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RUNNING HEAD: Positive Affect and Physical Activity Goals

Positive Affect and Physical Activity:

Testing Effects on Goal Setting, Activation, Prioritization, and Attainment

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Abstract

Objective: The present research tested whether incidental positive affect promotes pursuit of physical activity goals. Four key features of goal pursuit were examined – setting physical activity goals (Study 1), goal activation (Study 2), and goal prioritization and goal attainment (Study 3). ***Design***: Participants (*N*s = 80, 81, and 59, in Studies 1-3, respectively) were randomized to positive affect (joy, hope) or neutral affect (control) conditions in each study. ***Main Outcome Measures***: Questionnaire measures of goal level, goal commitment, and means selection (Study 1); a lexical decision task indexed goal activation (Study 2), a choice task captured goal prioritization and MET minutes quantified goal attainment (Study 3). ***Results:*** Study 1 showed that positive affect led to a greater number of intended physical activities, and that joy engendered greater willingness to try activities. In Study 2, a positive affect induction led to heightened activation of the physical activity goal compared to the control condition. The joy induction in Study 3 had a marginal effect on goal prioritization, and led to greater physical activity. ***Conclusion:*** These findings suggest that positive affect enhances the pursuit of physical activity goals. Implications for health behavior theories and interventions are outlined.

Keywords: physical activity, exercise, joy, positive affect, goals

Positive Affect and Physical Activity:
Testing Impacts on Goal Setting, Activation, Prioritization, and Attainment

The relationship between positive affect and physical activity has attracted a good deal of attention by researchers in behavioral medicine. Two key lines of research can be discerned. First, there is a large literature concerning the impact of physical activity on positive affect (Morgan, 1997). Physical activity is known to improve mood (for reviews, see Berger & Motl, 2000; Reed & Ones, 2006) and to increase energetic arousal while reducing feelings of tension (Hall, Ekkekakis, & Petruzzello, 2002). The second line of research concerns the role of beliefs about the positive affective consequences of physical activity on intentions to engage, and subsequent engagement, in physical activity. Studies of such *affective attitudes* have shown that intentions are strengthened and behavioral performance is enhanced when people anticipate enjoying physical activity or believe that it will improve affect (for a meta-analysis, see Rhodes, Fiala, & Conner, 2009). The present research tackles a different, and hitherto neglected, question concerning the relationship between physical activity and positive affect. The question addressed here is: "Can positive affect promote the pursuit of physical activity goals?" Thus, the present research tests the possibility that positive affect inductions may constitute a useful behavior change strategy in relation to physical activity.

Positive affect is associated with better physical health. For instance, people who score highly on measures of dispositional positive affect experience fewer physical symptoms and exhibit lower morbidity rates (reviews by Consedine & Moskowitz, 2007; Pressman & Cohen, 2005), and indices of positive affect are associated with biological markers of health (immune system response, Dockray & Steptoe, 2010; cortisol profiles, Howell, Kern, & Lyubomirsky, 2007), cardiovascular function (Steptoe, Dockray, & Wardle, 2009), and longevity (Howell et al., 2007)). Positive affect could also influence physical health via its impact on health-related

cognitions and behavior (e.g., Aspinwall, 1998; Fredrickson, 1998, 2013). However, a recent meta-analysis of experiments involving inductions of positive affect versus neutral or no-affect observed negligible effects on cognitions about, or performance of, health behaviors (Cameron, Bertenshaw, & Sheeran, 2014).

There are few experimental studies of the impact of positive affect on physical activity, and findings are mixed. Positive affect has been observed to engender favourable outcome expectancies for physical activity (Cunningham, 1988), to have no impact on outcome expectancies (Allen-Catellier & Yang, 2012), and to lower intentions to exercise compared to neutral-affect controls (Allen-Catellier & Yang, 2012). A positive affect plus self-affirmation induction increased physical activity among patients following a percutaneous coronary intervention (Peterson et al., 2012) but not among patients with asthma (Mancuso et al., 2012).

Two possible reasons why positive affect inductions have not so far proved effective in promoting health cognitions and behaviors in general, and physical activity in particular, are that (a) positive *mood* inductions rather than positive *emotion* inductions were used, and (b) recent conceptual developments in research on positive affect and self-regulation were not exploited. Virtually all research on positive affect and health cognitions and behavior has involved general positive mood inductions (e.g., film clips, music). Only two studies in Cameron et al.'s (2014) review induced any of the ten 'representative' positive emotions (joy, gratitude, serenity, interest, hope, pride, amusement, inspiration, awe, and love) identified by Fredrickson (2013). Moods are longer-lasting but less intense than specific emotions and, unlike emotions, moods occur without a specific, identifiable cause (e.g., Frijda, 1993; Scherer, 1984). Consedine, Magai and Bonanno (2002) argued that each discrete emotion represents an evolutionary adaptation to specific challenges and opportunities and so particular positive emotions may have more powerful effects on cognition, motivation, and resources relevant to health behaviors than more diffuse positive

mood states. Prior work has identified superior health behavior outcomes for *hope* as compared to *joy,* possibly because hope is a future-oriented emotion whereas joy is focused on the present (e.g., Winterich & Haws, 2011). However, other analyses suggest that joy may provide consequential resources for performing health behaviors (Fredrickson, 2001). The present research therefore targeted *joy* and *hope* in the positive affect inductions, but made no specific predictions about differential effects of these two types of positive affect.

At the conceptual level, previous research concerning positive incidental affect's impact on health cognitions and behavior appears to have been largely inspired by the feelings-as-information perspective (FAIP; e.g., Clore & Huntsinger, 2007; Schwarz & Clore, 1983) and work on the interplay between affect and cognition (e.g., Isen, 2004; Isen, 2000). According to the FAIP, mood provides information concerning one's feelings about a target, and so people in a positive mood are liable to make more favourable judgments about a target behavior. Research on affect-cognition relations indicates that positive affect promotes thorough and forward-looking thinking (e.g., Isen, 2004; Isen & Reeve, 2005), enhances openness to information (Estrada, Isen, & Young, 1994), and increases motivation (Isen & Reeve, 2005). Thus, there are good conceptual grounds for expecting that positive affect would promote health cognitions and behavior.

More recent research suggests, however, that "[t]he influence of affect on cognition … is akin to reward in that it is not dedicated to any one outcome" (Huntsinger, 2012, p. 600). Positive affect may not necessarily promote healthful cognitions and behavior. Rather, positive affect imbues thoughts and concerns that are currently accessible with value – whether those thoughts promote or undermine health. This conceptualization explains the mixed results of inducing positive affect on physical activity cognitions and behavior observed in previous research. If participants found the experimental task boring, or if other or multiple goals – unrelated to physical activity – were activated, then positive affect may not necessarily enhance the pursuit of

physical activity goals. According to this perspective, positive affect serves as a "go signal" for currently accessible thoughts and goals (see also Aarts, Custers, & Marien, 2008; Isen, 2008). Consistent with this idea, Fishbach and Labroo (2007) observed that positive affect increased the adoption of *both* self-improvement and mood management goals.

The Present Research

Three studies aimed to replicate and extend Fishbach and Labroo's (2007) analysis in three key respects. First, we focused on an important health behavior and addressed the question, "can positive affect promote pursuit of physical activity goals?" Second, we assessed the impact of two discrete positive emotions *joy* and *hope*, and not merely positive mood, on outcomes. Third, and most important, we assessed four key features of goal pursuit in relation to physical activity: (a) goal setting (goal level, goal commitment, and means selection), (b) goal activation (the accessibility of physical activity goals both in the presence and absence of temptation primes), (c) goal prioritization, and (d) goal attainment (an objective measure of the amount of physical activity undertaken by participants). The prediction tested was that positive affect (joy or hope) would promote goal setting, goal activation, goal prioritization, and goal attainment compared to a neutral affect, control condition.

Affect Induction Pre-Test

Prior to the main studies, a pilot study was undertaken to develop and test affect inductions to promote feelings of *joy* or *hope* compared to a neutral affect, control condition.

Method

Participants and Procedure

Participants were 79 staff and students (51 female, 28 male, *M*-age = 22.88, *SD* = 3.50) at a UK university who received £5 ($7) for participation. The *hope* and *joy* affect inductions were writing tasks, modelled on Winterich and Haws' procedure (2011). Participants wrote about three

experiences that made them hopeful (joyful), and described in detail the experience that made them most hopeful (joyful). The *neutral* affect, control induction also involved writing and was adapted from an activity recall task (Bodenhausen, Sheppard, & Kramer, 1994). Written inductions were chosen as writing exercises engender larger changes in affect than external stimuli (i.e., film presentation) in experimental settings (Salas, Radovic, & Turnbull, 2012).

Participants were randomly assigned to conditions, and were allocated ten minutes for the affect induction exercise. Next, participants completed the Russell Grid (Russell, Weiss, & Mendelsohn, 1989) to measure valence and arousal, and the modified Differential Emotions Scale (mDES) (Fredrickson, 2013). The mDES comprises 10 positive and 10 negative affect items (including *joy* and *hope*) and can be combined to form positive affect (Cronbach's alpha = .86) and negative affect (alpha = .87) scales, respectively. Participants completed a funnel debriefing (Bargh & Chartrand, 2000) concerning the purpose of the experiment and the relation between tasks. The experimenter then debriefed participants fully.

Results and Discussion

Data from 4 participants in the neutral essay condition were discarded for failing to follow instructions. No participant guessed the connections between tasks or the purpose of the study.

A 3-between (Affect induction: hope vs. joy vs. neutral) MANOVA was performed using hope, joy, positive affect, negative affect, and arousal and valence as the dependent variables. As anticipated, there was a significant multivariate effect of affect induction, $F(6, 68) = 3.20$, $p < 0.01$. Univariate tests showed a main effect of affective induction on positive affect, $F(2, 72) = 6.96$, $p < .01$, $d = 0.91$, hopefulness, $F(2, 72) = 6.98$, $p < 0.01$, $d = 1.04$, and joyfulness, $F(2, 72) = 6.05$, $p < 0.01$, $d = 0.98$, but no effects on the other outcomes (Fs < 0.49, *ns*). Tukey post-hoc tests indicated that participants in both the *hope* ($M = 3.30$, $SD = 0.76$) and *joy* inductions ($M = 3.23$, $SD = 0.59$) reported feeling significantly greater positive affect than participants in the

neutral condition (*M* = 2.59, *SD* = 0.68). Participants in the *hope* induction condition also reported feeling significantly more hopeful (*M* = 3.80, *SD* = 1.04) than participants in the neutral condition (*M* = 2.80, *SD* = 0.87), and participants in the *joy* induction condition reported feeling significantly more joyful (*M* = 3.80, *SD* = 0.87) than participants in the neutral condition (*M* = 2.92, *SD* = 0.95). However, the *joy* induction did not generate significantly greater joy than the *hope* induction (*M* = 3.80 and 3.36, *SD* = 0.87 and 0.86, respectively, *ns*), and the *hope* induction did not generate significantly greater hope than the *joy* induction (*M* = 3.80 and 3.44, *SD* = 1.04 and 0.96, respectively, *ns*). These findings are consistent with evidence that affect inductions are rarely successful in generating specific positive emotions, especially when those emotions share similar valence and arousal (see, e.g., Lindquist, Siegel, Quigley, & Barrett, 2013, for discussion).

The pilot study thus established the validity of the affect inductions to be used in Studies 1-3. The respective writing exercises were effective at inducing *joy* and *hope* compared to a neutral-affect, control condition. Studies 1-3 did not undertake manipulation checks of the *joy* and *hope* inductions because (a) the validity of the affect inductions was established in the pilot, and (b) completion of self-reports of emotion can bias subsequent cognition and behavior (Berkowitz, Jaffee, Jo, & Troccoli, 2000). We used a cover story to introduce the affect inductions in Studies 1-3 and deliberately did not bring participants' attention to bear on their experienced affect in order to observe effects on goal pursuit (see Harmon-Jones, Amodio, & Zinner, 2007 for discussion).

Study 1: The Impact of Positive Affect on Setting Physical Activity Goals

Study 1 examined the impact of positive affect on three key dimensions of goal setting in relation to physical activity. The first two dimensions are *goal level* (i.e., how many activities participants intend to do, and intended duration) and *goal commitment* (i.e., participants'

determination to achieve the set goal, Locke & Latham, 1990). Goal level and goal commitment are known to both determine rates of performance and goal attainment (see, Wofford, Goodwin, & Premack, 1992, for a meta-analysis). The third dimension of goal setting examined here is *means selection* (Custers, Eitam, & Bargh, 2012), operationalized in terms of participants' openness to trying various means to reach physical activity goals.

Broaden and build theory (BABT) offers a basis for proposing that positive affect will increase goal level and extend means selection (Fredrickson, 2001). Positive emotions broaden participants' thought-action repertoires, "prompting them to pursue a wider range of thoughts and actions than is typical" (Fredrickson & Branigan, 2005, p.314). Thus, we predict that participants who undergo a positive affect induction will specify a greater number of physical activities as goals for the coming week and intend to spend greater time engaged in physical activity compared to participants who undergo a neutral induction (control condition). We also predict than positive affect participants will exhibit greater willingness to try various, different physical activities (i.e., more extensive means selection) than control participants.

Associating positive affect with a goal or end-state (via evaluative conditioning) is known to increase efforts to attain that goal (Aarts et al., 2008). Thus, if incidental positive affect is transferred to physical activity goals, then a commensurate increase in goal commitment may be observed. In sum, we predict that positive affect will enhance goal level, goal commitment, and means selection.

Method

Participants and Procedure

Staff and students at a UK university (N = 80, 58% female; M-age = 26.74, SD = 8.03) took part in exchange for £5 ($7). Participants were allocated at random to one of three affect induction conditions: hope, joy, or neutral. Participants were tested individually in a laboratory

and told that the study involved answering questions about physical activity and completing an electronic diary concerning their physical activity goals for the next seven days. Participants first completed a questionnaire concerning their usual physical activity ("To what extent do you consider yourself physically active?"; 5-point scale, *not at all - extremely*).

Affect inductions. Before proceeding to complete the diary, participants were invited to take part in an ostensibly unrelated, additional study regarding life-experiences; this study served as the affect induction. The affect induction proceeded as described in the pre-test.

Exercise Diary. After completing the affect induction, participants filled in the physical activity diary. The diary contained columns for the next seven days (headed with the days and dates) and space to type in planned activities. Participants were prompted to include durations for each activity and were asked to estimate the total time engaging in physical activity for the week. *Goal level* was measured by two indices: (a) the number of entries in the diary, and (b) the duration (in hours) participants intended to engage in physical activity. Participants then completed two measures of *goal commitment*. Participants first completed the goal commitment scale (Hollenbeck, Williams, & Klein, 1989) adapted to physical activity. This scale comprises 9 items (e.g., "I am strongly committed to pursuing these physical activity goals", "Quite frankly I don't care if I achieve my physical activity goals or not"; 9-point scale, *strongly disagree* to *strongly agree*) and proved reliable (alpha = .72). In addition, participants completed a 2-item measure of disappointment in not meeting goals (e.g., How disappointed would you be if you did not meet these physical activity goals?"; 9-point scale, *not at all* to *very;* alpha = .72) (Oettingen, Pak, & Schnetter, 2001). Finally, *means selection* was measured by willingness to take part in 61 familiar (e.g., football) and unfamiliar (Jai-Alai) physical activities and sports. Definitions for each activity were provided; responses were on 0-100 thermometer scales (endpoints were *not at all willing* and *very willing;* alpha = .94).

Participants were debriefed at the close of the study; funnel debriefing (Bargh & Chartrand, 2000) indicated that no participants were aware of connections between tasks or the purpose of the experiment.

Results

Randomization Check

There was no significant difference in participant's perceived typical physical activity between the joy (M = 3.30, SD = 1.23), hope (M = 3.08, SD = 1.32), and neutral affect conditions (M = 3.48, SD = 1.08) at the outset of the study, $F(2, 77) = .73$, *ns*, indicating that randomisation to conditions was successful.

Impact of Positive Affect on Goal Setting Variables

Because the study design is hierarchical with positive affect versus neutral affect as the overarching factor, and the two discrete positive emotions (joy vs. hope) as a nested factor within the positive affect condition, hierarchical ANOVAs were used to examine the impact of positive affect (the overarching factor) and type of positive affect (joy vs. hope) on physical activity goal setting (see Table 1). Positive affect had a significant effect on one of the two measures of goal level. Participants intended to undertake a greater number of distinct activities in the positive affect condition (M = 14.42) compared to the neutral condition (M = 11.41), $F(1, 78) = 4.78$, $p < .05$, $d = 0.52$. There was no significant effect of condition, $F(1, 78) = 2.44$, *ns,* indicating that there was no difference between the hope and joy conditions in the number of intended activities. Neither positive affect nor condition had a significant effect on the amount of time participants intended to spend on physical activity, $F(1, 78) = 0.04$ and 0.35, respectively, *ns*.

Positive affect had no discernible effects on the two indices of goal commitment (the goal commitment scale, anticipated disappointment), $F(1, 78) = 0.001$ and 0.91, respectively, *ns*. There were no condition effects either, $F(1, 78) = 2.16$ and 0.08, respectively, *ns*.

There was a significant negative correlation between age and participants' willingness to try different physical activities, $r(78) = -.37$, $p < 0.05$. Older participants were less willing to try different means for exercise. The hierarchical ANCOVA therefore used age as a covariate. Positive affect did not have a significant effect on willingness to try physical activities $F(1, 78) = 1.63$, *ns*. However, there was a significant difference between the *hope* and *joy* conditions $F(1, 52) = 6.68$, $p < .05$, $d = 0.64$. Participants in the *joy* condition reported significantly greater willingness to try physical activities than participants in the *hope* condition. Post hoc comparisons showed that the *joy* condition also showed greater willingness to try different physical activities than the neutral condition, $F(1, 53) = 5.47$, $p < .05$, $d = 0.42$, but there was no difference between the *hope* and neutral conditions, $F(1, 52) = 0.06$, *ns*.

Discussion

The present findings offer the first evidence that positive affect influences goal level and means selection in relation to physical activity, and also indicates that positive affect does not influence commitment to physical activity goals. A positive affect induction caused participants to list a greater number of distinct activities as goals for the upcoming week, though they did not intend to spend more time undertaking those activities. Participants in all conditions intended to spend a mean of 10.31 hours ($SD = 5.59$) on physical activity in the coming week. It should be noted that these estimates include *all* intended physical activity (e.g., walking to work, work-time activities, as well as leisure-time physical activity). Nonetheless, it seems possible that the lack of impact of positive affect on intended duration could be due to a ceiling effect.

There was no significant effect of condition on commitment to physical activity goals as all participants showed the same high levels of commitment to physical activity. Again, a ceiling effect could explain this finding. However, it is also possible that positive affect influences *what* participants intend to do but does not influence how committed they feel to doing it. Joy, but not

hope, increased individuals' openness to new physical activities, consistent with the proposal that joy "create[s] the urge to play, push the limits, and be creative" (Fredrickson, 2001).

Study 2: The Impact of Positive Affect on the Activation of Physical Activity Goals.

Positive affect serves not only as a goal of self-regulation but also as a *resource* for self-regulation. In particular, positive affect signals to the person to adopt an accessible goal and so leads to higher rates of goal attainment compared to a neutral mood (Fishbach & Labroo, 2007). Study 2 explored the cognitive underpinnings of this idea in relation to physical activity goals. We predicted that a positive affect induction would increase the activation level (i.e., accessibility) of a focal physical activity goal compared to a neutral-affect, control condition. We also explored whether positive affect elicits overriding goal activation (Fishbach, Friedman, & Kruglanski, 2003), that is, leads to enhanced accessibility of the physical activity goal when participants are subliminally primed by temptation words (i.e., competing goal pursuits such as TV or the internet).

Method

Participants and Procedure

Students and staff from the University of Sheffield (N = 81, 62% female, M-age = 24.10, SD = 4.57) took part in exchange for £5 ($7). Participants were allocated at random to one of three affect induction conditions: hope, joy, or neutral.

Participants were tested individually in a laboratory and were told that they would take part in three tasks; the first two tasks related to their life experiences and goals, while the third would be a reaction time task for an (ostensibly) unrelated study. For the first task, all participants listed their goals for engaging in physical activity (including organised activities such as team sports and incidental activity such as a daily walk to work) during the next 7 days, including the activity time and approximate duration. Participants also listed up to five alternate

activities (as single words) that may be preferable to, or compete with, their physical activity goals (e.g., TV, internet). The top 3 items served as participants' personalised temptation words in the lexical decision task.

***Affect inductions*.** Immediately thereafter, participants undertook the affect induction described in the pre-test.

Lexical decision task. Participants were told that they would next undertake an entirely separate study of language fluency. In fact, participants undertook a sequential priming task similar to that used by Webb and Sheeran (2008). Participants' task was to decide as quickly as possible if letter strings presented were words or pseudo-words, and to indicate their choice by pressing labelled keys. Letter strings for the pseudo-word trials were drawn from the pseudo-word generative software Wuggy (Keuleers & Brysbaert, 2010). A single trial comprised the following sequence: presentation of (a) a fixation cross for 1,500ms, (b) the prime word for 17ms, (c) a random string of consonants of the same length of the prime (post-mask) for 225ms, and (d) the target word, until the participant responded. The prime was presented briefly enough to be outside participants' conscious awareness (Bargh & Chartrand, 2000) and the interval between presentation of the prime and target is considered too brief for participants to engage in strategic processing (Neely, 1991). Thus, any response time differences due to priming could be considered automatic.

The task consisted of 120 trials (60 words and 60 pseudo-words) and each dependent variable was based on 3 trials; thus, one in eight trials was critical. Amongst the target words and primes were (a) three items indexing the goal of physical activity (*exercise*, *fitness*, and *active*), (b) three neutral items matched for letters, syllables, and frequency of use to the goal words (*install*, *regard,* and *emphasis*), and (c) three items indexing participants' idiosyncratic temptations (e.g., *television, internet,* and *reading*). Table 2 shows the prime and targets used to

index the key dependent variables of physical activity (PA) goal accessibility and over-riding activation of the PA goal.[1]

Results and Discussion

Randomization Check

Response latencies were trimmed to within three standard deviations of the item mean in order to remove outlying responses. Latencies involving errors (2.3% of responses) were also removed. To test whether randomization to conditions was successful, we compared the three conditions on reaction times to the unmatched filler words and the matched neutral words. There was no significant difference for the unmatched filler words $F(1,78) = 1.20$, *ns*. However, there was a significant effect of affect condition on the matched neutral words, $F(1, 78) = 4.34$, $p < .05$. Moreover, response latencies to the neutral words were significantly associated with PA goal accessibility and activation of the overriding PA goal, *minimum* $F(1, 78) = 48.71$, $p < .001$. To control for these differences in processing speed, latencies to the matched neutral words were covaried in subsequent analyses.

Impact of Positive Affect on the Accessibility of Physical Activity Goals and Temptations

We conducted hierarchical ANCOVAs to examine the impact of positive affect (the overarching factor: positive affect vs. neutral) and condition (i.e., the nested factor concerning type of positive affect: hope vs. joy) on the dependent variables (see Table 3). Positive affect had a significant effect on PA goal accessibility, $F(1, 78) = 4.77$, $p < 0.05$, $d = .36$ and over-riding activation of physical activity goals, $F(1, 78) = 4.39$, $p < 0.05$, $d = .37$. Participants who underwent positive affect induction responded significantly faster to words representing their PA goals following priming by neutral words and temptation words ($M = 587$ and 589, respectively)

[1] We also collected data concerning the accessibility of temptations and inhibition of temptations by physical activity goals. Consistent with counteractive control theory (Fishbach, Friedman, & Kruglanski, 2003), we observed no significant effects on temptation. The findings for temptation are not discussed further.

than participants who underwent a neutral affect induction (M = 622 and 626, respectively). The nested factor, type of positive affect induction (hope vs. joy), had no significant effect on any of the dependent variables.

These findings suggest that positive affect increases the activation level of a focal physical activity goal, and does so regardless of whether or not temptation has been primed. The findings also suggest that it matters only that positive affect has been induced and not the specific type of positive affect experienced by participants (hope vs. joy) (see also Fredrickson & Branigan, 2005). Thus, the present study finds novel support for the idea that incidental positive affect acts as a "go signal" for goal pursuit, and does so in relation to participants' physical activity goals.

Study 3: The Impact of Positive Affect on the Prioritization and Attainment of Physical Activity Goals

Study 3 examined the impact of positive affect on both a key dimension of goal striving (prioritization of physical activity) and on goal attainment (amount of physical activity). Research on self-regulation has shown that positive affect causes participants to prioritise effortful or demanding tasks (Erez & Isen, 2002) and to invest greater effort in working towards a focal goal (Aarts et al., 2008; Isen & Reeve, 2005). Thus, we predicted that individuals who undergo a positive affect induction would prioritize physical activity (i.e., choose to engage in physical activity before engaging in a less active pursuit). We also predicted that positive affect would cause participants to expend more effort during a physical activity task compared to individuals who undergo a neutral affect induction (control condition). Study 3 used a single positive affect induction (joy) to ensure that the requisite number of participants could be run before the winter break, and because Studies 1 and 2 observed only one difference between joy and hope in terms of impact on outcomes (there was a significant effect of joy, but not hope, on the variety of

means selected by participants to pursue physical activity goals in Study 1).

Method

Participants and Procedure

Students from a UK university (N = 59, 68% Female, M-age = 21.44, SD = 3.83) took part in exchange for £5 ($7). Participants were allocated at random to one of two affect induction conditions: joy and neutral. Participants were tested individually in a laboratory and were told that they were taking part in the testing and calibration of GENEActiv® accelerometers. Participants first indicated their typical physical activity and for the next seven days using the item described in Study 1. Next, participants were told that they would take part in two 20-minute trials of the accelerometer: one in the lab, sat working at a desk and one outside of the lab, walking around the local area. The present study took place during the last weeks of November and the first weeks of December; the mean temperature high over the course of the study was 8°C (46°F).

Affect inductions. Next, participants undertook the joy or neutral inductions used in Studies 1 and 2. The induction was presented as a separate study that could be undertaken while the experimenter prepared the accelerometers for use.

Measures. Participants indicated whether they wanted to undertake the walking or sitting accelerometer trial *first*, which served as the index of prioritization of physical activity. Next, participants undertook their chosen condition (walking or remaining seated) while wearing the accelerometer (which was strapped to their wrist like a watch). Participants were instructed to return the accelerometer after using it for 20 minutes. The amount of activity undertaken by participants was determined by calculating *MET (metabolic equivalent of task) minutes*. This index is derived from the intensity of acceleration recorded by the accelerometer and the duration of use. One MET is the energy equivalent expended by an individual for one minute at rest; 20

minutes walking at a slow pace is the equivalent of 60 MET minutes. The GENEActiv® accelerometer used in the present study is considered a reliable and valid measurement tool for recording METs and classifying physical activity in adults (Esliger et al., 2011; Zhang, Rowlands, Murray, & Hurst, 2012).

After participants returned the accelerometer, they were thanked for participating, informed that they did not need to participate in the second trial (walking or sitting, as appropriate). (Participants were not asked to take part in the second trial as the affect induction was likely to have faded after 20 minutes.) Finally, participants were debriefed; funnel debriefing indicated no awareness of either the connection between the tasks or the purpose of the study.

Data preparation. The accelerometers record acceleration (in terms of *g*) across the three Cartesian axes at a rate of 100Hz. Before analysis, each accelerometer's data were converted into 60-second epochs using the GENEActiv® bespoke software (Version 2.2) and the sum of the vector magnitudes used to calculate the MET for each minute (e.g., Zhang et al., 2012).

Results and Discussion

Randomization Check

Participants in the joy condition ($M = 2.62$, $SD = 1.08$) and neutral affect condition ($M = 2.30$, $SD = .84$) showed similar levels of typical physical activity, $t(57) = .80$, *ns*, suggesting that randomization was successful.

Impact of Positive Affect on Goal Prioritization and Goal Attainment

Prioritization of physical activity was indexed by participants' choice to engage in the walking accelerometer trial first (as compared to choosing to undertake the sitting accelerometer trial first). Sixteen (55.17%) participants in the joy condition chose to go for a walk first, whereas 11 (36.67%) participants in the neutral condition did so. The association between affect condition and this index of prioritization approached significance, $\chi^2(1, N = 59) = 2.04$, $p = .077$, $d = .38$.

(see Figure 1)

Goal attainment was indexed by the amount of activity recorded by the accelerometers in the walking condition. Consistent with predictions, MET minutes were higher for participants in the joy condition (M = 113.75, SE = 7.02) compared to participants in the neutral affect condition (M = 97.11, SE = 4.24), $t(25) = 2.03$, $p < .05$, $d = .48$.

General Discussion

The present research sought to answer the question, "can positive affect promote the pursuit of physical activity goals?" Findings from three studies that assessed different features of goal pursuit offer initial evidence to suggest that the answer may be 'yes.' Study 1 showed that positive affect increased the level of the physical activity goal set by participants but not goal commitment. Study 1 further showed that joy but not hope led to broadened selection of means to achieve physical activity goals, in terms of greater willingness to try different activities. Study 2 showed, using a sequential priming paradigm, that positive affect led to increased accessibility of physical activity goals. This finding held both in the presence and in the absence of the priming of temptations (i.e., alternative goal pursuits that were identified by participants as antithetical to physical activity goal pursuit). Finally, Study 3 obtained some evidence that positive affect enhances the prioritization of physical goals, though the effect was only marginally significant. Most important, however, Study 3 showed that positive affect increased rates of goal attainment using an unobtrusive behavioral measure. Participants who underwent a joy induction were more active during a 20-minute test period compared to controls. Taken together, the present findings suggest that inducing positive affect could be a promising strategy to promote the pursuit of physical activity goals.

It is worth noting that evidence concerning the beneficial impact of positive affect obtained here occurs in the context of mixed findings for positive affect inductions in prior

research. Positive affect inductions have only small and unreliable effects on health-related attitudes, self-efficacy, intentions, and behavior (Cameron et al., 2014). The key innovations of the present research were to induce discrete positive emotions (rather than more diffuse moods), and to test hypotheses derived from conceptual analyses of positive affect and goal pursuit (Fishbach & Labroo, 2007; see also Huntsinger, 2012). Findings were consistent with the idea that inducing positive affect is helpful when participants are thinking about their physical activity goals and furthers the process of goal formation, the activation level of mental representations that guide goal striving, and subsequent behavioral performance.

We observed little evidence that specific types of positive affect (hope vs. joy) have distinct effects on outcomes. The one distinct effect pertained to willingness to try activities (means selection) where the joy induction enhanced willingness but the hope induction did not. While it is interesting that this finding is consistent with previous studies of broaden and build theory (Fredrickson & Branigan, 2005), it is also important to consider both (a) the possibility of false discovery, and (b) the fact that the inductions of joy and hope used here did not have differential effects on these emotions, but rather led to diffuse increases in positive affect.

As with any new research program, the present studies have limitations that should be acknowledged. First, the samples comprised university staff and students whose income and education do not represent that of the wider public. Relatedly, participants in the present studies appeared to set themselves ambitious physical activity goals. A convenience sample can be justified in initial tests of positive affect's impact on physical activity goal pursuit reported here. However, studies with larger, more representative samples should follow. The present studies were not powered to test moderator variables so an important avenue for future research will be to determine whether positive affect benefits participants with different levels of experience of, or commitment to, physical activity goals. Second, the significant findings for goal setting must be

viewed in the context of the large number of tests undertaken; findings were reliable for one of two measures of goal level, and the one measure of means selection, but were not reliable for either of the two goal commitment measures. Further tests with larger samples are needed to corroborate these findings and caution is warranted in drawing conclusions about the impact of positive affect on goal setting variables. Finally, the follow-up period for the measurement of physical activity, inevitably, was short – so that we could formally test whether discrete emotion indeed influences goal attainment immediately after the induction. The promising findings observed here suggest that it could be valuable to explore the impact of positive affect inductions over longer periods and to investigate the impact of repeated inductions on the frequency and intensity of physical activity.

More generally, the present research raises interesting questions about the relationship between interventions designed to promote well-being and interventions geared at promoting physical activity. Whereas physical activity interventions are known to increase positive affect (Berger & Motl, 2000; Reed & Ones, 2006; Hall et al., 2002), the present research offers the first evidence that the opposite relation also holds: Increasing positive affect also increases motivation and performance in relation to physical activity. A caveat, however, is that the timing of positive affect inductions may be crucial; interventions may be needed at the point when physical activity goals are activated in order to generate downstream consequences for goal pursuit. A program of research directed at understanding how best to induce positive affect and at optimising the timing of the delivery of positive affect interventions seems warranted.

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Table 1

Goal Setting by Positive Affect and Condition (Study 1)

Goal setting variables	Affect induction				Positive Affect *F*	Condition *F*
	Hope	Joy	Positive Affect (Hope & Joy)	Neutral		
Goal level						
Activities planned	13.19 (1.13)	15.59 (1.04)	14.42 (0.84)	11.41 (1.18)	4.78*	2.44
Duration of activities	9.81 (1.07)	10.62 (1.28)	10.22 (0.78)	10.50 (1.10)	0.04	0.35
Goal commitment						
Commitment to goal	7.40 (0.17)	7.00 (0.21)	7.20 (0.14)	7.21 (0.21)	0.00	2.16
Anticipated disappointment	5.71 (0.39)	5.56 (0.35)	5.63 (0.26)	6.06 (0.34)	0.99	0.08
Means selection						
Willingness to try physical activities	44.06 (2.76)	52.32 (2.28)	48.27 (1.85)	45.77 (3.56)	1.63	6.68*

Note. Standard errors are in parentheses. * $p < 0.05$

Table 2

Prime-Target Combinations for Accessibility Measures (Study 2)

Condition	Prime	Targets
PA goal accessibility	Neutral	Exercise, Fitness, Active
Over-riding activation of PA goal	First listed temptation	Exercise, Fitness, Active
Neutral word accessibility	Neutral	Emphasis, Install, Regard

Note. PA = physical activity.

Table 3

Mean Response Latencies (ms) for Physical Activity Goal by Positive Affect and Condition (Study 2)

Goal pursuit variables	Affect induction				Positive Affect *F*	Condition *F*
	Hope	Joy	Positive Affect (Hope & Joy)	Neutral		
PA goal accessibility	586 (13)	588 (13)	587 (10)	622 (13)	4.77*	0.92
Over-riding activation of PA goal	592 (15)	585 (15)	589 (10)	626 (15)	4.39*	0.74

Note. PA = physical activity. Standard errors are in parentheses.

* $p < 0.05$

Figure 1

Impact of Positive Affect on Goal Prioritization and Goal Attainment (Study 3)