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Abdul Hanan, Suhaila, King, Mark J., & Lewis, Ioni M. (2011) Understanding speeding in school zones in Malaysia and Australia using an extended Theory of Planned Behaviour : the potential role of mindfulness. *Journal of the Australasian College of Road Safety*, 22(2), pp. 56-62.

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# Understanding speeding in school zones in Malaysia and Australia using an extended Theory of Planned Behaviour: The potential role of mindfulness.

by S. Abdul Hanan, M.J. King and I.M. Lewis

Centre for Accident Research and Road Safety- Queensland (CARRS-Q)

Queensland University of Technology

email: suhaila.abdulhanan@qut.edu.au

## Abstract

Speeding in school zones is a problem in both Malaysia and Australia. While there are differences between the countries in terms of school zone treatments and more generally, these differences do not explain why people choose to speed in school zones. Because speeding is usually an intentional behaviour, the Theory of Planned Behaviour (TPB) has been used to understand speeding and develop interventions, however it has limitations which can be addressed by extending the model to incorporate other constructs. One promising construct is mindfulness, which can improve the explanatory value of the TPB by taking into account unintentional speeding attributable to a lack of focus on important elements of the driving environment. We explain what mindfulness is (and is not), how it can assist in providing a better understanding of speeding in school zones, and how it can contribute to the development of interventions. We then outline a program of research which has been commenced, investigating the contribution of mindfulness to an understanding of speed choice in school zones in two different settings (Australia and Malaysia) using the TPB.

## Keywords

School zones, Speeding, Theory of Planned Behaviour, Mindfulness, Malaysia, Australia

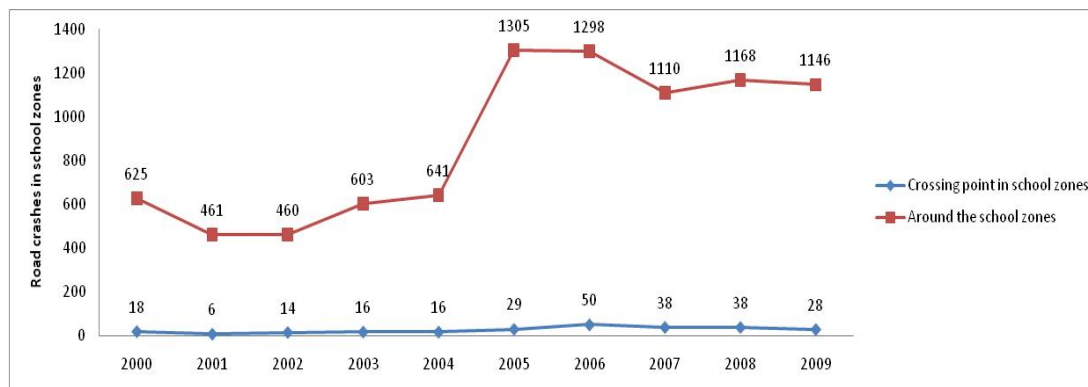
## Introduction

There has been growing concern associated with the increasing number of fatal road crashes in Malaysia in the last two decades. This concern has been shown in the extent of media discussion focused upon road safety, involving concerned citizens, academics and members of non-governmental organisations, such as Malaysians Unite for Road Safety (MUFORS). In 2009, out of a population of 28.3 million, 6,745 road users died in road crashes, compared with 4,048 in 1990 [1]. Among those who die on Malaysian roads, almost 10% are pedestrians. Of these, school children are among the victims.

Figure 1 shows that, in 2009 alone, 1,146 crashes occurred around school zones and 28 crashes occurred at crossing points in school zones [2]. These crashes resulted in 124 child pedestrian casualties (for children aged 6 to 16 years) and seven child pedestrian fatalities [2]. The involvement of children in road trauma in and around school zones generates concern at



all levels, and such concern has led to several research efforts directed at engineering approaches to the problem [3, 4].



Source: [2]

**Figure 1. Road crashes in school zones (2000-2009)**

In contrast, Australia appears to have had fewer problems in relation to child pedestrians in school zones. In 2008, 1,464 people died in road crashes in Australia [5]. Of these, 193 were pedestrians with only 13 of these pedestrians being aged 16 years or under [5]. The limited studies available indicate that child fatalities rarely occur in school zones. In Queensland, only 17 child pedestrians died and 366 were hospitalised in the 10 year period from 1991 to 2000. This figure is likely to overestimate school zone casualties since it includes all casualties in the periods during which children are travelling to and from school, regardless of where the crash occurred [6]. Similarly, in New South Wales, only two child pedestrian fatalities occurred in school zones over a period of 10 years in the period 2000 to 2009. Further, the data suggests that speeding was not a contributing factor in any of these fatal crashes. Speeding was associated with only two out of 166 vehicle-child pedestrian crashes in school zones, neither of which resulted in a fatality [7].

Although the absolute number of speed-related crashes in school zones in which child pedestrians are fatally injured is, fortunately, low in Australia, parents and the community more broadly are understandably concerned about the safety of school children. Young child pedestrians are less visible and more vulnerable in traffic due to their small physical size, and have less well-developed cognitive, attentional, perceptual and visual skills compared with older children and adults, which has implications for their ability to safely negotiate traffic situations [8]. Older children may also represent a safety concern, however, to the extent to which they fail to apply safe pedestrian skills [9].

There appear to be greater levels of speed compliance in school zones in Australia than in Malaysia, even when a vulnerable group is involved and “hard” traffic engineering measures are employed, e.g. the speed humps used in all school zones in Malaysia. There is limited evidence on speeds in school zones in Malaysia, with one study finding 85th percentile speeds of 78km/hr, 87km/hr and 96km/hr in three different school zones (two primary schools and one secondary school) [10]. In Australia, 85th percentile speeds of 59.7km/hr and 60km/hr have been recorded in school zones [11, 12]. It is notable that the 85th percentile speeds are much higher in Malaysia than in Australia, even though the typical speed limit in school zones is higher in Australia (40km/hr vs 30km/hr) and only “soft” engineering measures are used (signs and pavement markings). These findings raise questions about the nature of speeding in school zones in Malaysia and Australia, and suggest that a better understanding of the reasons for speed choice in school zones in both countries is needed, as a way of informing



countermeasures in Malaysia and Australia. As speeding is usually considered an intentional behaviour on the part of drivers, the widely used Theory of Planned Behaviour (TPB) provides an appropriate framework for research investigating such behaviour. The application of the TPB to speeding is outlined in the next section.

Since the TPB applies to intentional behaviour, and speeding in school zones may also be undertaken unintentionally by a driver (e.g., failing to notice the school zone sign, the presence of children, etc.) the use of the TPB could be extended by incorporating a construct which attempts to account for these unintentional factors. As explained below, the proposed construct is “mindfulness”, which is beginning to be used more widely in a number of settings. The discussion of mindfulness will clarify what the term means, how it applies to speed behaviour in school zones, and how it can be incorporated into the proposed future research program to be undertaken in both Malaysia and Australia.

### **Understanding why people speed - Theory of Planned Behaviour (TPB)**

The TPB has been applied widely in social behavioural research. In simple terms, the TPB states that actual behaviour is predicted by intended behaviour and the degree of control people believe that they have over the behaviour. In turn, intended behaviour is predicted by the combination of attitudes towards the behaviour, perceptions about how the behaviour would be regarded by others (social norms) and perceptions about how much one can control the behaviour.

In relation to speeding, across a range of settings, the TPB variables have been found to predict between 36% and 85% of intention to speed and between 32% and 77% of self-reported speeding behaviour [13-18]. However, while the TPB initially claimed to be a complete model of social behaviour, the intention-behaviour relationship might be affected by other variables [19, 20]. For instance, in relation to speeding behaviour, evidence shows that there are drivers who intend to speed but who do not perform the behaviour and also drivers who intend to comply with the speed limit, but who ultimately exceed the speed limit [15, 18]. Such anomalies suggest that additional constructs should be considered to bridge the gap between intention and behaviour, thus improving the predictive power of the TPB.

As mentioned above, one of the constructs which may hold promise in this regard, but which has not yet been tested as an additional predictor in the road safety context, is mindfulness. The origin and meaning of the concept are discussed in the next section, with an emphasis on the application of mindfulness to driving in general, and speeding in particular. We have previously published a more detailed account of the history of mindfulness and its application to driving to which interested readers can refer [21].

### **Mindfulness and its conceptualisation in relation to speeding behaviour**

Mindfulness is a concept derived from Buddhist philosophy which has been used widely in studies of consciousness. More recently, mindfulness has been applied to the understanding of behaviours in areas including clinical psychology, meditation, physical activity, education, business and social behaviour [21]. Most of these studies have attempted to conceptualise mindfulness in relation to the particular context in which the research is being conducted [refer to 21]. As a consequence, more than one definition of mindfulness can be found in the literature, and not all can be applied to driving. Table 1 presents a summary of these definitions and an assessment of their usefulness [see 21 for further detail].



**Table 1. Conceptualisation of mindfulness in relation to speeding behaviour research.**

<b>Author</b>	<b>Mindfulness Definition</b>	<b>Usage in speeding behaviour</b>
Kabat-Zinn, 2003	“paying attention in a particular way, on purpose in the present moment and non-judgementally to the unfolding of experience moment by moment”	Not appropriate – judgement needed
Baer, 2003	“a non-judgemental observation of the ongoing stream of internal and external stimuli”	Not appropriate – judgement needed
Langer & Moldoveanu, 2000	“a process of drawing novel distinctions”	Not appropriate – sees mindfulness as unmodifiable trait
Brown & Ryan, 2003	“enhance[d] attention to and awareness of current experience or present reality”	Appropriate concept

Source: Derived from [21].

As noted in Table 1, it is considered that the most relevant way to conceptualise mindfulness is borrowed from the ideas of Brown and Ryan [22]. They describe mindfulness as “enhance[d] attention to and awareness of current experience or present reality” where a core characteristic of mindfulness is described as open and receptive awareness and attention that may be reflected in a sustained consciousness of ongoing events and experiences (pp. 822-823). In this definition, Brown and Ryan emphasise awareness and attention as the central features of mindfulness. Awareness refers to the monitoring of the inner and outer environments which involves the capacity to be aware of internal and external events or phenomena at any given moment. On the other hand, attention is the process of focusing conscious awareness and being sensitive to the present reality of that particular time, capturing “figures” and holding them up for closer examination. It appears that, although there is a conceptual distinction between awareness and attention, they are intertwined within this conceptualisation of mindfulness.

Driving is a multitasking activity that requires drivers to manage their attention between various driving and non-driving-related tasks. The driving activity is one where both situational responsiveness and the capacity for changing one’s degree of awareness and attention are important, thus highlighting the particular value of the definition of mindfulness provided by Brown and Ryan [22] for use in driver behaviour research. An individual driver needs to stay focused, pay attention to the surrounding dynamic traffic environment, and be aware of what is happening around him/her in the present situation so that he or she can reflect on that information and take the right action. A driver travelling through an urban area needs to be aware of the unfolding environment, which includes being aware of potential risks which may change instantly. For example, when entering a school zone, where the speed limit changes and at certain times of the day when there are increased numbers of child pedestrians who could be at risk if the driver does not slow down. It is evident that this situation (entering a school zone) involves not just the awareness of one’s own behaviour, but also focusing of one’s attention on important elements of the environment.

In order to assess the potential role of mindfulness within the TPB model, some way of operationalising mindfulness in the driving context is required. There are several instruments based on differing conceptualisations of mindfulness. The scales include the Freiburg Mindfulness Inventory [FMI; 23], the Toronto Mindfulness Scale [TMS; 24], the Kentucky



Inventory of Mindfulness Skills [KIMS; 25] and the Mindfulness Awareness Attention Scale [MAAS; 22]. We have argued [21] that the most appropriate mindfulness scale for use in speeding-related behaviour research is the Mindfulness Awareness Attention Scale (MAAS) developed by Brown & Ryan [22] [see 21 for more detail].

**Table 2. Mindfulness and similar constructs.**

<b>Construct</b>	<b>Definition</b>	<b>Example</b>
Mindfulness	Recognising what is happening in the present moment, and being aware and attentive to events and experiences.	A driver travelling through an urban area needs to be aware of potential risks which may change instantly (e.g., when entering a school zone, the speed limit changes at certain times of the day, thus requiring a driver to be aware of the changing speed limit in school zones and to pay attention to the presence of child pedestrians).
Situational Awareness	On-going process involving judgement of happenings in the environment so as to provide meaning regarding the information at hand and to aid decision-making.	While driving, the driver needs to know where other vehicles and obstacles are as well as the status and movements of the vehicle being driven. For example, drivers must predict child pedestrian movement in school zones (e.g. run cross the road) so that they know when to stop or to speed.
Mindlessness	The human tendency to operate on autopilot without concern for consequences or outcome, whether by stereotyping, performing mechanically or simply by not paying attention.	A driver, when driving on a familiar route, and who arrives at their destination without recalling anything about their journey.
Distraction	An activity or event that diverts the attention of the individual away from the given task and, thus, compromises performance.	A driver's attention is not focused on the road, such as tuning the radio, eating, using a mobile phone or attending to a child.
Inattention	Important elements of the situation or environment that have not been attended to (which could be due to a range of factors including, for example, fatigue, intoxication).	Failure to notice a pedestrian crossing the road or a decelerating vehicle may result from fatigue or intoxication/impairment.

Source: Derived from [21].



In conceptualising the mindfulness construct, it is important to distinguish it from other seemingly similar constructs. As well as situational awareness (SA), the constructs of distraction and inattention have, on the surface, some similarity to an individual being less mindful, or exhibiting mindlessness. Table 2 presents a summary of these different constructs and examples of their application [see 21 for more detail].

To date, there has been minimal research linking the concept of mindfulness with safety behaviour and specifically driver behaviour. For instance, Demick [26] assessed the effects of cognitive style and other variables on driving behaviour. Interestingly, he found that the results could be reframed within mindfulness theory, as the task required a heightened cognitive state of mindfulness characterised by actively drawing distinctions. Similarly, Kass, Cole, and Legan [27] reviewed literature on driver distraction focusing on situational awareness (SA). To improve SA, these authors recommended mindfulness training as it may assist in educating drivers on how to be more aware of external and internal stimuli that are relevant to driving, stress and distraction. A recent study by Ledesma et al., [28] examined the validity of the newly-developed Attention-Related Driving Errors Scale (ARDES) in terms of several psychological variables that may be related to attention failure, among which they included mindfulness. They found that driver attention error is closely related to the lack of attention and awareness in the everyday lives of an individual driver.

In relation to school zones, “hard” engineering measures (i.e., traffic calming) have been implemented in Malaysia (see Figure 2), and in Australia “soft” engineering measures (i.e., 40km/hr speed limit sign and “School Zones” sign) have been applied to attract the attention of and build awareness among drivers when they enter the school zone. However, these measures appear to have limited success in raising drivers’ awareness, and reducing speeds in school zones. As noted earlier, the number of crashes in school zones remains high in Malaysia in comparison with Australia. This raises questions about whether, in addition to differences in the TPB constructs which predict intention and behaviour in each country, mindfulness might also differ between Malaysian and Australian drivers when they go through school zones.

Of the studies which are available, the evidence suggests that research on mindfulness in driving and similar situation is still in its early days, and that the role of mindfulness in relation to other constructs is far from clear or established. One important area in which clarification is needed was identified by Demick [26], who argued that there is a need to explore the relationship between intentionality and action in the driving context and to consider integrating mindfulness theory within any theoretical orientation which may help in understanding the complexity of behaviour. As noted above, the TPB is one of the primary theoretical approaches that posits a link between intention and action and that has demonstrated applicability in the road safety context. As such, Demick’s comments highlight a belief, similar to ours, that there is possibility for mindfulness to be considered in relation to the TPB and speeding-related research, particularly speeding in school zones. Ultimately, it is intended that the research will contribute to the development of interventions. If it can be demonstrated that the use of the TPB explains a practically important proportion of the variance in speeding behaviour in school zones when mindfulness is added, then interventions can be developed in accordance with the key factors that motivate the behaviour.





**Figure 2. Typical countermeasures in school zones in Malaysia. Clockwise - transverse bar, speed hump, traffic light with zebra crossing and school zones and 30km/hr speed limit sign.**

## Outline of proposed research

The proposed program of research will utilise qualitative and quantitative methods in two countries (Australia and Malaysia) to examine drivers' general beliefs, individual and situational predictors of intentions, as well as (self-reported) behaviour in relation to speeding in school zones. While school zones were chosen for the reasons outlined at the beginning of the paper, their use will help to increase road safety knowledge in other ways because understanding speeding in such contexts has attracted limited attention in previous research. For example, Parker, Manstead, Stradling, and Reason [14, 29] developed a speeding scenario in residential areas. Elliott and Armitage [18] and Elliott, Armitage, and Baughan [30] focused on 20mph, 30mph and 40mph roads in a built-up area. Forward [31, 32] also investigated speeding in an urban area, and Warner and Aberg [15, 33] explored speeding behaviour in urban and rural settings. In addition, the school is a centre for a child's daily activity and is intended to be safe for children during school times. A range of measures has been introduced to improve school zone effectiveness and these measures have evolved over time as a means of enhancing safety around schools.

The proposed program of research will be underpinned by the TPB and each of the three studies will be informed by and build upon the preceding studies. Specifically, the research will seek to elicit beliefs, examine a range of predictors of behavioural intentions, and finally explore the association between intentions and behaviour within an extended Theory of Planned Behaviour.



Specifically, Study 1, underpinned by the TPB, will examine the general beliefs associated with speeding violations in school zones, as well as a range of potential individual and situational factors influencing this behaviour. This examination will be conducted in both Australia and Malaysia and, as such, the research will be able to investigate similarities and differences between the beliefs and other factors influencing speeding in school zones between the two countries. In accordance with standard practice for the usage of the TPB, which is to elicit relevant beliefs, Study 1 will utilise focus group discussions. The focus group methodology functions as an important and effective means of eliciting relevant and appropriate TPB based beliefs, as well as initial exploration of the extent to which mindfulness may influence driver speed choice, across a range of driving contexts. Further, given that the study is investigating the proposed theoretical framework within Australian and Malaysian contexts, it is important to ensure that the beliefs and constructs explored are relevant and appropriate within these different contexts. The TPB's predictive capabilities are greatest when researchers take care to develop all measures in accordance with the TACT principles [i.e., Target, Action, Context, and Timing; see 19], so these principles will be observed in the research.

Study 2 will examine a range of independent variables contributing to intention to speed in school zones via a scenario-based study, where the variables will include mindfulness in addition to the standard TPB constructs. The dependent variable in this study will be intention to speed in school zones. Study 2 will be a cross-sectional study which will utilise a self-report questionnaire. The questionnaire will seek drivers' responses in relation to a series of driving scenarios. An example of scenario is as follows. *"It is a school day. You are driving alone through a school zone. The time is 8.30am on a fine and dry day. The road has a 40km/h speed limit and you are driving at 40km/h. You drive this route every day at this time. A car approaches you from behind at a higher speed, and cars travelling the other way are doing about 60km/h"*. It is anticipated that there will be four different driving scenarios, thus reflecting a 2 x 2 manipulation of factors (e.g., other driver and person-related factors). These factors will be determined from the results of Study 1 and the literature review. This study will therefore be a 2 x 2 between-groups design involving approximately 500 drivers.

Finally, Study 3 will examine the intention-behaviour relationship (how intentions translate into actual behaviour) and, in particular, the extent to which this relationship may be moderated (or mediated) by the mindfulness construct. It will represent an important extension of the previous two studies (i.e., Study 1 and Study 2) given that it will be a larger quantitative study based upon self-report questionnaires which will include a follow-up (self-reported) measure of behaviour. In this study, the dependent variable will be speeding behaviour in school zones.

As mentioned previously, all of the studies within the program of research will measure mindfulness according to Brown and Ryan's [22] MAAS (Mindfulness Awareness Attention Scale), in addition to the TPB questions. At the time of preparation of this paper, the first author is undertaking focus group research in Australia and will later conduct focus group research in Malaysia.

## **Conclusion**

In summary, speeding in school zones remains a pervasive problem in Malaysia despite the implementation of a range of interventions. Such behaviour needs to be better understood if more effective countermeasures are to be developed. While school zones in Australia rely



more on driver compliance, in Malaysia they rely more on the countermeasures actively “forcing” drivers to slow down through “hard” engineering features. Thus, the comparison between driver motivations for speeding in school zones (as well as those factors that reduce/prevent speeding) in both Australia and Malaysia may provide insights into the best way to proceed with future countermeasures in Malaysia.

Because of the intentional nature of speeding, the TPB is an appropriate model for understanding speeding behaviour in school zones, yet, there is still a considerable amount of variance in the intention and behaviour relationship which remains unexplained. As outlined in this paper, the concept of mindfulness can be applied to driving, and has some promise as a complement to the TPB, provided that definitional issues are clarified. This paper has proposed a definition of mindfulness which can be used to conduct research, and has outlined a proposed program of research. It is anticipated that the research will lead to a better understanding of drivers’ speeding in school zones, the development of interventions which incorporate consideration of mindfulness, and, ultimately, a reduction in child pedestrian casualties in both countries.

## Acknowledgments

The authors would like to thank Ms Syarifah Allyana Syed Abdul Rahim from the Malaysian Institute of Road Safety Research (MIROS) for the valuable statistical information and Mr Ahmad Kamil Abdul Hanan for the photos of school zones in Malaysia.

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