Use of mental simulations to change theory of planned behaviour variables

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Abstract

Objectives. The predictive validity of the theory of planned behaviour iswell established, but much less is known about: (a) whether there are causal relationships between key components of the model and (b) how to go about changing the theory of planned behaviour variables. This study tested the ability of outcome and process simulations to change variables specified in the theory of planned behaviour in relation to blood donation.

Design. Participants (N ¼ 146) were randomized to one of four conditions: outcome simulation only, process simulation only, process-plus-outcome simulation and a distractor control condition. The dependent variables were state anxiety, and intention attitude, subjective norm and perceived control from the theory of planned behaviour.

Methods. Participants were asked to empty their mind and visualize themselves: (a) after donating blood (outcome manipulation), (b) preparing to donate blood (process manipulation), (c) both preparing to donate blood and after having donated blood (process-plus-outcome manipulation) or (d) both preparing to get a high mark and after having got a high mark on their course (control condition). Following mental rehearsal, participants completed the dependent variables.

Results. There were no main effects of outcome simulation, but process simulation successfully increased intention, subjective norm and perceived control. There was also a significant outcome simulation £ process simulation interaction for attitude. The effect of the process manipulation on intention was mediated by subjective norm and perceived control.

Conclusions. The findings show promise for the use of mental simulations in changing cognitions and further research is required to extend the present findings to other health behaviours.

Use of Mental Simulations to Change Theory of Planned Behaviour Variables

The theory of planned behaviour (Ajzen, 1991; 1998) continues to receive considerable research attention from psychologists interested in predicting and changing health behaviour. Central to the model are people's intentions, a summary of their motivation to engage in a particular behaviour, which have been shown to exert causal influence on people's subsequent behaviour (Webb & Sheeran, 2006). Underpinning intentions are attitude, subjective norm and perceived control (Ajzen, 1991). Attitudes are global positive or negative evaluations of behaviour that in turn develop from beliefs about the likely positive or negative consequences of performing a particular behaviour and the value that is attached to those outcomes. Subjective norms are perceptions of social pressure from people or social groups who are important to us (i.e. with whom we are motivated to comply). Perceived control is the perception of whether or not a particular behaviour is achievable, and is regarded by the principal proponents of the constructs as being synonymous with Bandura's (1986) concept of self-efficacy, or 'confidence in one's own ability' (see Ajzen, 1998; Bandura, 1998; but see Norman & Conner, 2006, for an alternative view). In sum, according to the theory of planned behaviour, people intend to engage in behaviours that are evaluated positively, where there is social pressure to do so, and if they believe the behaviour is achievable.

Interest in the theory of planned behaviour stems from the idea that if the variables specified in the model are predictive of behavioural decisions and behaviour, they will provide targets for theory-based health interventions (cf. Michie & Abraham, 2004). To some extent, research in this area has proved very fruitful, and several meta-analyses attest to the predictive validity of the theory of planned behaviour in many contexts and

across many samples (e.g. Armitage & Conner, 2001a; Conner & Armitage, 1998; Godin & Kok, 1996). Of particular note, Webb and Sheeran's (2006) meta-analysis shows that intentions exert causal influence on behaviour. However, relatively little attention has been paid to the fact that although prediction can be useful, the ultimate goal is explanation (see Sutton, 1998). For example, attitudes have consistently been shown to be highly predictive of intentions, yet without also showing that attitudes explain (i.e. are causally related to) intentions, it is not necessarily the case that changing attitudes will lead to changes in intention (Sutton, 1998). In other words, the fact that attitudes are predictive of intentions tells us who might need to receive an intervention (i.e. those with negative attitudes), it does not necessarily mean that changing attitudes will bring about intention- or behaviour change. Moreover, such analyses do not provide any information about what an intervention should contain to bring about cognition and behaviour change.

Evidence for causal relationships between theory of planned behaviour variables has not been forthcoming: whereas Armitage and Conner's meta-analysis identified 185 independent studies testing the predictive validity of the theory of planned behaviour, Hardeman et al.'s systematic review identified just two studies that tested causal relationships between theory of planned behaviour variables. Although studies have appeared since (e.g. Chatzisarantis & Hagger, 2005), the literature testing the explanatory power of the theory of planned behaviour is still dwarfed by the literature testing the predictive validity of the model (contrast Armitage & Conner, 2001a with Hardeman et al., 2002). Thus, further work investigating whether there are cause-andeffect relationships between components of the theory of planned behaviour is required.

The question then arises as to how best to change theory of planned behaviour variables with an intervention. Ajzen and Fishbein (1980) advocate changing underlying salient beliefs, creating new salient beliefs, or making appropriate non-salient beliefs more salient. Consistent with this suggestion, Hardeman et al.'s (2002) review showed that the most common techniques for changing theory of planned behaviour variables were information provision (19 out of 24 interventions) and persuasion (13 out of 24 514 interventions). However, there is still much debate concerning the best way to change people's beliefs. For example, according to Petty and Cacioppo's (1986) elaboration likelihood model, the most sustained attitude change should occur when strong arguments are targeted at people who are both sufficiently motivated to process the message and who are capable of processing the message. However, given that: (a) there is not yet a consensus as to what constitutes a 'strong' or a 'weak' argument (e.g. Eagly & Chaiken, 1993, pp. 309–314), (b) there are no clear means of ensuring all recipients are motivated and capable of processing the message or (c) whether these techniques extend to changing the beliefs underpinning subjective norm and perceived control, it seems appropriate to consider other possible means of changing theory of planned behaviour variables.

Mental simulations

One approach that does not appear to have been tested in the context of the theory of planned behaviour is mental simulation. Clinicians, coaches and laboratory-based scientists have used mental simulations to facilitate the performance of a range of behaviours, and there is a growing body of evidence showing that mental simulations facilitate the link between thought and action (e.g. Taylor, Pham, Rivkin, & Armor, 1998). Of particular relevance to the present research is a distinction made by Pham and

Taylor (1999) between outcome simulations and process simulations (see also Taylor et al., 1998). Outcome simulations involve envisioning the desired outcome – someone wanting to lose weight might imagine how they would look having achieved the desired weight loss. In contrast, process simulations involve mentally simulating the process of achieving the goal – for the person trying to lose weight, this might involve imagining signing up to exercise classes, imagining removing fatty snacks from the diet and/or imagining increasing fruit and vegetable consumption.

Pham and Taylor (1999) showed that students who used process simulations scored significantly higher on exams than did students using outcome simulations, and also showed that the process manipulation worked by increasing planning and reducing anxiety.1 The question then arises as to what effects outcome and process manipulations might have on cognitions specified in the theory of planned behaviour. According to Ajzen (1991), attitudes are based on beliefs about outcomes, implying that attitudes might be liable to change when participants are asked to envision an outcome. Thus, asking participants to envisage a positive outcome is likely to make their attitudes more positive. In contrast, evaluation of the process of attaining goal maps more closely on to Bandura's (1997) work on subgoals and personal mastery, two strategies that have been shown to enhance perceived control. It is less clear how outcome and process simulations will affect subjective norm because imagined outcomes can be social in nature (e.g. celebrating with friends), as can be processes (e.g. going to the gym with friends).

Target behaviour

The target behaviour was blood donation, which is an important health behaviour for

three main reasons. First, the supply of blood is under threat because of the apparent reluctance of eligible donors to donate (Linden, Gregorio, & Kalish, 1988) and the limited success in attracting new donors (Ferguson & Bibby, 2002). Second, several studies show that the theory of planned behaviour is predictive of, but does not necessarily cause, blood donation behavioural decisions and behaviour (e.g. Armitage & Conner, 2001b; Giles & Cairns, 1995; for a review see Ferguson, 1996). Third, there may be direct health benefits to be derived from donating blood, including reduced risk of cardiovascular events (e.g. Meyers et al., 1997).

Rationale and hypotheses

The research reviewed above provides the following rationale for the present paper. First, understanding means by which cognitions within the theory of planned behaviour can be changed is important in developing theory-led interventions. Second, although research to date suggests that mental simulations are important in changing some cognitions, it is not clear how they will affect theory of planned behaviour variables. It is predicted that: (a) consistent with Pham and Taylor (1999), the process manipulation will increase intention and reduce state anxiety, (b) process simulations will increase perceived control (cf. Bandura, 1986, 1997), (c) outcome simulations will change attitudes and intentions (cf. Ajzen & Fishbein, 1980), and (d) that the effects of the interventions on intention will be mediated by state anxiety, attitude, subjective norm and perceived control.

Method

Participants

Students were approached in classrooms and asked to participate in a survey on blood

donation. Of the 161 people who were approached, 146 (90.12%) agreed to participate. The 15 people who did not participate reported that they were unable to donate blood for medical reasons. The sample consisted of 112 women and 34 men aged between 17 and 35 (M = 19.31, SD = 2.22). The University ethics committee approved the research.

Design and procedure

A 2 x 2 between-participants design was used. The independent variables were outcome manipulation (received vs. did not receive) and process manipulation (received vs. did not receive). The four conditions were therefore: outcome manipulation only, process manipulation only, process manipulation plus outcome manipulation, and a control condition who received neither manipulation but engaged in a distractor task.

Pham and Taylor (1999) conducted their study on participants as individuals or in groups of up to three, which raises two potential difficulties. First, under such circumstances, it is not possible for the researcher to be completely blind to condition, which raises the possibility that experimenter expectancy effects may have contaminated Pham and Taylor's (1999) findings. Second, we were interested in developing an intervention that could work on a broad scale and one-to-one interventions are costly to implement. Therefore, we sorted the experimental materials into random order using a web-based randomizer and delivered them to participants as they sat in classrooms. Participants were asked to complete the intervention and questionnaire in silence under exam conditions. The researcher was therefore blind to the conditions.

Manipulations

The manipulations were almost identical to those used by Pham and Taylor (1999) with minimal adaptations being made to frame the manipulations with respect to blood donation. To minimize experimenter involvement, all instructions associated with the manipulations were written on the first page of the questionnaire. On the second page of the questionnaire, participants received one of four paragraphs, depending on whether they had been randomly allocated to the outcome manipulation only, process manipulation only, process-plus-outcome manipulations or control (distractor) condition. They were instructed to read the paragraph, rehearse it with their eyes closed and then write down any thoughts in the space provided.

Each paragraph instructed the participant to empty their mind and visualize themselves: (a) after donating blood (outcome manipulation), (b) preparing to donate blood (process manipulation), (c) both preparing to donate blood and after having donated blood (process-plus-outcome manipulation) or (d) both preparing to get a high mark and after having got a high mark on their course (control condition). Each paragraph also gave participants examples of the kinds of things they might visualize, such as a sense of well being and feeling of elation (outcome manipulation), or arranging to go with friends and how you might get to the venue (process manipulation). Following these paragraphs, participants were instructed to close their eyes and rehearse the paragraph in their mind until the researcher asked them to stop. Participants were allowed 2 minutes from the beginning of the study to read these instructions and complete the visualization task. Participants then completed the dependent measures described in the following section.

Measures

State anxiety

State anxiety was measured using Marteau and Bekker's (1992) short form of the Spielberger state-trait anxiety inventory. The measure consists of six items that participants rated on 4-point scale labelled not at all, somewhat, moderately and very much. The items are: 'I feel calm' (reverse-scored), 'I am tense', 'I feel upset', 'I am relaxed' (reverse-scored), 'I feel content' (reverse-scored) and 'I am worried'. Cronbach's α indicated that the state anxiety scale possessed good internal reliability, $\alpha=0.85$.

Theory of planned behaviour

For the measure of attitude, participants were presented with the stem: 'My donating blood in the next month is/would be …. ', which was rated on five 7-point bipolar (-3 to +3) semantic differential scales, useless–useful, foolish–wise, unsafe–safe, harmful–beneficial and unhealthy–healthy. Cronbach's a indicated that the attitude scale possessed good internal reliability ($\alpha=0.91$). Subjective norm was operationalized with two items, which participants rated on 7-point unipolar (1–7) scales: 'People who are important to me think I: should not donate blood in the next month–should donate blood in the next month' and 'People who are important to me would: disapprove of my donating blood in the next month–approve of my donating blood in the next month'. Cronbach's α for the subjective norm scale was .76, indicating good internal reliability. Perceived control was measured by averaging responses to three items measured on 7-point unipolar (1–7) scales: 'I believe I have the ability to donate blood in the next month definitely do not–definitely do', 'My donating blood in the next month is/would be ….. difficult–easy' and 'How confident are you that you will be able to

donate blood in the next month? not very confident–very confident'. Cronbach's α was .84. Behavioural intention was measured with two items on 7-point bipolar (-3 to +3) scales: 'I intend to donate blood in the next month definitely do not–definitely do' and 'How likely is it that you will donate blood in the next month?, very unlikely–very likely'. Cronbach's α indicated that the behavioural intention scale possessed good internal reliability, α= 0.95.

Results

Randomization check

The success of the randomization procedure was verified using ANOVA and chi-squared. Outcome manipulation with two levels (received vs. did not receive) and process manipulation (received vs. did not receive) were the independent variables and age was the dependent variable. These analyses revealed no differences in age between those who received the outcome manipulation and those who did not, $F(1, 146) = 0.13$, $p = .71$, $\eta_p^2 < .01$, and no difference between those who received the process manipulation and those who did not, $F(1, 146) = 0.10$, $p = .75$, $\eta_p^2 < .01$ The outcome manipulation £ process manipulation interaction was also nonsignificant, $F(1, 146) = 0.04$, $p = .85$, $\eta_p^2 < .01$. Comparable analyses were carried out using chi-squared tests to see whether there were differences in gender across the conditions. No significant differences were found, χ^2s(1) = 0.14 to 1.13, ps > .28. Randomization was therefore deemed successful.

Effects of the manipulations

The effects of the manipulations were tested using MANOVA. *Outcome manipulation* with two levels (received versus did not receive) and *process manipulation* (received versus did

not receive) were the independent variables, anxiety and theory of planned behaviour variables were the dependent variables. The data presented in Table 1 show no significant main effects for the outcome manipulation on any dependent variable, $F(5, 138) = 0.99$, $p = .43$ $\eta_p^2 = .03$. In contrast, there were significant main effects of the process manipulation on anxiety, subjective norm, perceived control and intention, Fs(1, 146) = 5.15 to 7.37, ps < .05, η_p^2s > .04 (Table 1). The pattern of means reveals that the process manipulation decreased anxiety and increased subjective norm, perceived control and intention.

Although the multivariate test showed no significant outcome manipulation *x* process manipulation interaction, $F(5, 138) = 1.90$, $p = .10$, the effect size associated with this test ($\eta_p^2 = .06$) warranted further investigation. Univariate tests of the outcome manipulation *x* process manipulation interaction revealed one significant effect, for attitude, $F(1, 146) = 4.79$, $p < .05$, $\eta_p^2 = .03$ (Table 1). The nature of the interaction was probed using Tukey HSD *post-hoc* tests, which revealed that attitudes in the process condition were significantly higher than attitudes in the control condition ($p < .05$). Note, however, that this finding should be interpreted with caution, given that the effect size is small-to-medium (Cohen, 1988) and could represent a Type 1 error.

Mediator effects

Mediational analyses were conducted to test whether changes in cognition mediated the effects of the intervention on intention. The process manipulation was dummy-coded to create an independent variable and intention was used as the dependent variable. State anxiety and the remaining theory of planned behaviour variables served as potential mediators, which were tested using Preacher and Hayes' bootstrapping method for multiple mediator effects (Figure 1). Testing multiple mediators simultaneously is preferable to conducting a series of independent regression analyses because multiple

independent regression analyses lack the power to detect significant indirect effects (MacKinnon, Lockwood, Hoffman,West, & Sheets, 2002). The basis for these analyses is that the indirect effect of condition on intention is the product of the paths between condition and mediator (i.e. state anxiety, attitude, subjective norm and perceived control), and between mediator and intention. However, such indirect effects are not normally distributed, meaning that Sobel tests can be suspect (particularly in smaller samples) meaning that bootstrapping is necessary (Preacher & Hayes, 2007). This involves resampling random subsets of data in order to gain a non-parametric approximation of the sampling distribution of the product of the condition-mediator and mediator-intention paths. The analyses presented here are based on 5,000 resamples, although repeating the analyses with more resamples made no difference to the findings. These analyses revealed that both subjective norm (95% CI = .01, estimate =.33) and perceived control (95% CI = .12, estimate = 1.09) significantly ($ps < .05$) mediated the effect of the process manipulation on intention (Figure 1), although perceived control was the dominant mediator. The final model accounted for 63% of the variance in intention, $F(5, 140) = 47.63$, $p < .01$.

Discussion

The present study used mental simulations to try and increase people's intentions to donate blood. There was mixed support for the hypotheses because although process simulations affected mood and cognition, outcome simulations did not affect mood or cognition. Nevertheless, there were three key findings. First, the process manipulation was successful in increasing intentions. Second, the process manipulation reduced participants' state anxiety and increased attitudes, subjective norm and perceived control. Third, the effects of the process manipulation on intention were mediated by

subjective norm and perceived control. The following discussion focuses on the practical and theoretical implications of these findings.

The present findings are strikingly similar to those reported by Pham and Taylor (1999) insofar as process simulations, but not outcome simulations, affected the dependent variables. Thus, process simulations could represent a key means by which to change health behaviour. Moreover, it is notable that the process simulation manipulation was self-directed, worked even though participants were tested in large groups, and was shown to be independent of the experimenter expectancy effects that may have contaminated Pham and Taylor's (1999) findings. The implication is that there is scope for delivering interventions via means of process simulations on a much larger scale. That said, it would be valuable to know whether being delivered one-to-one in consultation with a health professional can enhance the effectiveness of process simulation manipulations, given that the process manipulation was associated with a small-to-medium effect size (Cohen, 1988).

The mediational analyses were consistent with the idea that the process simulation exerted its effects via perceived control and subjective norm, although perceived control was the principal mediator. Given that perceived control is regarded as being synonymous with self-efficacy (e.g. Ajzen, 1998), these findings can readily be interpreted as further evidence to show that creating subgoals and having personal mastery experiences are important in increasing perceived control (e.g. Bandura, 1997). Moreover, this finding maps on to Armitage and Conner's (1999) study that found perceived control was the only theory of planned behaviour variable that showed evidence of a cause-and-effect relationship with intention.

In contrast, asking people to make outcome simulations had null effects on theory of

planned behaviour variables. However, it is worth noting that outcome simulations are most likely to work by making currently appropriate non-salient beliefs more salient; it is less likely that outcome simulations would make new appropriate beliefs salient and they are not designed to change existing beliefs (cf. Ajzen & Fishbein, 1980). Thus, further work is required to test alternative means of changing attitudes by manipulating outcome beliefs.

We initially argued that either outcome simulations or process simulations might affect subjective norm because outcomes and processes can both be social in nature (e.g. celebrating success with friends vs. making plans to go to the venue with friends). However, the present findings showed that only the process manipulation affected subjective norm, raising the possibility that it might be easier to visualize social pressure to engage in instrumental acts (e.g. gaining social support, travelling to the location, waiting with friends) rather than social pressure associated with outcomes. Further work is required to investigate the impact of process and outcome simulations on subjective norms.

In contrast with Pham and Taylor (1999), the present effects were not mediated by state anxiety, meaning that state anxiety is more predictive of exam performance than blood donation. This might have important implications for designing interventions to promote blood donation, because although it is widely assumed that state anxiety is at the root of people's failure to donate blood, research actually suggests an indirect link between predonation state anxiety and subsequent donation (e.g. Ditto & France, 2006). Indeed, Ferguson and Bibby (2002) have shown that, at least for occasional (four or fewer previous blood donations) blood donors, intentions are very good predictors of subsequent behaviour. Nevertheless, the process simulation exercise was

associated with lower state anxiety, and it would be valuable to see whether these effects could be sustained more long term, or at least be used by people suffering anxiety in health-related decision-making contexts.

Limitations

Although the present study takes the theory of planned behaviour literature forward in some important respects, it is important to highlight some potential difficulties that should be addressed in future research. First, the principal outcome measure was intention rather than behaviour. Although there was a good practical reason for doing this, namely, that the low absolute rate of blood donation means thousands of participants would have been needed to demonstrate a significant effect (cf. Ferguson & Bibby, 2002; Linden et al., 1988), it would be valuable to test the effectiveness of the manipulations on behaviour. That said, Pham and Taylor (1999) showed that a process manipulation affected an objectively verifiable outcome measure andWebb and Sheeran provide compelling evidence to suggest there is a causal relationship between intention and behaviour (Webb & Sheeran, 2006), meaning we are cautiously optimistic about the effects carrying forward to behaviour. Second, the present sample consisted of students and so caution must be adopted if attempting to generalize the present sample to the broader populations. Nevertheless, given that many students donate blood (e.g. Wiwanitkit, 2002), they still represent a valid population at which to target interventions. A third possible limitation was that, due to a desire to minimize the burden placed on participants, we chose to limit the number of dependent variables that were assessed. This meant that salient beliefs were not measured directly, and that only their presumed effects on attitude, subjective norm and perceived control were assessed. It would be valuable in future research to see whether the effects of process simulation manipulations exert their effects via control beliefs. Alternatively, future

work might usefully interview participants to establish precisely how participants interpreted the manipulations.

Conclusions

The present study represents the first attempt to use mental simulations to change the theory of planned behaviour variables. The key findings were that process – but not outcome – simulations were effective in changing intentions, and that these effects were mediated by perceived control and subjective norm. Further research is required to establish whether these effects generalize beyond the present context and sample and, more broadly, to identify additional manipulations that might usefully be transplanted from the laboratory to the field (cf. Armitage, 2007; Armitage, Harris, Hepton, & Napper, 2008).

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Footnote 1

Note that Pham and Taylor (1999) report the mental simulations did not affect intention or perceived control. However, it should be emphasised that Pham and Taylor (1999) did not set out to test the theory of planned behaviour and so operationalised intention and perceived control differently to that typically found in the theory of planned behaviour literature. More specifically, while Pham and Taylor's (1999) mental simulations focused on attaining high marks in a set of exams, the intention and perceived control measures were framed in terms of making the requisite effort, working hard, and coping with the demands of the exam (perceived control), and with when they would start studying (intention). In other words, the measures of perceived control and intention were only indirectly related to the mental simulation manipulation, which asked students to think about getting a high grade on their exams. Had the measures been: 'How confident are you that you will gain a high mark' (perceived control) or 'Do you intend to gain a high mark?', the effects of the simulations might well have exerted significant effects. Indeed, Pham and Taylor's (1999) measure of planning seems closer to the accepted measurement of intention from a theory of planned behaviour perspective. It is also notable that Pham and Taylor's (1999) outcome simulation manipulation did not have an effect on cognition or behaviour-one possibility is that it failed to change attitudes.

Table 1

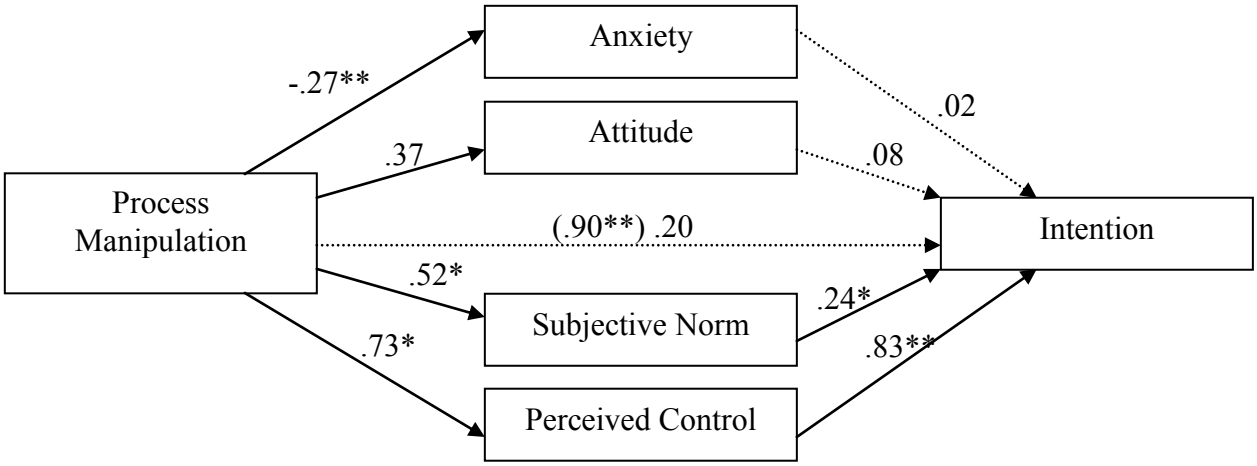
Means (Standard Deviations) Showing Differences Between Conditions

Dependent Variables	Manipulations				$F_{outcome}$	$F_{process}$	$F_{interaction}$	η_p^2
	Control (n = 39)	Outcome (n = 37)	Process (n = 36)	Combined (n = 34)	df = 1, 146	df = 1, 146	df = 1, 146	
Anxiety	2.03	2.09	1.88	1.68	0.49	7.37**	1.66	.05
	(0.50)	(0.74)	(0.69)	(0.49)				
Attitude	1.06	1.39	1.93	1.23	0.57	2.28	4.79*	.03
	(1.77)	(1.21)	(0.97)	(1.57)				
Subjective Norm	4.41	4.78	5.12	5.09	0.56	5.15*	0.83	.04
	(1.61)	(1.02)	(1.21)	(1.49)				
Perceived Control	3.81	4.13	5.05	4.32	0.47	5.76*	3.02	.04
	(1.76)	(1.76)	(1.79)	(1.90)				
Intention	-0.67	-0.51	0.65	-0.59	0.66	6.63*	1.57	.05
	(1.93)	(1.95)	(2.28)	(2.16)				

Note. The η_p^2 values refer to statistically significant effects only. According to Cohen (1988), η_p^2 = .01 is a 'small' effect size, η_p^2 = .09 is a 'medium' effect size and η_p^2 .25 is a 'large' effect size.

*p , :01; **p , :05.

Figure 1
Mediating Effects of the Process Manipulation on Intention



Note. Path coefficients are unstandardized betas (*B*). Tests of statistical significance are based on *t*-tests. Dotted lines indicate non-significant paths. The value in parenthesis indicates the strength in the path prior to the inclusion of the mediating variables.
**p* < .05. ***p* < .01.