

Changing exercise through targeting affective or cognitive attitudes

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Two studies investigated the impact of affective and cognitive messages compared to a no-message control on self-reported exercise. Students (Study 1, $N = 383$ and Study 2, $N = 197$) were randomly allocated to one of the three conditions (control – no message, affective message or cognitive message). Participants completed questionnaire measures tapping components of the theory of planned behaviour in relation to exercise and reported their level of exercise (3 weeks later). In Study 2, measures of need for affect (NFA) and need for cognition (NFC) were also completed. Results showed that affective messages consistently produced greater increases in self-reported level of exercise than the other conditions. In both studies, this effect was partly mediated by affective attitude change. Study 2 indicated these effects to be significantly stronger among those high in NFA or low in NFC. These findings indicate the value of affective messages that target affective attitudes in changing exercise behaviour.

Keywords: attitude-behaviour; affective attitudes; cognitive attitudes; persuasive messages

Introduction

A growing body of research has highlighted the importance of affective attitudes as a key correlate of various behaviours (Lawton, Conner, & McEachan, 2009). However, to date, little or no research has examined whether behaviour can be changed with messages targeting affective attitudes (Maio & Haddock, 2007). Traditionally, health promotion messages have ignored explicitly affective outcomes of health behaviours in favour of more instrumental (or cognitive) outcomes. This research reports two studies comparing a message targeting affective attitudes (affective) with one targeting cognitive attitudes (cognitive) and a no-message control in changing behaviour (self-reported levels of exercise over a 3-week time period). This research (Study 2) also tested the extent to which an affective message was more

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effective for individuals with a dispositional preference for affective information compared to cognitive information (i.e. those high in need for affect (NFA) or low in need for cognition (NFC)).

Social psychological models such as the theory of reasoned action/theory of planned behaviour (TRA/TPB; Ajzen, 1991; Fishbein & Ajzen, 1975) have long been used to understand and predict behaviours (Conner & Norman, 1996, 2005). The TPB suggests behaviour is determined by intentions which are in turn determined by attitudes, subjective norms and perceived behavioural control. Underlying these three factors are beliefs that can form the basis of interventions to change behaviour. A large number of studies have demonstrated the power of the TPB to predict various behaviours (Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton, *in press*), including exercise (Hagger, Chatzirisantis, & Biddle, 2002). The TPB and other social cognition models (Conner & Norman, 2005) have been used to design interventions to change health behaviours with varying degrees of success. These models are firmly grounded in the cognitive tradition (Mayne, 1999) and focus on cognitive (or instrumental) outcomes or beliefs (e.g. health) at the expense of affective and other influences (e.g. moral norms). Research has highlighted their failure to adequately account for the role of affect in decision making (Manstead & Parker, 1995; van der Pligt, Zeelenberg, van Dijk, de Vries, & Richard, 1998; Zanna & Rempel, 1988). Yet, despite there being a long-established distinction between cognitive and affective attitudes and outcomes (Abelson, Kinder, Peters, & Fiske, 1982; Ajzen & Driver, 1992; Breckler & Wiggins, 1989; Crites, Fabrigar, & Petty, 1994), it is only recently that there have been moves to reflect such distinctions in the structure of such models. For example, Ajzen and Fishbein (2005) recently noted that when measuring attitudes within the TRA/TPB, researchers should tap both instrumental and affective components. Conner and Sparks (2005) emphasise this distinction in discussing a two-component TPB in which two components of attitudes, norms and perceived behavioural control are distinguished (Rhodes, Blanchard, & Matheson, 2006), with the two components of attitudes being affective and instrumental/cognitive.

A number of recent studies have demonstrated affective attitudes to be stronger predictors of intentions and action than cognitive attitudes, at least for some behaviours (Glasman & Albarracin, 2006; Kraft, Rise, Sutton, & Roysamb, 2005; Trafimow & Sheeran, 1998; Trafimow et al., 2004; van den Berg, Manstead, van der Pligt, & Wigboldus, 2005). For example, Trafimow et al. (2004) found that for many, although not all, behaviours, affective attitudes made a larger contribution to the prediction of behavioural intentions than cognition. Fewer studies have examined the relative importance of cognitive and affective attitudes in predicting reported or observed health behaviour. Lawton, Conner, and Parker (2007) showed beliefs about affective outcomes to be stronger predictors than beliefs about instrumental outcomes when predicting objectively assessed smoking initiation and exceeding the posted speed limit in a car. More recently, Lawton et al. (2009) showed affective attitudes to be more predictive than cognitive attitudes for nine out of 14 health behaviours examined and a significant predictor for all behaviours examined. In addition, this research showed that many of the effects for affective attitudes on behaviour were not fully mediated by intentions (i.e. they exhibited direct effects on behaviour). There is strong evidence indicating larger effects for affective compared to cognitive attitudes in predicting exercise behaviours (Blanchard et al., 2008; Courneya, Conner, & Rhodes, 2006; Eves, Hoppe, & McLauren, 2003;

French et al., 2005; Lowe, Eves, & Carroll, 2002; Rhodes & Courneya, 2003; Rhodes et al., 2006). For example, Lowe et al. (2002) found that affective attitude, but not instrumental attitude, predicted physical activity scores 6 months later. Exercise was the target behaviour in this research.

Despite this growing body of correlational research showing affective attitudes and beliefs to be strong determinants of intentions and behaviour, few experimental studies have examined the impact of interventions targeting these affective reactions (see Maio & Haddock (2007) for a review). This is in contrast to the large body of research on cognitive reactions to attitude objects (Petty & Cacioppo, 1986). In one of the few studies focusing on affect, Fabrigar and Petty (1999) found that an affective message was more effective in changing an attitude based on affective information, while a cognitive message was more effective in changing an attitude based on cognitive information (Edwards, 1990; Edwards & von Hippel, 1995). More recently, Haddock, Maio, Arnold, and Huskinson (2008) examined the effectiveness of an affective versus a cognitive message in changing attitudes. Importantly, these authors showed that the effectiveness of the different messages varied as a function of individual differences in NFC (Cacioppo, Petty, & Kao, 1984) and NFA (Maio & Esses, 2001). NFC refers to the tendency for an individual to engage in and enjoy effortful cognitive activity and was predicted to be positively associated with a greater receptivity to messages emphasising cognitive information. NFA taps individual differences in the perceived desirability of emotions, the need to pursue them and the belief that emotions are useful in shaping judgement and behaviour (Maio & Esses, 2001). Haddock et al. (2008) predicted that individuals high in NFA would show greater receptivity to messages emphasising affective information. Consistent with predictions, Study 1 showed that an affective message elicited more positive attitudes among individuals low in NFC and high in NFA, while a cognitive message elicited more positive attitudes in individuals high in NFC and low in NFA. Study 2 showed that individuals high in NFA were more likely to change their attitudes in response to an affective message, while individuals high in NFC were more likely to change their attitudes in response to a cognitive message. As far as we are aware, no study has tested such effects on behaviour change and this was a focus of this research.

Recent research has also indicated the potential for using images to promote health behaviours (Niederdeppe, Bu, Borah, Kindig, & Robert, 2008; Severtson & Henriques, 2009), although the mechanism of effect has received limited attention to date (Williams & Cameron, 2009). Consequently, we compared messages which were or were not supplemented using images.

In summary, this research focused on testing the impact of an affective message compared to a cognitive message (both with and without images) and a no-message, control condition in changing exercise behaviour. We focused on the capacity of such messages to promote exercise in individuals not currently meeting recommended health promotion guidelines. UK guidelines specify at least four sessions (each of at least 30 min duration) of moderate or vigorous physical activity per week. In addition to these experimental tests, we tested for moderating effects of NFA and NFC (in Study 2). Finally, we examined the extent to which these effects were mediated by components of the TPB assessed in relation to exercise behaviour. In particular, we anticipated that changes in affective attitudes might mediate the effects of the affective message.

Study 1

Study 1 compared an affective message with a cognitive message and a no-message control in relation to changes in self-reported exercise behaviour. Affective and cognitive messages were combined with images selected to be either more affective (e.g. showing individuals smiling while exercising) or cognitive (e.g. showing diagrams of a heart). The messages were tested with and without matching images to ascertain whether images would increase the effectiveness of the messages. These four conditions were compared to a no-message control.

We piloted messages in a separate sample of 161 students who were exposed to one of the message types (cognitive versus affective with or without matching images). On measures of believability of content, informativeness of content, effectiveness in highlighting benefits of exercise, effectiveness in highlighting the importance of exercise, number of positive thoughts and number of negative thoughts, there were no differences between the affective and cognitive messages ($F(6, 151) = 0.83$, ns), images versus no images ($F(6, 151) = 0.20$, ns) or the interaction between the two ($F(6, 151) = 1.26$, ns). However, the affective and cognitive messages were seen to be different in how affective and cognitive the material was judged to be ($F(2, 155) = 13.2$, $p < 0.001$; there were no significant differences between the image versus no-image conditions, $F(2, 155) = 1.14$, ns; or the interaction between cognitive versus affective and images versus no image, $F(2, 155) = 0.09$, ns). The affective conditions were judged to be more affective ($F(1, 156) = 61.0$, $p < 0.001$) and the cognitive conditions were judged to be more cognitive ($F(1, 156) = 34.2$, $p < 0.001$). Thus, the messages were judged to be equivalent apart from their affective versus cognitive content.

Method

Participants and procedure

A total of 383 university students completed questionnaires at two time points separated by 3 weeks. Participants were recruited face-to-face by student experimenters and were told that the study was an examination of thoughts and beliefs surrounding exercise. Each questionnaire took approximately 10 min to complete. Questionnaires at time 1 (T1) and time 2 (T2) were matched using a personally generated code. At the first time point, participants were randomly allocated to one of the five conditions. Condition 1 was a control condition in which participants received no message. In conditions 2 and 3, participants received a message targeting affective attitudes (condition 2 was a written message; condition 3 was a written message plus an affective picture). In conditions 4 and 5, participants received a message targeting cognitive attitudes (condition 4 was a written message; condition 5 was a written message plus a cognitive picture). After reading the message, participants completed various measures in relation to exercising. At T2, participants completed a second questionnaire. Due to missing data, 12 participants were removed from the analyses. As we were interested in the impact of the interventions on those participants who were at or below the current recommended levels of physical activity, we excluded participants who performed more than four sessions (each of at least 30 min duration) per week of vigorous or moderate intensity ($N = 55$) exercise at T1. This was the currently recommended level of physical activity and was stated in the questionnaire. This resulted in a final sample of 316

participants who were used in all subsequent analyses (213 females; 103 males; mean age 22 years; $n_s = 46, 76, 50, 90$ and 54 for conditions 1 to 5, respectively).

Conditions

In the questionnaire, exercise was defined based on health recommendations as the following: 'taking part in physical activity, including sport, for more than 30 min at a time at moderate or higher intensity (i.e. at least some perspiration) on four or more days per week. For example, this would include exercise activities such as jogging, running, cycling, swimming lengths, football, hockey or attending exercise classes. It would not include incidental or mild exercise activities such as slow walking, relaxing in a swimming pool, bowling or golf (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). Participants in all conditions received the same definition. In conditions 2 and 3, participants also received an affective message while those in conditions 4 and 5 received a cognitive message. For example, in the *affective message conditions*, participants received information about the affective benefits of exercising (e.g. regular physical activity has been shown to reduce anxiety, depression and stress; regular physical activity often improves the way one feels about their body/appearance) and related research support (e.g. after only 20 min of moderate-to-vigorous physical activity, anxiety symptoms have been shown to decrease) including appropriate references. Similarly, in the *cognitive message conditions*, participants received information about the instrumental benefits of exercising (e.g. regular physical activity reduces the risk of developing colon and breast cancer; regular physical activity helps build and maintain healthy bones, muscles and joints) and related research support (e.g. the risk of getting a cardiovascular disease increases by 1.5 times in people who do not follow minimum physical activity recommendations), again including appropriate references. A total of six to eight benefits were listed for each of the affective and cognitive messages. The two types of message types were roughly matched in terms of text length (384 versus 427 words including references for affective and cognitive, respectively). In the conditions including pictures (conditions 3 and 5), the text was supplemented by three black and white photographs. In the affective-based message condition, these showed individuals or groups of individuals smiling while playing tennis, being at the swimming pool and walking the dog. In the cognitive-based message condition, the three pictures showed a diagram of a heart, a diagram of an individual running and a person standing on weighing scales.

Measures

The following measures were taken in relation to exercise.

Intention. Intentions to exercise were assessed at T1 using two items assessing intention to exercise at least four times per week at a moderate or higher intensity over the next 3 weeks (e.g. I plan to exercise at least four times per week for the next 3 weeks). Responses were on a 7-point response format and the mean of these items produced a composite score ($r = 0.50$).

Attitudes. Cognitive instrumental and affective attitudes towards the goal were measured at T1, using semantic differential scales. Five items were used to tap instrumental attitudes (e.g. 'For me, exercising at least four times per week for the next 3 weeks would be': useless–useful; unimportant–important; worthless–valuable; not worthwhile–worthwhile; harmful–beneficial), and four items were used to tap affective attitudes (e.g. 'For me, exercising at least four times per week for the next 3 weeks would be': unsatisfying–satisfying; unpleasant–pleasant; unenjoyable–enjoyable; boring–exciting). Each adjective pair was rated on a 7-point unipolar scale (1–7) and a mean computed (Cronbach's $\alpha = 0.84$ and 0.87 for instrumental and affective, respectively).

Subjective norm. Injunctive and descriptive norms were assessed at T1 using 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. Injunctive norm was represented by one item ('People who are important to me would approve–disapprove of me exercising at least four times per week for the next 3 weeks') as was descriptive norm ('Most people in my social network exercise at least four times per week').

Perceived behavioural control. Perceived control was assessed at T1 by two items (e.g. 'How much personal control do you feel you have over exercising at least four times per week over the next 3 weeks?', 1 = no control, 7 = complete control; $r = 0.67$). Self-efficacy was also assessed by two items (e.g. 'I am confident that I can exercise at least four times per week over the next 3 weeks', 1 = extremely unconfident, 7 = extremely confident; $r = 0.53$).

Exercise behaviour. Mild, moderate and strenuous leisure time exercise behaviour were assessed with the Godin leisure time exercise questionnaire (GLTEQ; Godin & Shepard, 1985) at both T1 and T2. This GLTEQ assessed how many times in a typical week over the past 3 weeks, participants engaged in each of the mild, moderate and strenuous activities. In order to obtain a measure that matched the definition of exercise given to participants, we computed the sum of exercise sessions that were of moderate or strenuous intensity and of 30 min or more duration. This measure was computed for T1 and T2.

Analyses

The analyses focused on examining differences between conditions across time. There were no significant sex differences in any of these results and therefore these results are not reported. In addition to F -values, we report η^2 and approximate Cohen's d 's to indicate effect sizes.

Results and discussion

The principal set of analyses focused on the effects of the interventions on behaviour. A mixed ANOVA with time (two levels: time 1 or 2), condition (three levels: control, affective and cognitive) and picture (two levels: no picture and picture) as independent variables was used. The results indicated that there were significant

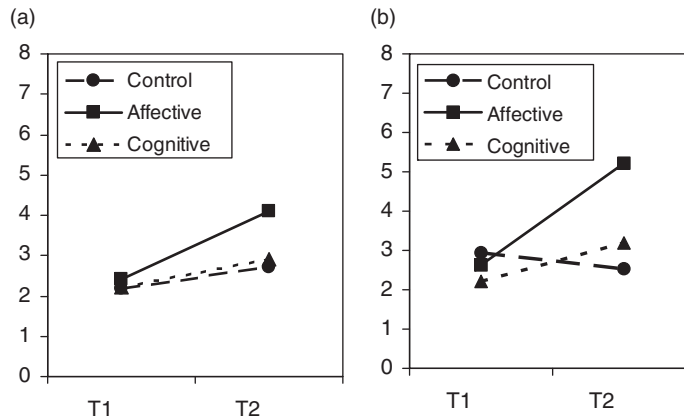


Figure 1. Mean number of exercise sessions split by time and condition in (a) Study 1 and (b) Study 2.

main effects of time ($F(1, 311) = 37.09$, $p < 0.001$, $\eta^2 = 0.107$; $d = 0.69$) and condition ($F(2, 311) = 4.20$, $p < 0.05$, $\eta^2 = 0.026$; $d = 0.33$), but no effect for picture ($F(1, 311) = 0.37$, ns, $\eta^2 = 0.001$; $d = 0.06$) on exercise behaviour. These main effects were qualified by a significant time by condition interaction ($F(4, 311) = 4.27$, $p < 0.05$, $\eta^2 = 0.027$; $d = 0.33$), but there were no significant time by picture ($F(1, 311) = 0.40$, ns, $\eta^2 = 0.001$; $d = 0.06$) or time by condition by picture ($F(1, 311) = 0.47$, ns, $\eta^2 = 0.001$; $d = 0.06$) interactions. Figure 1(a) plots the significant two-way interaction for time and condition on exercise behaviour. Exploration of this interaction indicated that exercise behaviour showed a small but significant increase in the control ($t(45) = 2.04$, $p < 0.05$) and the cognitive message ($t(143) = 2.88$, $p < 0.01$) conditions, but showed a large significant increase in the affective message ($t(125) = 6.47$, $p < 0.001$) conditions from T1 to T2. One-way ANOVAs at each time point showed that there were no significant differences between conditions at T1 ($F(2, 313) = 0.57$, ns), but there were significant differences between conditions at T2 ($F(2, 313) = 6.72$, $p < 0.001$). To further explore the significant effect at T2, we used Games–Howell *post-hoc* tests for unequal group sizes. This showed that the affective message conditions produced significantly higher levels of exercise than either the control or cognitive message conditions (p 's < 0.01 ; Table 1) and that the latter two conditions did not differ from one another. It is worth noting that we did not have a complete design here as the control plus picture condition was missing. Repeating the analysis without the control group revealed a very similar pattern of findings. Also, running the analysis as a 2×5 ANOVA again revealed a significant time by condition effect ($F(4, 311) = 2.86$, $p < 0.05$).

Given the lack of effect for inclusion of pictures, subsequent analyses focused on the three collapsed conditions (control, affective and cognitive). Table 1 also reports the means and standard deviations (SDs) for the TPB measures in each of the three conditions. Examination of the variables at T1 by one-way ANOVA indicated significant differences between groups for affective attitudes ($F(2, 313) = 3.90$, $p < 0.05$) and intentions ($F(2, 313) = 4.62$, $p < 0.01$) only. *Post-hoc* Games–Howell tests indicated a number of significant differences (indicated by superscripts to means in Table 1). These tests showed affective attitudes to be stronger in the affective

Table 1. Descriptive statistics (means and SDs) for measured variables in Study 1 ($N = 316$).

	Messages					
	Control ($N = 46$)		Affective ($N = 126$)		Cognitive ($N = 144$)	
	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD
Instrumental attitudes	5.43	1.26	5.71	0.95	5.85	0.86
Affective attitudes	4.85 ^{ab}	1.24	4.81 ^b	1.24	4.43 ^a	1.25
Injunctive norms	3.93	2.22	4.25	2.16	4.33	2.08
Descriptive norms	3.14	1.21	3.30	1.31	3.18	1.37
Perceived control	4.87	1.12	5.31	1.41	5.32	1.33
Perceived confidence	5.02	1.22	5.08	1.51	5.15	1.35
Intentions	4.09 ^a	1.29	4.83 ^b	1.52	4.53 ^{ab}	1.43
Behaviour (T1)	2.17	1.73	2.41	1.86	2.21	1.65
Behaviour (T2)	2.72 ^a	2.53	4.10 ^b	3.09	2.90 ^a	3.00

Note: Means in a row that do not share the same superscripts were significantly different based on *post-hoc* tests.

message condition compared to the cognitive message condition ($p < 0.05$). Intentions were also stronger in the affective message condition compared to the control condition ($p < 0.01$). These differences identified affective attitudes and intentions as potential mediators of the effects of the intervention on exercise behaviour (Baron & Kenny, 1986). Given the above analyses, it indicated that it was the affective message condition that produced the greatest change in exercise behaviour; this analysis dummy coded respondents into the affective message condition (coded 1) versus the control or cognitive message conditions combined (coded 0). Regressions to predict T2 behaviour controlling for T1 behaviour indicated dummy coded condition and affective attitude to be significant, but intention not to be (Figure 2(a)). A Sobel test indicated that affective attitude was a significant mediator of the impact of condition on T2 physical activity (Sobel test = 1.66, $p < 0.05$, one-tailed). However, the remaining significant effect of condition on behaviour after controlling for affective attitude and past behaviour indicated affective attitudes to be only partial mediators. This suggests that at least part of the impact of the affective message on exercise behaviour change was explained by it increasing affective attitudes towards exercising.

Study 2

Study 2 was designed to replicate and extend Study 1. We used the same messages as in Study 1, but only included the messages which contained images plus control. This decision was taken both because there were no effects attributable to the inclusion/exclusion of images and because pilot work had indicated that the messages with images were judged more appealing. In addition, we assessed the NFC and NFA. Otherwise an identical design was used. Previous research (Haddock et al., 2008) has suggested that affective messages are more effective among individuals low in NFC or high in NFA, while cognitive messages show the opposite pattern (more effective in individuals high in NFC or low in NFA). This was tested here by

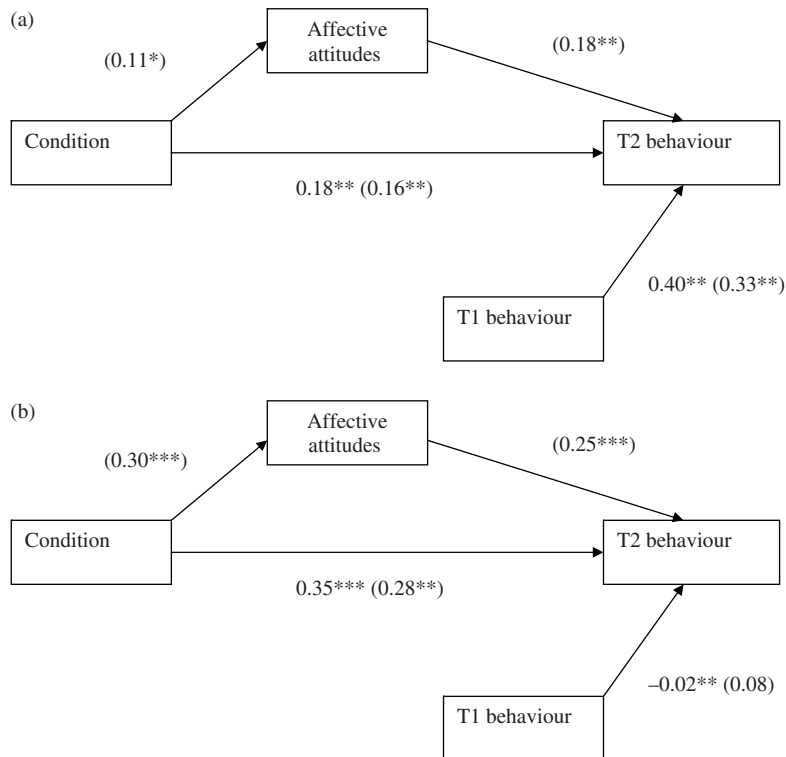


Figure 2. Mediation effects showing regression paths between variables – (a) Study 1 and (b) Study 2. Note: Paths in brackets are when controlling for affective attitudes. $*p < 0.05$, $**p < 0.01$ and $***p < 0.001$.

creating groups high versus low on NFC and NFA based on a median split on each variable and assessing interactions with time and condition. Based on the findings of Haddock et al. (2008) and Study 1, we expected our affective message to produce greatest impacts in those low in NFC or high in NFA.

Method

Participants and procedure

Study 2 used the same materials as Study 1 with a number of minor exceptions that are noted here. A total of 197 students completed questionnaires in class time at two time points (T1 and T2) separated by 3 weeks. At T1, respondents were randomly allocated to a control condition, to an affective message condition or to a cognitive message condition (including matching images). Due to missing data, 14 participants were removed from the analyses. As in Study 1, we excluded participants who were performing more than four sessions (each of at least 30 min duration) per week of vigorous or moderate intensity ($N = 64$) exercise at T1. This left a total of 121 participants who were used in all subsequent analyses (87 females; 34 males; mean age 21; 32 in control condition, 41 in affect condition and 48 in cognitive condition).

Measures

The TPB measures were the same as those used in Study 1: intentions ($r=0.84$), instrumental attitudes ($\alpha=0.85$), affective attitudes ($\alpha=0.80$), injunctive norms (single item), descriptive norms (single item), perceived control ($r=0.73$) and self-efficacy ($r=0.57$). Exercise behaviour was measured in the same way as for Study 1 at T1 and T2. At T2, we also assessed the NFC using an 18-item NFC scale (Cacioppo et al., 1984; $\alpha=0.81$) and NFA using the 26-item NFA scale (Maio & Esses, 2001; $\alpha=0.88$). The two measures were only moderately related ($r=0.29$, $p < 0.01$) in this data.

Message and images used in both studies reported here and all measures and materials are available from the first author.

Analyses

The analyses focused on examining differences between the three conditions. We also examined the extent to which the findings differed between those high or low on NFC and NFA. There were no significant sex differences in any of these results and therefore, these results are not reported.

Results and discussion

The principal analyses again focused on the effects of the intervention on behaviour. In order to test the impacts of the intervention, we ran an ANOVA on exercise behaviour (repeated measures, two levels) with the independent variables of condition (three levels), NFC and NFA (using a median split on these two variables; both two levels). The analyses indicated significant effects of time ($F(1, 110)=13.82$, $p < 0.001$, $\eta^2=0.112$; $d=0.71$) and condition ($F(2, 110)=11.61$, $p < 0.001$, $\eta^2=0.174$; $d=0.92$), but these were qualified by a significant time by condition interaction ($F(2, 110)=8.15$, $p < 0.001$, $\eta^2=0.129$; $d=0.77$) and by significant time by condition by NFC ($F(2, 110)=4.89$, $p < 0.01$, $\eta^2=0.082$; $d=0.60$) and time by condition by NFA ($F(2, 110)=3.13$, $p < 0.05$, $\eta^2=0.054$; $d=0.48$) interactions. Figure 1(b) illustrates the time by condition interaction (Table 2). Exploration of this two-way interaction indicated that exercise behaviour strongly and significantly increased from T1 to T2 in the affective message condition ($t(40)=5.10$, $p < 0.001$) and moderately and significantly increased in the cognitive message condition ($t(47)=2.07$, $p < 0.05$), but did not change in the control condition ($t < 1.0$). One-way ANOVAs at each time point showed that there were significant differences between conditions at T1 ($F(2, 118)=3.20$, $p < 0.05$) and T2 ($F(2, 118)=8.65$, $p < 0.001$). Games–Howell *post-hoc* tests for unequal group sizes showed that the control condition was significantly higher than the cognitive message condition at T1 ($p < 0.05$; Table 2) indicating some failure of randomisation (at least between control and cognitive conditions). At T2, *post-hoc* tests showed that the affective message condition was significantly higher than both the control and cognitive message conditions (p 's < 0.01 ; Table 2) and that the latter two conditions did not differ from one another.

We similarly explored the significant three-way interaction between time and condition and NFC (Figure 3(a)). In the *low NFC group*, exercise behaviour strongly increased across time points in the affective message condition ($t(14)=6.23$,

Table 2. Descriptive statistics (means and SDs) for measured variables in Study 2 ($N = 121$).

	Messages					
	Control ($N = 32$)		Affective ($N = 41$)		Cognitive ($N = 48$)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Instrumental attitudes	5.09 ^a	1.20	5.58 ^{ab}	0.96	5.70 ^b	0.87
Affective attitudes	4.30 ^a	1.10	4.93 ^b	0.57	4.21 ^a	1.27
Injunctive norms	5.71	1.61	5.34	1.57	4.92	1.53
Descriptive norms	3.00	1.19	2.68	1.23	3.02	1.44
Perceived control	4.39 ^a	1.01	5.05 ^b	1.27	5.23 ^b	1.19
Perceived confidence	4.83	1.38	4.83	1.65	5.02	1.35
Intentions	3.98	1.30	4.54	1.53	4.05	1.20
NFC (T2)	4.45	0.66	4.77	0.61	4.50	0.59
NFA (T2)	4.64	0.34	4.92	0.91	5.00	0.61
Behaviour (T1)	2.94 ^b	1.27	2.63 ^{ab}	1.39	2.21 ^a	1.22
Behaviour (T2)	2.53 ^a	2.36	5.22 ^b	2.92	3.19 ^a	1.44

Note: As in 'Notes' of Table 1.

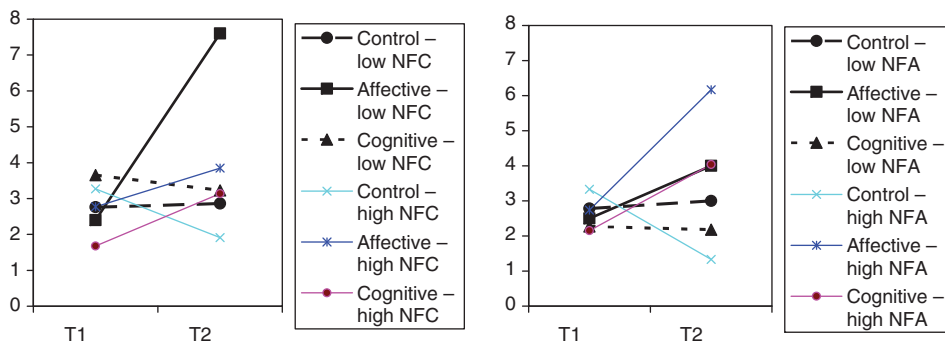


Figure 3. Mean number of exercise sessions in Study 2 split by time and condition and (a) NFC or (b) NFA.

$p < 0.001$; $\text{mean}_{T1} = 2.8$, $\text{mean}_{T2} = 7.7$), but did not change in the other two conditions ($t < 1.4$). One-way ANOVAs at each time point showed that there were no significant differences between conditions at T1 ($F(2, 53) = 0.46$, ns), but there were significant differences between conditions at T2 ($F(2, 53) = 19.04$, $p < 0.001$). Games–Howell *post-hoc* tests showed that at T2, the affective message condition was significantly higher than the control or cognitive message conditions (p 's < 0.001) and that the latter two conditions did not differ from one another. Similarly, in the *high NFC* group, exercise behaviour showed a small but significant increase across time in the affective message condition ($t(25) = 2.57$, $p < 0.05$; $\text{mean}_{T1} = 2.8$, $\text{mean}_{T2} = 4.0$), but showed no change in the control or cognitive message conditions (t 's < 2.0). However, one-way ANOVAs showed that there were significant differences between conditions at T1 ($F(2, 62) = 7.77$, $p < 0.01$), but there were no significant differences between conditions at T2 ($F(2, 62) = 1.59$, ns). Games–Howell

post-hoc tests showed that at T1, the control and affective message conditions were significantly higher than the cognitive message condition (p 's < 0.05) at T1 and that the first two conditions did not differ from one another (i.e. a partial randomisation failure). Thus, the predicted impact of the affective message on increasing exercise levels across time was only consistent for individuals low in NFC (Figure 3(a)).

Exploration of the three-way interaction between time, condition and NFA was conducted in a similar way (Figure 3(b)). In the *high NFA group*, behaviour showed a strong increase in the affective message condition ($t(22)=4.76$, $p < 0.001$; $\text{mean}_{T1}=2.8$, $\text{mean}_{T2}=6.2$), a moderate significant increase in the cognitive message condition ($t(25)=2.61$, $p < 0.05$; $\text{mean}_{T1}=2.2$, $\text{mean}_{T2}=3.9$) and a moderate significant decrease in the control condition ($t(8)=2.83$, $p < 0.05$; $\text{mean}_{T1}=3.4$, $\text{mean}_{T2}=1.4$). One-way ANOVAs showed that there were significant differences between conditions at T1 ($F(2, 62)=4.66$, $p < 0.05$) and T2 ($F(2, 62)=7.23$, $p < 0.01$). Games–Howell *post-hoc* tests showed that the control condition was significantly higher than the cognitive message condition at T1 ($p < 0.001$), indicating some degree of failure of randomisation (at least between the control and cognitive message conditions). At T2, the *post-hoc* tests indicated that the affective message condition was significantly higher than either of the other two conditions (p 's < 0.05) which did not differ from one another. In contrast, in the *low NFA group*, behaviour showed a small but significant increase in the affective message condition ($t(17)=2.39$, $p < 0.05$; $\text{Mean}_{T1}=2.6$, $\text{Mean}_{T2}=5.5$) but did not change in the other two conditions ($ts < 1.0$). However, one-way ANOVAs showed that there were no significant differences between conditions at T1 ($F(2, 53)=0.49$, ns) or T2 ($F(2, 53)=2.58$, ns). Thus, the impact of the affective message on exercise levels was only consistent for individuals high in NFA (Figure 3(b)).

Table 2 also presents the means and SDs for the TPB measures in each of the conditions. Examination of the variables indicated significant differences between groups for instrumental attitudes ($F(2, 118)=3.71$, $p < 0.05$), affective attitudes ($F(2, 118)=5.89$, $p < 0.01$) and perceived control ($F(2, 118)=5.12$, $p < 0.01$). *Post-hoc* Games–Howell tests indicated the nature of these differences (see superscripts in Table 2). Importantly, these *post-hoc* tests showed instrumental attitudes to be higher in the cognitive message condition compared to control groups while affective attitudes were higher in the affective message condition compared to either control message or the cognitive message conditions. Perceived control was higher in the two experimental groups compared to control. These differences suggest instrumental attitudes, affective attitudes and perceived control to be potential mediators of the effects of the intervention on behaviour. The results indicated that it was the affective message that produced greatest change in exercise behaviour. Consequently, this analysis again dummy coded the affective message condition (coded 1) against control and cognitive message conditions combined (coded 0). Regressions to predict T2 behaviour controlling for T1 behaviour indicated dummy coded condition and affective attitude to be significant but instrumental attitudes and perceived control not to be (Figure 2(b)). A Sobel test confirmed that affective attitudes were significant partial mediators of the effect of the affective-based message condition on T2 behaviour after controlling for T1 behaviour, Sobel test = 2.14, $p < 0.05$ (one-tailed). This suggests that, similar to Study 1 findings, the impact of the affective message on behaviour was partly explained by an increase in affective attitudes towards exercising.

General discussion

Recent research has shown the importance of affective attitudes as correlates of intention and action for health behaviours (Lawton et al., 2007, 2009; Lowe et al., 2002; Trafimow et al., 2004; van den Berg et al., 2005). This research complements these findings by showing for the first time that affective-based messages can also be effective in producing health behaviour change. In particular, an affective message was more effective than either a cognitive message or a no-message control in increasing levels of self-reported exercise behaviour in two independent studies. Mediation analyses indicated that the impact of the affective message was partially mediated by affective attitudes in both studies. Together, these findings indicate the importance of affective attitudes as determinants of behaviour. Supporting the work of Haddock et al. (2008), Study 2 also showed that the impact of an affective message was more consistent for those individuals who were either low in NFC or high in NFA.

In relation to understanding health behaviours, this research provides important experimental support for distinguishing between affective and cognitive attitudes in predictive models such as the TPB (Ajzen & Fishbein, 2005; Conner & Sparks, 2005). Indeed, these findings suggest that affective and cognitive attitudes are not simply two aspects of a higher order construct of attitude (Ajzen & Fishbein, 2005). Rather, the fact that affective attitudes can be manipulated without changing cognitive attitudes and that affective attitudes mediate the effects of the intervention on behaviour suggest two independent aspects of attitudes (Rhodes et al., 2006). As such, averaging across affective and cognitive attitudes to produce a higher order aggregate risks losing important potential information (see Trafimow, Sheeran, Conner, & Finlay, 2002 for similar arguments in relation to two components of PBC; see also Conner & Sparks, 2005 in relation to the two-factor TPB). Our work also support recent findings from Lawton et al. (2009) that such affective attitudes may directly impact on behaviour rather than being mediated by intentions (i.e. no mediation by intentions was found in either of the studies reported here; see Lowe et al. (2002); Rhodes et al. (2006) for similar findings). This would suggest that in addition to distinguishing cognitive and affective attitudes in reformulations of the TPB, a direct path from affective attitudes to behaviour should be included in addition to any path *via* intentions. This direct path might represent a way in which gut feelings determine behaviour, independent of a more reasoned route *via* intentions (Damasio, 1994). Collectively, these findings highlight the value of targeting affective attitudes in influencing behaviour independent of intentions.

In relation to behaviour change, this research suggests that simple affective persuasive messages can be developed that successfully change affective attitudes and have consequences for behaviour change. Affective appeals have generally been less used in the exercise domain or more broadly in changing health behaviours. Parrott, Tennant, Olejnik, and Poudevigne (2008) did report that a positively framed e-mail message partly targeting affective attitudes was effective in changing affective attitudes and increasing exercise behaviour over a 3-week period. These findings also suggest their potential value to supplement more widely used approaches targeting instrumental outcomes or self-regulation (Hillsdon, Foster, & Thorogood, 2005) in order to promote health behaviour change. This research demonstrated these effects in relation to exercise; future research might usefully attempt to extend these findings

to other health behaviours and explore the effectiveness of combining affective messages with other messages (e.g. targeting increasing self-efficacy). Nevertheless, this research points to the general potential for using affective outcomes in health promotion messages. The health outcomes of exercise are based on the long-term maintenance of change and, therefore, the present effects need confirming over longer time periods before they can be widely advocated for use in health promotion.

The moderating effects of NFC and NFA shown in Study 2 are also interesting. Previous research has indicated these two measures to be relatively independent (Haddock et al., 2008). Consistent with previous research (Haddock et al., 2008), this research showed that an affective message was more effective in changing behaviour among the group of individuals with a preference for affective information (i.e. those high in NFA). We also observed that the affective message was more effective for those with a preference for not thinking about information (i.e. low in NFC). Haddock et al. (2008) observed that a cognitive message was more effective among those high in NFC. Future research could further assess the moderating effects of NFC and NFA with cognitive and affective messages.

Among the key strengths of this research are replication of the main effects in two independent studies and the consistent demonstration of the partial mediation of the effect of the affective-based message by changes in affective attitudes. Among the key weaknesses is the fact that the key dependent measure of behaviour was only self-report. It is important to demonstrate this effect using more objective measures of behaviour. As noted earlier, future research might also examine longer-term effects on behaviour and the extent to which similar messages might be effective in changing other health behaviours. A further weakness of this research is the reliance on student samples. Although there is no particular reason to expect these effects not to extend to non-student samples, this needs to be formally tested in further research to provide further justification for the generalisability of the reported results. Finally, from a theoretical point of view, it would be useful for future work to more clearly distinguish the affective and cognitive messages and consider other dimensions along which outcomes lie such as temporal proximity and evaluation (Rhodes & Conner, 2010).

In conclusion, this research shows for the first time that affective messages can be used to effectively change an exercise behaviour. This experimental research complements and adds to existing correlational research (Lawton et al., 2009) in highlighting the importance of affective attitudes as determinants of health behaviours. Further research exploring the role of affective attitudes as determinants of health behaviour and affective messages as means of changing such behaviours is warranted.

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