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Published version

EVES, F. F., SCOTT, E. J., HOPPE, R. and FRENCH, D. P. (2007). Using the affective priming paradigm to explore the attitudes underlying walking behaviour. British journal of health psychology, 12 (4), p. 571.

Running Head: Walking and Affective Priming

Using the affective priming paradigm to explore the attitudes underlying walking behaviour

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ABSTRACT:

Objectives: Walking is poorly represented in memory making it difficult to measure using self-report and even harder to predict. To circumvent this, we used the affective priming paradigm (Fazio, Sanbonmatsu, Powell & Kardes, 1986) to assess implicit attitudes towards walking.

Methods: RAF trainee aircraftsmen (n=188) wore pedometers for one week prior to completing the affective priming paradigm, questionnaire and interview. The affective priming paradigm involved a computer-based response latency task containing physical activity words as primes followed by adjectives as targets to be evaluated. Targets were drawn from two bi-polar dichotomies, good-bad (the original Fazio et al items) and happy-sad (mood).

Results Priming for mood items was related to levels of physical activity with high frequency participants priming for the positive (happy) pole and low frequency participants priming for the negative (sad). Both groups primed for the negative element of the Fazio (good-bad) dichotomy. Regarding walking and running, there was no differentiation on the basis of participation level. Instead, facilitated responses to happy targets contrasted with inhibited responses to sad targets for both types of locomotion. There was weak evidence that intentions to run were associated with priming of positive target items, irrespective of category.

Conclusions: The relationship between implicit attitudes and behaviour is complex. Whereas implicit attitudes were related to overall exercise participation, they were not related to the specific activity of walking, despite the behaviour being mainly under automatic control.

INTRODUCTION:

Regular physical activity is beneficial to both physical and psychological health (British Heart Foundation, 2003; U.S. Department of Health and Human Services [U.S. DHHS], 1996). As large portions of the population are not meeting guidelines for participation, physical activity has become a major target for health promotion, with the emphasis now on the accumulation of at least 30 minutes of moderate intensity activity on five or more days of the week (Department of Health, 2004; U.S. DHHS, 1996). Regular walking at a brisk pace satisfies this moderate intensity criterion and has been identified as a key form of activity to promote as it is almost universally acceptable and accessible (Tannahill, 2000). Few people, however, accumulate the recommended 30 minutes per day (Department of Health, 2004) and hence it is important to assess walking determinants.

Walking is regulated in a number of ways which do not involve conscious awareness. Walkers modify their velocity in response to changes in the visual world (Prokop, Shubert & Berger, 1997), calibrate stride length based on changes in the consequences of walking (Reiser, Pick, Ashmead & Garing, 1995), choose the path of the least resistance across open ground (Helbing, Keitsch & Molnar, 1997) and minimize energy expenditure while walking (Holt, Fonseca & Obusek, 2000; Holt, Jeng, Radcliffe & Hamill, 1995; Warren, 1984). The cognitive processing involved in this regulation is automatic and hence inaccessible to consciousness. Consonant with this poor representation in consciousness, the amount of walking remains difficult to measure via self-report and even harder to predict. This is because walking behaviour is relatively automatic; its main function is to serve higher order goals such going to visit a friend. Thus self-reports correlate poorly with an objective measure of walking (Scott, Eves, French & Hoppé, *in submission*). Further, in contrast to all other types of physical activity (Hagger, Chatzisarantis & Biddle, 2002), TPB measures of intention to walk are not predicted by attitudes towards the activity (Eves, Hoppé & McLaren, 2003; Scott et al., *in submission*).

We attempted to circumvent this measurement issue by using an automatic measure of attitude, namely affective priming. We chose affective priming as research has suggested that affective rather than instrumental attitudes appear the major contributor to intention to exercise, both for the generic term "exercise" (Lowe, Eves & Carroll, 2002) and for specific types of physical activity (Eves et al., 2003). To the best of our knowledge the affective priming paradigm has not been used to investigate the determinants of physical activity behaviours to date.

Affective priming refers to the tendency for the affective valence of a prime stimulus to facilitate or inhibit the speed of evaluation of a subsequent target stimulus (Fazio, Sanbonmatsu, Powell & Kardes, 1986). In the original paradigm, a priming stimulus of interest (duration = 200ms) was presented 300ms before a target adjective which remained on the screen until participants made their response. Participants were required to evaluate the target adjective, e.g. 'appealing', as coming from the good or bad category by pressing the appropriate key as quickly as possible. If the target adjective of 'appealing' was preceded by an evaluatively positive priming stimulus, e.g. 'cake', then participants more rapidly identified the target adjective as coming from the good category (Fazio et al., 1986). Conversely, if the target was an adjective incongruent in valence with the preceding prime, e.g. a prime of 'snake' preceding the target adjective of 'appealing', the respondents were slower to evaluate the target adjective as a member of the good category. Instead, the prime stimulus 'snake' would facilitate the speed of identification of adjectives from the bad category, e.g. 'repulsive'. Subsequent research has demonstrated affective priming with subliminally presented primes, indicating the effect can occur automatically (see Bargh, 1997; Fazio, 2001).

There are number of conflicting explanations of the origins of affective priming. Fazio (2001) has recently reasoned that the prime stimulus automatically produces affective evaluation. As a consequence, processing of any subsequent target with valence congruent with the prime would be facilitated whereas processing of targets with incongruent valence would be inhibited. In essence, this explanation focuses on stimulus evaluation. An alternative explanation based on response competition (de Houwer, Hermans, Rothermund & Wentura, 2002; Klauer, 1998) reasoned that a prime stimulus such as ‘puppy’ elicits a response tendency, e.g. good. If the subsequent target requires a response that is congruent with the previously elicited response tendency, e.g. pleasant, then facilitation of the congruent response will occur. As the name implies this explanation of priming focuses on competition between responses after stimulus evaluation. A related explanation argued that negative priming (inhibition) can result when there is conflicting valence between the prime and the target on the previous trial (Wentura, 1999). A suppressed response tendency from the previous trial may inhibit responding to a target with the same valence on the current trial.

For the present purposes, it is important to note that all explanations for affective priming agree that it can assess attitude evaluations that may not be accessible to conscious introspection. Research has shown that the effects are most robust when the task requires evaluation of the target rather than either making a lexical decision or simply pronouncing the target (Klauer & Musch, 2002; Storbeck & Robinson, 2004). Further it appears that a consistent semantic category of prime stimuli may be beneficial (Storbeck & Robinson, 2004). Thus we employed an evaluation task with a consistent category of prime, namely physical activity words.

Two bipolar categories of adjectives were employed as targets, namely, Fazio et al.'s (1986) original category of good-bad and a second category of happy-sad. While affective priming has proved robust, there are some contradictory results in the literature. In a review, Fazio (2001) pointed out that the original research used adjectives that were purely evaluative, that is, virtually synonymous with good (p121). He emphasised that the adjectives had little descriptive content and hence could apply to any attitude object. In contrast, later research has employed target adjectives that can be 'irrelevant to the attitude objects e.g. personality traits, such as wise or lonely paired with physical objects' (p121). Therefore, the design compared Fazio's original descriptive words (good vs. bad) with a second positive and negative valence category of the mood-related words of happy vs. sad. It was predicted that the good-bad evaluative targets would yield stronger priming effects than the mood related words.

The order in which targets occurred was varied systematically. As noted above, Wentura (1999) proposed that response inhibition can occur on trials for which the current target is evaluatively congruent to the irrelevant, and thus suppressed, prime valence from the preceding trial. As a result, a consistent slowing or negative priming can occur. To control for this effect, the presentation order of targets was completely counterbalanced using a Latin square where every target was preceded by every other possible target once. The study used equal numbers of positive and negatively valenced targets and thus any differences between pairs of trials in target valence were perfectly counterbalanced. As prime stimuli were paired with an equal number of targets from each valence category, then overall the possible conflicts between prime valence and target valance were counterbalanced. This control for the possible effect of preceding trial valence on the current trial should minimise any contribution from response competition across the different target categories. In essence, the negative priming resulting from inhibition reported by Wentura should be evenly distributed across target categories.

Evidence for automatic evaluation has been taken from two sources. Primed target words can produce faster (facilitation) or slower (inhibition) responses compared to evaluatively neutral primes (e.g. Hermans, de Houwer & Eelan, 2001). Hence minimisation of inter-trial interference, an uncontrolled source of negative priming, would simplify interpretation of slower responses (inhibition). A second source of evidence for automatic evaluation comes from any difference in latency between positively and negatively valenced targets, in the absence of any control items (e.g. Ferguson & Bargh, 2004). One drawback of such an approach here is that the effects of the primes can be confounded with accessibility of the target categories themselves. For instance, positively valenced target items may be more accessible than negative ones, irrespective of any relationship between prime and target. The present study included control items to investigate the possibility that physical activity could prime both positive and negative targets. Physical activity can be seen as good in terms of health and fitness but as punitive or bad in terms of the effort or time required to perform it. Comparison of speed against a control items allowed a test for priming of both positive and negative targets.

The chosen primes were a mixture of vigorous, e.g. football, and moderate intensity physical activities, e.g. dancing. In all, 16 different primes were employed. To provide an index of affective valence specific to walking, two primes represented this method of locomotion, i.e. walking and strolling. These words were chosen from pilot work in which participants rated the intensity of a number of different methods of locomotion. To provide a comparison, two other primes represented a vigorous form of locomotion, i.e. running and jogging. While the moderate intensity activity walking may be poorly recalled, running or jogging generally requires advance planning; participants change into suitable clothes, arrange a time to go for a run and choose a route. This planning, coupled with the vigorous nature of the activity itself, makes it likely that episodes of running would leave a mental trace and hence be more accurately recalled (Eves et al., 2003).

In summary, this study assessed the relationship between affective priming indices and participation in physical activity using two separate categories of evaluatively positive and negative targets. First, the ability of physical activity words in general to prime was investigated in participants with high and low frequencies of physical activity. It was expected that more positive priming would occur in those with higher levels of participation and more negative priming for those low in participation consistent with the relationship between self-reported attitudes and exercise or physical activity. Second, priming by two specific types of physical activity, namely walking and running, was assessed, with equivalent expectations about the relationship between participation levels and the positive and negative poles. Following Fazio (2001), greater priming for the good-bad category than the mood category of happy-sad was expected.

METHOD:

Participants

Royal Air Force trainee aircraftsmen (n=188; 78.2% male, aged 20.0 ± 3.7 years) were recruited from two training bases in the United Kingdom. This study was approved by the University of Birmingham Safety and Ethics committee and all participants completed consent forms.

Design

All participants wore a *New Lifestyles NL-2000* pedometer for one week prior to completing a computer-based response latency task, questionnaire and interview.

For the response latency task, a physical activity prime (duration = 200 ms) was presented 300 ms before a target adjective. Participants were required to evaluate the adjective as good or bad by pressing the appropriate key as quickly as possible. The prime stimuli were eight vigorous (running, jogging, football, aerobics, squash, judo, hockey, volleyball) and eight moderate intensity (walking, strolling, cycling, table tennis, dancing, yoga, bowls, golf) physical activities, with four nonsense words (e.g. xxxyyyy, yyyzzzz) acting as control items that would not prime. There were four categories of targets, with four adjectives in each category: Fazio's original positive and negative categories of Good vs. Bad (Good: pleasant, appealing, delightful, enjoyable; Bad: repulsive, offensive, horrible, disgusting) and a second positive and negative pair that reflected moods of Happy vs. Sad (Happy: glad, cheerful, happy, joyous; Sad: depressing, miserable, gloomy, hopeless).

A pseudo-randomised counterbalanced stimulus order was produced using these primes and targets. To do this, the order of the adjective targets was first determined by a 16 x 16 Latin square to minimise the effects of the preceding trial target valence on the current trial (c.f. Wentura 1999) giving a total of 256 trials. Following this, prime and control stimuli were interleaved into the 16 x 16 Latin square with the constraints that: a) the sum of stimulus positions within the sequence was similar for each prime item to control for any possible fatigue effects; b) each prime was paired with three adjectives from each target category and c) the control stimuli had equivalent numbers of pairings with each target category. Full details of the stimulus order are available from the first author on request.

Procedure

All stimuli and materials were presented with a DELL computer with a 486 processor running at 33 Mhz using an enhanced graphics adaptor (EGA) using the DOS operating system. Timing of stimulus presentation and response latency was measured using a PC timer-DIO card with a program written in Microsoft QuickBASIC 4.5 resulting in timing accuracy of ± 1ms. Stimuli were presented in the centre of the monitor screen in lower case, in white type on a black background. Using QuickBASIC's screen 8 function resulted in letters 7mm high by 3mm wide. Participants responded to the evaluative decision task by depressing either the good key or the bad key on a custom-built response box according to whether they thought that the target adjective was good or bad.

For each trial sequence, a fixation point (+) appeared in the centre of the screen for 500ms before being replaced by the prime. The prime remained on screen for 200ms, was replaced by a blank screen for 100ms and then the target adjective. Hence the prime was supraliminal. The target was presented in the same position as the prime and remained on screen until a response was made. The inter-trial interval was 2.5 seconds, during which time the screen remained blank. The left and right index fingers were assigned the good and bad keys respectively.

Participants were initially presented with on screen instructions as follows: *In this test you will see a fixation mark, followed by a phrase representing a type of exercise or a nonsense word presented very briefly on the screen, e.g. running. This phrase will be replaced by a descriptive word, e.g. joyous. Your main task is to decide as quickly as possible, if the descriptive word is a good or bad state. For example, most people would think that joyous was good. If you think the descriptive word represents a good state then you should press the 'good' key. At the end of the main task, you will be tested for your memory of the exercise words. Nonetheless your main task is to decide, as quickly as possible, if the descriptive word is a good or a bad state. Press the good key to continue.*

Pressing the good key initiated a set of five practice trials and an average response latency of less than 1000ms was required to progress to the main task. This was to ensure participants had fully understood the instructions and to discourage deliberative processing. Participants with an average response latency greater than 1000ms were required to repeat the practice trials and a message appeared on screen encouraging them to concentrate on responding as quickly and accurately as possible. Following successful completion of the practice trials participants completed the main task. The 256 trials of the main task were split into two equal sized blocks of 128 trials, with an enforced rest of at least 15 seconds between blocks to minimise fatigue.

Interview and Questionnaires

At the conclusion of the computer task, participants completed the questionnaire and 7-day Physical Activity Recall (PAR) interview (Blair, 1985; Sallis et al., 1985). As outlined in the companion paper (Scott et al, submitted), participants completed TPB measures of intention, affective and instrumental attitudes, subjective norm and PBC for walking and running (all Cronbach's alpha > 0.84). In addition, participants rated the targets on a seven-point scale from very bad (1) to very good (7) and rated their current mood with the stem 'I feel' and the adjectives, sad, miserable, gloomy, happy, joyful and cheerful with the options of; not at all, a little, moderately, quite a bit and extremely.

In the PAR interview, individuals itemised all episodes of physical activity, their intensity and total duration over the past seven days. Respondents were aided with prompts and worked backwards from the current day. Each day was divided into three sections, morning, afternoon and evening, and participants recalled what they did during each period, indicated whether it was physical activity and, if so, at what intensity. While responses to this interview can be used to calculate a value for metabolic expenditure of the participant in the previous week (Sallis et al, 1985), here the frequency of participation was extracted from the interview for use in analyses.

Data reduction and analysis

Six participants failed to complete the response latency task. Following preliminary screening of the response latency data, participants were excluded if they did not have at least 3 correct responses in each target category for walking or running primes (n=32). In addition, inspection indicated that average responses to primed targets that differed by more than 150ms from responses to control targets from the same category were outliers. Hence participants with priming greater than 150ms in any target category for walking and running primes (n=38) were excluded. Finally, participants were excluded if they did not get a minimum of 100 trials correct for both positive and negative targets (n=5). Thus, following screening, 107 participants remained. This high loss of participants was dictated mainly by a desire to ensure that response latency measures for this test of affective priming were based on a minimum of three trials per category for the specific behaviours (n=32) and that these averages were not compromised by outliers (n=38). Further, there were no differences between the excluded participants and those retained for response latency, concurrent mood, TPB variables for walking or running, interview measures of behaviour, pedometer counts or ratings for 14 out of the 16 target stimuli. The two exceptions were that excluded participants rated the priming targets of joyous and delightful less positively (p <.01 given the number of comparisons).

Response times to control item were compared using Bonferroni t-tests, as were the target valence ratings. Priming was assessed using analysis of variance, for which the dependant variable was the magnitude of priming and item valence the within subjects factor. Both participation level and intentions to participate were considered as between subject factors. Separate analyses of the Fazio and mood items were conducted for exercise, running and walking.

RESULTS:

Preliminary analyses of the control trials, e.g. preceded by the nonsense string 'xxxyyyy', tested for possible differences in response latency to the adjective targets themselves. Paired t-tests revealed that responses to happy (481 ± 47ms) and good (482 ± 54ms) were of similar latency with both positive categories faster than the negative categories (sad, 513 ± 64ms; bad, 498 ± 58ms). In contrast, the responses to the sad category were slower than to the bad (all p <.001). These differences in response speed across the control trials meant that priming indices were calculated based on differences from their respective control category. Inspection of the word ratings tested for any differences in extremity of the ratings on the 7-point scale.

Paired *t*-tests revealed that the happy category (6.12 ± 0.45) was rated more extremely than the good category (5.82 ± 0.51) and the sad category (1.98 ± 0.57) was more extreme than the bad category (1.53 ± 0.77; all p <.001). While all the correlations between extremity of rating and response latency to the control items were positive (Pearson's *r*; median .08, range .01-.23), none of these correlations were significant with Bonferroni correction. Preliminary analyses including current mood state (happy and sad) as covariates revealed no effect of current mood on the pattern of results. Therefore all analyses are reported without the covariate of mood.

Participation in physical activity in the past week

For the initial analyses, participants were divided at the median on the basis of frequency of physical activity (excluding running and walking) reported during the previous week into high frequency (mean = 9.5 ± 4.5; n = 40) and low frequency (mean = 1.8 ± 1.5; n = 67) participants. As preliminary analyses revealed no significant difference in the response latency patterns for vigorous and moderate intensity activities, the data were collapsed across intensity levels, with response latencies for the running and walking items excluded

Priming for each category of target item was assessed separately. For the mood items, an ANOVA with the between subject factor of participation (high vs. low) and within subjects factor of valence (happy vs. sad) showed no main effects for participation or target valence. A significant interaction between participation and target valence was observed ($F_{1,105}$ = 4.91, p =.03), as figure 1 illustrates. As predicted, priming of the positive pole in high frequency participants contrasted with priming of the negative pole in those with less participation.

Analysis of the Fazio items revealed a main effect for item valence ($F_{1,105}$ = 6.61, p =.01), with participants demonstrating greater priming for the negative than positive items. There was no main effect for participation, nor was there an interaction between participation level and item valence, contrary to the initial predictions.

Insert figure 1 about here

The magnitude of priming exhibited by each participant group varied across categories, as shown in figure 1. *A priori* Bonferroni-corrected one-tailed *t*-tests showed that significant priming occurred in low frequency participants for both groups of negative adjectives (Sad: t_{66} = 3.82, p <.001; Bad: t_{66} = 5.27, p <.001). For high frequency participants, significant priming for positive mood items (Happy: t_{39} = 3.36, p =.004), but not for positive Fazio items, contrasted with significant priming for the negative Fazio items (Bad: t_{39} = 2.51, p =.04). These findings do not support the original prediction of greater priming for the Fazio items compared to the mood items.

Participation in running and walking in the past week

Using the interview reports of running, participants were grouped according to reported participation (n = 67) or lack of participation (n = 40) during the previous week. Examination of priming for the mood items with the between subjects factor of participation and within subjects factor of valence revealed a main effect for target valence ($F_{1,105}$ = 19.12, p <.001); conventional priming (facilitation) for the positive items contrasted with negative priming (inhibition) for the negative items (see figure 2). There was no main effect for participation and no interaction between participation and valence. Analysis of the Fazio items revealed a main effect for participation

($F_{1,105}$ = 10.26, p =.002), but not for valence and there was no interaction between the two. Participants who did not report running overall showed more priming (mean -16.7 ± 29.6ms) than those who ran in the previous week (mean 7.4 ± 41.6ms). Thus, the hypothesis that higher levels of participation in running would be associated with more positive priming and lower levels with more negative priming was not supported for either category of target items.

As there was no interaction between participation and valence participants were collapsed across participation groupings for the remaining analyses, *a priori* Bonferroni-corrected one-tailed *t*-tests. As illustrated in figure 2, significant negative priming was identified for the negative mood items (t_{106} = 4.43, p <.001) whereas the priming observed for positive mood items was of the conventional form (t_{106} = 2.38, p =.04). Contrary to the prediction of greater priming for the good-bad dichotomy, no significant priming was found for either positive or negative Fazio items.

Insert figure 2 about here

For walking, participants were divided into high and low volume walkers using a median split of recorded step count. Incomplete pedometer records were returned by 25 participants resulting in a reduced sample size of 82 for these analyses. Similar to running, inspection of the mood items revealed no main effect for participation, but a significant main effect for valence ($F_{1,80}$ = 10.91, p =.001), with conventional priming (facilitation) for positive items contrasted with negative priming (inhibition) for negative items. Again, there was no interaction between participation and valence. For Fazio items, there were no main or interaction effects for participation and valence. These findings do not support our predictions of greater priming of the positive and negative poles in those high and low in participation respectively.

As there was no notable differences in response pattern between participants on the basis of recorded step count, participants were collapsed across participation levels for the *a priori* Bonferroni *t*-tests and the 25 participants excluded on the basis of incomplete pedometer readings were reinstated. As illustrated in figure 3, walking did not prime for either category of negative items. As with running, the positive mood items exhibited conventional priming ($t_{106} = 3.38$, p =.001), while the positive Fazio items showed negative priming ($t_{106} = 2.98$, p =.004).

Insert figure 3 about here

Intentions to run and walk in the next week

Ferguson and Bargh (2004) argued that affective evaluation of a prime may be more directly related to unsatisfied goals (intentions) than completed goals (past behaviour). Thus, the analyses were repeated distinguishing participants on the basis of intentions for the coming week rather than behaviour during the past week.

For running, participants with an average score across TPB items of greater than four were considered as having positive intentions (n = 81), whereas those scoring four or less were regarded to have negative intentions (n = 26). Mixed between-within factor analysis of variance found no main effects for intention, item category or valence. There was, however, a significant between subjects term for intention and item valence ($F_{1,105} = 6.43$, p =.01). Post-hoc tests conducted on target items collapsed across categories indicated that participants who intended to run exhibited greater priming for the positive items (mean = -8.3 ± 36.6ms) than those who reported no intention to run (mean = 9.4 ± 44.6ms; t_{106} = 2.04, p =.04) though the effect is weak and not reliable with Bonferroni correction. There was no such difference found for the negative target items. Follow-up analyses tested effects of running participation in the next week. Interviews were completed by 86 of the participants, 60 of whom ran in the following week. For the mood items, the main effect of valence ($F_{1,83}$ = 12.06, p =.001) reflected the contrast between priming of happy and negative priming of sad (see figure 4). For the Fazio items, there was an interaction between participation and valence ($F_{1,83}$ = 7.77, p =.007). Non-significant priming of both categories in those who ran was contrasted with conventional priming of bad (facilitation) coupled with apparent negative priming for good (inhibition) in those who did not run (see figure 4). This contrast between facilitation and inhibition of opposite poles was significant in non-runners (t_{24} = 3.01, p =.008). Note that the figure does not contain any indication of the significance of priming as the uneven split in the population rendered comparison between participation groups confounded with statistical power.

Insert figure 4 about here

Intention to walk during the coming week was categorised using the same criteria. The majority of participants expressed intentions to walk during the coming week (n = 90), although some did not (n = 17). Analysis showed no main or interaction effects for intention, target category or valence. As all participants walked in the following week, no analyses of walking participation were possible.

Correlations between priming and self-report measures for running and walking

Finally, table 1 contains the correlations between the priming indices and the TPB constructs for running and walking. A negative correlation means that a more positive value for a TPB construct was associated with a faster response when the category was primed. While inspection of the table reveals five correlations that were significant with conventional levels of significance, none of these correlations survived Bonferroni correction.

Insert table 1 about here

DISCUSSION:

In summary, high frequency participation in physical activity was associated with priming of the positive mood category (happy) whereas priming of the negative pole (sad) occurred for those less physically active. In both groups, the negative element of the Fazio items (bad) was primed. For the specific locomotor behaviours of running and walking, a main effect of valence for the mood category for both types of activity reflected a contrast between positive priming of happy and negative priming of sad. With the Fazio items, negative priming of good for walking was the solitary effect. Finally, intentions to run were associated with priming of the positive pole relative to non-intenders whereas those who did not run in the following week showed priming of bad coupled with negative priming of good. No equivalent effects occurred for intentions to walk.

The data here provided little support for Fazio's (2001) contention that purely evaluative targets (good vs. bad) would show better evidence of priming; the mood category was associated with more priming. Nonetheless, a plausible pattern is evident in the contrast between mood and Fazio items. While assessment of walking was the main aim, the data from the general physical activity items were most informative. High frequency of participation was associated with priming of happy whereas for low frequency participants, the negative pole (sad) primed. Such a result would be consistent with more positive attitudes to physical activity in those who are regular participants (Ajzen & Driver, 1992; Lowe et al., 2002). Nonetheless, the negative Fazio category, bad, primed in both groups of participants. The latter result would be consistent with an implicit evaluation that physical activity can be punitive. The contrast between categories must reflect the items they contain. The mood items are primarily experiential, reflecting feelings. From this perspective, high frequency participators were positive about their physical activity experience whereas the less active were not. Further, this effect was independent of current mood and hence not a product of mood enhancement subsequent to physical activity (Gauvin, Rejeski & Norris, 1996). For the good-bad dichotomy, however, Fazio (2001) reasoned that these items can apply to the attitude object itself, namely physical activity. Hence the good-bad items reflect evaluation of the prime category itself and may be a purer implicit measure of attitude. Priming for the bad rather than good pole indicates a negative evaluation of physical activity itself, consistent with reports of affect *during* physical activity (Hall, Ekkekakis & Petruzzello, 2002; Parfitt, Markland & Holmes, 1994). While this appears to contradict self-reports of positive attitudes to participation in regular participants, it should be remembered that most of the population is *not* physically active at sufficient levels (Department of Health, 2004). A negative evaluation of physical activity better accords with this insufficiency. One point is clear. The complexity of the pattern in these data dispels any simplistic notion that the positive and negative poles of affective priming may provide an implicit measure that maps easily onto behaviour.

The majority of research on self-reported attitudes (TPB) and exercise or physical activity has concentrated on contributors to the generic term ‘exercise’ and the effects discussed above relate to the generic term. This priming reflects the category of words, namely exercise or physical activity, particularly as affective priming may be more prominent when a single category of prime is employed (Storbeck & Robinson, 2004). The term exercise, however, does not refer to a particular behaviour but rather to a collection of behaviours encompassing sport, e.g. football, conditioning exercise, e.g. yoga, and lifestyle physical activity such as walking and cycling to work. Research on the specific behaviours that contribute to the generic term has only covered a restricted number of these behaviours (Ajzen & Driver, 1992; Eves et al., 2003; Riddle, 1980). Nonetheless, with the exception of walking, contributions of self-reported attitude to physical activity are broadly similar for both the specific behaviours within this category and the generic term (see Eves et al., 2003). Hence one might expect similar priming effects for the overall category of physical activity and the specific exemplars of that category representing running and walking. Set against this, there were six times more trials for the category effects as for the specific behaviours. Consequently, superiority precision of the category measures relative to the specific behaviours is likely.

For both running and walking, a main effect of valence occurred for the mood items. Priming of happy (facilitation) was contrasted with negative priming of sad (inhibition). As we have minimized the effects of response competition between trials (Wentura, 1999), interpretation of the negative priming as reflecting incongruence between sad and the prime is simplified (Fazio et al., 1986). Inhibition of sad, coupled with facilitation of happy, reflects positive feelings associated with both behaviours. Unlike the general physical activity category, these effects were unrelated to levels of participation. The similarity between the locomotor behaviours, and the independence of actual participation, may reflect the fact that both behaviours were currently part of the participant's lifestyle. Walking is characteristic of humans and occurred in all participants. Running was unusual in this population in that trainee aircraftsmen are required to run regularly as part of their ongoing fitness training. In the previous week, 63% had run when free-living, off base and 76% intended to run in the coming week on base, with 71% actually doing so. This is in sharp contrast, to the 7% who report running or jogging in the general population of the UK (Fox & Rickards, 2004). Unlike walking, however, the data for running provided some evidence of differentiation based on participation and intention. Those who had not run when off-base showed greater priming of the Fazio items, irrespective of valence. It is possible that increased salience of an obligatory activity in those who have not participated could have influenced the response. The effects of intentions and behaviour in the following week were clearer. Participants intending to run during the coming week demonstrated more priming for the positive items, collapsed across categories, than those who did not. Further, those who did not actually run in the following week showed priming of the negative Fazio pole of bad, prior to not running. These findings are consistent with Ferguson and Bargh's (2004) report that priming may be more strongly related to currently active goals than past behaviour.

Concerning walking, the study aimed to circumvent the self-report problems with walking by using an implicit measure of attitudes. Despite this, there was a lack of differentiation between participants on the basis of step count or self-reported intention using this implicit measure of attitude. Indeed the only compelling result was priming of happy coupled with negative priming of sad, a finding that was shared with the other locomotor behaviour of running. Self-reports of intentions to walk regularly, however, also reveal no contribution from affective attitudes (Eves et al., 2003; Scott et al., *in submission*). Thus, the results from the implicit measure mirror those gained from self-report. It is possible that attitudes do not contribute to the majority of walking. Instead, walking is primarily determined by daily needs and personal transport requirements rather than affective judgements about the behaviour, even preconscious ones of which the participant may be unaware. The findings of this study confirm previous suggestions that walking is a truly unique form of physical activity which does not conform to patterns observed for other activities (Eves et al., 2003; Scott et al., *in submission*).

In conclusion, this study found that recent participation in various physical activities was related to the priming of mood items by these activities. In contrast, implicit evaluation of physical activity on Fazio's good-bad dimension revealed priming of the negative pole for both high and low frequency participants, consistent with affect reported during physical activity. For running, both intentions to run and actual behaviour were related to priming. Nonetheless, the complex pattern of results cautions against any simple relationship between priming indices and the physical activity behaviour. Once again, walking differed from other physical activities, demonstrating no discernable links between priming and intentions or actual behaviour. This reinforces our previous assertion that walking is a unique behaviour requiring further study to be fully understood.

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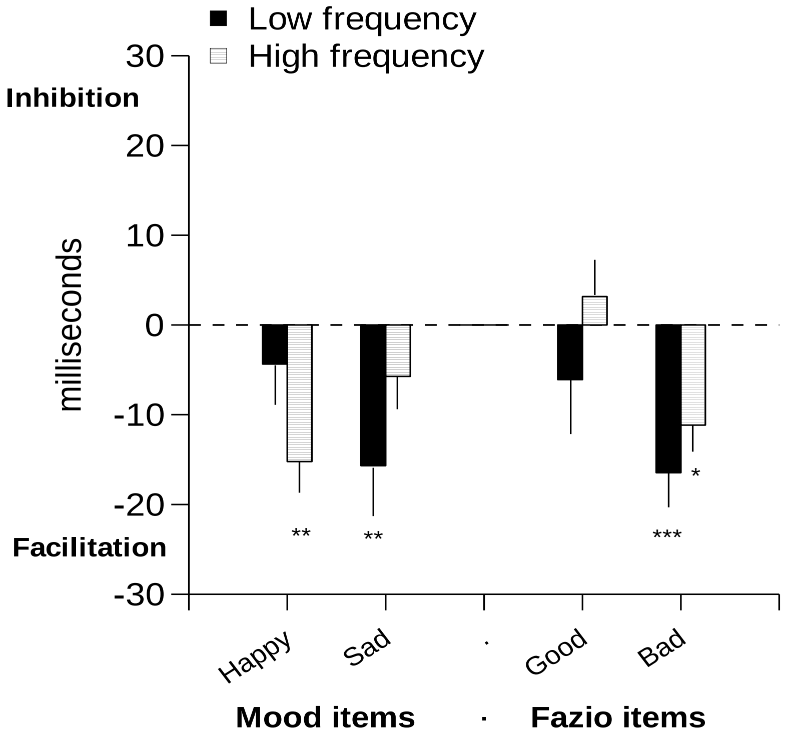
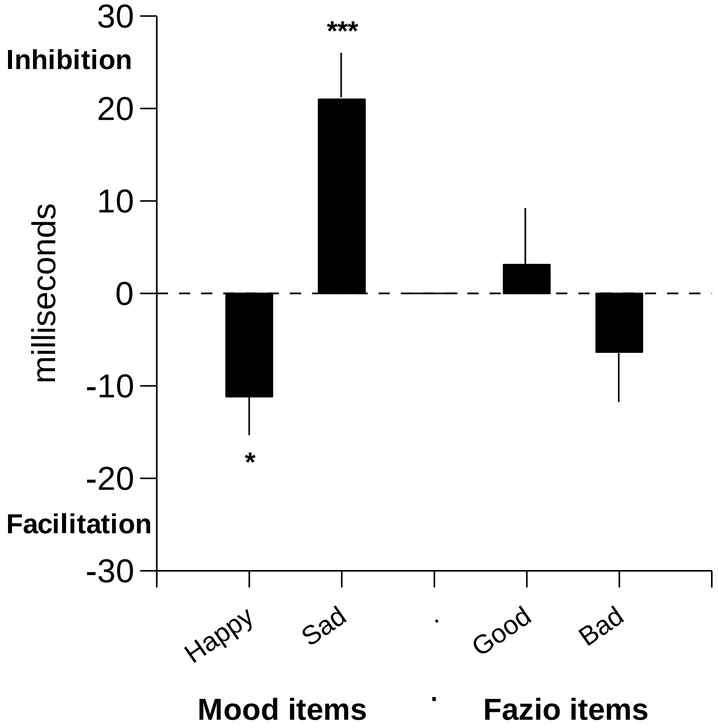
Figure 1: Priming for those high and low in frequency of physical activity



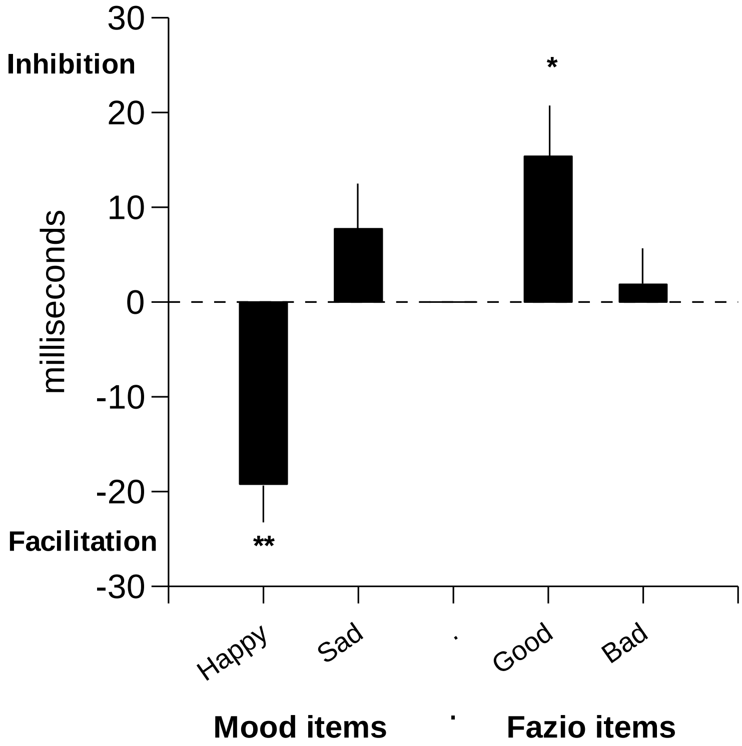
* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2: Priming by running



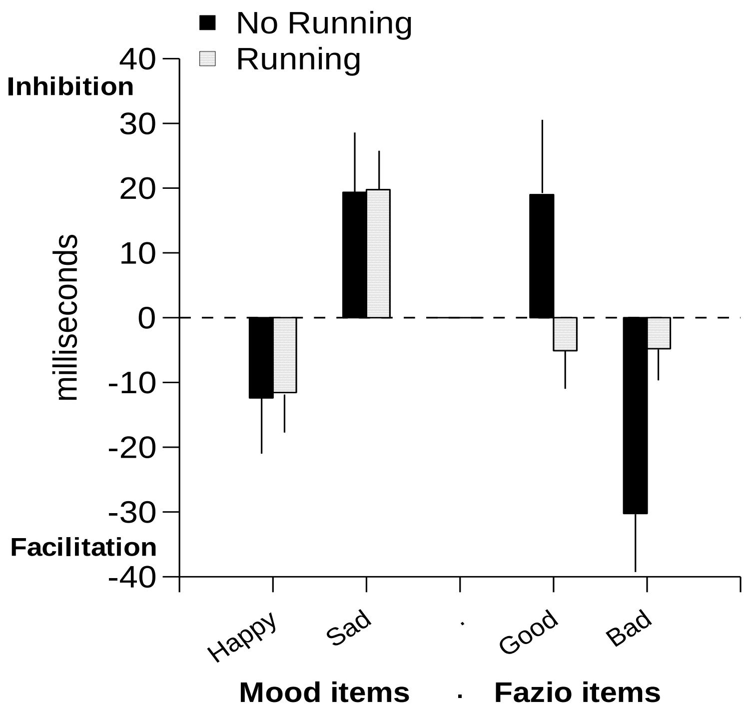
* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 3: Priming by walking



* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 4: Priming for participants who did and did not go on to participate in running



* $p < .05$, ** $p < .01$, *** $p < .001$

Table 1: Correlations between priming indices and TPB constructs

a) Running

	Happy	Sad	Good	Bad
Intention	-.21*	-.06	-.07	.16
Affective attitude	-.16	-.01	-.15	.10
Instrumental Attitude	-.02	-.19	-.13	.07
Subjective norm	-.09	-.03	-.04	.07
PBC	-.08	-.18	-.00	.14
Participation	-.05	.00	.09	.22*

b) Walking

	Happy	Sad	Good	Bad
Intention	-.11	-.06	.11	-.18
Affective attitude	-.14	-.23*	.04	-.08
Instrumental Attitude	-.20*	-.07	-.00	-.13
Subjective norm	-.00	.07	.17	-.24*
PBC	-.01	-.01	.04	.00
Participation	-.08	-.08	-.10	-.09

*=p<.05 **=p<.01 ***=p<.001