Young Drivers' Engagement with Social Interactive Technology on their Smartphone: Critical Beliefs to Target in Public Education Messages

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Abstract

The current study forms part of a larger study based on the Step Approach to Message Design and Testing (SatMDT), a new and innovative framework designed to guide the development and evaluation of health communication messages, including road safety messages. This four step framework is based on several theories, including the Theory of Planned Behaviour. The current study followed steps one and two of the SatMDT framework and utilised a quantitative survey to validate salient beliefs (behavioural, normative, and control) about initiating, monitoring/reading, and responding to social interactive technology on smartphones by $N = 114$ (88 F, 26 M) young drivers aged 17 to 25 years. These beliefs had been elicited in a prior in-depth qualitative study. A subsequent critical beliefs analysis identified seven beliefs as potential targets for public education messages, including, 'slow-moving traffic' (control belief - facilitator) for both monitoring/reading and responding behaviours; 'feeling at ease that you had received an expected communication' (behavioural belief -advantage) for monitoring/reading behaviour; and 'friends/peers more likely to approve' (normative belief) for responding behaviour. Potential message content targeting these seven critical beliefs is discussed in accordance with the SatMDT.

Keywords: Young drivers, Smartphone, Beliefs, Public education messages, Social interactive technology, Step approach to Message Design and Testing (SatMDT)

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Smartphones are a type of mobile phone with a range of functions superior to a standard mobile phone and similar to a computer. The term 'interactive technology' broadly encompasses functions that respond to user actions which, in turn, may cause the user to respond further (Interactive Technology Learning Curriculum, 2012). Social interactive technology accessible on smartphones allows the user to communicate with other people and includes social networking sites (e.g., Facebook, Twitter), emails, and also texting and calling. The idea that people communicate with others through a range of media (e.g., Skype, Facebook, phone calls) has been termed 'media multiplexity' and is increasingly characteristic of modern relationships (Baym, 2015, p 156). A recent Australian survey of over 2000 adults aged over 16 years from metropolitan and regional centres found that 75% of Australian mobile phone owners now have smartphones. This figure has more than doubled in the past three years and is expected to reach 91% by 2017 (Telstra, 2014).

The increased functionality of smartphones, compared to standard mobile phones, has meant that they have a greater potential to distract a driver. A survey of 415 drivers in the Australian state of New South Wales found that 68% had read emails and 25% had updated their Facebook status or tweeted while driving (National Roads and Motorists' Association [NRMA], 2012). Of particular concern is that drivers may be accessing the social interactive technologies in the hand-held mode (Rudin-Brown, Young, & Lenne, 2013), thereby increasing crash risk. Additionally, as hand-held mobile phone use is illegal for all Australian drivers, drivers may be concealing their use from outside view, making detection

and enforcement difficult (Rudin-Brown et al., 2013) and further diverting the driver's eyes from the road.

1.1 Young Drivers

In Australia, young drivers aged 17 to 25 years constitute just 12.4% of the population (Australian Bureau of Statistics, 2015) yet are represented in over 20% of road crash fatalities (Department of Infrastructure and Regional Development, 2014). In the Australian state of Queensland, where the current study was conducted, learner drivers and provisional licence holders under the age of 25 years are not permitted to use any form of mobile phone, including hands-free. Despite this legislation, younger drivers aged 18 to 25 years are more likely than any other age group to use a mobile phone while driving (Australian Associated Motor Insurers [AAMI], 2012), particularly a smartphone. Indeed, an Australian survey of 3,706 drivers of all ages found that young drivers aged 18 to 24 years were twice as likely to make a phone call and four times more likely to text than drivers over 50 years, and were more likely to read emails on their smartphones (AAMI, 2012). When asked to report the emotions that they experience in relation to their smartphone in a large American study, young people aged 18 to 29 years were more likely than any other age group to report feeling distracted (Smith, 2015). Such distraction, specifically the behaviours of dialling, reaching for a mobile phone, and sending or receiving text messages have been shown to significantly increase the risk of crash or near-crash of newly licensed drivers (Klauer, Guo, Simons-Morton, Ouimet, Lee, & Dingus, 2014). Young drivers' willingness to use a smartphone while driving and their greater propensity to feel distracted when they do so, combined with their relative lack of driving experience, significantly increases their chance of being involved in road trauma compared to more experienced drivers (Foss & Goodwin, 2014).

1.2 Initiating, Monitoring/reading, and Responding

There is a growing body of evidence that suggests mobile phone use comprises a number of distinct behaviours. Different motivations have been identified as underpinning driver behaviours such as sending and receiving text messages (Nemme & White, 2010), and obvious and concealed texting (Gauld, Lewis, & White, 2013). Few studies, however, have investigated the behaviours of initiating, monitoring/reading, and responding which could be broadly applied to the range of social interactive technologies. Waddell and Wiener (2014) found that drivers had greater intentions to engage in, and had reported more actual engagement in, responding behaviours than initiating behaviours and suggested that social pressure to respond may play an important role. Other research supports this conclusion, particularly within the population of young drivers (Atchley, Atwood, & Boulton 2011; Nemme & White, 2010). It is possible, therefore, that young drivers also feel a social pressure to respond when accessing additional social interactive technologies on their smartphones (e.g., email, Facebook).

Atchley et al. (2011) categorized texting behaviours into 'initiating', 'reading', and 'responding' and found that drivers perceived initiating and responding as having a similar level of risk as talking; whereas a significantly lower proportion of drivers believed that reading was more dangerous than talking. Contrary to these perceptions, recent experimental research has shown that simply hearing a notification (and not having follow-up contact with your phone) can significantly disrupt performance on an attention-demanding task at a magnitude similar to actual engagement with a call or text (Stothart, Mitchum, & Yehnert, 2015).

1.3 Theoretical Background

The current study forms part of a larger study that was guided by the Step approach to Message Design and Testing framework ([SatMDT]; Lewis, Watson, & White, in press). The SatMDT is a new and innovative framework that was specifically designed to aid the

development and evaluation of health communication messages, including road safety messages. The framework comprises four steps and is based on the underlying principles derived from social psychological theories of decision making and attitude-behaviour relations. The four main steps of the framework are: (1) identification of pre-existing individual characteristics; (2) development of message-related characteristics; (3) individual responses; and (4) evaluation of message outcomes (Lewis et al., in press). The main theories underpinning the framework are the Theory of Planned Behaviour (TPB; Ajzen, 1985, 1991), the Extended Parallel Process Model (EPPM; Witte, 1992), The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986), and Social Learning Theory (Bandura, 1969).

Of particular relevance to the current study are steps one and two of the SatMDT framework (see Figure 1). Step one is mainly guided by the TPB and involves the elicitation of salient beliefs underlying each of the TPB standard constructs of attitude, subjective norm and perceived behavioural control (PBC) for the behaviour being investigated (see Gauld, Lewis, White, & Watson, 2016, for this prior belief elicitation study). According to the TPB, attitude is influenced by behavioural beliefs, namely, the advantages and disadvantages of performing the behaviour; subjective norm is influenced by normative beliefs relating to the extent that individuals regard specific others as approving or disapproving of a particular behaviour; and PBC is influenced by control beliefs which are based on past experience and the perceived ability to perform the behaviour, in terms of barriers and facilitators (Ajzen, 1985, 1991). This belief elicitation phase of TPB has been successfully utilised independently across a range of behaviours including general mobile phone use while driving (e.g., White, Hyde, Walsh, & Watson, 2010), and concealed texting while driving (Gauld, Lewis, & White, 2014). According to step one of the SatMDT (Lewis et al., in press), validation (or verification) of the results of a small, in-depth belief elicitation qualitative study with a quantitative survey is then necessary to determine the extent to which the

findings are representative of the target audience. Choice of analysis of the survey results then depends on the aim of the study and may, for example, involve investigating the differences in beliefs

STEP 1 **Pre-existing individual characteristics**		Methodology Step 1 Pilot work	**STEP 2** **Message-related characteristics**	Methodology Step 2 Message exposure	**STEP 3** **Individual responses**	Methodology Step 3 Concept testing & message checks	**STEP 4** **Message outcomes**		Methodology Step 4 Quantitative-based assessment of persuasive effects
Identify	Elicit		Focus & Content		Emotional & Cognitive		Acceptance & Rejection		
Gender/ age + Extent & nature of involvement in/with behaviour	Salient beliefs + Strategies for avoiding behaviour (response efficacy)		<u>Focus of Message</u> Challenge perceived benefits and/or Highlight perceived disadvantages <u>Key content</u> *Emotional appeal type (e.g., fear-based, humour-based) *Modelling of behaviour *Strategies		Emotional responses (anticipated emotion elicited?) + Cognitive responses (e.g., perceptions of response efficacy, involvement)		Intentions to adopt message and/or denial, defensive avoidance reactions	Persuasive effects measured over time	

Figure 1. The SatMDT (Lewis et al., in press).

between low and high intenders to engage in behaviour of interest (e.g., Gauld et al., 2014; Lewis, Watson, White, & Elliott, 2013) or identifying the critical beliefs regarding a particular behaviours (e.g., White et al., 2015).

Step two of the SatMDT guides the development of messages targeting these underlying beliefs. For example, the SatMDT recommends focusing on challenging the perceived benefits or highlighting the perceived disadvantages which were elicited in the belief analysis in step one of the framework. Underpinning step two of the SatMDT is also Social Learning Theory (Bandura, 1969) and includes important considerations such as emotional appeal type and positive or negative modelling of behaviour. Social Learning Theory posits that individuals learn via the social context through, for example, modelling and observational learning (Bandura, 1969). In relation to the SatMDT and in accordance with Social Learning Theory, modelling behaviour as a component of the key message content is an effective means of facilitating the development of new behaviours (Bandura, 1969). Typically, threat appeals depict risky behaviours and the possible negative consequences of such behaviours (e.g., a crash or fatality); however, emerging research suggests that positive emotion-based appeals may be particularly effective for young male drivers (Lewis, Watson, & White, 2010; Lewis, Watson, & White, 2013; Lewis, Watson, White, & Tay, 2007). Depicting a more desirable behaviour and the associated positive outcomes (e.g., approval from peers), therefore, may also be an effective strategy to enhance persuasive effects of an advertisement.

The SatMDT emphasises the importance of including relevant strategies for reduction of the risky behaviour (i.e., response efficacy) in message content. Recommended strategies are elicited in the step one qualitative study, verified in the current study, and then included in message content (step two). Response efficacy was originally identified in the EPPM (Witte,

1992), and was recognised as a crucial component in the effectiveness of fear-based persuasion. Specifically, response efficacy involves the individual evaluating the effectiveness of the recommended response/strategy within the message (Witte, 1992). Response efficacy has since been shown to be an important factor which influences the effectiveness of persuasive emotional appeals beyond fear, including messages incorporating positive emotions, such as humour and pride (Lewis, et al., 2010; 2013). As for threat appeals, the persuasiveness of the message is the greatest when response efficacy is high (Lewis et al., 2007, Lewis et al., 2010; Lewis et al., 2013). Further, current research suggests that young people may respond better to positive appeals as they perceive them as potentially less condescending in nature and such messages may be able to model safe driving behaviour and the positive consequences of such behaviour (Lewis, Tay, Watson, & White, 2007).

Similar to the current study, Lewis et al. (2013) utilised the first two steps in the SatMDT to identify salient beliefs regarding the speeding behaviour of young male drivers and used such beliefs to guide the development of content for anti-speeding messages. For example, an important salient belief elicited in their study was that an advantage of speeding was to 'make up time when late'. The authors suggested that anti-speeding messages could emphasise the actual lack of progress when drivers speed, such as being stopped at red traffic lights. A suggested strategy (response efficacy) was to leave earlier or phone ahead (i.e., before getting in the car) if they were running late (Lewis et al., 2013).

1.4 The current study

Accessing social interactive technology on smartphones is an increasingly prevalent and risky behaviour among young drivers; however, few studies have investigated the underlying motivations of the smartphone capabilities beyond calling and texting. Young drivers have an elevated crash risk from smartphone use while driving. Specifically, they are inexperienced, more accepting of technology, and more likely to use it while driving.

Additionally, police face unique challenges when enforcing the law from, for example, drivers deliberately concealing their use to avoid apprehension and tinted car windows making it difficult to detect a smartphone. The development of alternate countermeasures such as public education messages, to work in parallel with support enforcement efforts is, therefore, critical. In accordance with the SatMDT framework (Lewis et al., in press), the aim of the current study was to firstly verify the salient beliefs that had been elicited via a prior, smaller in-depth qualitative study about initiating, monitoring/reading, and responding to social interactive technology on smartphones by young drivers aged 17 to 25 years (see Gauld et al., 2016). Specifically, the beliefs that had been previously elicited are verified with a new and larger sample of young drivers using a quantitative survey study. The survey enables identification of the beliefs that emerge as significant predictors of intention and therefore the beliefs of particular importance for informing message content. Secondly, this study aimed to identify critical beliefs as potential targets for public education messages. Potential content for the public education messages is suggested, in accordance with the SatMDT.

2. Method

2.1 Participants

Participants (N = 114; 88 females, 26 males) were predominantly first year psychology students (n = 90) self-selected via an online recruitment system at a large, non-residential, Australian university in South East Queensland. Additional participants (n = 24) were recruited from university email lists and from a snowballing of the researcher's family and friends. According to the participation criteria, they owned a smartphone, had a current driver's licence, and resided in Queensland (the Australian state in which the study was being conducted). All participants were aged between 17 and 25 years (M = 20 years, SD = 2.6 years), 77% had a provisional licence (P1 or P2) and 21% had an open licence, and 73% had

completed high school as their highest level of education. On average, the participants reported driving 7.3 hours per week (*SD* = 4.7 hours) in either an automatic (51%) or a manual car (49%). The majority of participants (82%) reported driving most frequently in suburban areas. On average, they had owned a smartphone for 4.5 years (*SD* = 1.8 years). All first year psychology students received partial course credit for their participation and other participants were entered into a draw to win one of three $AUD50 shopping vouchers.

2.2 Materials/measures

The survey was based on the standard TPB self-report format (Fishbein & Ajzen, 2009). As outlined in Fishbein and Ajzen (2009), the questions were framed in terms of reference to the target behaviour, action, context, and time (i.e., the TACT principle). Thus, the three target behaviours were "initiating social interactive technology use while driving in the next week", "monitoring/reading social interactive technology while driving in the next week", and "responding to social interactive technology while driving in the next week". Similar to previous studies (e.g., Atchley et al., 2011; Waddell and Wiener, 2014), participants were informed that "initiating" meant *starting* a communication with someone; "monitoring/reading" meant *checking* your smartphone for communications and/or *reading* them; and "responding" meant *replying to* a communication that was started by someone else. In addition, participants were told that "social interactive technology" referred to functions accessed on smartphones through which the user communicates with other people. Examples of social interactive technology include, but are not limited to, social networking sites (e.g., Facebook, Twitter), text messages, emails, phone calls, and Instagram. It was also stipulated that "while driving" included being stopped at traffic lights or in traffic; anywhere other than being in a parked vehicle and "a communication" is a general term that refers to the variety of means by which people share information with each other (e.g., text message, email).

As mentioned previously, all belief items were elicited in a prior study (see Gauld et al., 2016) and were each measured in the current study on a seven-point Likert scale, ranging from (1) *extremely unlikely* to (7) *extremely likely.* Table 1 outlines the question stems and provides sample belief items for each behaviour. Intention and past behaviour were also measured in the current study. Three items measured intention and were adapted for each behaviour: (1) "I intend to <initiate/monitor-read/respond to> social interactive technology on my smartphone while driving in the next week"; (2) "It is likely that I will <initiate/monitor-read/respond to> social interactive technology on my smartphone while driving in the next week"; and (3) "I am willing to <initiate/monitor-read/respond to> social interactive technology on my smartphone while driving in the next week". The intention scale was reliable for each behaviour: initiating (Cronbach's $\alpha = .90$), monitoring/reading (Cronbach's $\alpha = .91$), and responding (Cronbach's $\alpha = .91$).

Participants in the current study were presented with 10 previously identified strategies and asked "In order to reduce your crash risk, which of the following strategies have you ever used while using social interactive technology while driving?". Participants could mark as many responses as applied to them. They also responded to the question 'Which of the following social interactive technologies have you ever accessed on your smartphone while driving?'. They were then presented with 10 previously identified social interactive technologies and asked to mark as many responses as applied to them. Various demographic variables (e.g., gender, age, highest level of education attained) and frequency of smartphone use (i.e., for initiating, monitoring/reading, and responding) were also assessed.

Table 1

Questions for Initiating, Monitoring/reading, and Responding Behaviours for Behavioural, Normative, and Control Beliefs

Behaviour	Belief type	Question	Example beliefs
Initiating	Behavioural	How likely is it that initiating social interactive technology use while driving in the next week would result in the following?	Saving time, being apprehended by the police
	Normative	How likely is it that the following individuals or groups of people would approve of you initiating social interactive technology use while driving in the next week?	Parents, police
	Control		
	Facilitators	How likely is it that the following factors would encourage you to initiate communication on social interactive technology while driving in the next week?	Slow-moving traffic, believing you are a good driver
	Barriers	How likely is it that the following factors would prevent you from initiating communication on social interactive technology while driving in the next week?	Difficult road conditions, having passengers in your car
Monitoring/ reading	Behavioural	How likely is it that monitoring/reading social interactive technology while driving in the next week would result in the following?	Keeping up to date with friends' plans, feeling pressure to respond
	Normative	How likely is it that the following individuals or groups of people would approve of you monitoring/reading social interactive technology while driving in the next week?	Parents, police
	Control		
	Facilitators	How likely is it that the following factors would encourage you to monitor/read social interactive technology while driving in the next week?	Slow-moving traffic, having audible notifications of incoming communications
	Barriers	How likely is it that the following factors would prevent you from monitoring/reading social interactive technology while driving in the next week?	Difficult road conditions, having passengers in your car
Responding	Behavioural	How likely is it that responding to communication on social interactive technology while driving in the next week would result in the following?"	Allowing you to communicate with important people, being apprehended by police
	Normative	How likely is it that the following individuals or groups of people would approve of you responding to social interactive technology while driving in the next week?	Parents, police
	Control		
	Facilitators	How likely is it that the following factors would encourage you to respond to communication on social interactive technology while driving in the next week?	Slow-moving traffic, receiving a communication that is of immediate importance
	Barriers	How likely is it that the following factors would prevent you from responding to communication on social interactive technology while driving in the next week?	Difficult road conditions, having passengers in your car

2.3 Procedure

Prior to commencement of the study, ethics approval was obtained from the University's Human Research Ethics Committee. The survey study was completed online. Prior to commencement of the survey, information describing the project was provided; including what participation involved, expected benefits and risks, and confidentiality. Completion of the online survey was considered as participants having provided their consent to participate.

3. Results

3.1 Descriptive Analysis

Table 2 shows that young drivers are most likely to text (80.7% of participants), talk (73.7% of participants), and use Facebook (53.5% of participants) while driving. Table 3 describes how often participants reported engaging in initiating, monitoring/reading, and responding to social interactive technology on their smartphone while driving. For example, 32.4% of participants reported initiating a communication on social interactive technology on their smartphone while driving at least 1 to 2 times per week; 60.7% of participants reported monitoring/reading social interactive technology on their smartphone while driving at least 1 to 2 times per week; and 45.6% of participants reported responding to social interactive technology on their smartphone while driving at least 1 to 2 times per week. These results show that monitoring/reading was the most commonly engaged in behaviour and responding the second most common in this sample of young drivers. In addition, 40.5% of participants

Table 2

Social Interactive Technologies Participants Have Ever Accessed While Driving (N = 114*)*

Social Interactive Technology	% of participants who had ever accessed this social interactive technology while driving	
Texting	80.7	(*n* = 92)
Talking	73.7	(*n* = 84)
Facebook	53.5	(*n* = 61)
Snapchat	41.2	(*n* = 47)

Email	30.7	(n = 35)
Instagram	26.3	(n = 30)
Twitter	3.5	(n = 4)
Viber	3.5	(n = 4)
Skype	3.5	(n = 4)
Tinder	2.6	(n = 3)

Note: As participants could select more than one form of social interactive technology, the % column will add up to more than 100.

Table 3

Reported Frequencies (%) of Initiating, Monitoring/reading, and Responding to Social Interactive Technology on Smartphones while Driving

How often do you do the following on your smartphone while driving:	More than once per day	Daily	1 – 2 times per week	1 – 2 times per month	1 – 2 times per 6 months	Once a year	Never
Initiate communication on social interactive technology?	3.6	9.9	18.9	13.5	7.2	6.3	40.5
Monitor/read social interactive technology?	8.0	21.4	31.3	13.4	8.0	3.6	14.3
Respond to a communication on social interactive technology?	5.4	17.0	23.2	23.2	9.8	4.5	17.0

in the current study reported never engaging in initiating behaviours while driving (compared to 14.3% for never monitoring/reading and 17.0% for never responding). These findings are supported by previous literature (e.g., Atchley et al., 2011; Waddell & Wiener, 2014). In order to ensure potential public education message funding would be directed towards the most prevalent behaviours, the remainder of the analysis in the current study focuses on monitoring/reading and responding.

3.2 Critical Beliefs Analysis

A critical beliefs analysis was carried out in accordance with the procedures specified in von Haeften, Fishbein, Kasprzyk, and Montano (2001) and reported in previous studies (e.g., White et al., 2015). Broadly, the methodology involved (1) identifying beliefs that were significantly correlated with intention (at an alpha level of .05); (2) entering these significant beliefs, within each belief set (i.e., behavioural, normative, control – facilitators, and control – barriers), into individual stepwise regressions; and (3) entering the significant beliefs from each belief set together into a final stepwise regression. The beliefs that were significant predictors of intention from the final regression were the critical beliefs (von Haeften et al., 2001). The stepwise regressions included in this critical beliefs analysis were considered appropriate for the current study. In addition to analysing a large number of beliefs that could predict intention to monitor/read and respond to social interactive technology use, there was no pre-determined idea of which beliefs would have the greatest influence on these outcome variables (Aron, Aron, & Coup, 2006).

After carrying out the critical beliefs analysis as outlined in the previous paragraph (von Haeften et al., 2001), the principles of Hornik and Woolf (1999) were applied to the identified critical beliefs to streamline the analysis and to ensure the focus of subsequent messages had the potential to influence the largest possible target population. This combination of methodologies has been utilised in previous studies (e.g., Hamilton & White, 2011). Specifically, Hornik and Woolf (1999) stipulated that, in order for a message to be effective (or persuasive) there must be firstly a significant relationship between the belief and the outcome variable. In the current study, this first principle has, in effect, already been applied in the critical belief analysis outlined in the previous paragraph. All the critical beliefs identified have a significant relationship between the belief and the outcome variable (i.e., intention). The second principle states that it must be considered possible to move the target population to the endorsed position. In the current study, the endorsed position refers

to young drivers having the intention not to access social interactive technology on their smartphones. The authors of the current study believe it is reasonable to assume that young drivers wish to avoid the penalties and other potential consequences (e.g., crash) associated with engaging in this behaviour. It has therefore been deemed possible, and highly desirable, to move the young drivers towards this endorsed position. In the current study, and in accordance with the SatMDT, moving young drivers towards the endorsed position involves influencing their critical beliefs.

The third principle states that there must be a large proportion of people who do not already adhere to the endorsed position. In the current study, this third point applies to the critical beliefs. As such, the critical beliefs where fewer than 50% of participants already held the desired belief were, therefore, identified as targets for public education messages. Similar to previous critical belief studies (e.g., Hamilton & White, 2011), the percentage of participants who held the desired belief was calculated by adding up the percentage of participants who reported 'extremely likely'/'quite likely' or 'extremely unlikely'/'quite unlikely' (depending on how the belief item was worded and what the desired belief was) in response to the individual belief items. For an explanation of which Likert scale items were used to calculate the percentage of participants who held the desired belief for each individual belief item, see Table 7's endnote.

It has been suggested that this methodology combining the two approaches may be particularly relevant when it is necessary to identify only a small number of beliefs that have the strongest influence on the outcome variable (von Haeften et al., 2001). In particular, where the study is concerned with identifying beliefs as potential targets of public education messages, such as the current study, it could provide a justification for the allocation of resources to message development by identifying which beliefs have the potential to influence the largest possible target population (Hornik & Woolf, 1999).

Table 4

Means, Standard Deviations, and Correlations for Salient Beliefs regarding Intentions to Monitor/Read Social Interactive Technology on Smartphones while Driving (N = 114)

Beliefs	Mean (*SD*)	Intention (*r*)
Behavioural		
Allowing you to judge the importance of an incoming communication and the associated urgency of a response	4.85 (*1.84*)	.61***
Keeping up to date with friends' plans	4.42 (*1.90*)	.50***
Feeling at ease that you have received an expected communication	3.89 (*1.89*)	.59***
Being distracted from driving	4.82 (*1.76*)	.00
Being apprehended by police	4.14 (*1.92*)	-.18
Feeling pressure to respond	3.74 (*1.75*)	.26**
Normative		
Friends/Peers	4.01 (*1.87*)	.40***
Boyfriend/girlfriend/partner	3.94 (*2.48*)	.20*
Parents	1.87 (*1.36*)	.22*
Other family	2.04 (*1.30*)	.23*
Police	1.10 (*0.64*)	-.04
Drivers who have been involved in a crash from Smartphone use while driving	1.31 (*0.86*)	-.08
Older drivers	1.57 (*0.84*)	.07
Passengers	2.51 (*1.46*)	.40***
Control –facilitators		
Slow-moving traffic	4.86 (*1.76*)	.63***
Believing you are a good driver	3.10 (*1.78*)	.55***
Having audible notifications of an incoming communication	4.78 (*1.86*)	.60***
Control –barriers	6.15 (*1.41*)	-.22*
Difficult traffic/road conditions	6.34 (*1.23*)	-.15
The possibility of police apprehension	5.54 (*1.53*)	-.50***
Having passengers in your car	5.54 (*1.49*)	-.51***
Knowing about a crash/fatality that resulted from		

Smartphone use while driving	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

Table 5

Means, Standard Deviations, and Correlations for Salient Beliefs regarding Intention to Respond to Social Interactive Technology on Smartphones while Driving (N = 114)

Beliefs	Mean (*SD*)	Intention (*r*)
Behavioural		
Communicating with important people	4.34 (*1.78*)	.55***
Preventing ongoing/multiple communications until you respond	4.00 (*1.70*)	.35***
Being distracted from driving	5.39 (*1.57*)	-.21*
Being apprehended by police	4.68 (*1.77*)	-.32**
Being surprised at the content of an incoming communication	3.80 (*1.49*)	.29**
Normative		
Friends/Peers	3.69 (*1.90*)	.54***
Boyfriend/girlfriend/partner	3.89 (*2.47*)	.26**
Parents	1.82 (*1.32*)	.24*
Other family	1.81 (*1.16*)	.35***
Police	1.10 (*0.68*)	-.03*
Drivers who have been involved in a crash from Smartphone use while driving	1.32 (*0.82*)	.13
Older drivers	1.59 (*0.95*)	.23*
Passengers	2.28 (*1.44*)	.47***
Control –facilitators		
Slow-moving traffic	4.46 (*1.93*)	.70***
Believing you are a good driver	2.96 (*1.68*)	.55***
Receiving a communication of immediate importance	4.76 (*2.00*)	.67***
Control –barriers		
Difficult traffic/road conditions	6.53 (*1.00*)	-.08
The possibility of police apprehension	6.39 (*1.18*)	-.17
Having passengers in your car	5.76 (*1.39*)	-.46***
Knowing about a crash/fatality that resulted from	5.70 (*1.49*)	-.52***

Smartphone use while driving

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

Table 6

Results of Regression Analysis identifying Critical Beliefs for Intention to Monitor/read and Respond to Social Interactive Technology on Smartphones while Driving

Monitor/read ($N = 114$), $F(5,113) = 40.68$, $p<.001$, $R^2 = .65$		Respond ($N = 114$), $F(4,113) = 51.60$, $p<.001$, $R^2 = .65$	
Beliefs	β	Beliefs	β
Behavioural		Behavioural	
Feeling at ease that you have received an expected communication	.24**	Communicating with important people	.09
		Being distracted from driving	-.10
Being able to judge the importance of an incoming communication and the associated urgency of a response	.18*		
Normative		Normative	
Friends/peers	.02	Friends/peers	.21***
Passengers	-.01	Passengers	.08
		Other family	.10
Control – facilitators		Control – facilitators	
Believing you are a good driver	.17*	Believing you are a good driver	.18**
Slow-moving traffic	.26**	Slow-moving traffic	.45***
		Receiving a communication of immediate importance	.12
Control – barriers		Control – barriers	
Knowledge of crash/fatality from SP use	-.02	Knowledge of crash/fatality from SP use	-.24***
Having passengers in your car	-.29***	Having passengers in your car	-.10

Note. * $p < .05$, ** $p < .01$, *** $p< .001$, two-tailed

The results for each of the individual behaviours are detailed below.

3.2.1 Monitoring/reading.

Following the method described above, and as shown in Table 4, 15 out of the 21 individual beliefs were significantly correlated with intention to monitor/read social

interactive technology on smartphones while driving. After the individual belief set stepwise regression analyses were conducted, the beliefs that were significant predictors of intention

Table 7

Percentage of Participants Holding the Desired Critical Belief

	Monitoring/Reading		Responding	
	Critical belief	% of participants who hold the desired critical belief	Critical belief	% of participants who hold the desired critical belief
Behavioural	Feeling at ease that you had received an expected communication[1*]	30%* (effect size .04)		
	Being able to judge the importance of an incoming communication and the associated urgency of a response[1*]	17%* (effect size .02)		
Normative			Friends and peers would approve[1*]	34%* (effect size .03)
Control-barriers	Having passengers in your car[2]	63%	Knowing about a crash/fatality resulting from SP use while driving[2]	63%
Control – facilitators	Believing you are a good driver[1*]	47%* (effect size .02)	Believing you are a good driver[1*]	48%* (effect size .02)
	Slow moving traffic[1*]	15%*(effect size .03)	Slow moving traffic[1*]	21%*(effect size .14)

Note. [1]Scale measured on a 7-point scale (1 = extremely unlikely to 7 = extremely likely). The desired belief for these critical beliefs is a score of 1 (extremely unlikely) or 2 (quite unlikely). The percentages of participants who responded to these belief questions with a 1 or 2 were added to indicate the percentage of participants who already hold the desired belief (see Hamilton & White, 2011; Hornik & Woolf, 1999).
[2]Scale measured on a 7-point scale (1 = extremely unlikely to 7 = extremely likely). The desired belief for these critical beliefs is a score of 7 (extremely likely) or 6 (quite likely). The percentages of participants responding with 6 or 7 were added up to indicate the percentage of participants who already hold the desired belief (see Hamilton & White, 2011; Hornik & Woolf, 1999).
*Indicates fewer than 50% of participants held the desired belief.

are listed in Table 6. When these beliefs were entered together into the final stepwise regression, five beliefs emerged as significant predictors of intention and were identified as the critical beliefs for participants' self-reported intention to monitor/read social interactive technology on a smartphone while driving in the next week. Together, these five beliefs

accounted for a significant 65% of the variance in intention (see Table 6). As shown in Table 7, of these five beliefs, four had fewer than 50% of participants holding the desired critical belief. These four critical beliefs were therefore identified as potential targets for public education messages.

3.2.2 Responding.

For responding, 18 out of the 21 individual beliefs were significantly correlated with intention to respond (see Table 5). After the individual belief set stepwise regression analyses were conducted, the beliefs that were significant predictors of intention are listed in Table 6. When these beliefs were entered together into the final stepwise regression, four were significant predictors of intention and were identified as the critical beliefs for participants' self-reported intention to respond to social interactive technology on a smartphone while driving in the next week. Together, these four beliefs accounted for 65% of the variance in intention (see Table 6). As shown in Table 7, of these four beliefs, three

Table 8

Strategies Ever Used to Reduce Crash Risk While Engaging with Social Interactive Technology on a Smartphone While Driving.

Strategy	% of Participants who had ever used the strategy	
Had a passenger use your smartphone for you	93.9	(n = 107)
Not used your smartphone while driving	79.0	(n = 90)
Pulled over to use smartphone	69.3	(n = 79)
Made sure you alternated between looking at your smartphone and looking at the road	65.8	(n =75)
Put your smartphone on silent	57.0	(n = 65)
Put your smartphone out of sight	55.3	(n = 63)
Slowed down while using your smartphone	46.5	(n = 53)
Used a hands-free kit	43.0	(n = 49)
Kept your smartphone at eye level	25.4	(n = 29)

Used SIRI (i.e., a voice activated application that can, for example, turn words into text messages)	18.4	(n = 21)

Note: As participants could select more than one form of social interactive technology, the % column will add up to more than 100.

had fewer than 50% of participants holding the desired belief. These three critical beliefs were therefore identified as potential targets for public education messages.

3.3 Strategies to Reduce Crash Risk

Table 8 shows the number of participants who reported ever having used each strategy to reduce their crash risk while using social interactive technology on their smartphone while driving. Having a passenger use your smartphone for you, not using your smartphone while driving, and pulling over to use your smartphone were the three most commonly used strategies. While Table 8 indicates that a variety of strategies are frequently utilised, the importance of this information lies in the guidance it provides regarding which strategies could be utilised in a message to enhance its effectiveness (Lewis et al., 2010; Witte, 1992).

4. Discussion

In accordance with the SatMDT framework (Lewis et al., in press), the aim of the current study was to firstly verify the salient beliefs that had been elicited via a prior, smaller in-depth qualitative study (see Gauld et al., 2016), about initiating, monitoring/reading, and responding to social interactive technology on smartphones by young drivers aged 17 to 25 years. The second aim was to identify critical beliefs as potential targets for public education messages. Finally, the type of social interactive technology being accessed as well as strategies to reduce crash risk from using social interactive technology on smartphones while driving were also verified in the present study.

The critical beliefs analysis incorporated the methodologies of both von Haeften et al. (2001) and Hornik and Woolf (1999) and identified the beliefs with the strongest influence on the outcome variables (von Haeften et al., 2001), that is, intention to monitor/read and

intention to respond to social interactive technology on smartphones while driving. Additionally and importantly, the methodology identified which beliefs had the potential to influence the position of the largest possible target population, thereby adding strength to a potential justification of future resource allocation to message development (Hornik & Woolf, 1999). In accordance with this principle, the actual percentage of young drivers already holding the desired belief could be taken into consideration when developing the final message content. Prioritising the beliefs with the lowest percentages already holding the desired belief may further justify future resource allocation as there is the potential to reach more people who do not hold the desired belief. For example, in this study, it was found that just 15% of the sample reported holding the desired belief that they would not be encouraged to use their smartphone while driving in a situation where there is said to be slow-moving traffic. That means that the remaining 85% of the sample did not hold the desired belief (i.e., agreed that a situation involving slow-moving traffic would be one where they would be encouraged to use their smartphone while driving). Therefore, a message which sought to challenge this belief would have the potential to reach 85% of the sample and reinforce the views of the other 15% who already are less likely/unlikely to engage in the behaviour.

Overall, seven critical beliefs were identified as the beliefs to be targeted in potential public education messages. The findings revealed that there were differences between the behavioural, normative, and control (barrier) critical beliefs for monitoring/reading and responding behaviours; however, the critical beliefs for the control (facilitators) were the same for both behaviours. These beliefs are discussed in the remainder of the paper and possible associated message content is presented in Table 9. The message content is suggested in accordance with the SatMDT (Lewis et al., in press). Please note that the content proposed are suggestions only and all messages would need to be evaluated as per the SatMDT guidelines to determine their potential persuasiveness.

For monitoring/reading, two behavioural beliefs (advantages) were identified as critical beliefs. They were, 'feeling at ease that you had received an expected communication' (70% of participants agreed this belief was an advantage and 30% held the desired belief that it was not an advantage) and 'being able to judge the importance of an incoming communication and the associated urgency of a response' (83% of participants agreed this belief was an advantage and 17% held the desired belief that is was not an advantage). For the first belief, previous research has found that some young drivers reported continually checking their phone until they have received an expected communication (Gauld et al., 2016). Given that a recent study found that simply hearing a notification can be as distracting as actually interacting with a Smartphone for calls or text messages (Stothart et al., 2015), young drivers who regularly monitor/read social interactive technology on their

Table 9

Summary of Critical Beliefs and Potential Public Education Message Content

Critical Belief	**Possible Message Content and Strategies**
Behavioural - monitoring/reading 'Feeling at ease that you had received an expected communication'	Focus on other factors that could make the driver feel at ease, such as getting your passengers to their destination safely. Focus on the positive affect associated with *not* monitoring/reading their smartphone while driving; such as gaining approval from important others. The messages could also include strategies such as placing the phone out of sight (e.g., in the glove box) before driving.
Behavioural - monitoring/reading 'Being able to judge the importance of an incoming communication and the associated urgency of a response '	Challenge the perceived significance of being able to judge the importance of incoming communications, when nothing could be as important as driving safely. Challenge whether responding to an 'important' person on their Smartphone is ever more 'urgent' than driving safely. Suggest that important communications need full attention, not attention divided between the driving task and the Smartphone. A strategy may be to pull over and park before you monitor/read communications on your Smartphone.
Control (facilitator) – monitoring/reading and responding 'Believing you are a good driver'	Challenge the idea that young drivers are the good drivers they think they are. For example, show their car driving erratically when the young driver is using their Smartphone, which is very obvious to the drivers around them, but not to the young driver themself. Question whether important others (e.g., parents, friends) who have been a passenger in the car, think the young driver has the ability to safely monitor/read or respond to their Smartphone while driving. Alternatively, present a young driver not monitoring their smartphone when a communication comes through and safely braking when a toddler runs out on the road. Possible strategies include putting the Smartphone on silent or out of sight (e.g., in the glovebox) before starting to drive.
Control (facilitator) – monitoring/reading and responding 'Slow moving traffic '	Emphasise the importance of drivers being responsible for paying constant attention to the road regardless of traffic conditions, as it is difficult to predict the behaviour of other drivers and pedestrian (e.g., depict a young driver stuck in a traffic jam and rolling into the car behind when using their Smartphone; have a pedestrian run out unexpectedly in front of the car to cross the road; or have the young driver not notice when the traffic lights turn green and then 'flooring it' when they do). Strategies could include pulling over and parking before you monitor/read or respond to communications on your Smartphone.
Normative - responding 'Friends and peers more likely to approve'	Challenge this perception by having friends tell the driver how they really feel (e.g., unsafe) when they are a passenger in their friend's car and their friend responds to a communication while driving. Focus on others' disapproval of this behaviour or, alternatively, by reinforcing approval for those who do not engage in this behaviour. Challenge whether the perception of friends' approval by suggesting that, although they may not verbalise it, many friends might not approve at all. A suitable strategy may be for the passenger to respond for the driver.

smartphones may also have an increased crash risk. Monitoring/reading social interactive technology is likely to occur in hand-held mode (Rudin-Brown et al., 2013) and often through a variety of media such as text messages, Facebook, and emails (Baym, 2015) thereby increasing the potential frequency and associated crash risk for this behaviour. A key component of the belief, 'feeling at ease that you had received an expected communication', is the positive affect an individual experiences when an expected communication arrives. A previous study by Lewis et al., (2013) investigated speeding behaviour among young drivers found that the positive affect associated with speeding was also a motivating factor. The authors suggested that messages could focus on gaining positive affect from other avenues as a consequence of not speeding, for example; how impressed girls are with a young male driver who chooses not to speed (Lewis et al., 2013). This idea of receiving approval from important others could also be applied to young drivers who do *not* monitor/read their Smartphone while driving, thereby generating positive affect such as pride. This focus on positive affect is consistent with research suggesting that positive emotion-based appeals may be particularly effective for male drivers (Lewis et al., 2010; Lewis et al., 2013; Lewis et al., 2007).

The second critical belief for monitoring/reading, that is, 'being able to judge the importance of an incoming communication and the associated urgency of a response', was reported as an advantage by 83% of participants. This critical belief indicates that young drivers are keen to keep up to date with friends, family, and colleagues at all times, regardless of the risk involved. It also suggests that some communications are more important than others. Although this critical belief was significant for monitoring/reading behaviour, it could be taken a step further by, for example, challenging whether responding to an 'important' person on their Smartphone is ever more 'urgent' than driving safely (see Gauld et al., 2016).

'Believing you are a good driver' was found to be a critical belief (control belief – facilitator) for both monitoring/reading and responding behaviours and was held by 53% and 52% of participants, respectively (therefore 47% and 48%, respectively, held the desired belief that believing you are a good driver would not facilitate smartphone use). Young drivers who perceived themselves as good drivers were more likely to monitor/read and respond to communications on their smartphone. Previous research has shown that it is not uncommon for young drivers to perceive themselves as having a greater skill level than their peers and confidence in their ability to multitask (e.g., Hill et al., 2014). This overinflated belief in driving ability can lead to greater engagement in dangerous driving behaviours such as mobile phone use (e.g., Hill et al., 2014). A recent simulator study of undergraduate students in an American university (M_{age} = 21.8 years) found that there was no correlation between self-assessment of driving safeness and actual driving errors (Sanbonmatsu, Strayer, Biondi, Behrends, & Moore, 2015). The authors concluded that not only did mobile phone use reduce the safeness of their participants' driving but it also impaired their awareness of their safeness. As a result, young drivers will continue to use their mobile phones while driving as long as they believe they can safely do so (Sanbonmatsu et al., 2015). Young drivers need to be challenged and presented with the reality that they are only good drivers when they are *not* using their smartphone.

'Slow-moving traffic' was also found to be a critical belief (control belief – facilitator) for both monitoring/reading and responding and held by 85% and 79% or participants, respectively (therefore just 15% and 21%, respectively, already held the desired belief that slow-moving traffic would not facilitate smartphone use). Specifically, young drivers were more likely to monitor/read and respond to social interactive technologies on their smartphones whilst in slow moving traffic. Previous studies have found similar results. For example, frequent users of mobile phones (many young people could be classified as

frequent users) were less likely to perceive the risk of heavy traffic as preventing them from using their mobile phone while driving (White, Walsh, Hyde, & Watson, 2012). A recent observational study reported five times the number of drivers (14.5%) were texting when stopped at a red traffic light compared to drivers in moving vehicles (Bernstein & Bernstein, 2015). While a driver may perceive that using their smartphone at a red light is less risky than in moving traffic, it can result in the loss of situational awareness and a delayed response to a sudden change in road conditions, such as the traffic light turning green (Bernstein & Bernstein, 2015).

For responding only, 'friends/peers more likely to approve' was a critical belief (normative belief) with 66% of participants holding this belief (meaning that only 34% already held the desired belief that friends/peers were not likely to approve). Past research has also found that young drivers believe that friends and peers are the most likely normative group to approve of their Smartphone use while driving (e.g., Gauld et al., 2014). As friends and peers are particularly influential to young people, their ability to persuade a young driver not to respond to incoming communications on their smartphone should be modelled in public education messages (Beck & Watters, 2016)

Although the current study was based on a theoretically-sound framework, there were limitations. First, the reliance on a self-report survey may have encouraged participants to present themselves in a socially desirable manner; particularly as the behaviours being investigated were illegal. However, due the anonymous nature of the survey, the effects of such reporting bias should have been minimised. Second, while effort was made to recruit a broader sample, 79% of the sample comprised university students. As university students are generally more educated, the beliefs they supported in the survey may not be truly representative of the broader population of young drivers. Finally, while the decision was

made to focus on monitoring/reading and responding in the current study, future research could focus on initiating behaviour.

The current study was guided by the first two steps of the SatMDT framework (Lewis et al., in press) and provides a greater understanding of the beliefs underlying monitoring/reading and responding to social interactive technology on smartphones while driving. Specifically, the SatMDT provided theoretically-based guidance on the verification of beliefs elicited in a prior qualitative study; analysis of these beliefs to determine the critical ones; and, the development of message content targeting these critical beliefs regarding monitoring/reading and responding to social interactive technology on smartphones among young drivers aged 17 to 25 years. Consistent with Steps 3 and 4 of the SatMDT, these messages would need to be piloted to ensure that they are working as intended and then have their effectiveness evaluated via a large quantitative study.

While limited to steps one and two, the current study adds to the literature by providing a greater understanding of the beliefs that underpin monitoring/reading and responding to social interactive technology on smartphones among young drivers. The current findings highlight the value of the first step of the SatMDT framework where salient beliefs are elicited, verified, and then analysed to determine the key beliefs as potential message targets. Suggestions about how the guidelines for message content development (step two) may be applied to target these key beliefs are then provided. While there is a growing body of studies utilising the SatMDT framework that provide some preliminary evidence attesting to its efficacy (e.g., Lewis et al., 2013), it is a relatively new framework and studies such as the current one are essential for its validation. As young drivers increasingly access the additional social interactive technologies available on smartphones, particularly in hand-held mode, the need for public education messages, developed with

sound theoretical guidance, is increasingly necessary to prevent road trauma and the potential loss of young lives.

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