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Evidence that attitude accessibility augments the relationship between speeding attitudes and speeding behavior: A test of the MODE model in the context of driving

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Abstract

According to the MODE model of attitude-to-behavior processes, attitude accessibility augments attitude-behavior correspondence, reflecting an automatic influence of attitudes on behavior. We therefore tested whether attitude accessibility moderates the attitude-behavior relationship in a context that is governed by characteristically automatic behavior, namely driving. In study 1 (correlational design), participants (N = 130) completed online questionnaire measures of the valences and accessibilities of their attitudes towards speeding. Two weeks later, online questionnaire measures of subsequent speeding behavior were obtained. Attitude valence was a significantly better predictor of behavior at high (mean + 1 *SD*) versus low (mean – 1 *SD*) levels of attitude accessibility. In study 2 (experimental design), attitude accessibility was manipulated with a repeated attitude expression task. Immediately after the manipulation, participants (N = 122) completed online questionnaire measures of attitude valence and accessibility, and two weeks later, subsequent speeding behavior. Increased attitude accessibility in the experimental (versus control) condition generated an increase in attitude-behavior correspondence. The findings are consistent with the MODE model's proposition that attitudes can exert an automatic influence on behavior. Interventions to reduce speeding could usefully increase the accessibility of anti-speeding attitudes and reduce the accessibility of pro-speeding attitudes.

KEY WORDS: Speeding behavior; Attitude valence; Attitude accessibility; Implicit attitudes; MODE model

1. Introduction

Many studies have focused on the relationship between attitudes (cognitive associations between objects [e.g., cars] or behaviors [e.g., speeding] and evaluations of them) and driving behaviors (e.g., Castanier et al., 2013; Conner et al., 2007; Elliott, 2012; Elliott et al., 2003, 2007 and 2013; Letirand & Delhomme, 2005; Tseng et al., 2013). Models of deliberative decision-making have been used in virtually all of these studies, in particular the theory of planned behavior (Ajzen, 1985) and its predecessor, the theory of reasoned action (Fishbein & Ajzen, 1975). Central to these models is the idea that the performance of a behavior (e.g., speeding) is dictated by intentions (plans of action) that are formed on the basis of attitudinal deliberation (consideration of the possible positive and negative consequences of behavior). Under most conditions, however, drivers are likely to lack the motivation and opportunity that is required for attitudinal deliberation. Drivers are likely to lack the motivation to deliberate on their attitudes because driving is largely habitual, meaning that they are often controlled by automatic processes that reduce the need for cognitive effort (see Ouellette & Wood, 1998). Similarly, drivers are likely to be afforded few opportunities for attitudinal deliberation because the driving task requires them to adjust their behavior on moment-by-moment basis in order to cope with changes in road and traffic conditions. Models that focus exclusively on deliberate decision-making processes are therefore unlikely to be the most appropriate for explaining driver behavior. On the other hand, the MODE (Motivation and Opportunity as DEterminants) model of attitude-to-behavior processes (e.g., Fazio, 1986 and 1990a; Fazio & Towles-Schwen, 1999) provides an account of how attitudes can influence behavior automatically, under conditions of low motivation and opportunity for deliberation. In this research, we therefore applied the MODE model to drivers' speeding behavior – a highly automated behavior that takes place on a continual moment-by-moment basis (e.g., Elliott et al., 2003; Elliott & Thomson, 2010).

According to the MODE model, attitudes must be 'activated' in order to guide behavior, and there are two cognitive processing modes through which attitudes can be activated. The first

is the deliberative processing mode. In this mode, it is proposed that attitudes are activated when they are retrieved from memory effortfully, through the same processes that are outlined by deliberative decision-making models (i.e., consideration of the positive and negative outcomes of a behavior). However, this processing mode is reserved for situations in which individuals have the motivation and opportunity to deliberate on their attitudes. When individuals lack either the motivation or opportunity to deliberate, it is proposed that attitudes are activated through the second, *spontaneous processing mode*. In this mode, an individual's attitude towards an object is held to be activated automatically when the attitude object or salient cues associated with it are encountered. The automatically activated attitude is then held to exert a biasing effect on how the attitude object is perceived in the immediate situation, effectively priming (initiating rapidly and without conscious awareness) attitude-congruent behavior (e.g., Fazio, 2001; Olson & Fazio, 2009).

Importantly, it is specified in the MODE model that only 'strong' attitudes that are chronically accessible in memory can be activated automatically. More specifically, it is proposed that all attitudes are located on a 'non-attitude' to 'attitude' continuum of associative strength. At the non-attitude end of the continuum, an individual has not yet developed an association between an object and his (her) evaluation of it. Thus, when the object is encountered, there is no pre-established attitude that can be activated to guide behavior. At the other end of the continuum, however, attitudes are characterized by strong, well-learned, object-evaluation associations. These attitudes are therefore chronically accessible and capable of being activated automatically.

The assumption within the MODE model, therefore, is that when individuals are in the spontaneous processing mode, the chronic accessibility of an attitude will moderate the relationship between attitude valence and subsequent behavior. Imagine, for example, two drivers who have equally positive attitudes towards speeding. The first driver has an attitude that is characterized by a strong, well-learned association between the act of speeding and his (her)

positive evaluation of that behavior (e.g., through having had the association reinforced by many directly experienced positive outcomes of speeding). The second driver has an attitude that is characterized by a weak association between the act of speeding and his (her) positive evaluation. Despite equally positive attitudes, the first driver would be more likely to speed because only (s)he would possess an attitude of sufficient associative strength to be chronically accessible. Therefore, when this driver encounters situational cues to speeding (e.g., being late for an appointment or overtaken by other traffic), his (her) attitude will be activated. In turn, access to the positive behavioral evaluation will be granted and this will bias subsequent behavior, making the act of speeding more likely. On the other hand, when the second driver encounters the same situation, his (her) positive evaluation will not be activated, meaning that (s)he will not be granted access to the same behaviorally biasing evaluation.

The spontaneous processes that are proposed within the MODE model therefore provide a potentially suitable account of driving behaviors that are typically performed under conditions of low motivation and opportunity for attitudinal deliberation. However, no studies have tested whether attitude accessibility moderates attitude-behavior correspondence in the context of driving. Nevertheless, evidence for an *attitude accessibility moderator effect* would provide important information about the types of attitudes that are likely to influence driver behavior (i.e., chronically accessible attitudes) and therefore the types of attitudes that need to be promoted in order to encourage safe driving. Additionally, research shows that attitudes are only moderately correlated with subsequent driver behavior (e.g., Elliott, 2012) and attempts to provide a more complete understanding of driving have tended to focus on the development and application of increasingly complex models, which incorporate numerous behavioral predictors in addition to attitudes (e.g., Conner et al., 2007; Coogan et al., in press; Elliott & Thomson, 2010). Whilst these models account for additional variation in driver behavior, over and above attitudes, they potentially undermine the importance of the attitude construct because they do not take into account the attitudinal qualities that moderate attitude-behavior correspondence.

Evidence that attitude-behavior correspondence varies as a function of attitude accessibility would help researchers account for the modest attitude-behavior correlations in the literature and demonstrate that attitudes have greater importance in the prediction of driver behavior than they have been attributed previously.

More generally, outside the context of driving, there are just three previous correlational studies (Fazio et al., 1989; Fazio & Williams, 1986; Kokkinaki & Lunt, 1997) and three previous experimental studies (Berger, 1992; Berger & Mitchell, 1989; Fazio et al., 1982 [experiment 4]) in which researchers have explicitly tested the moderating effect of attitude accessibility on the relationship between attitude valence and subsequent behavioral performance[1]. In line with the MODE model, two of the three correlational studies have shown that participants with higher levels of attitude accessibility demonstrate greater attitude-behavior correspondence than do participants with lower levels of attitude accessibility. However, Fazio and Williams (1986) presented mixed evidence. More specifically, these researchers found that attitude accessibility increased the correlation between attitudes towards Ronald Regan and subsequent voting in the 1984 US presidential election but it did not moderate the correlation between attitudes towards presidential candidate Mondale and subsequent voting behavior. Similarly, two of the three previous experimental studies showed that participants who received manipulations of attitude accessibility subsequently demonstrated greater attitude-behavior correspondence than did control participants (Berger & Mitchell, 1989; Fazio et al., 1982 [experiment 4]). However, the other experimental study showed that attitude-behavior correspondence did not vary across experimental and control conditions (Berger, 1992). Thus, both the correlational and experimental evidence for the attitude accessibility moderator effect is not entirely conclusive. In

[1] We acknowledge that the moderating effect of attitude accessibility on attitude-behavior correspondence has been tested in studies using measures of past rather than subsequent behavior (e.g., Rhodes & Ewoldsen, 2009) and in studies using measures of behavioral willingness or behavioral intention as proxies for behavior (e.g., Smith & Terry, 2003; White et al., 2002). However, past behavior violates the proposed causal sequencing within the MODE model (i.e., attitudes → behavior), and both behavioral willingness and behavioral intention are far from perfectly correlated with subsequent behavior (e.g., McEachan et al., 2011; Gibbons et al., 1998), meaning that they are not suitable proxies for subsequent behavior.

addition, there are several potential limitations with previous studies that we aimed to address in this research.

First, the above cited tests of the attitude accessibility moderator effect have all focused on a narrow range of characteristically deliberative behaviors, such as voting (e.g., Fazio & Williams, 1986) and consumer product choices (e.g., Berger, 1992; Berger & Mitchel, 1989; Kokkinaki & Lunt, 1997; Fazio et al., 1982 [experiment 4] and 1989). Given that attitude accessibility is held to augment attitude-behavior correspondence within the MODE model's spontaneous mode of processing only (Fazio, 1990a), highly automated behaviors, such as those readily found in the context of driving, are likely to provide a more exacting test of the attitude accessibility moderator effect.

Second, only one of the above cited tests of the attitude accessibility moderator effect was a field study focusing on a real-world behavior (Fazio and Williams, 1986). In all of the other studies, behavior was observed in laboratory sessions and behavior measures obtained from laboratories can be criticized for lacking ecological validity. In this research, we therefore focused on the commission of speeding behavior in the real-world (e.g., Conner et al., 2007 [study 2]; Elliott et al., 2003 and 2013; Elliott & Thomson, 2010) rather than the laboratory (e.g., Conner et al., 2007 [study 1]; Elliott et al., 2007).

Third, previous research testing the attitude accessibility moderator effect is characterized by immediate post-attitude measures of behavior (but see Fazio & Williams, 1986). This limits researchers' ability to draw conclusions about longer-term attitude-behavior relationships and confidence in interventions designed to bring about lasting attitude- and behavior-change. Additionally, the MODE model posits that it is the *chronic* accessibility of an attitude dictates its ability to guide behavior (e.g., Fazio, 1990a) and increases in the short-term relationship between attitude valence and behavior could be attributable to acute attitude accessibility (e.g., experimental manipulations generating only temporary increases in attitude accessibility). In this research, we introduced a time lag between the measurement of attitude valence and subsequent

behavior.

Finally, researchers have previously tested the extent to which attitude accessibility moderates the relationship between attitudes towards objects (e.g., presidential candidates) and subsequent behavior, rather than the relationship between attitudes towards behaviors (e.g., voting for presidential candidates) and subsequent behavior. However, attitudes towards behaviors are more proximal determinants of action (see Eagly & Chaiken, 1993) and therefore constitute more effective levers for changing behavior (e.g., Armitage & Conner, 2002; Elliott, 2012). We acknowledge that the MODE model's spontaneous processing mode does, in fact, focus on attitudes towards objects rather than attitudes towards behaviors. The rationale is that individuals in the spontaneous processing mode will not be sufficiently motivated or have the opportunity to construct an attitude towards the specific behavior that is required in the immediate situation (Fazio, 1990a). However, theories of attitude formation dictate that individuals can develop behavior-evaluation associations (i.e., attitudes towards behaviors) through the same processes as object-evaluation associations (i.e., attitudes towards objects): for example attitudes towards behaviors can be formed through self-perception (e.g., Bem, 1972), cognitive dissonance (Festinger, 1962), expectancy-value reasoning (e.g., Fishbein & Ajzen, 1975), or evaluative conditioning (e.g., Geng, Liu, Xu, Zhou, Fang, 2013). Therefore, attitudes towards behaviors do not need to be constructed afresh, prior to the execution of each and every behavioral performance. Consistent with our above description of the attitude accessibility moderator effect, it follows that attitudes towards behaviors should be capable of automatic activation when they are sufficiently established, and therefore accessible in memory (for a similar discussion of how behavior-specific cognitions can guide behavior see Ajzen & Fishbein, 2000). In this research, our focus on speeding behavior permitted an explicit test of whether attitude accessibility moderates the relationship between attitudes towards behaviors and subsequent behavioral performance.

2. Study 1

Study 1 was designed to provide a correlational test of the moderating role of attitude accessibility on the relationship between attitude valence and speeding behavior. In line with the above review, we hypothesized that attitude accessibility would moderate the relationship between attitude valence and subsequent speeding behavior, with attitude valence being more predictive of subsequent speeding for participants with high (mean + 1 SD) levels of attitude accessibility than for participants with low (mean – 1 SD) levels of attitude accessibility.

2.1 Method

2.1.1 Participants. One hundred and fifty four drivers were sampled from a university and two businesses located in a large city in the west of Scotland. The university students volunteered to participate in return for a course credit, following advertisements placed on virtual learning environments and notice boards around campus, and announcements made in lectures asking for volunteers. The participants from the two local businesses were invited to take part in the study to ensure that non-students had some representation in the final sample and that the final sample would therefore more closely resemble the general population. These participants were colleagues of the two research assistants who collected the data for this study, and other employees in the same companies who found out about the project through word-of-mouth. All of the participants were required to hold a full UK driving license and to drive at least once a week. One hundred and thirty participants completed the study (50% were sampled from the university). The final sample (N = 130) had a mean age of 29.36 years old (SD = 12.79) and 56% was female.

2.1.2 Design and procedure. A prospective design was employed. At time 1, each participant (N = 154) was sent an email that provided a link to an online, self-completion questionnaire. The questionnaire was developed and administered using Qualtrics Survey Design and Administration software. The questionnaire contained three sections. Section 1 provided general information about the study and sought participants' consent. The participants were told that the study was a general purpose investigation into drivers' attitudes towards speeding, that

participation would involve the completion of two questionnaires a fortnight apart, that there were no right or wrong answers to any of the questions, that participation was anonymous, that the data would be used only for research purposes, and that they had the right to withdraw from the study at any time. In section 2 of the questionnaire, the participants completed items to measure their basic demography (age and gender).

In section 3, we measured both the valence and accessibility of each participant's attitude towards speeding using standard procedures. The participants were presented with a screen on which they were instructed to: "answer the next question as quickly as possible while making sure that your response accurately reflects your opinion". They were also instructed to click on a 'NEXT' button when they were ready to complete the item. After clicking on the NEXT button, the participants were presented with the item stem: "For me, exceeding the speed limit whilst driving over the next fortnight would be…". They completed this item stem using a 9-point bipolar, semantic differential scale with the end-points labelled *extremely negative* (scored -4) and *extremely positive* (scored +4). Participants' responses on this semantic differential scale served as the measure of attitude valence. We purposely avoided a multi-item measure of attitude valence because it would have required participants to repeatedly express their attitudes. This is problematic because repeated attitude expression increases attitude accessibility (e.g., Holland et al., 2003; Powell & Fazio, 1984; also see section 3.2.2), meaning that only single item measures of attitudes can be used in studies such as this one[2]. It should be noted, however, that the attitude valence item used in this study has been used as standard in attitude research, across numerous behavioral domains (e.g., Fishbein & Ajzen, 2010). In the present context, it has been shown to possess both convergent and predictive validity: responses to it are correlated strongly with multi-item measures of attitude valence (r[N=150] = 0.80; Elliott et al., 2007) and they are reliable predictors of subsequent speeding behavior (Elliott, 2012; Elliott & Thomson, 2010). The item also possesses good test-retest reliability: responses to it have been shown to correlate

[2] We also did not employ repeated measures of attitudes (in study 1 or in study 2) for the same reason.

significantly over a 6-month period (see Elliott et al., 2013).

The standard measure of attitude accessibility employed in previous research (e.g., Fazio, 1990b; Fazio et al., 2000) was also used in this study. More specifically, attitude accessibility was measured using the latencies of the participants' responses to the attitude valence item (in milliseconds). Latency recordings began upon initial presentation of the attitude valence item. They were terminated when participants provided their final response on the semantic differential scale. Following Fazio's (1990b) recommendations, the latency recordings were subjected to a reciprocal transformation (1/response latency) in order to increase the normality of their distribution. We also multiplied the resulting transformed scores by 1000 to avoid rounding problems associated with small numbers (see Fazio, 1990b for a discussion of these transformation procedures). Given that the response latencies were subjected to a reciprocal transformation, higher scores indicated greater attitude accessibility. The rationale for this response latency measure of attitude accessibility is that participants cannot report an attitude quickly if that attitude is not accessible in memory (e.g., if a behavior-evaluation association is not already established). Instead, participants must expend the cognitive effort that is required to construct the attitude on the spot, which is time consuming. On the other hand, participants are able to report their attitudes with increasingly faster latencies as the accessibilities of their attitudes increase (Fazio, 1990b).

In addition to measuring attitude valence and accessibility, section 3 of the online questionnaire contained two filler items. These were standard items commonly used in research on the theory of planned behavior to measure subjective norm (perceived social pressure to speed) and perceived behavioral control (perceived ability to speed), respectively (see Elliott & Thomson, 2010). The latencies of the participants' responses to these filler items were measured using the same procedure as specified above. The response latencies for the filler items were included in the subsequent data analysis as control variables. In particular, they were used to control for literacy and psychomotor abilities (e.g., Fazio, 1990b). However, since these response

latencies are not relevant to this study in any other respect, data relating to them are not presented in this article.

Two-weeks post- time 1, each participant was sent an email that contained a link to a second online questionnaire, which was again developed and administered using Qualtrics Survey Design and Administration software. Of the $N = 154$ participants who completed the time 1 questionnaire, 84% ($N = 130$) completed the time 2 questionnaire. The time 2 questionnaire contained three standard items to measure subsequent speeding behavior. These items were presented amongst seven filler items in order to help avoid potential consistency biases (e.g., Budd, 1987). The participants responded to each behavior item using a 9-point unipolar scale. The three behavior items were: 'How often did you drive faster than the speed limit over the last fortnight?' (response scale: *never* [scored +1] to *frequently* [scored +9]); 'I drove faster than the speed limit over the last fortnight' (response scale: *not at all* [scored +1] to *very much* [scored +9]); and 'Over the last fortnight, I have driven faster than the speed limit (response scale: *strong agree* [scored +9] to *strongly disagree* [scored +1). Higher scores therefore reflected a greater frequency of reported speeding. The mean of the three items served as a reliable composite measure of subsequent speeding behavior (Cronbach's $\alpha = 0.97$). After completing the time 2 questionnaire, the participants were thanked and debriefed by means of an 'end of questionnaire message'. Ethical approval for this study was granted by the School of Psychological Sciences and Health.

2.2 Results

2.2.1 Tests of attrition. Several analyses were conducted to ensure that there were no systematic differences between the participants who dropped out of the study at time 2 ($N = 24$) and those who completed it ($N = 130$). A series of ANOVAs showed that the 'drop-outs' did not differ significantly from the 'completers' in age, $F(1, 152) = 0.14$, *ns,* or on the time 1 measures of attitude valence, $F(1, 152) = 2.22$, *ns*, or accessibility, $F(1, 152) = 0.70$, *ns*. A chi-squared test additionally showed that there were no gender differences between the drop-outs and the

completers, $\chi^2(1) = 0.71$, *ns*. Therefore, attrition from time 1 to time 2 of the study did not unduly affect the sample and the subsequent data analyses are based only on the final sample of $N = 130$.

2.2.2 Descriptive statistics. Consistent with prior research on driver behavior (e.g., Elliott, 2012; Elliott et al., 2003 and 2007), the sample mean for the attitude valence item showed that the participants were, on average, negatively orientated towards speeding ($M = -0.75$, $SD = 3.03$). The mean attitude accessibility score was 284.39 ($SD = 234.19$), meaning that the average (mean) latency of response to the attitude valence item was 4.89 seconds ($SD = 2.91$). On average, the participants reported exceeding the speed limit reasonably frequently ($M = 5.58$, $SD = 2.87$). Also, in line with previous research (e.g., Elliott et al., 2003 and 2007), attitude valence was correlated positively with subsequent speeding behavior ($r = .64$, $p < .01$). Attitude accessibility was not correlated with either attitude valence ($r = .12$, *ns*) or speeding behavior ($r = .09$, *ns*).

2.2.3 Moderator analyses. Following standard procedures, we used a moderated linear regression (Baron & Kenny, 1986) with follow-up simple slopes analyses (Aiken & West, 1991) to test the hypothesis that attitude accessibility would augment the relationship between attitude valence and speeding behavior. The dependent variable in the moderated regression was subsequent speeding behavior. The independent variables were attitude valence and attitude accessibility, and a two-way interaction between attitude valence and attitude accessibility that was calculated by multiplying the participants' scores on the attitude valence and accessibility measures. Both attitude valence and attitude accessibility were mean-centered before they were multiplied to reduce the possible effects of multicolinearity in the moderated regression (see Aiken & West, 1991).

As table 1 shows, 43% of the variance in subsequent speeding behavior was accounted for by the moderated regression model. Attitude valence had a significant standardized beta weight but attitude accessibility did not. Critically, the two-way attitude valence X attitude accessibility interaction had a significant standardized beta weight. The follow-up simple slopes analyses

probing this significant interaction (see figure 1) showed that attitude valence had a larger standardized beta weight for participants with high (mean + 1 *SD*) levels of attitude accessibility ($\beta = .83$, $p < .001$) than for participants with low (mean – 1 *SD*) levels of attitude accessibility ($\beta = .37$, $p < .01$).

2.3 Discussion

The findings from study 1 are consistent with and extend previous correlational research testing the attitude accessibility moderator effect (e.g., Fazio & Williams, 1986). In support of the hypothesis, attitude valence was significantly more predictive of subsequent speeding behavior for participants with high levels of attitude accessibility than it was for participants with low levels of attitude accessibility. This finding is consistent with the MODE model's proposition that attitude accessibility moderates attitude-behavior correspondence. However, as with any correlational study, there is a risk that the findings are attributable to a third variable problem (e.g., Mauro, 1990). More specifically, the observed moderator effect is potentially spurious because attitude accessibility might be associated with an unmeasured variable that is the genuine cause of high attitude-behavior correspondence. Most notably, attitude accessibility is correlated with other facets of attitude strength (e.g., attitude certainty), which are also known to moderate the relationship between attitude valence and behavior (e.g., Glasman & Albarracín, 2006; Kokkinaki & Lunt, 1997; Kraus, 1995). A second study was therefore designed.

3. Study 2

In study 2, we used an experimental design to test whether attitude accessibility causally determines attitude-behavior correspondence. More specifically, we aimed to demonstrate that experimentally induced increases in attitude accessibility generate subsequent increases in the relationship between attitude valence and subsequent speeding behavior. Previous experimental studies have not fully addressed this issue. As discussed in the general introduction, Berger and Mitchell (1989) and Fazio et al. (1982 [experiment 4]) showed that their experimental participants, who received manipulations of attitude accessibility, subsequently possessed higher

levels of attitude-behavior correspondence than did their control participants. These researchers also showed that experimental participants had faster post-manipulation response latencies to attitudinal inquiries, indicating that the experimental manipulations successfully increased attitude accessibility. However, mediation analyses were not conducted in either study to demonstrate that the observed effects of the experimental manipulations on increased attitude-behavior correspondence were attributable to the observed increases in attitude accessibility. This is an important issue because experimental manipulations of attitude accessibility have also been shown to increase other facets of attitude strength (e.g., Berger & Mitchell, 1989; Holland et al., 2003). As is the case with correlational research, therefore, previous experimental tests of the attitude accessibility moderator effect are vulnerable to a possible third variable problem. In this study, we therefore tested the following two hypotheses. *Hypothesis 1*: attitude valence would be a better predictor of speeding behavior for experimental participants, who receive a manipulation of attitude accessibility, than it would for control participants. *Hypothesis 2:* the observed difference between experimental and control participants in their level of attitude-behavior correspondence would be mediated by observed differences between experimental and control conditions in attitude accessibility (i.e., experimental manipulation → greater attitude accessibility → greater attitude-behavior correspondence).

3.1 Method

3.1.1 Participants. One hundred and thirty two drivers were sampled from the same university as in study 1, using the same recruitment procedures and criteria (note that none of the participants who took part in the previous study participated in this second study). One hundred and twenty two of the participants completed the study. The mean age of the final sample (N = 122) was 20.97 years old (SD = 1.68) and 61% was female.

3.1.2 Design and procedure. A between-groups controlled design was employed. All of the participants (N = 132) were emailed a link to an online, self-completion questionnaire that was developed and administered using Qualtrics Survey Design and Administration software. The

questionnaire contained four sections. Sections 1 and 2 were the same for all participants. Section 1 provided general information about the study (exactly the same as in study 1) and sought participant consent. Section 2 included items to measure basic demography (age and gender) and month of birth. Month of birth was used to assign the participants to the conditions. The participants born in January and every other month after were assigned to the experimental condition. The participants born in February and every other month after were assigned to the control condition.

The experimental and control participants received different content in section 3 of the online questionnaire. Consistent with previous research (e.g., Fazio et al., 1982 [experiment 4]), the participants in the experimental condition received a repeated attitude expression task to manipulate attitude accessibility (Powell & Fazio, 1984). More specifically, the experimental participants were required to complete multiple items that asked about their attitudes towards speeding. All items contained the following stem: "for me, driving faster than the speed limit while driving over the next fortnight would be…". The experimental participants were required to complete this sentence using 9-point, bipolar, semantic differential scales, with the following adjectives at either end: *good/bad*, *enjoyable/unenjoyable*, *fun/boring*, *pleasant/unpleasant*, *positive/negative*, *beneficial/harmful*. These six items were presented three times each, in a pseudo random order, interspersed with filler items. The rationale for this task is that it requires participants to rehearse their attitudes, thus strengthening the mental association between the behavior (speeding) and participants' evaluations of it. In line with the MODE model, this increase in associative strength should promote increased attitude accessibility (e.g., Fazio, 1990a). Accordingly, previous research has shown that asking participants to repeatedly complete attitude items decreases latencies of responses to a final attitude item (e.g., Holland et al., 2003; Powell & Fazio, 1984).

The control participants completed a similar task to the experimental participants in section 3 of their questionnaire. They completed the same items as did the experimental participants, and

in the same order, but the item stems specified the target behavior of "engaging in a binge-drinking session" rather than "driving faster than the speed limit". Therefore, with the exception of the specific target behavior, the control task was identical to the experimental task, even down to the number of words that were specified in each item.

In section 4 of the online questionnaire, both the experimental and control participants completed the same measures of attitude valence and accessibility that were used in study 1. Also as in study 1, we measured participants' latencies of response to two filler items, one of which measured subjective norm and the other perceived behavioral control.

Two-weeks post-time 1, all participants were sent a weblink to a second online questionnaire. The time 2 questionnaire contained the same three items to measure speeding behavior that were used in study 1. The time 2 questionnaire was completed by 92% ($N = 122$) of the initial sample ($n = 60$ experimental participants; $n = 62$ controls). The mean of the three items that measured subsequent speeding behavior formed a reliable composite scale for use in the subsequent data analyses (Cronbach's $\alpha = 0.89$). Ethical approval for study 2 was granted by the School of Psychological Sciences and Health's ethical committee.

3.2 Results

3.2.1 Tests of attrition. As in study 1, attrition from time 1 to time 2 of this study did not unduly affect the sample. ANOVAs showed that the drop-outs at time 2 ($N = 10$) did not differ significantly from the study completers ($N = 122$) in age, $F(1, 130) = 1.06$, *ns,* or on the time 1 measures of attitude valence, $F(1, 130) = 0.01$, *ns*, or accessibility, $F(1, 130) = 1.18$, *ns*. A chi-squared test also showed that there were no gender differences, $\chi^2(1) = 1.00$, *ns*. The subsequent data analyses are therefore based only on the final sample of $N = 122$.

3.2.2 Descriptive statistics and tests of manipulation effectiveness. In line with study 1, the sample mean for the attitude valence item indicated that participants had, on average, a slightly negative attitude towards speeding ($M = -0.64$; $SD = 2.17$). The mean attitude accessibility score was 285.37 ($SD = 115.19$), meaning that the average (mean) post-manipulation latency of

response to the attitude valence item was 3.93 seconds (*SD* = 1.28). On average, participants reported exceeding the speed limit moderately often at the two-week follow-up (*M* = 4.54, *SD* = 2.49).

An ANOVA was conducted to test whether the experimental manipulation was successful at increasing attitude accessibility. The dependent variable was attitude accessibility. The independent variable was condition (0 = control; 1 = experimental). The results showed that the experimental participants had more accessible attitudes (*M* = 316.19; *SD* = 134.13) than did the control participants (*M* = 255.06; *SD* = 83.42) after receiving the experimental manipulation, F (1, 120) = 9.25, $p < .01$, $d = 0.55$).

To ensure that the experimental manipulation did not simply increase participants' general speed of responding to our measures, we conducted another two ANOVAs. The dependent variables in these analyses were the latencies of participants' responses to the two filler items in the time 1 questionnaire. In the first ANOVA, the dependent variable was the response latency for the subjective norm item. In the second ANOVA, the dependent variable was the response latency for the perceived behavioral control item. The independent variable in both ANOVAs was condition (0 = control; 1 = experimental). These analyses revealed no significant differences in participants' latencies of response for the subjective norm item, F (1, 120) = 0.55, *ns*, d = 0.13), or the perceived control item, F (1, 120) = 1.19, *ns*, $d = 0.19$).

We also conducted another ANOVA to ensure that the experimental manipulation did not alter the valences of the participants' attitudes. The dependent variable in this ANOVA was the measure of attitude valence. The independent variable was condition. The results showed that there was no difference between the experimental and control conditions on attitude valence scores, F (1, 120) = 0.26, *ns*, $d = 0.09$). Overall therefore, the experimental manipulation successfully increased attitude accessibility and did not alter the other constructs.

3.2.3 Moderator analyses. We used the same analytical procedure as in study 1 to test the hypothesis that attitude valence would be a better predictor of speeding behavior for

experimental participants than it would for control participants (*hypothesis 1*). A moderated linear regression was conducted. The measure of subsequent speeding behavior was the dependent variable. Attitude valence and condition (0 = control; 1 = experimental) were the independent variables, along with a two-way attitude valence X condition interaction. Following Aiken and West (1991), attitude valence (i.e., the continuous variable) was mean centred prior to computation of the two-way interaction to reduce possible multicollinearity.

As shown in table 2, the regression model accounted for 45% of the variance in subsequent speeding behavior. Attitude valence had a significant standardized beta weight whereas condition did not. The two-way interaction between attitude valence and condition was statistically significant. In support of hypothesis 1, simple slopes analyses (see figure 2) showed that the standardized beta weight for attitude valence was larger for the experimental condition ($\beta = .61$, $p < .001$) than for the control condition ($\beta = .29$, $p = .07$).

3.2.4 Mediation analysis. In line with standard practice for establishing mediation, we used the following procedure to test hypothesis 2 (that the observed difference between the experimental and control conditions in attitude-behavior correspondence would be mediated by the observed differences between conditions in attitude accessibility). First, we calculated the absolute difference between participants' scores on the measures of attitude valence and subsequent speeding behavior. We then inversed this difference score to derive an overall index of attitude-behavior correspondence, with higher scores equating to greater consistency between attitude valence and subsequent speeding behavior. Second, we ran three separate simple linear regressions: one predicting attitude accessibility from condition (see path a in figure 3); one predicting attitude-behavior correspondence from attitude accessibility (see path b); and one predicting attitude-behavior correspondence from condition (see path c). Third, we ran a multiple linear regression predicting attitude-behavior correspondence from condition, while controlling for attitude accessibility (see c' path in figure 3). Consistent with established criteria for demonstrating mediation (Baron & Kenny, 1986), the standardized beta weights for paths a, b

and c in figure 3 were statistically significant and the standardized beta weight for the c' path was smaller than was the standardized beta weight for the c path (also see figure 3).

Additionally, we used Preacher and Hayes' (2007) bootstrapping procedure to test the significance of the mediation effect. This procedure involves re-sampling random subsets of the data to derive a non-parametric estimation of the sampling distribution of the products of the paths between the independent variables (e.g., condition) and the proposed mediator (e.g., attitude accessibility) and between the proposed mediator and the dependent variable (e.g., attitude-behavior correspondence). This procedure is therefore suitable for testing mediation, and is preferable to the use of the Sobel test, because mediation effects are not normally distributed (Preacher & Hayes, 2007). One thousand random subsets of the data were re-sampled in the present analyses. Additional re-samples made no difference to the findings. The analysis showed that the 99% confidence interval for the mediation effect of condition on attitude-behavior correspondence through attitude accessibility was: 99% CI = 0.5179 to 0.0457. Attitude accessibility therefore significantly mediated the effect of condition on attitude-behavior correspondence because the 99% confidence interval did not span zero.

3.3 Discussion

Study 2 extends the findings from study 1 and previous experimental research testing the moderating role of attitude accessibility on attitude-behavior correspondence (e.g., Berger & Mitchell, 1989). The experimental participants completed a repeated attitude expression task that successfully increased the accessibilities of their attitudes towards speeding, as indicated by faster post-manipulation latencies of response to a subsequent attitude valence item compared to the control participants. In support of hypothesis 1, the post-manipulation measures of attitude valence were significantly better predictors of subsequent speeding behavior for the experimental participants than they were for the control participants. In support of hypothesis 2, the mediation analyses showed that the observed difference between the experimental and control conditions in attitude-behavior correspondence was attributable to the observed differences between the

conditions in attitude accessibility. Thus, we demonstrated, for the first time, that experimentally induced increases in attitude accessibility mediated increased levels of attitude-behavior correspondence.

4. General Discussion

This research was conducted because previous studies into attitudes and driving behaviors have focused on deliberative decision-making models, which are unlikely to be the most appropriate for explaining behavior that is performed under conditions of low motivation and opportunity for attitudinal consideration. We therefore, provided the first test of the MODE model of attitude-to-behavior processes (e.g., Fazio, 1986 and 1990a) in the context of driving. In line with the spontaneous processing mode that is specified by this model, our principal aim was to test whether attitude accessibility increases the relationship between attitude valence and subsequent speeding behavior. We found converging evidence for this attitude accessibility moderator effect from two independent studies. In study 1, we found correlational evidence that participants with higher levels of attitude accessibility possess greater levels of attitude-behavior correspondence than do participants with lower levels of attitude accessibility. More specifically, scores on a standard questionnaire measure of attitude valence were significantly more predictive of subsequent (two-weeks later) speeding behavior for participants who completed the attitude valence measure with faster than slower latencies of response. In study 2, we found experimental evidence that increases in attitude accessibility generate increases in attitude-behavior correspondence. More specifically, experimental participants, whose attitude accessibilities were successfully manipulated with a repeated attitude expression task (Powell & Fazio, 1984), demonstrated significantly higher levels of correspondence between their speeding attitudes and subsequent (two-weeks later) speeding behavior than did control participants. Additionally, mediation analyses provided evidence that the higher levels of attitude-behavior correspondence in the experimental condition was attributable to higher (experimental versus control) levels of attitude accessibility.

The present findings are, therefore, consistent with previous correlational (Fazio, 1989; Fazio & Williams, 1986; Kokkinaki & Lunt, 1997) and experimental (Berger & Mitchell, 1982; Fazio et al., 1982 [experiment 4]) studies in which researchers have also demonstrated that attitude accessibility increases attitude-behavior correspondence. However, the present findings represent an important contribution to the literature on attitude accessibility for several reasons. First, they show that attitude accessibility moderates the relationship between attitude valence and subsequent behavior in a real-world context, rather than a laboratory setting (also see Fazio & Williams, 1986). The present findings therefore possess high ecological validity. Second, the findings show that attitude accessibility moderates the attitude-behavior relationship when a time gap between the measurement of attitudes and behavior is used (also see Fazio & Williams, 1986). Therefore, compared with studies in which researchers have used immediate post-attitude measures of behavior, we can be more confident that the moderator effects observed in this research are attributable to chronic rather than acute attitude accessibility, in line with the theoretical postulate of the MODE model. Additionally, the finding that attitude accessibility augments the relationship between speeding attitudes and speeding behavior over time means we conclude with greater confidence that interventions which successfully target attitude accessibility will have lasting effects on driver behavior (we return to the issue of road safety interventions later in this section).

The third reason why our findings represent an important contribution to the literature is that they demonstrate that attitude accessibility moderates the relationship between attitude valence and a characteristically automatic behavior (i.e., speeding; see Elliott et al., 2003; Elliott & Thomson, 2010). This is in contrast to previous studies, in which researchers have focused on characteristically deliberative behaviors when testing the attitude accessibility moderator effect. The present research is therefore more in keeping with the spontaneous processes outlined in the MODE model, through which attitude accessibility is theorized to exclusively facilitate attitude-congruent behavior (e.g., Fazio, 1990a). This research therefore provides a more theoretically

exacting test of the attitude accessibility moderator effect than does previous research. It therefore goes some way to explaining the discrepancies in the literature, caused by null results (e.g., Berger, 1992).

The final reason why our findings represent an important contribution to the literature on attitude accessibility is that they demonstrate, for the first time, that attitude accessibility can moderate the relationship between attitudes towards a specific behavior and the subsequent performance of that behavior. This is important because Fazio (1990a) has previously argued that automatic attitude activation is reserved for chronically accessible attitudes towards *objects* (see section 1). In line with the MODE model's spontaneous processes, through which attitudes towards objects are theorized to influence behavior, our findings imply that chronically accessible attitudes towards *behaviors* might also be activated automatically, and do not necessarily need to be the subject of strategic deliberation prior to the execution of each and every behavioral performance (cf. Ajzen & Fishbein, 2000). Our findings therefore broaden the conceptual framework of the MODE model to encompass attitudes towards behaviors.

It is important to note, however, that whilst our findings are consistent with the MODE model's theoretical assumptions, they do not actually demonstrate that chronically accessible attitudes exert a strong influence on driver behavior *because* they are activated automatically. Following previous research, we used the latencies of participants' responses to an attitude valence item to measure attitude accessibility, with faster latencies of response indicating more accessible attitudes. Since rapid responding is a key feature of automaticity (Moors & De Houwer, 2006), the assumption is that faster response latencies indicate greater levels of automatic attitude activation. A potential concern with this assumption is that rapid responding to a direct attitude inquiry could equally indicate that participants' attitudes are retrieved from memory efficiently, via a controlled, deliberative process (Fazio et al., 1986). That said, response latencies to direct inquiries have been shown to correlate with facilitation measures of attitudes that are derived from priming tasks (e.g., Fazio et al., 2000). Briefly, facilitation measures of

attitudes are indices of the extent to which an attitude object (the prime) facilitates or inhibits the speed by which participants are able to evaluate positively and negatively valenced targets, typically adjectives in a 'word meaning task' (e.g., Fazio et al., 1986). Greater facilitation on positively valenced targets is indicative of a more positive attitude towards the primed object and greater facilitation on negatively valenced targets is indicative of a more negative attitude. Facilitation measures therefore tap the degree to which positive or negative attitudes are activated when the attitude object is presented. Furthermore, attitude activation is automatic because participants do not explicitly evaluate the primed attitude object and are unaware their attitudes are being assessed (Olson & Fazio, 2009). Response latencies such as those used in the present research therefore yield valid indicators of automatically activated attitudes. However, in line with research in other domains (see Fazio, 2001; Olson & Fazio, 2009) researchers could usefully employ facilitation measures of attitudes in future studies of driver behavior.

Regardless of whether the present findings reflect an automatic influence of attitudes on subsequent behavior or a more deliberative, but efficient, processing of attitudes, the finding that attitude accessibility moderated the speeding attitude-speeding behavior relationship is important in its own right. First, the finding helps explain the rather modest correlations between drivers' attitudes and behavior that are typically found in the literature (e.g., Elliott, 2012). More specifically, the present findings suggest that these modest correlations are attributable, at least in part, to relatively inaccessible attitudes attenuating attitude-behaivour correspondence. On the other hand, accessible attitudes, which are well-established in memory, are strong predictors of driver behavior. Second, and on a related point, the finding that attitude accessibility moderated the speeding attitude-speeding behavior relationship demonstrates that attitudes have more importance in the prediction of driver behavior than they have been attributed in previous studies. More specifically, research that is concerned with predicting variance in driver behavior from numerous independent constructs, in addition to attitudes, ignores the attitudinal qualities (e.g., attitude accessibility) that dictate attitude-behavior correspondence (e.g., Conner et al.,

2007; Coogan et al., in press; Elliott & Thomson, 2010). Future research concerned with predicting driver behavior should therefore use measures of attitude accessibility in addition to measures of attitude valence. The accessibility of other constructs that are widely used to predict driver behavior might also be usefully investigated. For instance, subjective norms (e.g., Cialdini et al., 1991), perceived control or self-efficacy (e.g., Bandura, 1997), moral norms (e.g., Manstead, 2000), self- and social- identity (e.g., Hogg et al., 1995) and prototype perceptions (e.g., Gerrard et al., 2008) are, like attitudes, held to be represented in memory, and therefore their ability to predict behavior should be dictated by their accessibility in memory. Research examining the accessibility of these constructs is warranted to gain a more complete insight into social behavior generally (e.g., Rhodes & Ewoldsen, 2009; Rhodes et al., 2014).

The finding that attitude accessibility moderated the relationship between drivers' attitudes and their subsequent speeding behavior also has important implications for road safety interventions (e.g., driver education and training). In particular, the finding implies that interventions should not only seek to promote anti-speeding attitudes (e.g., Elliott & Armitage, 2009; Stead et al., 2005), but also increase the accessibility of those attitudes, in order to help ensure that they are translated into behavior (i.e., the avoidance of speeding). The repeated attitude expression task used in this research (study 2) was effective at increasing attitude accessibility and therefore represents a useful, easy to administer and cost-effective intervention technique. However, such interventions should only be targeted at individuals with anti-speeding attitudes. As the present findings indicate, increasing the accessibility of pro-speeding attitudes is likely to *increase* speeding behavior. Interventions that reduce attitude accessibility are therefore needed for drivers with pro-speeding attitudes. Psychotherapeutic techniques that have been found to be effective at reducing the automatic activation of unwanted cognitions (e.g., cognitive restructuring or thought stopping; see Foa et al., 2005) represent potentially useful intervention strategies for achieving this aim and are worthwhile targets for future intervention research in road safety.

While the present findings have important theoretical and practical implications, a number of methodological issues need to be considered when interpreting the results (also see the above discussion of the measurement of attitude accessibility). First, in both studies, we employed self-reported measures of speeding behavior and self-reports have attracted criticism in the literature because they are potentially vulnerable to a cognitive (e.g., Luchins, 1957), affective (e.g., Bower, 1992) and self-presentational (e.g., Paulhus, 2002) biases. However, self-reported behavior measures are commonly employed in social research and they have been shown to be accurate proxies for objectively measured speeding behavior (e.g., Elliott et al., 2007). Second, although we used a time gap between the measures of attitudes and speeding behavior, the time gap (two weeks) was relatively short in both studies. However, as noted earlier, almost all previous studies testing the attitude accessibility moderator effect have used immediate post-attitude measures of behavior. We also draw confidence from Fazio and Williams (1986), who used a 6-month time gap between their measures of attitudes and behavior, and still found evidence for the attitude accessibility moderator effect. Also, as noted in footnote 1 (in section 1), there are several studies of the attitude accessibility moderator effect in which researchers have used measures of past behavior, behavioral intentions or behavioral willingness as dependent variables. These limited proxies for subsequent behavior are a direct result of cross sectional designs (i.e., no time gap between the measurement of attitudes and behavior). The prospective measurement of behavior should therefore be considered a strength of the present investigation.

A third methodological issue that is worth considering is that the present findings are based on predominantly student samples. However, previous research has shown that attitudes are reliable predictors of behavior regardless of whether student samples (e.., Elliott, 2012; Elliott et al., 2013 [study 1]; Letirand & Delhomme, 2005) or general population samples (e.g., Conner et al., 2007 [study 2]; Elliott et al., 2003, 2007, 2010 and 2013 [study 2]) are used. In addition, there is evidence that student and non-student samples are equally influenced by

interventions (e.g., Gollwitzer & Sheeran, 2006). Finally, while the sample used in study 2 of this research comprised exclusively university students, the sample used in study 1 comprised 50% non-students. Overall, therefore, we are highly confident in the validity of the findings.

In conclusion, this research provides both correlational and experimental evidence that attitude accessibility increases the relationship between speeding attitudes and speeding behavior. The findings are consistent with the MODE model's proposition that attitudes exert an automatic influence on behavior. The present findings therefore extend previous research on attitudes and driver behavior, which has focused almost exclusively on deliberative decision-making models. Future research into the prediction of driver behavior should utilize measures of attitude accessibility in addition to measures of attitude valence. Future research into the automaticity of attitudes and driver behavior should utilize facilitation measures of attitudes. The findings imply that road safety interventions need to increase the accessibility of anti-speeding attitudes and reduce the accessibility of pro-speeding attitudes.

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Table 1. *Moderated regression predicting subsequent speeding behavior from attitude valence, attitude accessibility and attitude valence X attitude accessibility* (Study 1)

Variable	R^2	*F*	β
Attitude Valence	.43	31.38**	.60**
Attitude Accessibility			.11
Attitude Valence X Attitude Accessibility			.18*

* $p < .05$. ** $p < .001$

Table 2. *Moderated regression predicting speeding behavior from attitude valence, condition and attitude valence X condition* (Study 2)

Variable	R^2	*F*	β
Attitude Valence	.45	32.34**	.45**
Condition (0 = control; 1 = Experimental)			.13
Attitude Valence X Condition			.24*

* $p < .05$. ** $p < .001$.

Figure 1. Simple slopes for the relationship between attitude valence and subsequent speeding behavior: High versus low levels of attitude accessibility (Study 1)

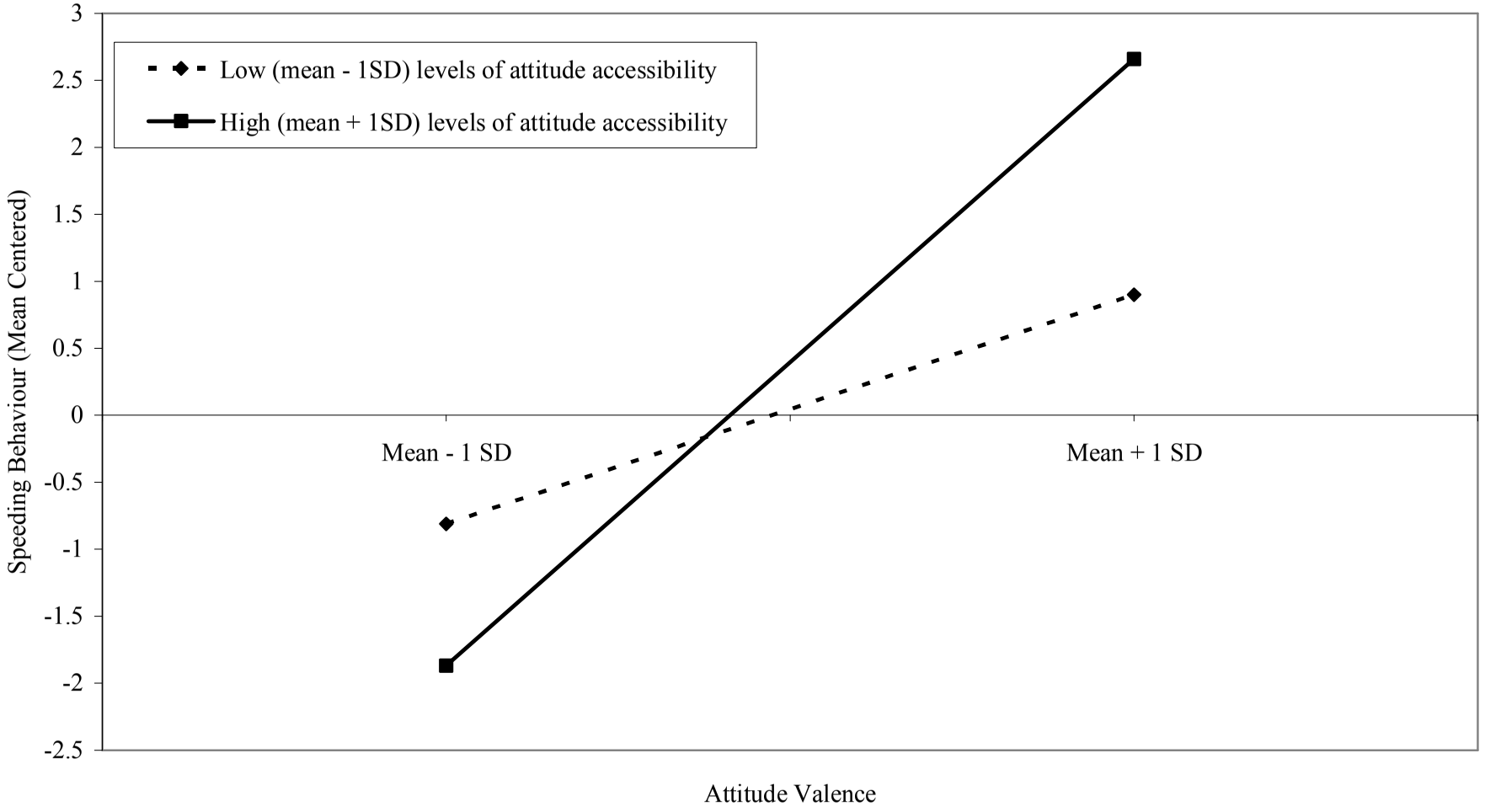


Figure 2. Simple slopes for the relationship between attitude valence and subsequent speeding behavior: Experimental versus control participants (Study 2)

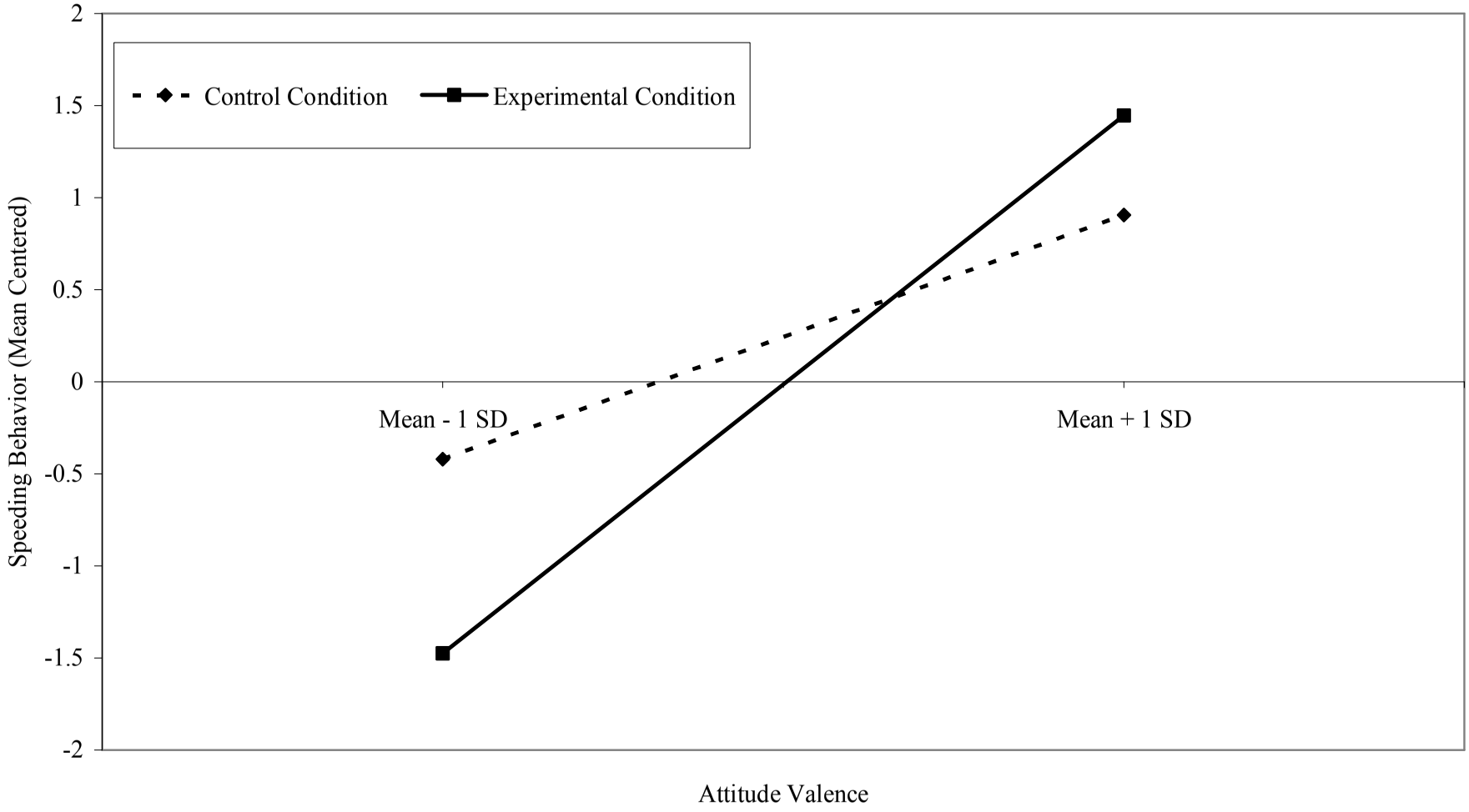
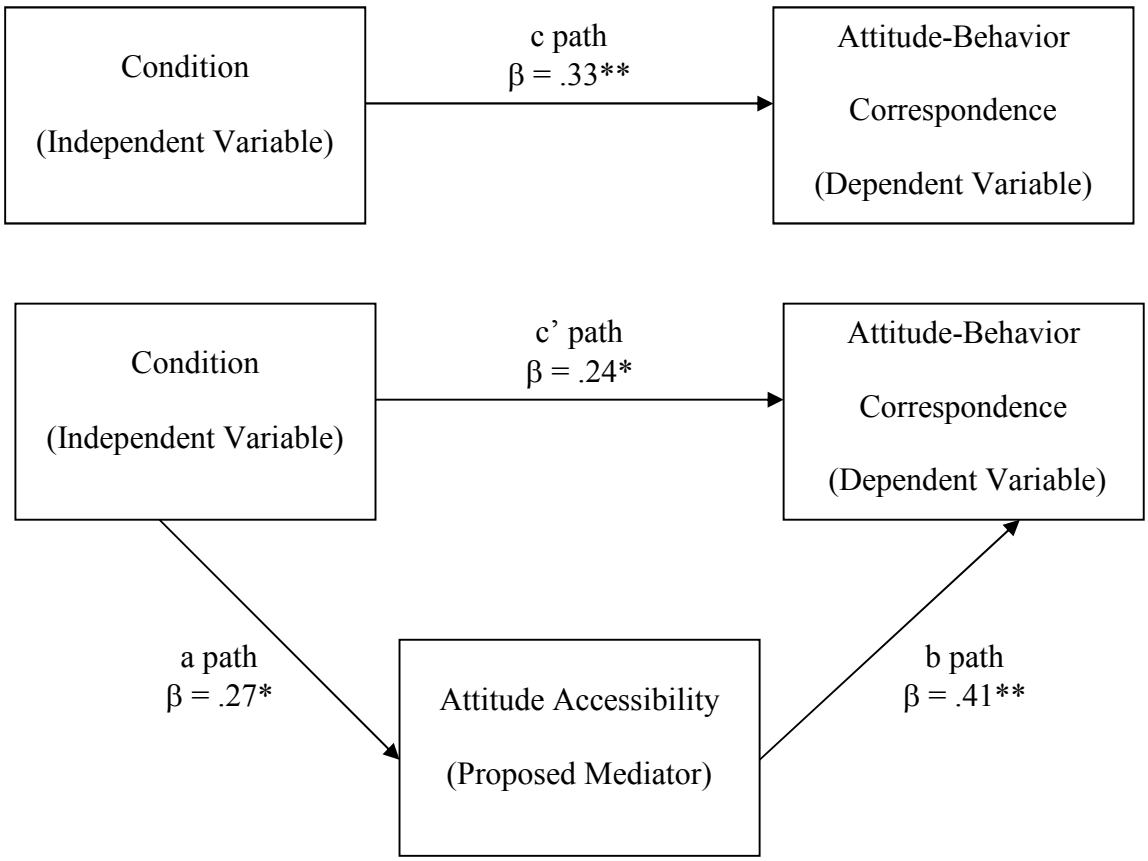


Figure 3. Mediation of the effects of condition (manipulation of attitude accessibility received versus not received) on subsequent attitude-behavior correspondence by attitude accessibility



Note. All beta weights are standardized. The beta weight for the c' path is from a regression model predicting the dependent variable from both the independent variable and the proposed mediator. All other beta weights are from regression models with single predictor variables.

* $p < .01$. ** $p < .001$.