Relating Action to Abstract Goals Increases Physical Activity Reported a Week Later

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Abstract

Objective: The primary aim of the present study was to investigate whether construing action abstractly versus concretely increases physical activity over a one-week period. *Design and Method:* An experimental study was conducted in which participants were asked to commit to engaging in physical activity at least four times in the coming week. After making this commitment, participants were randomly assigned to think about the concrete procedures or the abstract purpose of their actions. Additionally, in an attempt to induce differences in level of goal conflict, participants were assigned randomly to receive a reminder of a different or consistent goal. The main outcome variable of interest was the number of minutes spent on physical activity over the following 7-day period. *Results:* Consistent with the hypothesis, participants in the abstract condition reported engaging in significantly more minutes of physical activity than did those in the concrete condition. Level of goal conflict did not significantly impact physical activity. The effect of abstract versus concrete thinking on physical activity also was related to the processing of negative affect. *Conclusion:* By providing evidence that construing action abstractly impacts physical activity, the present investigation makes an important addition to research aiming to identify effective means of increasing physical activity.

Keywords: construal level; physical activity; self regulation; affect

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People can think about their goals at varying levels of abstraction. For example, an individual desiring to get more physical activity may focus on the specific, concrete procedures of action (e.g., *How* do I get more physical activity?) or on the general, abstract aims of action (e.g., *Why* do I want to get more physical activity?). This difference, that is, focusing on the concrete versus the abstract features of an event, is referred to as a difference in construal level (Trope & Liberman, 2003; 2010). High-level construals facilitate an *abstract mindset,* a state characterized by increased attention to the global, superordinate and central features of an event, including the abstract purpose of a given behavior (Freitas, Gollwitzer & Trope, 2004; Liberman, Sagristano & Trope, 2002). Low-level construals facilitate a *concrete mindset,* a state characterized by increased attention for local, subordinate and peripheral features, such as the concrete procedures of carrying out a behavior. Changes in construal level can be elicited through manipulations of psychological distance (Fujita, Henderson, Eng, Trope & Liberman, 2006; Trope & Liberman, 2003; 2010) and through procedures that promote a focus on the low-level procedures versus the abstract aims of action (Freitas et al., 2004; Fujita, Trope, Liberman, Levin-Sagi, 2006).

What implications might thinking in an abstract or concrete manner have for goal-directed action? Previous research indicates that relative to a concrete mindset, an abstract mindset increases self-control (Fujita, 2009; Mischel, Shoda & Rodriquez, 1989). For example, children who are promised two marshmallows if they can resist eating one marshmallow are more successful at delaying their gratification if they think about the marshmallow in abstract terms (e.g., imagining the marshmallows as clouds) than if they focus on the consummatory

aspects of the reward (e.g., thinking about how good marshmallows taste; Mischel et al., 1989). More direct support for the prediction that an abstract mindset increases self-control comes from research indicating that relative to a concrete mindset, an abstract mindset increases the amount of time spent holding a hand grip, (Fujita et al., 2006), behavioral intentions to exert self-control (Fujita et al., 2006), preference for an apple over a candy bar (Fujita & Han, 2009), and influences prospective decisions about future temptations (Fujita & Roberts, 2010).

In regulating one's self-control, there is an inherent trade-off between abstract, long-term desires and immediate, concrete experiences (Mischel et al., 1989; Trope & Fishbach, 2000). To attain the long-term benefits of engaging in physical activity, such as an increase in physical fitness, one must undergo immediate and potentially aversive experiences, such as sore muscles. Relatedly, individuals in an abstract mindset, relative to those in a concrete mindset, show increased sensitivity to long-term aims rather than immediate discomforts (Freitas et al., 2004). For example, in one study, participants in an abstract (relative to a concrete) mindset indicated that it would be more worthwhile to receive accurate negative feedback, which is potentially aversive but facilitates greater long-term benefits, than positive feedback (Freitas et al., 2004).

Adopting an abstract mindset appears to change how people think about their present actions. Can such a strategy be used to affect behaviors that extend outside of the lab (e.g., physical activity)? Despite theoretical support for such a prediction, no research has addressed whether changes in construal level can be used as a strategy to promote health behavior change (for review, see Mann, de Ridder & Fujita, 2013). More broadly, little research has addressed the longevity of changes in mental construal, given that past research has focused primarily on lab-based effects. To address this gap in the literature, the present study tests whether construal level impacts time spent on physical activity over one week. We hypothesize that an abstract mindset

should increase physical activity more so than a concrete mindset. As explained, below, we also investigated two potential moderators of the relation between construal level and physical activity: (1) perceived conflict between an exercise goal and other life goals and (2) affect.

Goal Conflict

Perceiving conflict between an exercise goal and other life goals is associated with various negative outcomes, including a decrease in physical activity (Bailis, Thatcher, Aird & Lipschitz, 2011; Li & Chan, 2008) and in trait and state well-being (Riediger & Freund, 2004). We propose that an abstract (relative to a concrete) mindset may reduce perceptions of conflict between one's goals. Support for this prediction comes from studies indicating that an abstract (relative to concrete) mindset leads individuals to see separate goals as more closely related to one another (Clark & Freitas, 2013; Freitas, Clark, Kim, & Levy, 2009). However, it remains unclear whether the effect of construal level on perceived goal correspondence impacts behavior outside of the laboratory. That is, will the increase in perceived goal correspondence afforded by an abstract mindset lead an individual to engage in more physical activity?

To address this possibility, we attempted to manipulate goal conflict, such that participants were reminded of a conflicting academic goal or of a consistent physical activity goal. Following research indicating that goal conflict undermines goal progress (Bailis et al., 2011), we expected that participants reminded of a conflicting goal would perceive greater conflict between their goals and would engage in less physical activity than would those reminded of a consistent goal. We further predicted that the effect of conflict would be moderated by construal level, with participants in the abstract and goal conflict condition perceiving less goal conflict and engaging in more physical activity than those in the concrete and goal conflict condition.

Affect

Affect impacts people's decision to exercise (Ajzen & Driver, 1992; Kwan & Bryan, 2010a). Several studies suggest that positive affective responses to exercise are associated with higher levels of exercise behavior and more stable exercise intentions (Kiviniemi, Voss-Humke, & Seifert, 2007; Kwan & Bryan, 2010a; Kwan & Bryan, 2010b). Positive affective responses to exercise significantly moderate the relation between exercise intentions and behavior, with positive affective responses increasing the likelihood that intentions lead to behavior; conversely, negative affect may negatively influence exercise behavior by eliciting less favorable attitudes towards exercise relative to positive or neutral affect (Allen Catellier & Yang, 2013). Together, such findings suggest that negative affect hinders physical activity more so than positive affect.

Accordingly, the present study also explored whether differences in affect would help clarify any effect of construal level on physical activity. There is some evidence that an abstract (relative to a concrete) mindset increases attention to affective information (Critcher & Ferguson, 2011); however, it remains unclear whether an abstract mindset differentially influences attention to positive versus negative affect. Such a distinction could be significant, as increased attention to positive affect may increase physical activity, whereas increased attention to negative affect may decrease physical activity. With past research supporting multiple possible predictions, we did not generate an *a priori* hypothesis about how affect combines with construal level to impact physical activity. Instead, measures of affect were included to explore and clarify the nature of the relation between construal, positive versus negative affect and physical activity.

The Present Study

In the present study, participants committed to the goal of engaging in 30 minutes of physical activity on each of four separate days over a 7-day period. After making this

commitment, participants construed action in either concrete or abstract terms through a two-part construal-level manipulation task. Drawing from the approach used by Bailis and colleagues (2011), we then manipulated goal conflict by reminding participants of a different or consistent goal. A 7-day follow-up period was selected in order to be consistent with the methods used by Bailis and colleagues (2011). Furthermore, given that little research has tested the effect of construal level on behaviors outside of the lab, we reasoned that testing for effects of construal level over one week would be an appropriately conservative approach. Our primary hypothesis was that participants assigned to the abstract condition would report engaging in more physical activity than would participants assigned to the concrete condition.

Method

Design

Participants were assigned randomly to one of four conditions in a 2(Construal Level: Abstract or Concrete) X 2(Goal Conflict: Conflict or No Conflict) between-participants design. The main outcome variable was physical activity measured over 7 days. Secondary outcomes included perceived level of goal conflict, goal commitment, and goal challenge.

Participants

Seventy-six undergraduate students (30 male), aged 18-35 (M = 19.35)[1], participated in exchange for course credit or $15. Of these 76, 46 completed all of the follow-up measures (response rate = 60.52%). Follow up data were not collected from 9 participants due to complications arising as a result of Hurricane Sandy in November 2012. Two individuals completed the follow-up measures; however, their data could not be included because they did not complete the necessary identification information. Excluding these 11 participants, an

[1] Twelve participants did not report their age.

adjusted estimate of the response rate is 70.76% (46/65). American Psychological Association ethical standards were followed in the conduct of the study. Prior to data collection, all procedures and materials were approved by the university's human subjects research committee.

To determine an appropriate sample size for the present study, we drew on past studies of self-regulation and construal level. Past studies have found differences between abstract and concrete mindsets with approximately 20 (Fujita et al., 2006), 30 (Freitas et al., 2006), and 22 (Fujita & Han, 2009) participants per level-of-construal condition, and have yielded large sized effects (d = .41 – .72). Accordingly, we reasoned that recruiting 24 participants per level-of-construal condition would afford sufficient statistical power to test the main effect of level of construal on reported physical activity. To test potential moderating effects, we aimed to double that sample size (to total N = 96) if possible given practical constraints. Prior to data collection, we determined that we could conduct the study for one academic year. At the end of the allotted time, we stopped all data collection and only then began data analyses.

Screening Protocol. All participants completed a screening questionnaire to assess their eligibility. The aim of the screening procedure was to identify individuals with moderate to strong physical activity and academic goals. The screening questionnaire was administered to Introduction to Psychology students, and was available electronically to individuals who responded to a flier. Of the 664 individuals who completed the screening questionnaire, 285 were eligible (42.92%). Participants responded to the following items using 5-point scales: "Overall how important is getting more physical activity/exercise to you?", "How strongly committed are you to getting more physical activity/exercise in the next 4–6 months?", "Overall how important is receiving good grades at Stony Brook University to you?" and How strongly committed are you to receiving good grades at Stony Brook University in the next 4–6 months?". To be eligible,

participants needed to indicate a score of at least 3 on all items ("*Moderately Important*" or "*Moderately Committed*").

Procedure

Random Allocation

Before collecting any data, a set of 96 non-unique numbers ranging between 1 to 4 (the experimental condition code) were generated using Excel (V. 14.1.0). Participants were given an identification number between 1 and 96 (e.g., participant # 1). Participants were assigned the condition code that corresponded to their identification number. Three of the four experimenters were blind to the hypotheses and to participants' assignment to the conflict or no conflict conditions.[2] The participant folders containing the exercise goal commitment document and the how or why diagram were prepared by the author (AS) approximately two weeks before data collection began in the Fall of 2012.

Data Collection

The experiment consisted of 1 lab session and 2 online follow-up questionnaires. In the lab, participants were run individually and completed all of the experimental materials seated at a computer desk. The lab session involved 6 parts. After giving informed consent, participants read two educational fliers created by the U.S. Center for Disease Control. The fliers were included to

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[2] Experimenters were not fully blind to assignment to the concrete or abstract conditions. Upon opening each participant's folder, the experimenter did see whether the participant had a why or how diagram. Therefore, if the experimenter thought to reflect upon the pattern, it would have been possible for the experimenters to figure out which condition code corresponded to the abstract and concrete conditions.

The condition code was generated by the first author, who ran approximately 25% of participants. Knowledge of condition code and the hypotheses had no significant main effect on any of the dependent measures, nor did it moderate the effect of construal level or level of goal conflict, all Fs = .00 - 2.59, ps = .12 - .99. Additionally, knowledge of the condition code did not significantly predict whether participants completed the follow-up measures, OR = 1.59, p = .37.

provide some context for the upcoming exercise goal commitment. Second, participants completed a measure of their baseline level of physical activity from the previous week. Third, following a standardized script, a research assistant held a brief interview with the participant. As a cover story, participants were informed that we were investigating "individual differences and goals", and to this end, we were asking all participants to agree to the same goal. All participants were then asked the following: "For the purposes of this study, would you be willing to commit to the goal of exercising moderately to vigorously for at least 30 minutes, 4 times in the coming week?" Participants verbally agreed to commit to this goal.[3] To document their commitment, participants read and signed a document entitled "Exercise Goal Commitment." The document consisted of a single piece of paper, folded in half, with the exercise goal commitment information facing up. The document stated the goal, the time frame for completing the goal, and information about the follow-up questionnaires. After signing the document, the experimenter placed the document inside a folder kept at the participant's desk.

Fourth, participants completed a two-part construal level manipulation. First, they completed Freitas and colleagues' (2004) mindset manipulation in which they considered how (concrete conditions) or why (abstract condition) to improve and maintain their health. Next, participants viewed a series of behaviors from Vallacher and Wegner's (1989) Behavioral Identification Form (BIF) and were asked to reframe behaviors in terms of how (concrete condition) or why (abstract condition) they are performed (Critcher & Ferguson, 2011). Fifth, goal conflict was manipulated by reminding participants of a consistent goal (exercise) or a conflicting goal (academics). Participants answered questions about their exercise or academic goals and rated the amount of conflict they perceived between their exercise goal and other

[3] Two participants would not agree to the goal; one was concerned with final exams and a second was recovering from an illness.

goals. Sixth, participants answered questions about their goal commitment, affect and self-concept clarity. With the exception of the educational fliers, the mindset manipulation, and the exercise goal commitment document, all experimental materials were computer-administered using the program Medialab.

Four days after the lab session participants completed the first online survey. In the first survey, participants reported their physical activity over the last three days, using the measures described below. Participants had 48 hours to complete this survey. Then, four days later, participants received the second survey. They reported their physical activity from the past four days, and had 48 hours to complete the survey. We included two surveys to reduce any potential memory bias in recalling one's physical activity over the 7-day period.

Measures and Materials

Educational Fliers. The first flier, "Be Active Your Way: A Fact Sheet for Adults," described what kind and how much physical exercise is needed for a healthy adult, and included definitions and examples of moderate and vigorous activities. The second flier, "There are a lot of ways to get the physical activity you need," provided examples of exercise schedules. Both fliers were free resources from: http://www.health.gov/paguidelines/adultguide/

Physical Activity. Baseline and follow-up physical exercise were measured with the short version of the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). The IPAQ has satisfactory test-retest reliability (.65 - .88; Craig et al., 2003). At baseline, participants reported their physical activity over the last 7 days, including days of vigorous and moderate activity, and the average number of minutes spent daily on each of these types of activity. To compute baseline physical activity scores (i.e., total minutes of physical activity at baseline), we used the following equation: (days spent on vigorous exercise * average minutes spent on

vigorous exercise) + (days spent on moderate exercise * average minutes spent on moderate exercise). See Fleig and colleagues (2013) for a similar approach.

In the follow-up questionnaires, these items were adapted to ask about each day of the week. In both follow-up surveys, participants reported the frequency and type of activity carried out over the last several days (e.g., "During the last 4 days (Tuesday, Wednesday, Thursday, Friday), on how many days did you do vigorous physical activities," and "During the last 4 days (Tuesday, Wednesday, Thursday, Friday), on how many days did you do moderate physical activities"). When reporting minutes of activity, the items were tailored to each day of week and each type of activity (e.g., "How many minutes did you spend doing vigorous physical activities on Tuesday"). Follow-up physical activity scores (i.e., total minutes of physical activity across the 7 day period) were calculated by summing the minutes of vigorous and moderate exercise from the two questionnaires. As part of the second follow-up questionnaire, using the scale (1 = *Not at All*, 5 = *Extremely*), participants rated their *perceived goal challenge* by responding to the item, "How challenging was it for you to meet the exercise goal (exercising at least 4 times)?" and their *perceived academic satisfaction* by responding to the item "In the last week, how satisfied were you with the amount of effort you put towards doing homework and studying?"

Construal Level Manipulation. In Freitas and colleagues' (2004) mindset manipulation, participants complete a diagram in which they consider how or why to improve and maintain their physical health. In the concrete condition, the goal "Improve and Maintain Health" is listed at the top of the page with four blank boxes positioned below it. Participants were provided with the following instructions: To show how the goal of "improving and maintaining your physical health" can be met through specific activities, please fill in the 4 blank boxes below, in the series on the right. Beginning in the highest blank box (the one just below the box labeled "Improve

and Maintain Health"), fill in each box by answering the question "How I can meet the goal described in the immediately higher box?"

Conversely, in the abstract condition, the goal "Improve and Maintain Health" is listed at the bottom of the page, with four blank boxes positioned above it. Participants in the abstract condition were given the following instructions: To show how the activity of "improving and maintaining your physical health" can help you meet important life goals that you have, please fill in the 4 blank boxes below. Beginning in the lowest blank box (the one just above the box labeled "Improve and Maintain Health"), fill in each box by answering the question "Why do I engage in the behavior described in the immediately lower box?" As seen in Figure 1, which shows completed examples of both the how and why diagrams, the diagrams are structured so that those in the concrete condition give increasingly specific responses, whereas those in the abstract condition give increasingly broad responses.

Next, participants viewed a list of 25 everyday behaviors from Vallacher and Wegner's BIF (1989; e.g., "making a list", "washing clothes" and "greeting someone"). For each behavior, participants are asked to decide between a lower-level (concrete) and higher-level (abstract) description of each behavior. For example, for the behavior "Locking the door," participants are asked to decide whether the concrete response, "putting a key in the lock," or the abstract response, "securing the house," best captures the behavior. In the present study, following the procedures of Critcher and Ferguson (2011), rather than showing participants the concrete and abstract responses for each behavior, participants reframed each behavior in terms of how (concrete condition) or why (abstract condition) the behavior is performed.

Instructions for the task were as follows (with substitutions for the abstract condition in parentheses): "In the following section, you will be presented with several different behaviors.

For each behavior listed, please reframe the behavior in terms of the specific process ("purpose") of that behavior. That is, try to think about HOW ("WHY") the behavior is performed." After providing their own reframing of the 25 behaviors, participants rated from 1 (*Not at All Well*) to 5 (*Perfectly*), how well the provided description (i.e., the abstract or concrete response from the original form) captured how or why one would perform each behavior. Thus, participants repeatedly reconstrued behaviors in terms of their abstract purpose or concrete process and were exposed to the concrete and abstract choices from the original BIF.

Goal Conflict Manipulation. In the no conflict conditions, participants responded to the item: "In the coming week, how many hours do you plan to spend exercising?" Using a 5-point scale, (1 = *Not at all Important*, 5 = *Extremely Important*) they then indicated, "How important is exercising to you?" Conversely, those in the conflict conditions indicated *yes* or *no* to the item "In the next few weeks, do you have any exams or papers due?" They next were asked "In the next week, how much time do you expect to spend studying and doing homework?" To answer this question, participants removed their exercise goal commitment document from the folder on their desk. Once unfolded, the top of this document showed their exercise goal commitment (which they previously signed). The bottom half of this document was titled "Academic Goals." Participants signed their name and filled in the blanks: "I, __, plan to spend _____ hours studying and _____ hours doing homework in the coming week." They then reported "How important is receiving good grades in your courses to you" (1 = *Not at All Important*, 5 = *Extremely Important*). The aim of this procedure was to highlight the conflict between their academic and exercise goals. Finally, to assess *perceived goal conflict* all participants rated "To what extent does succeeding in your exercise goal have a helpful or harmful effect on other goals

you may have" (1 = *A very helpful effect on other goals I have*, 5 = *A very harmful effect on other goals I have*; adapted from Emmons & King, 1988).

Goal Commitment. Participants rated their commitment to their exercise goal using Klein, Wesson, Hollenbeck, Wright and Deshon's (2001) five-item scale (α = .74) using a 5-point scale (1= *Strongly Disagree*, 5 = *Strongly Agree*).

Affect. Participants completed the Positive and Negative Affect Scale (Watson, Clark & Tellegen, 1988; Positive Affect, α = .88; Negative Affect, α = .80). Using a 5-point scale (1 = *Very slightly*, 5 = *Extremely*) they rated the extent to which they felt 20 emotions about their exercise goal. Participants were asked to: "Indicate how you feel right now, that is, at the present moment about exercising at least 4 times in the coming week." They also completed the valence and arousal scales of the Self-Assessment Manikin (Bradley & Lang, 1994). Instructions for the items were as follows (with substitutions for the arousal scale in parentheses): "Use the figures to indicate how happy (excited) you feel about your exercise commitment right now." The figures ranged from 1 = *completely relaxed* (arousal) and *completely unhappy* (valence) to 9 = *completely stimulated* (arousal) or *completely happy* (valence).

Self-Concept Clarity. Participants rated their self-concept clarity using Campbell et al.'s (1996) 12-item scale (α = .85) using a 5-point scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*).

Overview of Data Analyses

The data were analyzed using SPSS (V. 20). Data analyses proceeded in five stages. First, we checked for outliers in the physical activity scores using the guidelines for the short version of the IPAQ (Sjöström et al., 2005). Consistent with these guidelines, participants who reported more than 180 minutes of activity per day both at baseline or on any of the follow-up days were considered outliers. Values exceeding 180 were recoded to be equal to 180 minutes. At baseline,

3 participants had scores that were recoded to 180. At follow-up, we recoded the daily physical activity score from one participant who reported more than 180 minutes of activity. Values of 10 minutes or less were recoded to zero (which occurred for one participant at follow-up).

Second, we checked whether: a) the randomization of participants to conditions was successful, b) there were differences between those who did and did not complete the follow-up measures, and c) participants completed the how/why diagrams correctly (i.e., a manipulation check). Third, we tested the following hypotheses: 1) the abstract conditions will engage in more physical activity than the concrete conditions, 2) the goal conflict conditions will engage in less physical activity than the no goal conflict conditions, and 3) the abstract and goal conflict condition will engage in more physical activity than those in the concrete and goal conflict condition. To this end, we: a) compared the number of participants that met the goal across conditions, b) conducted an analysis on the total number of minutes spent on physical activity among participants that completed all the follow-up measures, and c) conducted an intention-to-treat analysis to include all participants from the original sample using a multiple imputation procedure. Fourth, we tested the effects of construal level and level of goal conflict on goal commitment, perceived goal conflict and goal challenge. Finally, we tested perceived goal conflict and affect as potential moderators of the effect of construal level on physical activity.

Randomization Check

There was no difference in baseline physical activity between the concrete and abstract conditions, $F(1, 72) = .59$, $p = .45$, $\eta_p^2 = .01$, between the conflict and no conflict conditions, $F(1, 72) = .02$, $p = .90$, $\eta_p^2 = .00$, nor an interaction between factors, $F(1, 72) = .02$, $p = .90$, $\eta_p^2 = .00$. In addition, we used information from the baseline physical activity questionnaire to test for differences in the number of participants that were meeting the goal at baseline. Because of the

format of the IPAQ, for 12 participants we could not determine whether they were meeting the goal at baseline. Among the remaining 64 participants, a chi-square test revealed no significant difference between the number of participants that were meeting the goal at baseline across the four conditions, χ^2 (6, N = 76) = 4.80, p = .57.

There was no significant difference in age between the abstract and concrete conditions, F(1, 62) = .99, p = .32, η_p^2= .02, and no difference between the conflict and no conflict conditions, F(1, 62) = .91, p = .34, η_p^2= .01. There was, however, a significant interaction between construal level and level of conflict on age, F(1, 62) = 4.18, p = .05, η_p^2= .06, such that among participants in the abstract condition the no conflict condition were older (M = 20.53, SD = 4.85) than the conflict condition (M = 18.47, SD = 1.06). A chi-square test revealed no significant difference between the number of males or females assigned to each condition, χ^2 (3, N = 76) = 2.99, p = .39. Table 1 shows the descriptive statistics for baseline physical activity, percent of participants meeting the goal at baseline, age and gender for the four conditions. Together, these analyses suggest that the random assignment procedure was successful.

Participants Lost to Follow-Up

There was no significant difference in the number of participants lost to follow-up across the four conditions, χ^2 (3, N = 76) = .91, p = .82. Furthermore, a logistic regression with completion of the follow-up measures as the criterion variable ("1" = complete data, "0" = incomplete data) indicated that gender did not predict whether participants completed the study, OR = .95, p = .91, 95% CI = .37 – 2.42. Baseline physical activity, perceived goal conflict, goal commitment, positive affect, negative affect, valence and arousal scores from the Self-Assessment Manikin (SAM) were tested using a multivariate analysis of variance (MANOVA),

which was nonsignificant, $F(7, 68) = 1.14$, $p = .35$, $\eta_p^2 = .11$.[4] The univariate tests were not significant (Fs(1, 74) = .01 - 3.48, ps = .07 - .91, η_p^2= .00-.05), except for valence scores on the SAM ($F(1,74) = 5.43$, $p = .02$, $\eta_p^2 = .07$). Valence scores indicated that participants who completed the follow-up measures felt less happy about the goal ($M = 6.72$, $SD = 1.31$) than those who did not complete the follow-up measures ($M = 7.37$, $SD = .96$). Taken together, these analyses suggest few differences between participants who did and did not complete the follow-up measures.

Manipulation Check

As a manipulation check of Freitas and colleagues' (2004) mindset manipulation, two judges unaware of condition or hypotheses assessed the abstractness of participants' responses to the diagrams. Drawing from the procedure used by Fujita and colleagues (2006), if a response described a subordinate means for maintaining/improving health, judges coded the response as -1. If the response described a superordinate purpose of maintain/improving health, judges coded the responses as +1. If a response fit neither criterion, it was coded as 0. Ratings for each of the participants' 4 responses were summed to yield a measure of level of construal (ranging from -4 to +4), such that higher scores indicate more abstract thinking. The judges' scores were highly correlated $r = .94$, $p < .01$, and reliability was high (83%). Disagreements were settled with discussion. Participants who completed the why diagram generated more abstract responses ($M = 3.85$, $SD = .43$) than did those who completed the how diagram ($M = -3.28$, $SD = .78$), $t(74) = 50.15$, $p < .01$, $r = .98$, suggesting that the manipulation was successful. Among those in the abstract condition, there was no difference in the level of construal between participants who did

[4] Age was not included in the MANOVA because there were missing values, which impacted the degrees of freedom of the MANOVA. An independent sample t-test indicated no difference in age between participants who did and did not complete the follow-up measures, $t(64) = .71$, $p = .48$, $d = .18$.

and did not complete the follow-up measures, $t(38) = 1.06$, $p = .30$, $r = .17$ Similarly, among those in the concrete condition, there was no difference in the level of construal between participants who did and did not complete the follow-up measures, $t(34) = -.482$, $p = .63$, $r = .08$.

Impact of Construal Level and Level of Goal Conflict on Physical Activity at Follow-Up

First, we tested for differences in the number of participants that met the goal across conditions. Among participants who completed all of the follow-up measures ($n = 46$), 3 participants did not meet the goal. All 3 were in the concrete condition. In terms of total minutes of physical activity, however, all participants engaged in at least 130 minutes of physical activity over the one-week period ($M = 361.17$, $SD = 170.70$). Second, we analyzed the total number of minutes spent on physical activity for participants who completed all of the follow-up measures. A 2(Construal Level) X 2(Level of Conflict) between-subjects analysis of covariance (ANCOVA, with baseline physical activity as a covariate) on follow-up physical activity revealed a significant main effect for construal level, $F(1, 42) = 5.45$, $p = .03$, $\eta_p^2 = .12$, such that participants in the abstract conditions engaged in more physical activity than those in the concrete conditions (see Table 2). There was no main effect for level of goal conflict ($F(1, 42) = .13$, $p = .72$, $\eta_p^2 = .00$), nor an interaction between the factors ($F(1, 42) = .05$, $p = .82$, $\eta_p^2 = .00$).[5]

Third, to account for missing physical activity scores, we conducted an intention-to-treat analysis. We used the automatic imputation method in SPSS Missing Values (V. 20) to generate multiple imputation datasets. Multiple Imputation is a Bayesian approach to accounting for missing values, and involves imputing plausible estimates of the missing values over the course

[5] Baseline and follow-up physical activity scores violated assumptions of normality, Shapiro-Wilk ($df = 46$) = .90 - .91, $p < .01$. A square root transformation corrected for the positive skew in both baseline and follow-up physical activity scores. We ran the ANCOVA with the raw scores and the transformed scores. Both analyses yielded significant main effects of construal level; thus, we opted to leave the scores in their untransformed form.

of a specified number of datasets. Each dataset was used to test the effect of experimental condition on physical activity. The results of each dataset were then combined to yield a single estimate. Compared to other approaches for accounting for missing values (e.g., mean replacement) multiple imputation yields parameter estimates that are less biased (Graham, 2009; Schafer & Graham, 2002). Five to ten multiple imputations are considered to be sufficient for generating accurate parameter estimates; we generated 10 datasets, as this number has been shown to provide unbiased parameter estimates among datasets with large amounts of missing data (Schafer & Graham, 2002).

Baseline physical activity, assignment to the concrete or abstract condition, and assignment to the conflict or no conflict condition were included as predictors to inform imputation estimates for the missing values of physical activity. Estimated values for physical activity were restricted between 0 minutes and 810 minutes, as 810 minutes was the maximum physical activity score among participants who completed all the measures. A series of 2(Construal Level) X 2(Level of Conflict) between-subjects ANCOVAs (with baseline physical activity as a covariate) was run on the imputed datasets. To combine the results from the 10 datasets, we used Raghunathan and Dong's (2011) formulas for pooling analysis of variance results with multiple imputation datasets. The formulas are adapted from Rubin (1987). Again, the results indicated a significant main effect for construal level (see Table 3), with higher physical activity scores in the abstract ($M_{Adj.}$ = 400.67, *SE* = 28.16, 95% *CI* = 345.05, 456.28) than the concrete condition (M_{Adj} = 307.39, *SE* = 28.95, 95% *CI* = 250.33, 364.45). There was no significant effect of level of conflict, nor was there a significant interaction between the factors.

Goal Commitment, Perceived Goal Conflict and Goal Challenge

A series of between-participants ANOVAs was run to test for effects of condition on goal commitment, perceived goal conflict and goal challenge (see Table 2). There was no difference in goal commitment between participants in the concrete and abstract conditions ($F(1, 72) = .12$, $p = .73$, $\eta_p^2 = .00$), the conflict and no conflict conditions ($F(1, 42) = 1.01$, $p = .32$, $\eta_p^2 = .01$), nor an interaction between the factors ($F(1, 42) = .08$, $p = .78$, $\eta_p^2 = .00$). Next, in regards to how much conflict participants perceived between their exercise goal and their other goals, those in the abstract condition indicated that their exercise goal had more of a helpful effect on their other goals relative to the concrete condition, $F(1, 72) = 4.16$, $p = .05$, $\eta_p^2 = .06$. There was no significant main effect for level of goal conflict ($F(1,72) = 1.83$, $p = .18$, $\eta_p^2 = .03$), nor an interaction between the factors ($F(1,72) = .01$, $p = .92$, $\eta_p^2 = .00$). Finally, in regards to how challenging it was to meet the exercise goal at the end of the 7-day period, participants in the concrete condition found the goal more challenging than did participants in the abstract condition, $F(1, 46) = 4.20$, $p = .05$, $\eta_p^2 = .08$. There was no difference in perceptions of goal challenge between the conflict and no conflict conditions, $F(1, 46) = .01$, $p = .95$, $\eta_p^2 = .00$), nor a significant interaction between factors ($F(1, 46) = 2.94$, $p = .09$, $\eta_p^2 = .06$).[6]

Testing for Moderation of the Relation Between Construal Level and Physical Activity

Next, we tested perceived goal conflict and affect as potential moderators of the effect of construal level on physical activity. First, to test whether perceptions of goal conflict explain how construal level impacts physical activity, participants' ratings of perceived goal conflict were regressed onto their physical activity score, their assignment to the concrete or abstract conditions (coded as "0" and "1", respectively), and the product of the 2 predictor variables. Perceived goal conflict was mean-centered prior to analysis. The multiple regression analysis

[6] Note that this analysis includes four participants who completed the second follow-up survey only (in which the goal challenge item was included).

yielded a non-significant construal level by perceived goal conflict interaction, B = -23.94, SE = 51.80, $t(42)$ = -.46, p = .65, 95% CI = -128.48, 80.60, suggesting that the effect of construal level on physical activity was not related to perceptions of goal conflict.

Second, we tested whether differences in affect would help to clarify the effect of construal level on physical activity. First, participants' ratings of negative affect were regressed onto their physical activity score, their assignment to the concrete or abstract conditions, and the product of the two predictor variables. Negative affect was mean-centered prior to analysis. The multiple regression analysis yielded a significant construal level by negative affect interaction, B = 26.24, SE = 9.82, $t(42)$ = 2.67, p = .01, 95% CI = 6.42, 46.06. To clarify the nature of this interaction, we conducted simple slopes analyses (Aiken & West, 1991; Preacher, Curran, & Bower, 2006). Participants' ratings of negative affect related to their physical activity score in the abstract condition, B = 20.32, SE = 8.73, p = .03, 95% CI = 2.21, 38.43, but not in the concrete condition B = -5.92, SE = 5.03, p = .25, 95% CI = -16.41, 4.56. As indicated in Figure 2, among participants with high negative affect, those in the abstract condition engaged in more physical activity than did those in the concrete condition.

Next, we tested whether the interaction between negative affect and construal level would replicate with an alternative measure of affect. Affect ratings from the valence scale of SAM were regressed onto participants' physical activity score, their assignment to the concrete or abstract conditions, and the product of the two predictor variables. Affect ratings were mean-centered prior to analysis. The multiple regression analysis yielded a significant construal level by affect interaction, B = -94.28, SE = 42.07, p = .03, 95% CI = -179.17, -9.38. Simple slopes analyses revealed that ratings of affect related to physical activity scores for participants in the concrete condition, B = 71.81 , SE = 25.15, p = . 01, 95% CI = 19.35, 124.26, but not in the

abstract condition, B = -22.47 , SE = 25.23, p = .38, 95% CI = -74.78, 29.84. Like Figure 2, Figure 3 shows that among participants with high levels of negative affect, the abstract condition spent more minutes on physical activity. In separate sets of analyses, participants' ratings of positive affect and arousal scores from the SAM were regressed onto total minutes of exercise, along with their assignment to the concrete or abstract conditions, and the product of the two predictor variables. None of these analyses yielded significant interactions.

Discussion

The present study examined whether construing action abstractly versus concretely impacts physical activity. As hypothesized, participants in the abstract condition reported engaging in more physical activity over a 7-day period than did those in the concrete condition. Consistent with this main finding, participants in the abstract condition reported finding the goal to be less challenging and perceived less conflict between their various goals, relative to those in the concrete condition. This latter finding is consistent with past research indicating that individuals perceive separate goals as more closely related in an abstract than a concrete mindset (Clark & Freitas, 2013; Freitas et al., 2009). Taken together, these findings suggest that thinking abstractly facilitates a variety of advantages relevant to successful goal-pursuit.

No significant differences were found between the conflict and no-conflict conditions on any of the dependent measures, suggesting that the attempted experimental manipulation of goal conflict was unsuccessful. We built our manipulation off of that used by Bailis and colleagues (2011). In that study, after agreeing to an exercise goal, participants wrote about a desired outcome in academics or exercise. Contrary to the present study, those authors found that among participants with high academic goals, those who wrote about a conflicting academic goal exercised less over the following week. These divergent findings may be explained by

differences in the type of participants recruited. We reasoned that only individuals who cared about both of these domains would be susceptible to goal conflict; however, another possibility is that such individuals have already learned how to cope with these types of conflicts.

The present study also provided some initial evidence that the effect of construal level on physical activity relates to experiences of negative affect. Among individuals who experienced high levels of negative affect, those in the abstract condition engaged in more physical activity than did those in the concrete condition. This finding was not predicted beforehand and therefore necessitates further confirmation. A close look at past research on the role of negative affect in goal-pursuit reveals that negative affect can lead to strikingly different outcomes depending on the task at hand. There is evidence that in some contexts negative affect leads individuals to decrease effort (Herrald & Tomaka, 2002; Ilies & Judge, 2005; Martin, Ward, Achee & Wyer, 1993). Specifically, individuals oriented towards the discomforting nature of a task may use negative affect as a signal to abandon a task (Martin et al., 1993). Alternatively, from the perspective that affect provides people with information about the effectiveness of their on-going actions (Carver, & Scheier, 1990; Schwarz & Bless, 1991), other researchers have proposed that positive affect should promote "coasting," given that it signals satisfactory progress towards a goal; conversely, negative affect should signal to individuals that they need to increase effort (Carver, 2003; Cervone, Kopp, Schaumann & Scott, 1994).

Findings that negative affect may increase or decrease behavior, depending on the context, may help to shed some light on the present results. As reviewed previously, a concrete mindset orients attention towards the low-level features of a behavior, including the immediate discomforts of a behavior (Freitas et al., 2004). Alternatively, an abstract mindset highlights the global aspects of action, including the long-term aims of a behavior. From this perspective,

construal level may lead individuals to interpret negative affect in different ways, with individuals in a concrete mindset using it as a signal to disengage and those in an abstract mindset using it as a cue to increase effort. By specifying conditions under which negative affect increases or decreases goal-directed behavior, these findings, if confirmed through replication, could help to bridge two disparate lines of research on the role of negative affect.

There are several limitations to this study. First, physical activity was assessed with a self-report measure. Future research may consider using a more objective measure of physical activity, such as accelerometer-assessed physical activity. Importantly, past research has found moderate levels of agreement between physical activity scores collected with the IPAQ and with accelerometers (Craig et al., 2003). A second limitation of the present study is that there was no control group. Past research suggests that when construal level is not manipulated, people will use their typical everyday level of construal (Vallacher & Wegner, 1989); we would expect, then, that a control group would show greater variability in level of construal than would groups receiving a concrete or abstract manipulation. Third, the study was conducted with undergraduate students as participants. Previous research indicates that reasons for engaging in physical activity change across the lifespan, such that younger adults tend to exercise for appearance purposes (Sabiston, Crocker, & Munroe-Chandler, 2005; Strong, Martin Ginis, Mack, & Wilson, 2006), whereas older adults tend to exercise for a source of personal challenge (Beck, Gillison, & Standage, 2010) or to boost physical functioning (Reboussin et al., 2000). Future research is needed to address whether age-related differences in exercise motivation impact the effect of construal level on physical activity.

The present study provides the first experimental evidence that construal level impacts physical activity. Whereas past research has studied construal level and self-regulation in the lab,

to the best of our knowledge, this is the first study to assess the effect of construal level as it unfolds in a more naturalistic setting. Leading individuals to construe action in abstract vs. concrete terms is relatively inexpensive and easy to implement, making it a good candidate for future interventions aiming to increase physical activity. We acknowledge, however, that the present results were found among individuals who already were somewhat physically active. Caution should be exercised in generalizing to populations that are completely inactive. Finally, an important step for future research will be to investigate whether construal level can be used as a tool to impact long-term changes in physical activity (e.g., over one month or longer).

Conclusions

The present study set out to test whether thinking concretely or abstractly about action impacts physical activity over a 7-day period. We found that participants in the abstract condition engaged in significantly more physical activity than those in the concrete condition.

Acknowledgements

We thank Olivia Rodriguez, Cayla Leung and Celine Li for research assistance, and Johana Bien-Aime and Shamrin Virani for assistance with coding.

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Table 1.

Baseline characteristics of the sample.

	Concrete			Abstract		
Variable	Conflict	No Conflict	Total	Conflict	No Conflict	Total
Baseline Physical Activity						
M	273.13	272.75	272.92	242.94	231.26	236.23
n	16	20	36	17	23	40
SD	146.42	253.22	209.75	201.85	182.23	188.37
95% *CI*	[195.10, 351.15]	[154.24, 391.26]	[201.95, 343.89]	[139.16, 346.72]	[152.45, 310.07]	[175.98, 296.47]
Meeting Exercise Goal at Baseline (%)	61.54	35.29	46.67	43.75	33.33	38.24
Age						
M	19.19	18.44	18.81	18.47	20.53	19.62
SD	1.42	0.81	1.20	1.06	4.85	3.79
95% *CI*	[18.43, 19.95]	[18.00, 18.87]	[18.38, 19.25]	[17.92, 19.02]	[18.19, 22.86]	[18.30, 20.94]
Gender (%)						
Male	43.75%	55.0%	50.0%	70.59%	65.22%	67.50%
Female	56.25%	45.0%	50.0%	29.41%	34.78%	32.50%

Table 2.

Effect of Construal Level and Level of Goal Conflict on All Dependent Measures

	Concrete			Abstract		
Variable	Conflict	No Conflict	Total	Conflict	No Conflict	Total
Follow-Up Physical Activity						
M[a]	286.80	315.25	301.02	409.98	416.32	413.15
SD	159.0	158.72	161.21	158.73	158.86	163.97
n	9	13	22	9	15	24
95% *CI*	[179.77, 393.84]	[226.34, 404.15]	[231.48, 370.57]	[303.13, 516.83]	[333.48, 499.15]	[345.56, 480.74]
Goal Commitment						
M	4.25	4.34	4.30	4.26	4.42	4.35
SD	.49	.52	.50	.58	.53	.55
N	16	20	36	17	23	40
95% *CI*	[3.99, 4.51]	[4.10, 4.58]	[4.13, 4.47]	[3.96, 4.56]	[4.19, 4.65]	[4.17, 4.53]
Perceived Goal Conflict						
M	2.44	2.10	2.25	1.94	1.65	1.78
SD	1.09	.97	1.02	1.14	.83	.97
n	16	20	36	17	23	40
95% *CI*	[1.86, 3.02]	[1.65, 2.55]	[1.90, 2.60]	[1.35, 2.53]	[1.29, 2.01]	[1.47, 2.09]
Goal Challenge						
M	2.89	2.46	2.64	1.92	2.38	2.18
SD	.78	.88	.85	.79	1.03	.95
n	9	13	22	12	16	28
95% *CI*	[2.29, 3.49]	[1.93, 2.99]	[2.26, 3.02]	[1.41, 2.42]	[1.83, 2.92]	[1.81, 2.55]

Note. [a] Means adjusted for baseline physical activity scores.

Table 3.

Pooled ANCOVA Results from the Multiple Imputation Datasets.

	Construal Level	Level of Conflict	Construal X Level of Conflict
df_D	70	70	70
F	6.09	0.06	0.07
p	0.004	0.81	0.79

Note. df_D = Degrees of freedom for the denominator, calculated with the equations from Raghunathan & Dong (2011).

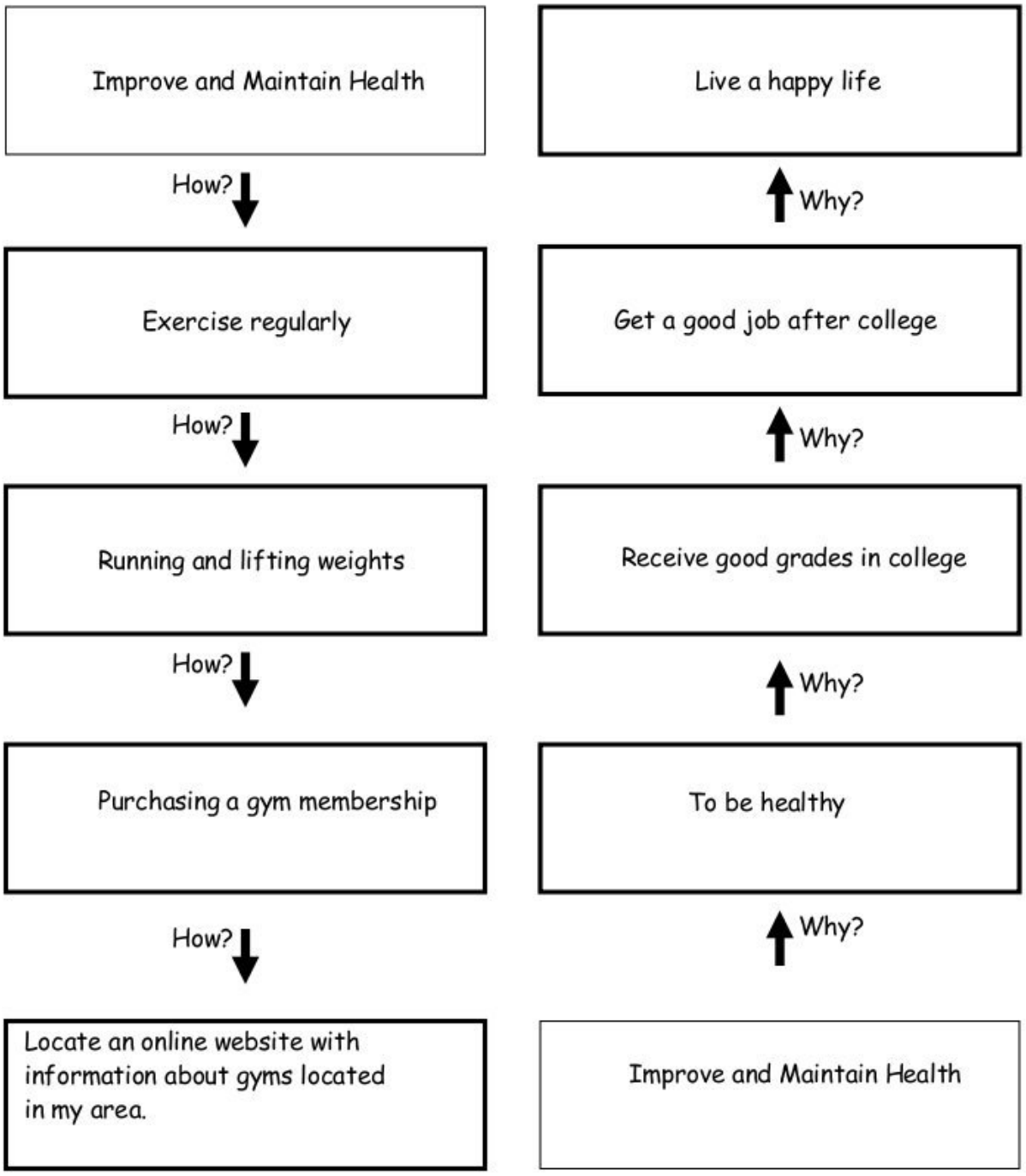

Figure 1. Completed examples of the diagrams for the Concrete (Left) and Abstract (Right) conditions.

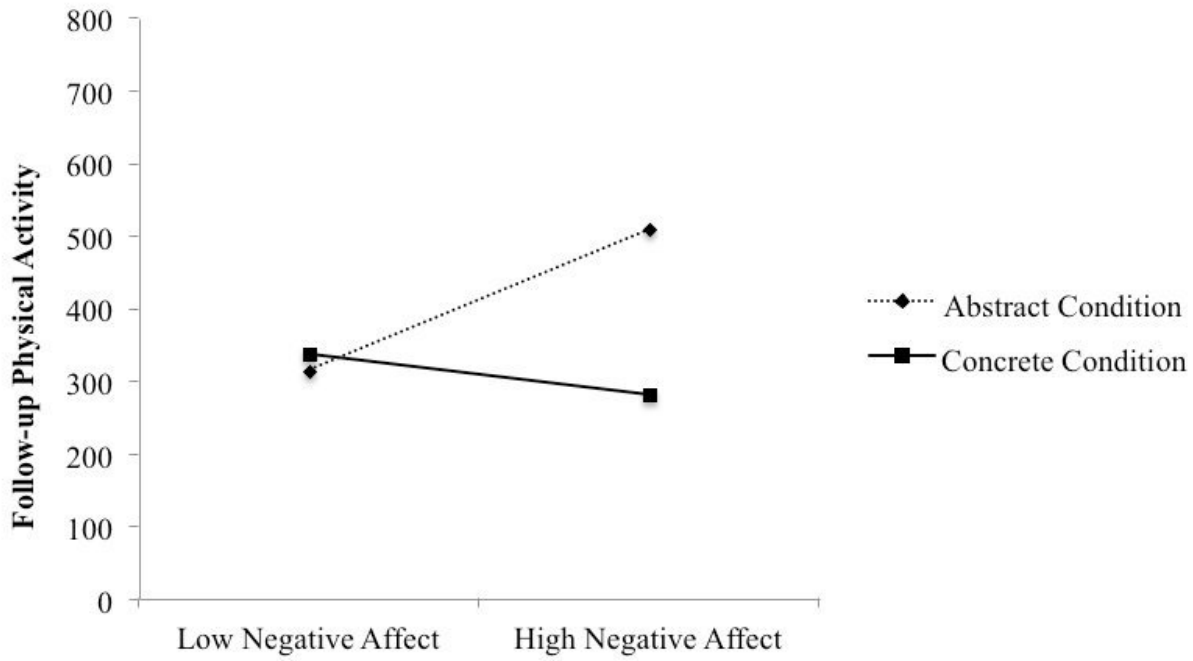

Figure 2. Predicted values in total minutes of physical activity for participants scoring one standard deviation above and below the mean in negative affect, among participants in the concrete and abstract conditions.

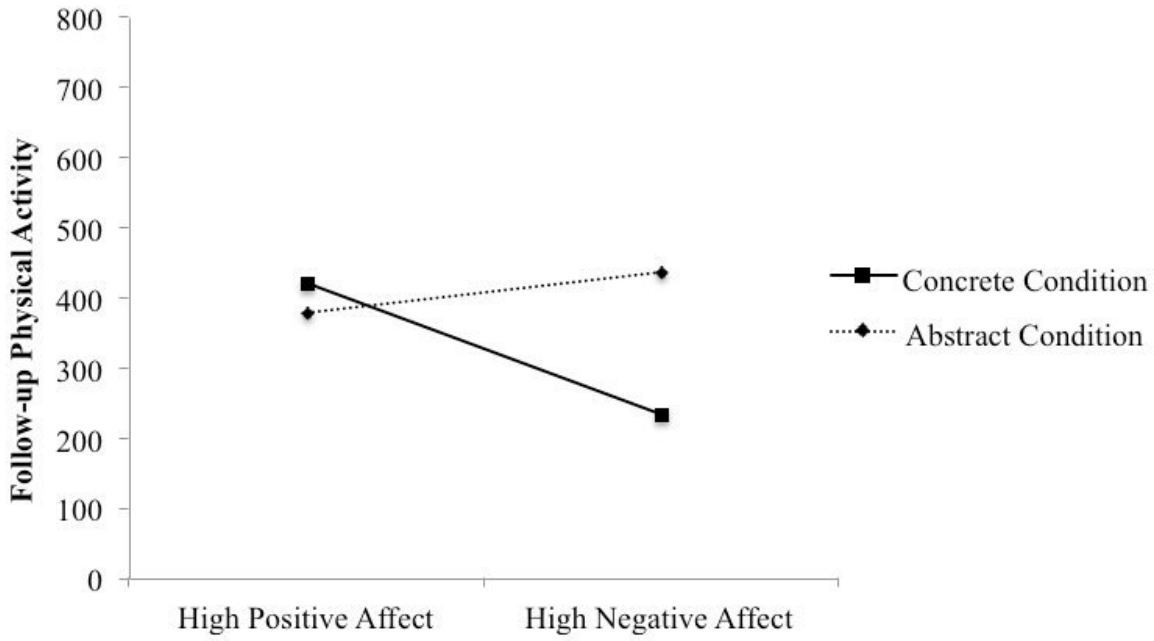

Figure 3. Predicted values in total minutes of physical activity for participants scoring one standard deviation above and below the mean in valence scores from the SAM, among participants in the concrete and abstract conditions.