et al., 2004; Reips, 2002). In traditional survey-based studies, participant recruitment can be time-consuming and limited by logistical challenges. In contrast, online experiments can recruit participants quickly, which can accelerate the research timeline (Birnbaum, 2004).

Hence, the second phase of this research project integrated an online-based experiment. An experimental design employing a between-subjects approach (BSD) was selected. Utilizing the Facebook platform, participants were randomly assigned across four distinct groups (as illustrated in Figure 1 and Figure 2). Participant recruitment occurred through the Facebook platform and email correspondence. The study encompassed participants from six higher learning institutions, both public and private, situated in the Klang Valley, Malaysia. The age range of the study participants spanned from 18 to 25 years old.

Initially, a total of 400 participants were recruited, but the final phase of the study only included 337 participants. The participants received a compensation of MYR50.00 (equivalent to approximately USD10.68) for their study involvement. The participants' mean age and standard deviations were as follows: Group 1: Mean age 20.7 (SD = 1.67), Group 2: Mean age 20.8 (SD =

1.61), Group 3: Mean age 20.8 (SD = 1.66), and Group 4: Mean age 20.9 (SD = 1.87).

The experiment was conducted within Facebook groups and involved a one-week discussion period, followed by a one-week break and identifying central actors within the groups. This sequence was then followed by the final week, during which the nudge was introduced, while also gauging participants' attitudes toward safe driving (refer Figure 1 and Figure 2).

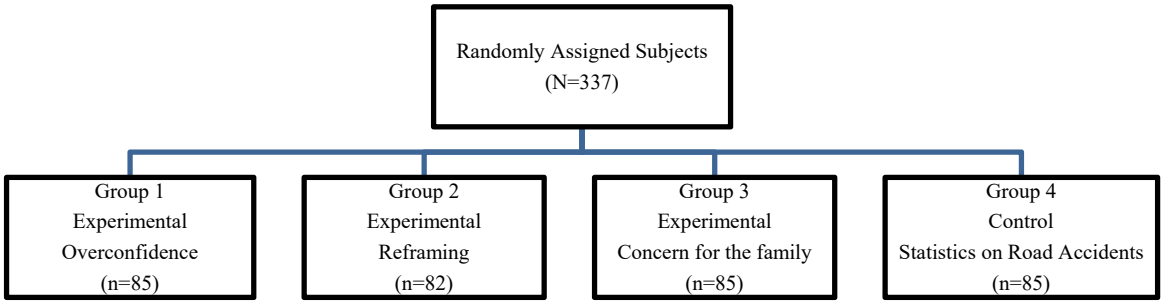

Figure 1. Experimental groupings

Week 1	All groups started with general discussion
Week 2	One week interval, in the meantime we identified central actors for the groups
Week 3	All groups discuss each of the different messages as described in the experiment layout

Figure 2. Procedure of implementation

The Attitudes toward Safe Driving Scale (ASDS) was used to measure participants' attitudes toward safe driving (Masuri et al., 2016). The questionnaire comprises 46 items and employs a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). This scale, previously utilized in Malaysia, was translated, and its cross-cultural validity established (Masuri et al., 2016). The reliability alpha value for the ASDS was recorded at .839 (Masuri et al., 2016).

In accordance with the findings of the focus groups, the next phase of this research involved the development of an online experiment. Below is a compilation of messages developed based on the

nudging approach that were used for the online experiment, which aimed to measure changes in the Malaysian youths' attitudes toward road safety:

Overconfidence (Group-1). Overconfidence bias refers to the tendency of people to overestimate either their knowledge or their ability to control a situation. In other words, the tendency to overestimate one's abilities in performing a task. A typical example of self-overestimation is gamblers who systematically overestimate their ability to predict the correct probabilities in games. In this study, this applied to overestimating oneself in terms of one's level of attention to safe driving. We chose a brief video titled "Test your awareness", available at the following link: https://www.youtube.com/watch?v=Ahg6qcgoay4 (commonly known as the "Moonwalking Bear" video) to illustrate the constraints of our attention span.

Reframing (Group-2). One of the techniques used to address cognitive distortions is reframing. Reframing means putting problems in a different frame (a frame of reference) to avoid processing them in the form of mental shortcuts in order to create a common basis for discussion. One form of reframing concerns the inversion of the relationship between something that is socially accepted by a particular group, using the same symbolic language but conveying the opposite message. As a stimulus the title of a famous movie "The fast and the furious" series about driving fast reinterpreted with reality.

Concern for the family (Group-3). Another aspect we wanted to take advantage of to raise awareness about safe driving was the importance of family ties in Malaysian society. To capitalise on the importance of family ties in the context of safe driving, we shifted the focus of the risks associated with driving from the driver to the driver's family. Therefore, the consequences of reckless driving behaviour were linked to the impact of that behaviour on the driver's family in order to induce feelings of shame and guilt and to raise awareness about safe driving. Picture of a grieving mother embedded with the text "Don't leave your loved ones behind the scars of loss to bear. Drive safe" used as a stimulus to test concern for the family.

Statistical data on traffic accidents (Group-4). This message will show statistics on the frequency

of traffic accidents. This message was given to the control group because it represents the typical approach of social issues communication campaigns which are driven by factual information.

There is a long literature on persuasion that looks at the effect of different sources on the persuasive effectiveness of a message (Cialdini, 2021). With the advent of new media, and especially with the widespread use of social media, other criteria also affect the credibility of information (Veltri & Atanasova, 2015). In particular, the degree of participation of a particular actor in a social network becomes an important factor when considering online information sources on these platforms (Newman et al., 2011; Nahon & Hemsley, 2014). A popular actor within the Facebook group was created on ad hoc basis for each group in this study. The modality of nudges dissemination take place via popular person or influencer within the online group. The identified central actor for each group posted the relevant stimuli and moderated the discussion.

A two-tailed t-test was conducted to compare scores before and after the intervention. In a between-subjects design (BSD), each participant took part in a single group (refer Figure 1). The results of each group were then compared to examine differences. A BSD is one way to avoid the carryover effects that can occur in within-subjects designs. BSDs are more conservative in terms of maintaining independence of groups, but they are also more expensive to conduct because adding a new treatment to be tested requires a new and separate group of participants.

Results

The results of this study are as follows: First, the qualitative findings on Objective 1 shed light on Malaysian youths' concerns about road safety and their experiences with driving. Second, the results of the online experiment on Objective 2 demonstrate the effectiveness of campaign messages in nudging Malaysian youths' to adopt safe driving behaviors. In summary, the study provided qualitative insights into youths' driving experiences and effectively tested the impact of nudge-based campaign messages on promoting safe driving behaviour in Malaysia.

Objective 1- Explore the road safety concerns and driving experience among Malaysian youths

A thematic analysis was conducted to explore road safety concerns and driving experience among Malaysian youths, and four themes emerged from the focus group discussions.

Theme 1: Unsafe driving groups

The focus group discussion showed that there are three groups involved in unsafe driving, namely young people, older people, and experienced drivers.

"Yah, I observed old age people normally drive very-very slow, I really don't like it. I think this caused road accident. Driving very slow also dangerous because troubling those rushing to work and schools" (FG1: Participant 2).

"Experienced drivers make mistake too when driving. Some lorry drivers very experienced but became arrogant when driving. I think lorry drivers never bothered small cars and other people. Their licence should confiscated" (FG3: Participant 5).

"All people driving terrible. I was hit by young guy in Myvi car. After that he accused me. I don't know where he got licence. He said want to settle. He didn't pay me" (FG1: Participant 4)

"Some have experience in many years driving but got accident, All age people not careful when driving, they only thinking about themselves. They always blame young people driving dangerous" (FG2: Participant 7).

Theme 2: Reasons for unsafe driving

Focus group participants cited many reasons for unsafe driving. One of the most important issues mentioned by most participants was that drivers or road users do not follow the safety rules on the road. Participants stated that most drivers do not follow traffic rules because others do not follow the rules. Some participants believed that others took advantage of those who do follow the rules by, for example, skipping queues at traffic lights or toll booths or using the hard shoulder in heavy traffic.

"Drivers and other road users don't bother follow rules and regulations. Some selfish drivers cut que and use emergency lane. This is very bad. I think they don't fear samans. I think they don't have fear of samans because every time got discount to pay the samans" (FG3: Participant 8)

"We can see people always cut que, even I always see drivers cut que in tollgates. During the heavy traffic some take advantage and don't follow rules" (FG3: Participant 5)

"The problem is good drivers also cannot do anything, because they think if they follow rules then others

will take advantage on them and never give a way to them. That's why some good people also break road rules" (FG1: Participant 4)

According to participants, unsafe driving is also due to poor road conditions, inadequate street lighting systems, and potholes in the road surface. Participants felt that road maintenance crews should place more emphasis on repairing street lighting when a problem occurs. Participants also pointed out that heavy vehicles such as trucks and lorries also cause road damage, contributing to road accidents.

"Purely cannot blame road users for accidents, because Malaysia road condition not good. Got a lot of potholes. Heavy vehicle like lorry and truck frequently damage road. In Sungai Long and Cheras can see many potholes which is dangerous" (FG3: Participant 1)

"I think road lights also have problems. Night time difficult to see the road because of that road accident can happened. Government should take action to improve the road lighting system for better vision. (FG2: Participant 2)

Participants expressed their intention to use public transportation, but lamented that the public transportation system is still inadequate to connect destinations and provide travel options. For example, there is no direct train service to the campus, so students must drive to campus. To reach class on time, students often break the rules in heavy traffic, such as exceeding the speed limit or driving on the emergency lane.

"UTAR students want to use public transport but it is not convenience. There is no direct train connection to UTAR. I wish to use train to UTAR, but not good option to use. That's why I am driving to campus" (FG3: Participant 9)

"To reach to class on time I have to rush campus by driving. I also speed to reach campus. Sometime my friends also do that. Emergency lane we use to attend classes on time. I know it is bad" (FG2: Participant 3)

Some drivers are fundamentally aggressive in their driving. Sometimes aggressive drivers escalate into road rage. Participants often experienced aggressive drivers who do not give other drivers the opportunity to overtake them. Lack of police enforcement was cited as another reason for unsafe driving behaviour. Participants also believed that people only obey the rules when law enforcement officers are around, and that some get away with road safety violations by bribing officers.

"Some aggressive drivers do all kind of stunts when driving. If someone cut them, then immediately they will show of like call the other driver for racing. This aggressive drivers also zig zag when driving to show they are macho. They don't like to see others pass them" (FG1: Participant 2)

"I realised drivers only follow rules when police guys around. If they do road offence these people can bribe police man so can escape. So basically the police enforcement is missing then people no fear break road rules" (FG2: Participant 4)

Theme 3: Sources of information about driving

Focus group participants emphasised that the sources of information about driving are the police, parents, driving schools, and public information advertising. They felt that driving schools could be a good source of information about driving ethics and rules. Theory lessons in driving schools are often conducted by inexperienced and unprofessional driving instructors who cannot teach much to young drivers taking a driving test.

"We can get information about driving from police and driving school give good information too. TV and Radio advertising on road safety campaign supply good knowledge on safety driving and road accidents" (FG3: Participant 3)

Driving school instructors are also not very interested in teaching road safety and traffic rules but focus on how to get through the theoretical or written driving test. Those who attend theory classes do so only to fulfil the requirements for the driver's licence, not to learn traffic safety rules. Although a certain number of theory lessons are required to qualify for the practical test, some skip lessons because they find them uninteresting and the driving instructors only tell incoherent stories about traffic safety.

"Driving school give theory class. Teachers here not professional enough. These teachers not much share real driving experience with those attending the theory class. Teachers in driving school only interested to student pass the theory class and writing test" (FG2: Participant 5)

Government agencies are supposed to promote traffic safety for drivers and road users, but their inconsistent efforts do not contribute significantly to reducing traffic accidents. Traffic safety campaigns do not help create traffic safety awareness among young people. The focus group participants felt that road safety campaigns should be continuous rather than occasional, and that

frequent violators of road safety rules should be punished more severely.

"Government road safety campaign not continuously happening. I observe campaign during Chinese New Year, Hari Raya and Indian festivals. Other times very rare to see campaigns. I think if consistent campaign can reduce road accidents among young people" (FG1: Participant 5)

"Punishments on traffic offenders can reduce road accidents, but cannot give discount. Then people know cannot break rules" (FG1: Participant 2)

Theme 4: Experiences with unsafe driving

Participants were aware that unsafe driving can contribute to traffic accidents, and most of them had personal experiences with traffic accidents more than once. Because of the large number of traffic accidents, students reported that their parents imposed some driving restrictions on teens, such as only allowing them to drive to campus and home.

"Myself got few times accidents. One time with motorcycle food panda guy. He rides motorcycle very speed and reckless. Another time with Honda city car, he was rushing to work and suddenly break so I hit him. In January I got accident with Nissan car, he make sudden turn without put signal, so I meet in accident" (FG2: Participant 7)

"Parents worried about road accidents. I met an accident on lorry last semester. After that my mother only allowed me drive to campus to home. No other places let me go. So I cannot drive to other places as I wish" (FG3: Participant 5)

Bicycling is a good way to reduce traffic congestion and keeps people healthy. The youths were interested and motivated in riding bikes, but they were very aware of the dangers of biking. They talked about how dangerous it is to ride a bike on Malaysian roads because there are no proper bike lanes or sidewalks for pedestrians. One participant shared his experience of riding a bicycle to campus. He gave up riding because drivers were not considerate and did not give cyclists the right of way. As a result, he found that it was quite difficult to ride a bicycle in the city because the number of vehicles on the road was overwhelming.

"I like to ride bicycle. I want bicycle to campus, but no bicycle lane. So dangerous ride cycles around. My friend got bad experience when she is hit by a car when she cycle to home from campus. She give up cycling now. Cars and lorries are a lot in road. So I think riding bicycle is not a good idea" (FG3: Participant 1)

Participants noted that it is always chaotic when an accident occurs and that accidents are common. Massive traffic jams occur when traffic accidents occur, and it can take hours to clear the accident scene and allow traffic to flow freely again. Road users, especially motorists, slow down to look at the accident instead of stopping to help victims. One panellist pointed out that he gave up riding motorcycles after he had a bad experience, became paranoid, and decided not to ride anymore. Another participant responded that she had a bad experience driving and decided not to drive to campus after an accident, but to move closer to campus and rent a room there, even though it was expensive.

"People like to watch accidents and slowdown vehicles. This cause terrible traffic jam. This people not stop to help but to just watch. It take long hour to clear the jam" (FG2: Participant 6)

"I use to ride motorcycle to campus but now no more after got bad accident last year. I got trauma. I am afraid to ride after that. Now I move to closer to campus although rental is expensive. So I just walk to campus now" (FG3: Participant 4)

These factors led to a common feeling that the roads were unsafe. Participants felt that the ethics of driving and the rules of road safety are not taught enough, resulting in many drivers exhibiting unprofessional driving behaviours. The focus group participants also experienced that drivers of large vehicles such as trucks and lorries tend to harass small cars.

"Big vehicle like lorry and containers like to bully small cars. They just enter any points of road and make turn without considering other road users. This is very arrogant and unprofessional behaviour can be dangerous to others" (FG1: Participant 3)

Overconfidence in driving was also seen as another factor in traffic accidents. One particular example of this was that focus group participants reported observing many young drivers using cell phones while driving, as cell phones are very common in daily life. Young people tend to text and use other online social networks while driving without much concern for traffic safety. They seem to have too much confidence in their ability to drive while distracted by mobile technology.

"Using phone while driving cause accidents. Young people overconfident. People are very much on texting and talking without handsfree. Young people too much in social media while driving. This types behaviour will cause accident among youngster" (FG2: Participant 5)

The focus group findings suggest that driver attitudes, along with a range of unsafe driving practises, are an important factor in traffic accidents. Against a backdrop of inadequate enforcement of traffic rules, young people appear to have a careless attitude toward road safety, lack knowledge about road safety, are overconfident when driving, and use cell phones while driving - all factors that are critical to road accidents involving young drivers in Malaysia. Added to this is the perception that Malaysia's roads are scary, intimidating, and dangerous, as well as the fear of driving. In light of these observations, some suggestions can be made for the design of the second phase of the quantitative research considering these qualitative research findings. The online experimental study must be designed to provide the basis for influencing and changing young people's driving behaviour. The approach taken was to create traffic safety messages based on the literature review and qualitative research, in an online experiment that allowed for the evaluation of the effectiveness of different types of messages on attitudes and intended behaviours related to traffic safety.

Objective 2-Test effectiveness of campaign messages to nudge Malaysian youths toward safe driving

The construct "attitudes toward safe driving" served as the main dependent variable, which consisted of a 46-item scale measuring various dimensions of driving safety. The scale was analysed using principal component analysis (PCA), which revealed that the scale has five main dimensions related to attitudes and driving safety.

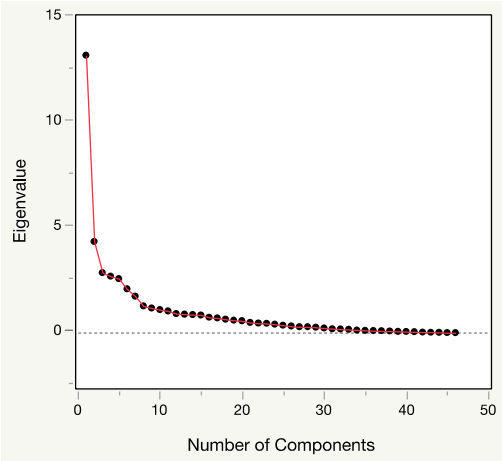

Figure 1. Scree plot of the PCA carried out on the attitudes for safe driving items.

The analysis indicates that five principal components can be identified, as shown in the scree plot in Figure 5 and in Table 1, which reports that these five components account for more than 50% of the variance in attitude toward safe driving.

Table 1. Cumulative eigenvalues of the components and significance test of the five components solution.

Number	Eigenvalue	Percent	Cum Percent
1	13,1822	28,657	28,657
2	4,3420	9,439	38,096
3	2,8619	6,222	44,318
4	2,6943	5,857	50,175
5	2,5778	5,604	55,779

These are the dimensions identified in the context of safe attitude toward driving,

Control. This refers to the sense of control people have over their driving. It is about the belief that one can control the situation on the road. A very strong sense of control can lead to overestimation of self, a thinking error that occurs because we overestimate our ability to control

events that are not necessarily within our control. Road traffic involves individuals, but it also involves "uncontrollable" elements such as the behaviour of other drivers, the weather, road conditions, etc.

Unruliness. This dimension includes a flexible understanding of the law, the tendency not to follow the rules if we are not observed or we are sure that there will be no consequences in the form of sanctions. It refers to the style of "I drive according to my needs" and not according to the rules. Related to this is the belief that most people do the same and therefore they only feel a little guilty when they break the rules.

Compliance with the rules. This dimension contrasts with recalcitrance and captures following the rules of the road without adapting them to our needs. This includes stopping at a red light even when there is no other road user on the road. It is the sense of legitimacy of rules that leads to compliance. Thus, driving a car is done according to the rules.

Feelings of guilt. Another dimension that has emerged is those who occasionally break the rules and feel guilty about it. This dimension captures the intermediate state, a movement from rule following to rule breaking and back.

Alertness. This dimension captures the degree of alertness that respondents believe is necessary for safe driving. There is a complex relationship with control, as a high level of control can lead to low alertness, while a lack of control can lead to high alertness. This factor captures the level of perceived alertness that respondents believe they have while driving on the road.

The pre-post design of this study included measurements of the above dimensions before and after the introduction of the visual nudges to test whether they would lead to statistically significant changes of direction compared to the first measurement. Figure 6 summarises the rationale for the analysis embedded in the pre-post design. The control group was used to further test whether context affects changes between the first and second measurements. There were no statistically significant differences between the pre- and- post measurements in the control group,

suggesting that no external event other than the introduction of the visual nudges is likely to have influenced the other groups.

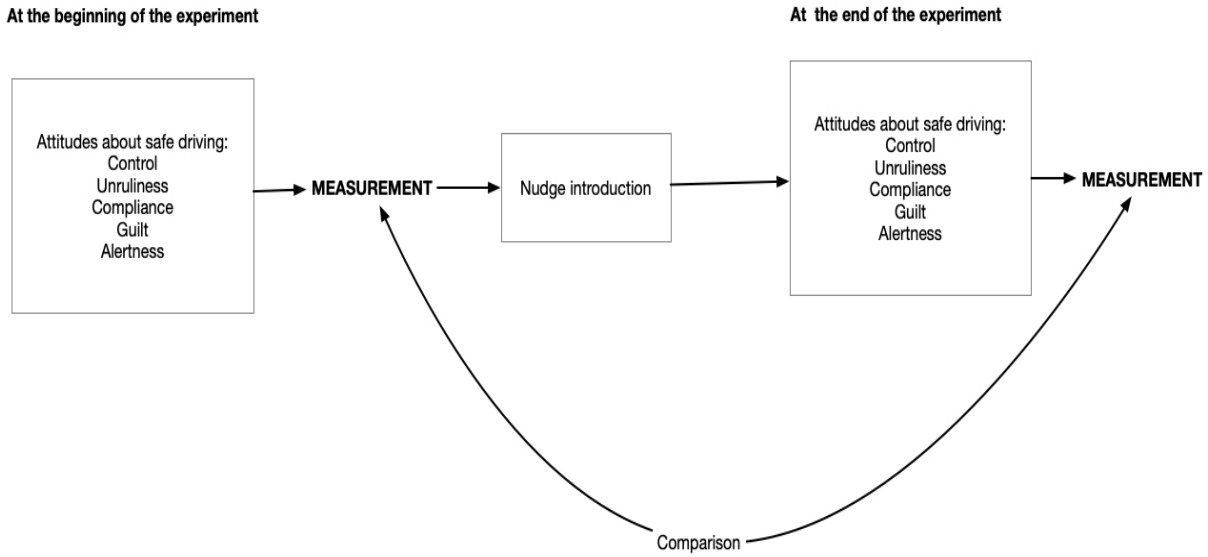

Figure 6. Pre-post design for attitude about safe driving

Next, the results of the comparison shown in Figure 6 were examined. These were the three nudges based on three different psychological principles: concern for family, where the risk of safe driving behaviour was presented as a loss to the driver's family (funeral scenario); overconfidence, where a short video was shown to illustrate how limited our attention span is; reframing, i.e., placing problems in a different frame (a frame of reference) to avoid processing them in the form of mental shortcuts that are undesirable.

Overconfidence

The effect of visual nudge on the five dimensions of the Safe Driving Attitude Scale was tested. Results of group comparisons were analysed using a two-tailed t-test to compare pre- and post-intervention results:

Control: There was no significant difference in scores for control before the nudge (M=5.550, SD =0.79) and after the nudge (M=5.504, SD =0.83); t (204) = 0.404, p = 0.656.

Guilt: There was no significant difference in pre-nudge (M=5.315, SD =1.35) and post-nudge

(M=5.364, SD =1.33) control scores; t (204) = 0.259, p = 0.602.
Unruliness: There was no significant difference in control scores before nudging (M=17.58, SD = 7.80) and after nudging (M=18.52, SD = 8.15); t (204) = 0.850, p = 0.198.
Alertness: There was a significant difference in control scores before nudging (M=4.616, SD =1.12) and after nudging (M=5.03, SD = 1.01); t (204) = -2.910, p = 0.001. It was significant in the expected direction, i.e., vigilance was higher after seeing the visual nudge.
Compliance: There was a near-significant difference in pre-nudge (M=5.75, SD = 0.66) and post-nudge (M=5.90, SD = 0.74) control scores; t (204) =1.538, p = 0.052. It was a borderline significant t in the expected direction, i.e., more compliance after the visual nudge was seen.

In summary, the effect of the visual cue on confidence was effective on the dimensions of alertness and nearly significant for compliance. Participants stated that after seeing the visual reminder of the message of overconfidence about careless driving, they were more aware of the attention required while driving and were more compliant with the rules.

Reframing

The effect of visual nudging by reframing on the five dimensions of the Safe Driving Attitude Scale was tested. Group comparison results were analysed using a two-tailed t-test to compare pre- and post-intervention results:

Control: There was no significant difference in scores for control before the nudge (M=5.224, SD =0.822) and after the nudge (M=5.236, SD =0.861); t (162) = 0.092, p = 0.463.
Guilt: There was no significant difference in pre-nudge (M=5.097, SD =1.208) and post-nudge (M=5.176, SD =1.338) control scores; t (162) = 0.398, p = 0.654.
Unruliness: There was no significant difference in control scores before nudging (M=18.76, SD =7.72) and after nudging (M=19.64, SD =8.04); t (162) = 0.714, p = 0.238.
Alertness: There was no significant difference in control scores before nudging (M=4.634, SD =0.99) and after nudging (M=4.771, SD = 0.97); t (162) = 0.891, p = 0.186.
Compliance: There was no significant difference in control scores before nudging (M=5.656, SD =0.87) and after nudging (M=5.571, SD = 0.86); t (162) =0.626, p = 0.265.

In summary, based on reframing, the effect of the visual nudge did not produce significant changes in attitudes toward safe driving.

Concern for the family

The effect of the visual cue " concern for family" was tested on the five dimensions of the Safe Driving Attitudes Scale. Results of group comparisons were analysed using a two-tailed t-test to compare scores before and after the intervention:

Control: There was no significant difference in pre-nudge (M=5.403, SD =0.979) and post-nudge (M=5.260, SD =1.004) control scores; t(168)= 0.9285, p = 0.825.

Guilt: there was no significant difference in pre-nudge (M=5.405, SD =1.381) and post-nudge (M=5.288, SD =1.235) control scores; t(168)= 0.585, p = 0.276.

Unruliness: there was a significant difference in control scores before the nudge (M=17.08, SD = 6.29) and after the nudge (M=19.03, SD = 7.13); t(168)= 1.888, p = 0.030. It was significant in the expected direction, i.e., unruliness was lower after seeing the visual nudge.

Alertness: There was no significant difference in control scores before nudging (M=4.567, SD =1.12) and after nudging (M=4.641, SD = 1.01); t (168) = 0.446, p = 0.655.

Compliance: There was a significant difference in scores for control before nudging (M=5.788, SD = 0.898) and after nudging (M=5.511, SD = 0.965); t (168) =1.919, p = 0.028. It was significant in the expected direction, i.e., compliance was greater after visual nudging.

In conclusion, the effect of the visual nudge based on family concern was effective on the dimensions of disobedience and compliance, which are interrelated. After being reminded of the effects of careless family driving, participants stated that they were less likely to break the rules and more compliant.

Conclusion

The implementation of nudging strategies, grounded in the concept of family concern, has proven to be a profoundly effective approach in influencing key dimensions of road safety behaviour. Through the strategic utilization of a funeral scenario coupled with emotionally charged language,

this intervention has wielded a considerable impact on the domains of compliance and unruliness. The results illuminate the potential of harnessing the emotional connection individuals share with their families to engender significant shifts in driving attitudes and behaviours.

The efficacy of the intervention is particularly noteworthy given its resonance within the broader sociocultural context. The study's findings can be contextualized within the framework of a collective society, which is prevalent in the research setting. In societies that prioritize communal values and interdependence, familial bonds hold immense significance (Hussin et al., 2020). The emotional attachment to family members extends beyond mere sentimentality; it embodies a sense of duty and shared responsibility (Ariapooran et al., 2018). Thus, the intervention's focus on family consequences directly taps into this wellspring of emotion, aligning with the deeply ingrained cultural fabric.

The collective nature of the society also permeates the interpretation of accidents and their ramifications. The study rightly points out that mishaps resulting in harm to family members elicit lifelong emotional trauma (Ghazali et al., 2014; Yzermans et al., 2020). In a society where interconnections are profound, such incidents reverberate through the family unit and beyond, impacting the broader community as well. These findings reinforce the power of family ties as a motivating force that transcends individual considerations.

The implications of this research extend beyond its immediate findings, offering policymakers a strategic vantage point for effecting meaningful change in road safety behaviour, particularly among young citizens in Malaysia. The integration of family consequences within road safety campaigns emerges as a compelling strategy, as it capitalizes on the intrinsic emotional drive associated with protecting loved ones. This emotionally charged approach is not intended to induce fear, but rather to stimulate a more profound sense of responsibility and consideration, thereby influencing individuals to make safer choices on the road.

It is important to acknowledge that the effectiveness of the nudging intervention might interact with cultural dimensions. In individualistic societies, for instance, where personal autonomy and

achievement are more highly emphasized, the impact of family-oriented appeals may differ. Therefore, it becomes imperative for policymakers to tailor interventions to the cultural context to maximize their effectiveness.

However, the implementation of family-oriented consequences as a part of road safety campaigns should not be seen as a standalone solution. Instead, it can be synergistically integrated with other measures to create a holistic approach to road safety. The study rightly suggests that a combination of strategies, including higher fines and stricter enforcement of traffic laws, can fortify the impact of such interventions. A multi-pronged approach acknowledges the complex interplay of psychological, sociocultural, and external factors that contribute to road safety behaviour.

Moreover, this study paves the way for future research avenues. The exploration of nudging effects across different age groups promises valuable insights into how generational attitudes and experiences intersect with such interventions. Additionally, the advent of the digital age has redefined communication channels. Consequently, there lies ample scope in investigating the efficacy of these nudging strategies across diverse social media platforms, each with its unique audience and engagement dynamics.

In conclusion, the study's findings underscore the potency of nudging strategies rooted in family concern as a catalyst for promoting responsible driving behaviour. By channelling the emotional power of family ties, these interventions have the potential to trigger significant shifts in the dimensions of compliance and unruliness. The broader implications of the study highlight the intricate interplay between culture, emotion, and road safety behaviour. It prompts policymakers to recalibrate their approaches, encourage them to tap into emotional touch points that can create lasting change. The study adds to the body of knowledge and encourages future research to explore uncharted territories, ensuring that road safety interventions continue to respond to the evolving social dynamics and communication landscapes.

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