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Selecting anti-speeding messages for roadside application

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ABSTRACT

Purpose: Analyze qualitative and quantitative data to determine the relative effectiveness of theoretically-developed anti-speeding messages, as judged by relatively inexperienced and experienced drivers, both for themselves as a driver, and for drivers in general.
Method: Eight focus groups and three individual interviews were conducted. Participants initially completed a questionnaire, ranking sets of three anti-speeding messages representing each of the six components of protection motivation theory (PMT). Participants were encouraged to write down the reasons for their rankings. During group and individual facilitation sessions, the rankings and reasons for them were discussed to identify salient reasons for participants' judgments. The ranking data were analyzed quantitatively, with individual and group-based comments being analyzed thematically.
Results: Quantitative analyses of message pairs revealed five third-person effects (TPEs). Three messages were perceived as more relevant to drivers in general than to the participant-as-driver while two were associated with reverse TPEs, which participants perceived as more relevant to themselves-as-driver than for drivers in general. For four PMT components (rewards, self-efficacy, response efficacy, response costs), one or more messages received significantly higher rankings than one or more other messages representing the same component. Substantial variation was found within the individual and group discussion comments in respect of nearly all the messages, reflecting different driver perspectives and demographics.
Discussion: A general preference for shorter messages was evident, leading to a revision of most of the messages comprising the stimuli for this study. On the basis of the focus group and interview responses, consideration was given as to which messages would be recommended for a pilot field study.

1. Introduction

Robust evaluation is required to test roadside message effectiveness (Algie, 2011), which should be theoretically based (Glendon and Walker, 2013; Lewis et al., 2016; Parker et al., 1992; Stead et al., 2005; Tay and de Barros, 2008, 2010). Protection motivation theory (PMT) has demonstrated predictive validity for risky driving behaviors, particularly speeding (Cathcart and Glendon, 2016; Glendon and Walker, 2013; Lewis et al., 2007; Tay, 2005). To augment studies adopting a primarily quantitative approach (Cathcart and Glendon, 2016; Glendon and Walker, 2013), this qualitative study aimed to identify whether messages representing PMT components could be effective in influencing drivers to drive within the speed limit. As well as confirming that drivers would be motivated by different message types, consistent with Lewis et al. (2007) some messages were expected to be influenced by third-person (self vs. other) effects.

1.1. Protection motivation theory (PMT)

PMT predicts that people's intentions to engage in certain behaviors are influenced by their cognitions about both the maladaptive responses (e.g., speeding) and alternative adaptive responses (e.g., driving within speed limits) (Floyd et al., 2000). PMT explains motivation to adopt either adaptive or maladaptive behaviors in response to threats. In PMT, primary threat appraisal (TA) comprises perceived: a) threat severity, b) vulnerability to the threat, and c) rewards associated with a maladaptive response. Secondary coping appraisal (CA) components are perceived: a) self-efficacy to adopt the adaptive behavior, b)

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response efficacy in controlling/minimizing the threat, and c) cost of the adaptive response, all of which tend to decrease the likelihood of adopting that response. The likelihood of an adaptive behavioral response is greater when the person perceives strong response efficacy and self-efficacy as well as associating few costs with performing the behavior. Performing maladaptive behaviors is more likely when the person holds positive beliefs about the rewards associated with the behavior, and perceives low vulnerability and severity outcomes for engaging in the behavior (Floyd et al., 2000; Grunfeld, 2004; Maddux and Rogers, 1983).

Combined, these two appraisal processes form protection motivation, the key mediator between appraisal and behavior (Milne et al., 2000; Prentice-Dunn et al., 2009). Protection motivation comprises an intention to perform a behavior (e.g., drive within a speed limit), being a function of a belief that: a) the threat is severe, b) the individual is personally vulnerable to the threat, c) the adaptive behavior will effectively avert the threat, d) the individual is competent to complete the adaptive response, e) rewards associated with the maladaptive behavior are small, and f) costs associated with making the adaptive response are small (Cismaru, 2006). According to PMT, campaign effectiveness will be maximized when a message influences an individual in one or more of these ways.

1.2. Cognitive approaches to driver speeding

Driving researchers have used a great number of theoretical models (Glendon, 2011). Driver speeding, defined most simply as exceeding a signed speed limit, is complex, reflecting various motivations, including a driver: 1) not perceiving a speed instruction (e.g., being distracted), 2) deliberately not adhering to it (Recarte and Nunes, 2002), or 3) being unaware that they are exceeding the limit (Lewis-Evans et al., 2011). While acknowledging that PMT cannot provide a basis for addressing all possible driver speeding behaviors, it might be instructive to consider the possible impact of a driver viewing roadside anti-speeding messages within the context of some other driver behaviour theories. Various theories have been forwarded as a basis for driver speeding, including attentional speed control (e.g., Recarte and Nunes, 2002), cognitive load (e.g., Lewis-Evans et al., 2011), and cognitive control (e.g., Engström et al., 2017).

Attentional speed control theory (Recarte and Nunes, 2002) proposes that, in the absence of specific speed restrictions, drivers seek to minimize attentional effort by selecting an optimum preferred speed for the (traffic, weather, etc.) conditions. However, imposition of speed restrictions requires additional cognitive resources (e.g., monitoring speedometer, accelerator pedal adjustment) to maintain speed control. Although this approach has been operationalized for experimental study, the near-ubiquity of posted speed limits means that public road driving, at least in most OECD countries[1], offers virtually no legal basis for completely unrestricted speeding. This implies that some attentional control is always involved in maintaining a speed that is within a signed limit, as well as to address other features of safe driving (e.g., maintaining adequate headway from a lead vehicle). While attention to speed control might be attenuated by vehicle features such as adaptive cruise control, these involve driver vigilance for other aspects of the traffic and roadway environment, thereby requiring continued deployment of attentional control. Although increased attentional resources could be devoted to speed control when a driver sees a speed restriction sign in a highway setting (Recarte and Nunes, 2002), this might only occur if such a perception makes a noticeable difference to the driver's optimal choice of speed under those traffic conditions. In summary, evidence from attentional speed control theory is currently insufficient to suggest that roadside signage displaying brief speed awareness messages might significantly increase attentional resources required for speed control.

While the theory of planned behavior, including various enhancements, has been extensively adopted as a basis for considering driver motivations (Glendon, 2011), in many instances theories seeking to explain various aspects of driving (e.g., speeding) have been developed separately from social–cognitive approaches to motivation (e.g., PMT, health belief model, health action process approach, extended parallel process model). However, driver cognitions have been key to many motivational theories specific to driving. Within a cognitive load framework, Lewis-Evans et al. (2011) contrasted monitoring versus threshold type motivational theories of driving, favoring the latter based on findings from their driving simulator studies. These authors noted that different countermeasures would be required to target drivers exceeding speed limits unintentionally, from those seeking to address intentional speeding. However, although an implicit assumption in the current study was that at least some speeding is intentional, anti-speeding message dissemination via roadside signage when a driver may be speeding, could also address instances of unintentional speeding by providing a reminder about speed at a relevant time (Phillips et al., 2011), thereby addressing both message content and display context.

Based on guided activation theory, the cognitive control hypothesis (Engström et al., 2017) maintains that cognitive load impairs driving sub-tasks that require cognitive control (e.g., wayfinding), leaving automatic performance (e.g., lane control) unaffected. Cognitive load refers to the cognitive resources demanded of the driver by competing activities, and might either improve performance (e.g., by increasing attentional load to the optimum), degrade performance (e.g., by interfering with one or more critical driving tasks), or leave driving performance essentially unchanged (e.g., by being readily accommodated with critical driving tasks). In an extensive review, Engström et al. (2017) found that cognitive load effects on driving were highly selective and task dependent, including that cognitive load might be a factor underlying unintentional speeding. Their definition of driver distraction excluded activities critical for safe driving, which might include reading driving-related roadside signage. Cognitive load could therefore be relevant to roadside signage in terms of the amount of information to be perceived and acted upon within the context of the driver's existing workload, including routine scanning of the road environment, and whether this comprised either an automated activity, which would remain unaffected, or an activity requiring cognitive control.

Unlike cognitive load conditions typically employed in experimental (e.g., driving simulator) experiments, as a standard feature of the natural driving environment, the impact of any particular example of roadside signage in terms of its effect on a driver's cognitive (e.g., attentional) load is unknown. However, if it could be shown to increase a driver's cognitive load, then the trade-off would be the expected benefit that it could serve as a motivational trigger and thereby reduce speeding behavior, which could justify its application.

In many theoretical expositions of driver behavior (e.g., speeding), "risk" is either not defined, or implicitly represents only "crash likelihood". However, as reflected in PMT and some other social–cognitive motivation theories, "risk" is interpreted multi-dimensionally within the broader concept of threat, in this case addressing potential benefits or rewards of speeding, as well as possible dis-benefits or costs. As all those proposed theories may have some merit, a "grand theory" of driver behavior may remain elusive. However, drivers are motivated by many different things, both between drivers and for the same driver across different situations. Beyond the laboratory, anti-speeding campaigns would ideally reflect this complexity. The PMT framework describes motivational factors targeting how individuals (and groups) might consider the extent to which, inter alia, they are vulnerable to a particular threat, and how severe its consequences could be. For different threats, PMT provides guidance as to how a message can be

[1] There are a few exceptions. For example, in Germany 40% of autobahns have no speed limit, while for cars and motorcycles, beyond city limts there is no national speed limit on highways with central reservations and two lanes in each direction.