

## **Improving self-report measures of speeding**

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### **Abstract**

There is continuing debate regarding the psychometric properties of self-report measures of behaviour, particularly in road safety research. Practical considerations often preclude the use of objective assessments, leading to reliance on self-report measures. Acknowledging that such measures are likely to remain commonly used, this pilot project sought not to argue whether self-report measures should continue to be used, but to explore factors associated with how individuals respond to self-reported speeding measures. This paper reports preliminary findings from a qualitative study (focus groups and in-depth interviews) conducted with licensed drivers to explore the operational utility of self-reported speeding behaviour measures. Drawing upon concepts from the Theory of Planned Behaviour (TPB; Ajzen, 1991) and Agency Theory (Bandura, 2001), we identified four dimensions of self-reported speeding: including timeframe, speed zone, degree over the speed limit and, overall frequency of the behaviour, and examined participants' perceptions of the operational utility of these factors. Issues related to comprehensibility, perceived accuracy, response format and layout were also explored. Results indicated that: heterogeneity in the timeframe of behavioural reflections suggests a need to provide a set timeframe for participants to consider when thinking about their previous speeding behaviour; response categories and formats should be carefully considered to ensure the most accurate representations of the frequency and degree of speeding are captured; the need to clearly articulate "low-level" speeding on self-report measures; and, that self-reports of speeding behaviour are typically context-irrelevant unless stipulated in the question. Limitations and directions for further research are discussed.

### **Introduction**

Psychometrically sound measures are imperative for understanding the prevalence of speeding. Two approaches are commonly used: objective measures (e.g., offence data) and subjective measures (e.g., self-report surveys), each with their own strengths and limitations. Studies have shown significant and moderate positive correlations (i.e.,  $r = .20-.65$ ) between objective and subjective measures of speeding behaviour (Aberg & Warner, 2008; De Waard & Rooijers, 1994; Fildes, Rumbold, & Leening, 1991; Hagland & Aberg, 2000; Harrison, Fitzgerald, Pronk, & Fildes, 1998; Parker, 1997; West, French, Kemp, & Elander, 1993). However, based on current literature it is unclear whether self-reported speeding measures accurately assess actual speeding behaviour (see Greaves & Ellison, 2011). Moreover, there is limited research evaluating the operational utility of self-report measures in this area.

The use of self-report measures of speeding behaviour is common and represents an efficient and cost-effective approach (Furr, 2009; Krueger & Kling, 2000). Such measures also offer access to information (e.g., attitudes, beliefs) that may be unobtainable using objective methods (Krueger & King, 2000). Also, to the extent that offending goes undetected, such measures may provide greater insight into the prevalence of a behaviour, compared with data from official sources (Corbett

& Simon, 1992). While subjective and objective measures of speeding can be validated against one another (e.g., via naturalistic driving studies), limited research has examined this relationship.

As Haefel and Howard (2010; p.187) argue, previous critiques of self-report methods have been “presented in a theoretical vacuum and rarely explain why alternative measures [such as objective measures] would be better options than self-report”. Acknowledging the inherent difficulties associated with individuals reporting on their own cognitive processes, they argue that the low or moderate correlations between self-report and objective measures may reflect weaknesses in objective measures, rather than in subjective assessments of behaviour.

The primary limitation of self-report measures relates to the assumption made by researchers that “people are capable of meaningful introspection about their psychological [or behavioural] status on the variable of interest and can be relied on to report about it in a meaningful way” (Krueger & Kling, 2000; p.220). The extent to which such subjective descriptions are inaccurate has implications for the validity of data generated by such methods. Such inaccuracies can be due to difficulties associated with the comprehension of items, recalling of information and/or the ability to accurately report information once it has been recalled (Hatfield, Fernandes, Faunce, & Job, 2008; Krueger & Kling, 2000). Therefore, efforts to minimise or eliminate these inaccuracies will enhance data quality.

Various self-report measures of speeding behaviour have been adopted in previous studies. Some have examined overall speeding behaviour, while others have investigated speeding in relation to numerous characteristics, including, for instance: speed limit or road type; degree over the limit; typical/normal speeds versus preferred speeds; weather and traffic conditions (e.g., free-flow, presence of other traffic); the timeframe in which respondents are required to draw from their memory; and, the influence of normative factors (e.g., peer pressure, other drivers).

Past measures have differed in terms of the number of items employed (e.g., single items versus scales), the wording of items (e.g., focus on speeding behaviour or compliance), order of items, and response categories and labels presented to respondents (e.g., all points anchored versus end points only). Furthermore, while questionnaire and scale development has received significant research attention across a range of behaviours, we argue that speeding represents a complex and unique behaviour that warrants special attention, given its transient nature. We also argue that a limitation of previously developed self-report speeding measures is that they are atheoretical in nature. The development of a scale in the absence of a guiding theoretical/conceptual framework is problematic to the extent that, similar to any other behaviour, speeding is dependent upon interplay between the environment, the person, and the behaviour. Thus, these factors need to be captured within a self-report scale so as to provide a comprehensive measure of an individual’s capacity to engage in speeding.

To accurately identify the dimensions of speeding, the current work adopts the theoretical frameworks of the Theory Planned Behaviour (TPB; Ajzen, 1991) and Agency theory (Bandura, 2001). In accordance with these theories and a review of existing empirical evidence, we argue that four key dimensions need to be incorporated within a self-report measure of speeding: (i) timeframe; (ii) speed zone;

(iii) degree over the speed limit; and, (iv) overall frequency of the behaviour. These dimensions align with the core features of Agency Theory, including intentionality, forethought, self-reactiveness and self-reflectiveness. Furthermore, the first three dimensions are supported by the TPB's TACT principle. This theory posits that to enhance behavioural explanation, target behaviour and action, time and context need to be specified.

The aim of this study is to examine the operational utility of these dimensions of self-reported speeding. Despite meaningful recent critiques of self-report measures, which caution against their use (af Wahlberg, 2009; Harrison, 2010), they are likely to continue to be used in road safety research. Thus, a fundamental objective is to select subjective measures that most comprehensively capture the complexities associated with asking drivers to estimate their behaviour. This paper presents the methodology and findings of a pilot study designed to explore such complexities and inform the development of a psychometrically sound self-report measure of speeding.

## **Methodology**

This pilot study sought to gain greater insight into how drivers respond when asked to report on their driving speeds, via qualitative investigation. Group discussions and individual interviews were conducted. All discussions/interviews were conducted by the first author using a structured interview schedule and four example self-report measures which were devised by the researchers based on considerations of previous literature (see Figure 1). Specifically, participants were asked to describe how they thought about their driving speeds and how they could report such speeds accurately before they were presented with the four example measures. The four measures were presented to each participant using a counterbalanced, within-subjects design.

The research addressed issues associated with the way in which drivers reflect on their behaviour, which in turn impacts on their subsequent responses to self-report speeding measures. That is, the project focused on *how* participants responded to the measures, rather than the actual content of their responses. As noted previously, the four key components investigated were: timeframe (which individuals consider when thinking about reporting on their speeding behaviour), degree and frequency of speeding (how participants considered and described the amount and severity of their speeding), and the situational and contextual factors (e.g., speed zone) that are considered when responding and which may influence the responses provided to a self-report measure. Participants also were asked about the perceived comprehensibility of the measures and preferences regarding format and layout of the measures.

Licensed drivers were recruited from an inner city university campus. Three focus groups ( $n = 12$ ) and five interviews ( $n = 5$ ) were conducted. The sample consisted of twelve females and five males. Focus groups took approximately one hour, and the interviews were completed within 30 minutes. Participants received a \$20 gift voucher to reimburse them for their time.

## **Findings**

Findings are presented in relation to the four key components: timeframe of recall; frequency of the behaviour; severity of behaviour; and, the situational/contextual characteristics influencing behaviour (and subsequent responding on a self-report survey). A brief description of discussions associated with the perceived accuracy and comprehensibility of each of the four example self-report speeding measures, as well as other related issues, are then presented.

### ***Timeframe of responses***

Participants were asked to describe, when answering questions regarding their speeding behaviour, how far back in time they considered. Timeframes varied with the majority of participants suggesting between 3-12 months. However, a number of respondents reported that they drew upon longer periods or even their entire driving lifetime.

Participants were also asked whether questions probing speeding behaviour should specify the timeframe in order to improve their accuracy. The majority agreed with this practice; however, there was variation in the preferred timeframe to be specified: *"You've got to put a bit of a time limit on it because compared to when I first started driving compared to how I drive now, it's changed"* (Female, FG3).

### ***Degree of speeding behaviour***

Participants were asked to outline how they would describe the degree to which they exceeded the speed limit. The majority of participants operationalised the degree to which they sped as the number of km/h over the limit: *"I usually go by how many k's over"* (Female, FG1).

A number of respondents highlighted the need for response categories to be carefully considered. Many argued that including 1-5km/h over and 6-10km/h over (rather than just a single category of 'up to 10km/h over') would improve the accuracy of responses, particularly in relation to lower speed limit zones. Indeed, it was argued that there is a substantial difference between travelling 2km/h and 10km/h over the speed limit and that less restrictive degree categories may encourage inaccurate responses as a function of social desirability bias. Moreover, it was argued that more clearly specifying lower level speeding categories would improve the interpretation of subsequent data: *"When you look at the results you might find that five hundred people are in that 1 to 10 kilometre category but then if you sat down and talked to them you might find that three hundred of them only go a couple of kilometres an hour over and it's normally by an accident"* (Female, Int1).

### ***Frequency of speeding***

The majority of respondents viewed their frequency of speeding as a proportion of their overall driving time that was spent exceeding the speed limit: *"I think of it as a percentage ... I think what percent of the time am I over the limit"* (Male, FG1). Moreover, many participants, in accordance with a perceived 10% enforcement tolerance, reported driving within 10% above the speed limit. When probed, these respondents still acknowledged that this represented speeding and

that they factored such instances into their responses: *“I know on the freeway you can’t get booked until over a hundred and ten so I always stick just under that ... It’s not drastic but you’re technically still breaking the law”* (Female, FG1).

Participants tended to only consider instances of driving in free-flowing traffic when answering questions regarding the frequency of their speeding behaviour. However, respondents were polarised regarding whether they considered deliberate, inadvertent or both types of speeding when responding. Approximately half the sample reported that they included both deliberate and inadvertent speeding, while the remaining participants reported considering only deliberate speeding.

### ***Situational/contextual characteristics of speeding behaviour***

Participants highlighted numerous factors that influenced their speed choices. These included road and environmental factors, such as the quality and type of road surface, traffic flow, weather conditions, speed zone and type of road (e.g., highways versus urban streets versus residential streets). A number of social and personal influences were also outlined, including time-pressures (e.g., running late), mood, normative influences of other drivers and whether passengers were present.

Despite considerable insight into these factors, when probed, participants stated that when asked to describe their speeding behaviour, they typically thought about general driving situations in free-flowing traffic rather than focusing on any of the aforementioned factors. However, the type of road and the speed limit were reported as influencing responses: *“I think different type style roads would dictate what sort of speed I do”* (Male, FG1).

A number of participants suggested the need to distinguish between 40km school zones and 40km/h roadwork zones, reporting different attitudes toward, and subsequent behaviour in, these zones. The majority of participants reported very rarely (and almost never) intentionally speeding in school zones. However, many reported regularly speeding in 40km/h roadwork zones, particularly when they perceived that the level of work being performed was minimal: *“When I think forty kilometres an hour, if it’s a road works, I tend, I don’t know why, I always speed through road works, I’m always over the limit ... if the sign is there and they’re not doing anything then it’s straight through but if there’s actually people there I take it as a school zone as such”* (Male, FG1).

Finally, a number of participants suggested that if questions were designed to examine behaviour in different speed zones, that the zones should be exhaustive rather than only addressing the major speed zones (e.g., 40km/h, 60km/h and 100km/h): *“I drive in a lot of seventy and eighty zones so it’s like do I put the seventy and eighty in that category or that category ... It might be a little bit difficult but I think it would be more accurate separating them”* (Female, Int1).

### ***Comprehensibility and perceived accuracy***

Figure 1 outlines the four example measures presented to participants. All measures examined speeding behaviour in 40km/h, 60km/h and 100/110km/h zones, at various degrees (at or below the speed limit, between 1-10km/h over,

Figure 1. Examples of the self-reported speeding measures presented to participants.

<b>EXAMPLE 1<sup>a</sup></b>										
When <b>you</b> are driving in a 60km/hr speed zone or urban road, how often did <b>you</b> engage in the following behaviours?										
		Never					Always			
		1	2	3	4	5	6	7		
a) Drive at or below the speed limit		1	2	3	4	5	6	7		
b) Drive between 1-10km/hr over		1	2	3	4	5	6	7		
c) Drive between 11-20km/hr over		1	2	3	4	5	6	7		
d) Drive more than 20km/hr over		1	2	3	4	5	6	7		
<b>EXAMPLE 2<sup>a</sup></b>										
When <b>you</b> are driving in a 40km/hr speed zone or school zone, what percentage of time do you spend (must add up to 100%)?									%	
a) Drive at or below the speed limit									_____ %	
b) Drive between 1-10km/hr over									_____ %	
c) Drive between 11-20km/hr over									_____ %	
d) Drive more than 20km/hr over									_____ %	
<b>EXAMPLE 3</b>										
What proportion of your driving is done in the following speed zones (answers reading across the page must add up to 100%)?										
40km/h		50km/h		60km/h		70-90km/h		100+km/h	Total	
	+		+		+		+		= 100%	
How often do you engage in the following behaviours in each of these speed zones (answers reading across the page must add up to 100%)?										
	% at or below		% 1-10km/h over		% 11-20km/h over		% 21+ km/h over	Total		
40km/h		+		+		+		= 100%		
60km/h		+		+		+		= 100%		
100km/h		+		+		+		= 100%		
<b>EXAMPLE 4</b>										
What proportion of your driving is done in the following speed zones (answers reading across the page must add up to 100%)?										
40km/h		50km/h		60km/h		70-90km/h		100+km/h	Total	
	+		+		+		+		= 100%	
How often do you engage in the following behaviours in each of these speed zones (answers reading across the page must add up to 100%)?										
	Location	% at or below		% 1-10km over the limit		% 11-20km over the limit		% 21+ km over the limit	Total	
40km/h	Urban		+		+		+		= 100%	
	Rural		+		+		+		= 100%	
60km/h	Urban		+		+		+		= 100%	
	Rural		+		+		+		= 100%	
100km/h	Urban		+		+		+		= 100%	
	Rural		+		+		+		= 100%	

<sup>a</sup> Note: these same questions were asked for each of three speed limit zones – 40km/h, 60km/h and 100/110km/h.

between 11-20km/h over, more than 20km/h over). Differences included the response format employed, layout of the measure and inclusion of ancillary questions. Specifically, Example 1 employed a 7-point Likert scale response format,

anchored only at the end points (“Never” and “Always”), with a vertical (e.g., top-down) layout. Example 2 employed an identical vertical layout, but used a percentage-based response format. Examples 3 and 4 also employed a percentage-based response format and included an additional question about the proportion of driving conducted in various speed zones. Examples 3 and 4 were presented using a horizontal (e.g., left to right) layout. The main difference between 3 and 4 was that the latter included measurement of speeding behaviour on rural versus urban roads.

As Table 1 shows, most participants reported that Examples 1 and 2 were relatively straightforward to fill out, while Examples 3 and 4 involved increasingly higher degrees of difficulty to complete. Response set bias was reported in association with all measures, with some participants suggesting that initial responses heavily influenced subsequent responses. This tendency applied particularly to the percentage-based approaches. The unfamiliarity associated with the horizontal layout of Examples 3 and 4 was reported as enhancing completion difficulties of these measures. Finally, the addition of plus signs and the rural/urban split of behaviour tended to reduce the clarity of the measures and increase the complexity associated with responding.

Example 1 was reported to most poorly reflect actual behaviour. The response categories used for this measure were identified as somewhat illogical, such that it was possible to report driving at or below the speed limit as well as always driving at some degree over the speed limit. Conversely, Example 2 was reported to reflect actual behaviour relatively accurately and Example 3 was perceived to be highly accurate. Interestingly, the same feature that was identified as making the measures more difficult to complete (i.e., the need to assign proportions to the frequency of behaviour) was the same characteristic that was perceived to increase their relative accuracy. Respondents were divided in their opinions

*Table 1. Perceived comprehension and accuracy associated with the example self-reported speeding measures.*

<b>Example</b>	<b>Response format</b>	<b>Additional questions</b>	<b>Ease of responding</b>	<b>Accurate reflection of behaviour</b>
One	Likert; vertical	No	Very easy	Low accuracy
Two	Percentage; vertical	No	Very easy	Accurate
Three	Percentage; horizontal	% time in zones	Somewhat difficult	Very accurate
Four	Percentage; horizontal	% time in zones; rural/urban split	Difficult	Mixed accuracy based on rural versus urban estimates

regarding the accuracy of Example 4. The perceived accuracy of the measure was reported as being dependent on the level of exposure to rural roads, such that it would be more accurate for those who commonly drive on rural roads.

### ***Response format and layout***

In relation to the Likert-scale measure (Example 1), the majority of participants reported assigning their own descriptive terms for the unanchored points or conceptualising the points as a sliding scale representing a percentage. It was suggested that anchoring all points of the scale would remove ambiguity and improve the accuracy of responses, given that each individual would otherwise conceptualise the points differently. This finding is consistent with previous research suggesting that response options should be exhaustive and mutually exclusive (Krosnick & Presser, 2010). Overall, the use of a 7-point scale was supported; however a number of participants suggested that a 5-point scale may be more accurate, such that while the meaning of points 1, 4 and 7 were clear, they were less clear about the difference between points 2 and 3 and points 5 and 6.

A number of issues were expressed in relation to the use of percentage-based response formats (Examples 2, 3 and 4). While the majority of participants reported rounding numbers ending in 5 or 0, few perceived this as reducing the accuracy of the measure. More critical to the perceived accuracy of the measure was the reported tendency to fill out a certain part of the response sheet and base future responses from that initial response. Some respondents suggested a reluctance to change initial responses which could have potentially biased subsequent estimates and detracted from the accuracy of overall responses. A number of participants reported that responding in a vertical fashion (Examples 1 or 2) was more aesthetically pleasing and facilitated the ease and comprehensibility of responding to the measures, compared with responding in a horizontal fashion (Examples 3 or 4).

A number of issues arose regarding the requirement to identify behaviour on both urban and rural roads separately. The most common criticism came from respondents who reported not regularly driving in rural areas, with many suggesting their responses represented estimated guesses. Indeed, there was substantial variation in the manner in which participants considered rural and urban roads. Subsequently, a number of respondents suggested that the inclusion of a 'non-applicable' response option or an exposure item (similar to that employed to measure proportion of driving in various speed zones) would enhance accuracy. Finally, a number of participants suggested that the complexity of the measure could be reduced by presenting a series of items relating to urban roads, followed by the same series of questions for rural roads, rather than integrating the two.

### **Discussion & Conclusions**

Despite their subjective nature, self-report measures of speeding behaviour are likely to remain a tool in road safety research. Thus, this pilot study aimed to investigate how the complexities associated with such measures can be minimised. Utilising a qualitative research design, we examined the operational utility of particular dimensions underlying speeding behaviour based upon a conceptual framework (comprised of the TPB and Agency Theory). Issues relating to the layout and response format of measures were also examined.

The varied responses in relation to timeframe for considering speeding suggest a need for a precise specification to remove ambiguity. Participants also suggested that the use of two response categories (i.e., 1-5km/hr and 6-10km/hr over the speed limit), rather than using 'up to 10km/hr over the speed limit', would improve the accuracy of responses, particularly in relation to low-level speeding. This finding is particularly important in light of recent evidence to suggest that up to 70% of speeding behaviour involves exceeding the speed limit by less than 10km/h (Greaves & Ellison, 2011). Therefore, we recommend that future research should employ measures which accurately capture low-level speeding. It was also suggested that measures should include more speed zones in which behaviour is examined; however this decision should largely be informed by research needs. Overall, when asked to describe their speeding behaviour, participants reflected upon their general driving in typical conditions. While many factors were acknowledged as influencing speeding (e.g., running late, driving with traffic flow), participants typically only considered these factors if they regularly occurred. Overall, the results indicated a preference for percentage-style response formats, compared with more traditional Likert scale approaches and reported that percentage responses more accurately reflected their behaviour. Vertical layouts were regarded as more aesthetically pleasing and more comprehensible.

A strength of this study is that the speeding dimensions were identified from the literature, as well as from relevant theory, namely TPB (Ajzen, 1991) and Agency Theory (Bandura, 2001). Only one paper to date has examined driving behaviour within a relevant theoretical model (Newnam, Greenslade, Newton, & Watson, in press). This is an important stage in the scale development process as it provides the foundations to the development of a psychometrically sound scale. Thus, future research can develop a scale that identifies the core factors constituting speeding behaviour. In achieving this task, we argue that this will reduce any contaminated sources of variance associated with measures that adopt less stringent goal perspectives. Limitations of the research include the small sample size and lack of representativeness of the sample. In addition, this study represents only preliminary pilot research. The examples employed in the current study were chosen to explore the conceptual framework discussed earlier and it is acknowledged that these measures are not an exhaustive representation of measures used in previous research. Finally, a number of additional psychometric properties associated with measurement development were not fully explored in the current research (e.g., anchoring of Likert-scale responses, validity checks, etc).

Future research should further explore the applicability of the conceptual framework and the four dimensions identified as relevant to speeding with a larger, more representative sample. Greater attention must also be paid to the psychometric properties of the example measures, such as response formats, layout, validity checks, test-retest reliability and the anchoring of Likert scale response options (Krosnick & Presser, 2010). A product of this research is likely to be the development of a self-report measure that can be rigorously validated against appropriately collected objective data from the same sample. Efforts such as the current study to improve self-report measures may improve our understanding of speeding behaviour and, thus ultimately, the manner in which we can work towards reducing and preventing such behaviour.

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