

**Are you a mindful driver?
A review of the potential explanatory value of mindfulness in predicting speeding behaviour**

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Abstract

Mindfulness is a concept which has been widely used in studies on consciousness, but has recently been applied to the understanding of behaviours in other areas, including clinical psychology, meditation, physical activity, education and business. It has been suggested that mindfulness can also be applied to road safety, though this has not yet been researched. A standard definition of mindfulness is “paying attention in a particular way, on purpose in the present moment and non-judgemental to the unfolding of experience moment by moment” [1]. Scales have been developed to measure mindfulness; however, there are different views in the literature on the nature of the mindfulness construct. This paper reviews the issues raised in the literature and arrives at an operational definition of mindfulness considered relevant to road safety. It is further proposed that mindfulness is best construed as operating together with other psychosocial factors to influence road safety behaviours. The specific case of speeding behaviour is outlined, where the psychosocial variables in the Theory of Planned Behaviour (TPB) have been demonstrated to predict both intention to speed and actual speeding behaviour. A role is proposed for mindfulness in enhancing the explanatory and predictive powers of the TPB concerning speeding. The implications of mindfulness for speeding countermeasures are discussed and a program of future research is outlined.

Keywords

Mindfulness, Theory of Planned Behaviour, Speeding

Introduction

Illegal behaviours, such as speeding are involved in a significant proportion of the road toll. Much research has been directed towards understanding why drivers continue to speed (or behave illegally in other ways) even though the risks are widely known, and towards developing countermeasures aimed at reducing speeding and other illegal behaviours. A range of theoretical approaches have been employed to facilitate understanding and intervention development, one of which is the Theory of Planned Behaviour (TPB). However, as for most illegal behaviours, the TPB and other theories have only been able to account for a limited proportion of the variance in speeding and efforts have been made to build other constructs into these theoretical approaches in order to increase their explanatory value. In most cases, these constructs are drawn from the wider field of psychology rather than being specific to driving. As such, part of the challenge has been to demonstrate the applicability of these constructs to the driving situation. This paper explores the potential contribution of mindfulness in potentially providing a greater understanding of speeding behaviour.

Speeding in road safety in relation to Theory of Planned Behaviour (TPB)

Speeding has been defined legally as travelling above the posted speed limit, or travelling within the speed limit but too fast for the conditions (e.g., a wet road). By engaging in excessive speed, the driver reduces the ability to control the vehicle [2] and increases the stopping distance, and, thus, reduces the time available to avoid a crash [3]. Additionally, several studies provide evidence that exceeding the speed limit is associated with an increased frequency of road crashes [4, 5]. However, while excessive speed has been acknowledged as a violation that leads to increased crash risk, many drivers choose to continue the behaviour.

The Theory of Planned Behaviour (TPB) has been applied widely in social behavioural research. A number of researchers have also demonstrated the applicability of the TPB in various contexts to road

safety-related behaviour including driving violation [6, 7], speeding [8-10], pedestrian crossing [11, 12], and mobile phone use while driving [13].

As speeding violation may be considered largely as an intentional act on the part of the driver, the TPB has been used extensively to explain this behaviour [7, 14] with some encouraging findings (in relation to the TPB's predictive utility) having been reported. For instance, Parker *et al.* [7] found that 47.2% of variance in intentions to speed were explained by the TPB. Similarly, Elliott and Armitage [15] indicated that the TPB variables accounted for 32% of the variance in speeding behaviour, with intention and perceived behavioural control being significant independent predictors. Moreover, further research by Elliot, Armitage, and Baughan [16] showed that 54% of the variance in intention was explained by all of the TPB constructs. Intentions and perceived behavioural control were found to be significant predictors of self-reported behaviour, and together accounted for 67% of the variance.

In a recent study by Paris and van den Broucke [9], it was found that the TPB constructs explained 36% of the variance in intention to keep within speed limits with an overall 77% of the variance in self-reported speeding behaviour being explained by the combination of intentions and perceived behavioural control. Similarly, Warner *et al.*, [10], in a comparison study comparing drivers in Sweden and Turkey, found that the TPB explained 85% and 84% of variance in drivers' intention to comply with speed limit and 58% and 57% of variance in drivers' self-reported actual compliance with the speed limit respectively.

In summary, studies have demonstrated that attitudes, subjective norm and perceived behavioural control are significant predictors of speeding intentions and behaviour. The findings of the preceding TPB-based studies are also consistent with the conclusions made by Armitage and Conner [17] in their meta-analysis of 185 empirical research studies of the TPB. Armitage and Conner found that the average multiple correlations of attitude, subjective norms and perceived behavioural control with intentions explained 39% of variance in social behaviour. These results provide support for the application of the TPB to speeding behaviour research.

However, while the TPB initially claimed to be a complete model of social behaviour, the intention-behaviour relationship might be affected by other variables [e.g 18, 19]. Indeed, Ajzen [18] himself suggested that additional predictors could be added to the TPB to improve its predictive and explanatory capabilities. In relation to speeding behaviour, several additional predictors have been used to explain further variance in intentions and behaviour. For instance, other drivers' behaviour [20, 21], descriptive norms [22], past behaviour [22] and habit [23] have all been found to explain additional variance over and above the standard TPB constructs.

One construct which may hold promise yet which has not been tested as an additional predictor in the road safety context and, in particular in relation to the TPB framework and speeding specifically, is mindfulness. One definition of mindfulness has been cited as, "paying attention in a particular way, on purpose in the present moment and non-judgementally to the unfolding of experience moment by moment" [1]. However, this definition represents one of the many possible definitions that have been used to conceptualise mindfulness. This paper discusses how mindfulness has been conceptualised and which type of conceptualisation may have the greatest potential benefits in contributing to the contemporary understanding of road user behaviour.

History of mindfulness

Recently, there has been a growing interest in the research literature about 'being mindful'. Mindfulness is a concept which has been widely used in the studies of consciousness, but has recently been applied to the understanding of behaviours in other areas, including clinical psychology, meditation, physical activity, education, business and social behaviour.

Historically, mindfulness is rooted in the Eastern philosophy, specifically Buddhism and other contemplative traditions, where conscious attention and awareness are actively cultivated. Mindfulness is an English translation of the Pali word, Sati. In the Buddhist context, mindfulness is considered to be based on three functional activities: "1) mindfulness reminds an individual of what the person is supposed to be doing; 2) helps an individual to see things as they really are; and 3) helps an individual to see the

deep nature of all phenomena” [24]. These functions are considered important in spiritual day-to-day practices, especially meditation, in creating mindful people. Thus, traditionally, “mindfulness practice involves disciplined attention to the body (including breathing), felt reactions, patterns of the mind and apprehension of the basic nature of reality in all experience”[25].

In contrast to its widespread use in meditation practise in the East, most empirical studies on mindfulness have been conducted by Western researchers. For instance, mindfulness has been applied in clinical psychology, medicine, meditation and neuroscience research [1, 26-28], health and well-being [29-31], business [32, 33], education and intelligence-related research [34-36] and socio-psychological behavioural research [37, 38]. Contemporary definitions of mindfulness that have emerged from Western studies recognise an immediate and receptive awareness, shorn of reactions and judgement [25]. However, there can be significant differences between any given concept of mindfulness [25]. These diverse conceptualisations have led to the development of different scales of mindfulness to operationalise the construct, which are typically influenced by the researcher’s particular discipline.

Along this line, although mindfulness has been shown to be a useful construct in understanding a variety of behaviours, its relations to other constructs in socio-psychology have not yet been fully explored. A review of the available literature reveals that there are notable distinctions evident in terms of how mindfulness has been defined. In the next section, this paper will discuss definitions of mindfulness and how they can be applied in road safety research, specifically in relation to speeding behaviour.

Mindfulness and its conceptualisation in relation to speeding behaviour

As mindfulness research has emerged over two decades, most studies have attempted to explore mindfulness in relation to a particular research context (e.g. clinical psychology, meditation, physical activity, intimate relationships, education, business and social behaviour) from which the researcher/s derives who is conducting the study. This paper will provide four conceptualisations of mindfulness from clinical and socio-psychological research and will identify what the authors believe is the most appropriate definition for research in the driver behaviour context.

Since mindfulness originally was applied in clinical practice and research, the first two definitions of mindfulness indicate these particular clinical approaches. First, Kabat-Zinn [1] defined mindfulness in clinical research which examined stress and pain among patients as, “paying attention in a particular way, on purpose in the present moment and non-judgementally to the unfolding of experience moment by moment” (p.145). The second definition was developed by Baer [39]. He described mindfulness as “a non-judgemental observation of the ongoing stream of internal and external stimuli” (p.125). Interestingly, both researchers used the word “non-judgemental”. “Non-judgement” means that experiences (stimuli, feeling) are not being selectively interpreted, censored, weighed or ignored.

While these definitions provide important insights into the history of the mindfulness construct, arguably, such definitions are not relevant to driver behaviour. Kabat-Zinn’s and Baer’s definitions were applied to the development of training intervention intended to enhance mindfulness. This training was found to successfully enhance individuals’ ability to be mindful through meditation. In meditation, mindfulness can be achieved when an individual maintains awareness in a moment-by-moment manner. They may disengage from a strong attachment to beliefs and thoughts and, thus, develop a sense of emotional balance and well-being [1]. In other words, meditation will alter the impact of, and response to, thoughts, feelings and sensations of a patient. For instance, Mindfulness-Based Stress Reduction [MBSR: 1] has been used widely to teach patients to manage stress and emotional distress due to chronic pain caused by conditions such as cancer. Further, according to this conceptualisation of mindfulness, it is believed that meditative practices can be an effective route to the enhancement of one’s ability to be mindful.

Driving, in contrast, is a multitasking activity that requires drivers to manage their attention between various driving and non-driving-related tasks. For instance, during driving, a driver not only focuses his or her attention on the driving task, but at the same time is aware of what is happening around them. This involves making judgement about other road users’ actions so that they can anticipate happenings on the road. In contrast, during meditation the mind becomes relaxed and the individual, ideally, should have empty mind and be open to immediate experience in a passive way. Although meditative practices may enhance mindfulness, it is neither practical nor applicable in the driving context to conceptualise

mindfulness in this particular way due to the dynamic environment that is the driving context which fosters awareness of and attention to the driving activity.

The third definition of mindfulness, which comes from Langer and Moldoveanu [40], describes mindfulness in relation to education as, “a process of drawing novel distinctions” (p.1) which leads to an individual’s heightened sensitivity towards his or her emotion, behaviour and environment. It involves “greater openness to novelty, alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives and orientation in the present” [35]. For example, a person notices a new object around them, and the very fact that they recognize it as new in that context has the effect of situating them in the present. This absorption into current experience will make them aware of the context and each action taken at that time [41]. Although Langer and Moldoveanu’s definition has significant implications to a wide range of social issues and problems, this definition would not be appropriate for use within driver-related research, primarily because Langer viewed mindfulness as a trait rather than as a state [40]. As a trait, mindfulness is examined within the framework of individual differences (i.e. intelligence and personality) and as an enduring characteristic of a person. Sternberg [42] notes that mindfulness has been seen as a trait by a number of writers, and incorporated into research on the “big-five” trait theory (i.e. neuroticism, extraversion, openness to experience, agreeableness and conscientiousness). A recent example is Giluk’s [43] study of mindfulness in relation to the big-five trait theory. Giluk found that conscientiousness, neuroticism and agreeableness had moderate to strong relationships with mindfulness (with a negative effect for neuroticism) and weaker correlations with extraversion and openness to experience. However, conceptualising mindfulness as a trait implies that there is limited opportunity for individuals to become more mindful in general, or across different situations.

In contrast, as a state, mindfulness can be seen as something which varies across situations, and which can perhaps be “trained”. The potential benefits of this conceptualisation at a broader level have been pointed out by Brown and Ryan [38], who argue that increasing one’s mindfulness will foster positive psychological flow or well-being, thus leading to a healthy lifestyle. An individual may take responsibility for his or her experience by paying attention to the present moment and cultivating a different attitude towards the current events. In the driving context, enduring personality traits are not very relevant to the operation of the vehicle, whereas an individual driver needs to have focus, pay attention to the surrounding dynamic traffic environment, and be aware of what is happening around him at any given moment.

Thus, arguably, the most relevant way to conceptualize mindfulness in the driving context is to borrow from the ideas of Brown and Ryan [38]. They offer an alternative conceptualisation of mindfulness and, arguably, it is this latter conceptualisation that is more applicable and relevant to the driving context. Brown and Ryan [38] describe mindfulness as “enhance[d] attention to and awareness of current experience or present reality” where a core characteristic of mindfulness has been described as open and receptive awareness and attention that may be reflected in a sustained consciousness of ongoing events and experiences (pp. 822-823). It is an attribute of consciousness related to wellbeing and naturally occurring individual characteristics [44]. In this definition, Brown and Ryan emphasize 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 the internal and external events or phenomena at any given moment. For instance, 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 (e.g., when entering a school zone, where the speed limit changes and at certain times of the day when there are increased risks for pedestrians if the driver does not slow down). Clearly this situation involves not just the awareness of one’s own behaviour, but also the focusing of attention on important elements of the environment. Thus, raises an interesting question about the relationship between mindfulness as openness to the whole situation, versus the focusing of attention on specific elements (which must therefore be weighted in some way). Brown and Ryan [38] defined attention as 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. Brown and Ryan were not alone in combining these concepts, as Hefner and Felver-Gant [45] also referred to mindfulness as recognising what is happening in the present moment, and being aware and attentive to events and experiences.

With respect to driving activities, where both situational responsiveness and the capacity for changing one's degree of awareness and attention are important, the definition provided by Brown and Ryan [38] is appropriate for driver behaviour research. An individual driver needs to be aware of and attentive to, the present situation around him/ her so that he or she can reflect on their behaviours and take the right action. Thus, an increase in awareness and attention during driving can decrease the probability of dangerous driving. As such, drivers who are mindful may have a lower risk of being involved in a crash.

In conceptualising the mindfulness construct, we need to note the constructs of distraction and inattention, which, on the surface, have some similarity to an individual being less mindful, or exhibiting mindlessness. According to Brown and Ryan [38], a "mindless" person tends to be less attentive and aware of the present moment. Moreover, they tend to act based on past experience which can limit their attention to, and awareness of, the reality of the current situation. An example may be a driver, when driving on a familiar route, and who arrives at their destination without recalling anything about the journey. There is a clear distinction between the two concepts of distraction and mindlessness. Distraction refers to an activity or event that diverts the attention of the individual from the given task and, thus, compromises performance [46]; in contrast, mindlessness is a result of a lack of attention to the present situation. Mindlessness is therefore more similar to the concept of "inattention", however, these concepts also are not one in the same. While inattention is a broader concept which basically means that important elements of the situation or environment have not been attended to (which could be due to a range of factors including, for example, fatigue, intoxication), mindlessness is defined as the human tendency to operate on autopilot without concern for consequences or outcome, whether by stereotyping, performing mechanically or simply not paying attention [47]. This definition incorporates inattention, but goes further to include including forms of automatic responding. Taking the example of speeding behaviour, distraction can be caused by anything that draws the driver's attention away from the road, such as tuning the radio, eating, using a mobile phone (either speaking or texting) or attending to a child. In contrast, mindlessness may result from the familiarity of the driving environment [41]. For instance, a journey from home to the workplace may become very routine, such that over-learning of the driving task on this route occurs, leading the driver to drive as though "on autopilot" and, thus, exhibiting mindless behaviour. Another interesting question which arises in the driving context, but which has not yet been addressed in the mindfulness literature, relates to how undesirable such automatic behaviour really is. Since learning to drive may involve over-learning the manual control tasks, driver may respond automatically to simultaneous events, it appears that mindlessness may have some positive as well as negative aspects in driving context. Besides distraction and inattention, another construct that shares some similarity with mindfulness is situational awareness (SA). Both constructs incorporate an awareness of environmental elements; however, SA represents an 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 [48]. For example, while driving, the driver needs to know where other vehicles and obstacles are as well as the status and movements of vehicle driven; the information gathered about these aspects assists the individual in making decisions that impact upon the way they drive and are driving at any given time.

To date, there has been minimal research linking the concept of mindfulness with safety behaviour and specifically driver behaviour. For instance, Demick [49] 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 characterized by actively drawing distinctions. Similarly, Kass, Cole, and Legan [50] reviewed literature on driver distraction focusing on situational awareness (SA); to improve SA, they 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., [37] 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.

These limited numbers of studies suggest that the use of mindfulness construct can contribute to driver behaviour research, but also illustrates that such research 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 [49], 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 that 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.

In order to assess the potential role of mindfulness within the TPB model, some way of operationalising mindfulness in the driving context is required. In the past few years, self-report questionnaires to assess mindfulness have begun to appear in the literature [38, 51-53]. Not surprisingly, given the different conceptualisations of mindfulness reviewed earlier, these instruments differ in the conceptualisation of mindfulness on which they are based on and the intended usage of the scales. Some of the scales include; the Freiburg Mindfulness Inventory (FMI) [51], the Toronto Mindfulness Scale (TMS) [52], the Kentucky Inventory of Mindfulness Skills (KIMS) [53] and the Mindfulness Awareness Attention Scale (MAAS) [38]. Of these, based on the preceding discussion of the different conceptualisations of mindfulness, only the MAAS is useful in road safety research.

Brown and Ryan [38] developed the Mindfulness Awareness Attention Scale (MAAS) based on their definition of mindfulness (i.e. focusing on awareness and attention). It is a 15 item instrument with a single factor structure. In particular, the MAAS measures the general tendency for an individual to be attentive to, and aware of, the present situation or experiences in daily life. A series of validation studies have been conducted that attest to the scale's validity and sensitivity to change [29, 54]. The items have been designed to reflect mindfulness in general terms in daily circumstances. For example, participants will indicate how often they experience automatic behaviour, from 1 (almost always) to 6 (almost never) (i.e., "I do jobs or tasks automatically, without being aware of what I'm doing"), or how often they experience problems in paying attention to the present situation (e.g., "I find it difficult to stay focused on what's happening at the present moment"). Individuals who score highly on the MAAS are considered to be high on mindfulness, and the scale includes items relevant to driving. Recently, it has been used to validate the Attention related driving errors scale (as discussed above in relation to the Ledesma et al., [37] study). The following discussion therefore assumes that the MAAS will be used to operationalise mindfulness in investigating the potential role of mindfulness when using the TPB to explain speeding behaviour.

The TPB and the intention-behaviour gap

We have outlined the conceptualisation and operationalization of mindfulness which we believe to be the most relevant for application in relation to driver behaviour (i.e., speeding). Next, evidence relating to the existence of the intention-behaviour gap is discussed particularly in relation to how mindfulness may function to improve the TPB's predictive and explanatory capabilities by operating to improve the link between intentions and subsequent behaviour.

The TPB offers a simple model for the relationships among beliefs, attitudes and behaviour, where behaviour is said to be determined by behavioural intention, which, in turn, is predicted by attitude, subjective norms and perceived behavioural control [55]. As mentioned previously, the TPB model has been used widely in social behavioural research due to its simplicity and applicability [56, 57] including research on driver behaviour [6, 21, 22, 58, 59]. However, while the TPB was initially devised as a complete model for social behaviour, Sheeran [19] highlighted that there is a gap in the intention-behaviour relationship that needs further explanation.

Speeding behaviour appears to be well-suited to explorations based within the TPB framework, since speeding can be considered as an intentional and conscious act on the part of the driver (i.e., the driver has control over the behaviour, and therefore should be fully able to make the intention to speed become reality [60]). However, in relation to speeding behaviour, Warner and Aberg [14] found 39% of the variance in self-reported speeding, and 28% of the variance in the logged speeding, while noting that there were drivers who had intended to speed but did not do so. In addition to this group of "intenders who do not take action", Elliot and Armitage [16] found 25% of drivers who intended to comply with the speed limit, did not go on to perform the required behaviour more often than the average driver. 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.

There is reason to expect that the construct of mindfulness could influence the intention-behaviour relationship in speeding behaviour, such that higher or more mindfulness should contribute to a higher probability that intention will lead to behaviour. Mindfulness helps individuals to fulfil their intentions by strengthening the ability for self-control (i.e., the ability to stay focused on plans and control counter-intentional thoughts). In contrast, less mindful individuals behave automatically, which would detract them from following through on their intentions. Thus, the integration of the mindfulness construct within the TPB is expected to likely explain further variance in driver behaviour (i.e., speeding).

Despite this promising line of theoretical development, limited research has been conducted so far that has examined mindfulness in relation to the intention-behaviour relationship. At this stage, only one such study has been identified: Chatzisarantis and Hagger [31]. These researchers demonstrated that mindfulness moderated the intention-behaviour relationship, with the interaction of mindfulness and intentions explaining an additional 5% of variance in physical activity participation after controlling the effects of habit. This result suggests that individuals who act mindfully are more likely to enact their intentions than less-mindful individuals. Although this study was focused on leisure-time physical activity, the possibility of including mindfulness as an additional construct in the TPB for exploring speeding behaviour is promising.

Conclusion

In summary, the TPB has been used widely in the studies of driver behaviour but, although attitude, subjective norms and perceived behavioural control have been shown to be significant predictors of intention as well as subsequent behaviour in these studies, there is still a considerable amount of variance in the intention and behaviour relationship which remains unexplained. As such, the role of mindfulness within the TPB framework represents an important avenue for future research to explore. Further, the use of this framework together with mindfulness to investigate speeding behaviour represents an important research endeavour if we are to further contemporary understanding of how intentions can better predict subsequent behaviour in relation to speeding. To the best of the authors' knowledge, there is no previous study which has conceptualised mindfulness in a road safety context in order to study its influence on behaviour, and certainly not within the TPB.

The first author is currently designing a program of research based upon the TPB framework and will examine mindfulness and speeding behaviour. It is anticipated that this research will shed light on the role of mindfulness in improving the association between intentions and subsequent behaviour. 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.

Considering the existing research on speeding behaviour in relation to the TPB and the limitations outlined above, it is expected that this research will enhance the understanding of the factors underpinning the speeding behaviour in school zones. Furthermore, it is expected that the application of a well established theoretical model will enable comparisons between Australian and Malaysian drivers' behaviours, thus highlighting similarities and differences across these contexts. Finally, by addressing the limitations outlined above (i.e., limited understanding of mindfulness in speeding behaviour), the proposed study may offer two important benefits: (i) it may provide insight into the need for mindfulness to be incorporated in future studies as well as the guidance on how the construct may be operationalised in this context; and (2) it may help to inform the development of interventions which, ultimately, may reduce the risk of road crashes. In terms of the interventions, this research may inform, as an example, the design of safer roadside environments in terms of signage and advertising (e.g., content and design of billboards).

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