The Invisible Benefits of Exercise

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Objective: To examine whether—and why—people underestimate how much they enjoy exercise.
Design: Across four studies, 279 adults predicted how much they would enjoy exercising, or reported
their actual feelings after exercising. ***Main Outcome Measures:*** Main outcome measures were predicted
and actual enjoyment ratings of exercise routines, as well as intention to exercise. ***Results:*** Participants
significantly underestimated how much they would enjoy exercising; this *affective forecasting* bias
emerged consistently for group and individual exercise, and moderate and challenging workouts spanning
a wide range of forms, from yoga and Pilates to aerobic exercise and weight training (Studies 1 and 2).
We argue that this bias stems largely from *forecasting myopia*, whereby people place disproportionate
weight on the beginning of a workout, which is typically unpleasant. We demonstrate that forecasting
myopia can be harnessed (Study 3) or overcome (Study 4), thereby increasing expected enjoyment of
exercise. Finally, Study 4 provides evidence for a mediational model, in which improving people's
expected enjoyment of exercise leads to increased intention to exercise. ***Conclusion:*** People underesti-
mate how much they enjoy exercise because of a myopic focus on the unpleasant beginning of exercise,
but this tendency can be harnessed or overcome, potentially increasing intention to exercise.

Keywords: affective attitudes, affective forecasting, enjoyment, exercise, start points

In the past decade, obesity has been recognized as one of the
chief threats to the health and well-being of North Americans. The
majority of adults in the United States and Canada are obese or
overweight (Tjepkema, 2006; U.S. Department of Health and
Human Services, 2001), and excess weight is expected to overtake
smoking as the leading cause of death in the United States (Mok-
dad, Marks, Stroup, & Gerberding, 2004). According to the U.S.
Surgeon General (U.S. Department of Health and Human Services,
2001), the cost of obesity has topped $100 billion annually, and
sedentary lifestyles are partly to blame—indeed, less than one-
third of adults engage in the amount of physical activity recom-
mended for maintaining health. During their leisure time, many
people choose not to engage in any physical activity at all (Centers
for Disease Control and Prevention, 2005). People choose not to
exercise for a number of reasons, such as lack of time (Booth,
Bauman, Owen, & Gore, 1997), money (Reichert, Barros, &
Domingues, 2007), or energy (Salmon, Owen, Crawford, Bauman,
& Sallis, 2003). We propose that another reason why people may
not engage in exercise is that they fail to fully appreciate how
much they will enjoy it.

Indeed, a burgeoning body of research suggests that people
frequently make incorrect predictions (or *affective forecasts*) about
what will make them happy. People incorrectly predict that spend-
ing money on themselves will make them happier than spending it
on others (Dunn, Aknin, & Norton, 2008), and that living in a
warm and sunny climate will make them happier (Schkade &
Kahneman, 1998). Likewise, they overestimate the negative im-
pact of such events as failing to achieve tenure (Gilbert, Pinel,
Wilson, Blumberg, & Wheatley, 1998) and receiving unwanted
pregnancy test results (Mellers & McGraw, 2001). Furthermore,
evidence suggests that people may often fail to learn from their
past experiences when making affective forecasts (Wilson, Mey-
ers, & Gilbert, 2001).

Compounding these general shortcomings of affective forecasts,
the effortful nature of exercise may exacerbate forecasting errors.
Although no research has examined people's affective forecasting
errors regarding exercise, there is new evidence that people may
underestimate the affective benefits of social interactions that
require effort, such as actively engaging in positive self-
presentation with one's romantic partner or an opposite sex
stranger (Dunn, Biesanz, Human, & Finn, 2007). Thus, just as
people may fail to appreciate the affective benefits of activities that
require social effort, so too may they fail to fully appreciate the
affective benefits of activities requiring physical effort. Why might
effortful activities seem unappealing in prospect? We suggest that
effortful activities might seem particularly unappealing because
their beginnings are often genuinely unpleasant. To the extent that
initiating an activity is difficult or unpleasant—such as breaking
the ice at a party where one does not know any other guests,
beginning to write a paper, or jogging the first mile—people may
underestimate their enjoyment of the activity as a whole because
their affective forecasts for the activity are anchored by these
unpleasant beginnings.

When people evaluate an experience prospectively or retrospec-
tively, they must weight various aspects of the experience in order
to arrive at an overall evaluation. In making such summary eval-
uations, however, people do not weight all aspects of an experi-
ence equally (Kahneman, Fredrickson, Schreiber, & Redelmeier,
1993; Redelmeier & Kahneman, 1996). In particular, when people

look back on a broad range of events, from social interactions to painful medical procedures, their retrospective evaluations are disproportionately influenced by the *endings* of these episodes. Increasing the positivity of the ending therefore leads people to evaluate the episode as a whole more positively. For example, individuals' retrospective ratings of a cold pressor task were more positive when a slightly warmer, less painful segment was included at the end of the procedure, even though this additional segment increased the total pain experienced (Kahneman et al., 1993). Conversely, then, just as endings disproportionately influence retrospective evaluations, we propose that beginnings disproportionately influence prospective evaluations. If this is the case, then making the beginning of an activity more enjoyable should significantly increase people's expected enjoyment of the activity as a whole. For activities such as exercise that typically feel unpleasant at the beginning, spreading people's attention throughout all phases of the activity—from the relatively uncomfortable beginning to the other, more enjoyable phases—should provide a practical way to increase expected enjoyment.

If people expect to enjoy exercising, they may be more likely to do so; according to Azjen and Fishbein's Theory of Planned Behavior (TPB; 1980, 2005), attitudes—along with subjective social norms and perceived behavioral control—predict intent to engage in behaviors such as exercise. These behavioral intentions, in turn, strongly predict the likelihood of engaging in the behavior. Meta-analyses have confirmed that the TPB is highly effective in predicting intention to exercise, with affective attitudes emerging as a particularly important predictor of intentions (Godin & Kok, 1996; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). Across 23 studies examining the predictive power of the TPB, Hausenblas et al. (1997) found the weighted average correlation between attitudes and intentions to be .52, almost double the correlation between subjective norms and intentions ($r = .27$). Furthermore, Dunton and Vaughan (2008) showed that anticipated positive emotions about successfully engaging in physical activity predicted exercise adoption and maintenance after three months. As well as predicting exercise intentions, affective attitudes may moderate the link between intentions and exercise behavior. Kwan and Bryan (2010) found that participants who reported a more positive affective response to exercise exhibited a stronger relationship between their exercise intentions and behavior. Additionally, a growing body of research by Rhodes and colleagues also illustrates the dramatic role that affective attitudes play in predicting both exercise intentions and exercise behavior, across a broad range of exercise modalities (Rhodes, Blanchard, Courneya, & Plotnikoff, 2009; Rhodes & Courneya, 2003; Rhodes, Courneya, & Jones, 2003).

Using the framework of the TPB, we have chosen to focus our investigation on expected enjoyment, which both nests within the affective attitudes component of the Theory of Planned Behavior (Azjen & Fishbein, 1980) and constitutes the critical affective component in prominent theories of intrinsic motivation (e.g., Ryan & Deci, 2000). Recent work by French et al. (2005) demonstrated that anticipated enjoyment of exercise was a key factor in predicting intention to exercise, explaining an additional 11% of variance in participants' intention to increase physical activity, above and beyond the 48% of variance explained by instrumental attitudes, subjective norms, and perceived behavioral control. Thus, by examining whether and why people underestimate their

enjoyment of exercise, our research builds directly upon important work on affective forecasting, as well as research on exercise motivation and behavior.

In the present research, we provide support for two novel hypotheses. In Studies 1 and 2, we demonstrate that even for short, discrete exercise episodes, such as completing a workout routine, people systematically underestimate their enjoyment of exercise, and we show that this bias is robust across a wide variety of exercise (e.g., Pilates, weight training). Furthermore, in Studies 3 and 4, we provide evidence that people's forecasts regarding their overall enjoyment of exercise are dragged down by a myopic focus on the affective components associated with the very beginning of the experience. As such, people's expected enjoyment can be enhanced by a) increasing the positivity of the very beginning of an exercise routine (Study 3) or b) spreading people's attention across the entirety of the experience (Study 4). Finally, in Study 4, we show that enhancing expected enjoyment leads, in turn, to greater intention to engage in future exercise behavior. Across studies, we examine members of the general population (rather than professional athletes), thereby broadening the relevance of our findings.

Study 1

Method

One week before running the study, we obtained informed consent from 40 members of a private gym ($M_{age} = 23$, $SD_{age} = 6.44$, 78% women[1]) across seven, hour-long group fitness classes (four cardiovascular and three yoga/Pilates) to participate in a study of attitudes toward exercise behavior. In this way, we ensured that all participants were familiar with their respective classes, having completed them in the past week. The following week, 5 min before each class began, we randomly assigned 21 participants to forecast how much they would enjoy the upcoming workout on a scale from 1 (*not at all*) to 10 (*very much*). Immediately after class, they rated their actual enjoyment on the same scale. Following Loewenstein and Schkade's (1999) recommendation, we randomly assigned the other 19 participants to be pure "experiencers," who only rated enjoyment immediately after the class; this hybrid design enabled us to use powerful within-subjects analyses, while secondarily allowing us to check whether similar results occurred between-subjects. The instructors of the group exercise classes were blind to the experimental hypothesis, and participants were compensated for their time with an entry into a cash drawing. In this study, and all of the subsequent studies in this article, participants received informed-consent forms, with all procedures approved by the University of British Columbia (UBC) research ethics board, and participants were randomly assigned to experimental conditions via standard randomization procedures (i.e., preshuffled experimental packets).

Results and Discussion

To examine the difference between participants' forecasted and experienced enjoyment, we performed a 2 (time: forecast, experi-

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[1] Gender did not moderate our critical effects in this study or the subsequent studies and thus is not discussed further.

ence) $\times$ 2 (class type: cardio, yoga/Pilates) mixed model analysis of variance (ANOVA) on enjoyment with repeated measures on the first factor. We found a significant effect of time, $F(1, 17) = 10.35$, $p = .005$, $d = .63$, such that participants reported greater enjoyment after completing the workout ($M = 8.42$, $SD = 1.26$) than they had predicted ($M = 7.58$, $SD = 1.43$). Neither the effect of class type, $F(1, 17) = 1.94$, $p = .181$, nor the interaction between time and class type, $F(1, 17) = .21$, $p = .652$, was significant. Likewise, to account for possible anchoring biases, in which participants' enjoyment predictions might color their reported enjoyment, we examined the difference between forecasters' predicted enjoyment, and pure experiencers' reported enjoyment. Consistent with the within-subject analyses, pure experiencers reported enjoying the class significantly more ($M = 8.62$, $SD = 1.16$) than the forecasters had predicted, $F(1, 36) = 5.09$, $p = .030$, $d = .80$. Neither the effect of class type, $F(1, 36) = .01$, $p = .945$ nor the interaction between time and class type, $F(1, 36) = 2.35$, $p = .134$, was significant. There was no missing data for any of the variables included in these analyses.

Thus, Study 1 provides initial evidence that people may systematically underestimate how much they enjoy exercising. Although participants were regular gym members with experience attending their respective exercise classes, it is possible that the particular workouts completed during the study were not what they were accustomed to doing, given that the workouts were designed by the instructors rather than participants. We would have stronger support for our findings if participants designed their workouts themselves, and therefore knew exactly what exercises they would complete. Thus, we sought to replicate our findings in a second study, where participants would forecast and report enjoyment for individual workouts that they designed themselves. According to Ekkekakis' (2003) dual-model theory of response to exercise, people generally find exercise more pleasurable when it is done below the ventilatory threshold (i.e., at moderate to vigorous intensity). Although we recruited participants from a range of classes, we did not explicitly control workout intensity in Study 1. Therefore, in Study 2, we also manipulated workout intensity, to investigate whether people underestimate their enjoyment of both moderate and challenging exercise.

Study 2

Method

Thirty-two ($M_{age} = 21$, $SD_{age} = 5.63$, 41% women) members of a campus gym at the UBC participated in this study in exchange for their choice of bottled water or a sports drink. We asked participants to write descriptions of both a 1-hr moderate and 1-hr challenging workout that they would be willing to complete. Every participant was then randomly assigned to complete either the moderate ($N = 17$) or the challenging ($N = 15$) self-designed workout. Immediately before exercising, each participant rated expected enjoyment of this workout on a scale from 1 (*not at all*) to 10 (*very much*), and immediately after the workout, rated actual enjoyment on the same scale.

Results and Discussion

To examine the difference between participants' forecasted and experienced enjoyment, we performed a 2 (time: forecast, enjoy-

ment) $\times$ 2 (intensity: moderate, challenging) mixed measures ANOVA on enjoyment with repeated measures on the first factor. As in Study 1, we found a significant effect of time, such that participants enjoyed their workout significantly more ($M = 7.69$, $SD = 1.33$) than they had forecasted ($M = 6.94$, $SD = 1.48$), $F(1, 30) = 9.28$, $p = .005$, $d = .53$. Neither the effect of intensity, $F(1, 30) = 0.66$, $p = .422$), nor the interaction between time and intensity, $F(1, 30) = 0.88$, $p = .356$, was significant. There was no missing data for any of the variables included in these analyses.

Study 2 provides further evidence that people systematically underestimate their enjoyment of exercise, even if they themselves design the workout. Taken together, Studies 1 and 2 yielded results that were consistent across university and private gyms, group and individual exercise, and moderate and challenging workouts spanning a wide range of forms, from yoga and Pilates to aerobic exercise and weight training.

According to our hypotheses, people may underestimate their enjoyment of exercise to the extent that (a) the beginning of a workout is negative, and (b) the beginning of the workout drives the forecast. If our hypotheses are correct, then it should follow that affective forecasts can be made more positive by having people move the most enjoyable component of their workout to the very beginning. That is, it should be possible to capitalize on the tendency to focus excessively on the beginning of the event to increase expected enjoyment. Furthermore, we expected the effect of this manipulation to hold even when controlling for past exercise behavior. To investigate this, we conducted a third study, in which people about to engage in workouts of their own design were asked to forecast enjoyment after being assigned to move their favorite or least favorite exercise to the start of their workout.

Study 3

Method

Participants were recruited at the entrance of the UBC gym in exchange for a sports drink. Fifty-three gym members ($M_{age} = 23$, $SD_{age} = 4.92$, 34% women) on their way to work out completed all the study measures. Participants were asked to list all of the exercises they were planning to complete in the main body of their impending workout (excluding warm-up and cool-down), and then to indicate their single favorite and least favorite of the listed exercises. All participants listed at least 3 different exercises that they were planning to do that day.[2] Participants were randomly assigned to consider rearranging their workout to do their favorite exercise first and least favorite exercise last ($N = 27$), or to consider rearranging their workout in the opposite fashion (least favorite exercise first, favorite exercise last; $N = 26$). Participants were then asked to forecast their expected enjoyment of the rearranged workout on a scale of 0 (*not at all*) to 10 (*very much*). Finally, participants indicated how many times per week, and for how many minutes per session, they had already been engaging in exercise, allowing us to control for previous exercise behavior.

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[2] Fifteen additional members who either did not list at least 3 exercises, or failed to identify their favorite and least favorite exercises from within their planned workout, and thus did not rearrange their workouts in accordance to the manipulation, were not included in the analyses.

Results and Discussion

To test the effects of forecasting condition on overall enjoyment, we performed a univariate ANOVA. Participants in the best part first condition forecasted significantly higher enjoyment ($M = 7.98$, $SD = 1.38$) than did participants in the best part last condition ($M = 7.04$, $SD = 1.71$), $F(1, 51) = 4.92$, $p = .031$, $d = .61$. Furthermore, this effect of condition on forecasted enjoyment held even after controlling for past exercise behavior, $F(1, 45) = 5.24$, $p = .027$, $d = .67$.

In this study, participants reported greater expected enjoyment of their self-designed workout routines when they considered beginning their routine with their favorite exercise and ending with their least favorite exercise. It is important to note that the actual content of the workout did not change, but a simple alteration of its sequence caused participants to predict greater enjoyment, even when controlling for the effects of past exercise behavior. Thus, this study provides support for our proposal that, when making an affective forecast for exercise, the beginning of the experience carries disproportionate weight.

Although the data supported our hypotheses, there are potential drawbacks in having people move their favorite exercise to the beginning of their workout. That is, one's favorite exercise could demand multiple muscle groups and, if performed too early, could interfere with the ability to perform subsequent exercises. In addition, the beginning of an exercise routine may be inherently unpleasant because the onset of exercise involves activating muscle groups and increasing respiration. Thus, we sought to develop a more practical, theory-based intervention that could increase participants' expected enjoyment of exercise, and thereby increase their intention to exercise.

Furthermore, although broad, one-item measures are standard in much affective forecasting research (Wilson & Gilbert, 2003), we wished to demonstrate the same pattern of results with a multi-item measure of enjoyment, to address potential reliability concerns.

Thus, we conducted a final study with five primary goals. First, to confirm our assumption that people typically view the initial phase of exercise as particularly aversive, we sought to show that people expect to enjoy the warm-up phase of exercise significantly less than the remainder of the workout. Second and most importantly, we hypothesized that by asking participants to consider how much they would enjoy each phase of an exercise routine, from beginning to end, their attention would be spread to the more enjoyable phases, leading them to forecast greater overall enjoyment for the routine; past research on affective forecasting has shown that spreading people's attention to aspects of an experience that they typically overlook can reduce forecasting biases (e.g., Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000). Third, we had one wave of participants forecast enjoyment on our previously utilized single-item measure, and another wave of participants forecast enjoyment on a multi-item measure adapted from the Physical Activity Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991) allowing us to compare these measures. Fourth, we examined whether increasing participants' expected enjoyment would mediate their intention to engage in exercise, using a validated measure of exercise intentions that has been shown to predict actual exercise behavior (Blue, Wilbur, & Marston-Scott, 2001). Finally, because past exercise behavior has been shown to attenuate the impact of attitudes on exercise intentions (Bagozzi, 1981),

we sought to demonstrate that our meditational model would hold when controlling for frequency and duration of past exercise behavior. Moving beyond studying gym members exclusively, we sampled from a general university population.

Study 4

Method

One hundred fifty-four people ($M_{age} = 24$, $SD_{age} = 6.22$, 44% women) from the University of British Columbia campus volunteered to participate in this study and completed all the study measures.[3] All participants read descriptions of a "race day" spin class on a stationary exercise bike, with three phases: warm-up, main workout, and cool-down. The warm-up and cool-down phases were identical, consisting of 10 min of pedaling at a light resistance, as one would on a flat road. The main workout simulated riding over a series of increasingly steeper hills (see Appendix).

Participants were randomly assigned to one of two conditions. In the control condition ($N = 79$), participants read the routine in one fluid block of text, and simply forecasted their expected enjoyment for the overall routine. In the attention spreading condition ($N = 75$), participants were asked to reflect on and forecast expected enjoyment for each phase of the workout (warm-up, main workout, and cool-down), and then forecast expected enjoyment for the overall routine. We collected these data in two waves. In the first wave of data collection ($N = 62$), participants made all enjoyment forecasts on the broad, single-item measure used in Studies 1–3. In the second wave of data collection, ($N = 92$) a different sample of participants forecasted enjoyment on a three-item measure ($\alpha = .93$) adapted from the PACES (Kendzierski & DeCarlo, 1991; see Appendix). All ratings were made on a scale from 0 (*not at all*) to 10 (*very much*). We standardized and averaged the three items to form a composite measure of enjoyment. Likewise, we standardized the single-item enjoyment measure, allowing us to examine whether our attention-spreading manipulation produced consistent effects across the two waves on the same standardized metric.

After making affective forecasts, participants reported their intent to engage in exercise on a two item measure ($\alpha = .94$), which Blue et al. (2001) found significantly predicted future exercise behavior: "To what extent do you *intend* to exercise for at least 20 minutes, at least 3 times a week, for the next month" and "To what extent are you *likely* to exercise for at least 20 minutes, at least 3 times a week, for the next month," on scales of 0 (*definitely not/not at all likely*) to 7 (*definitely will/very likely*). Finally, participants indicated how many times per week, and for how many minutes per session, they had already been engaging in exercise, allowing us to control for previous exercise behavior.

Results and Discussion

To test the hypothesis that participants would predict relatively low levels of enjoyment for the beginning of a workout, we

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[3] Seven additional participants who did not complete all measures, and one outlier who gave ratings of 0 to all enjoyment measures, were not included in the analyses.

performed a repeated measures ANOVA on the forecasts of participants in the attention-spreading condition, comparing their expected enjoyment for the warm-up, main workout, and cool-down phases. Although the warm-up and cool-down phases were identical, there was a significant effect of time, $F(2, 72) = 11.79$, $p < .001$, such that expected enjoyment for the warm-up ($M = 5.58$, $SD = 2.09$) was lower than expected enjoyment for the main workout ($M = 6.06$, $SD = 2.17$) and cool-down ($M = 7.10$, $SD = 2.03$). A follow up paired samples t test indicated that expected enjoyment was significantly lower for the warm-up ($M = 5.58$, $SD = 2.09$) than for the remainder of the workout ($M = 6.58$, $SD = 1.63$), $t(1, 73) = 4.16$, $p < .001$, $d = .54$.

Next, we tested our central hypothesis that spreading attention to all phases of the workout would enhance participants' expected enjoyment of the overall routine. To examine whether our attention spreading manipulation produced consistent effects on both our single and multi-item measures, we submitted participants' expected enjoyment for the overall routine to a 2 (Condition: Control, Attention Spreading) × 2 (Wave: Single-Item Enjoyment, Multi-Item Enjoyment) ANOVA. This ANOVA revealed only the hypothesized main effect of condition; participants in the attention-spreading condition expected to enjoy the overall workout routine ($M = .31$, $SD = .76$) significantly more than did participants in the control condition ($M = -.13$, $SD = .96$), $F(1, 147) = 9.61$, $p = .002$, $d = .51$. Neither the main effect of wave, $F(1, 147) = 0.06$, $p = .813$, nor the interaction of condition and wave were significant, $F(1, 147) = 0.10$, $p = .756$, indicating that consistent effects emerged regardless of whether we used a single-item or multi-item measure of forecasted enjoyment. Furthermore, when we added past exercise behavior as an additional control variable, the effect of condition on forecasted enjoyment remained significant, $F(1, 146) = 9.31$, $p = .003$, $d = .50$.

Turning to exercise intentions, we found that participants in the attention-spreading condition reported significantly greater intention to engage in exercise ($M = 5.91$, $SD = 1.39$) than did participants in the control condition ($M = 5.36$, $SD = 1.64$), $F(1, 147) = 5.17$, $p = .024$, $d = .36$. Neither the main effect of wave, $F(1, 147) = 0.79$, $p = .374$, nor the interaction of condition and wave, $F(1, 147) = 0.55$, $p = .458$, were significant. Furthermore, the effect of condition on exercise intention held upon controlling for past exercise behavior, $F(1, 146) = 5.54$, $p = .022$, $d = .33$.

To examine whether forecasted enjoyment mediated the effects of condition on exercise intent (Figure 1), we ran bootstrapping analyses with 5,000 resamples (Preacher & Hayes, 2004, 2008) to calculate the confidence intervals of indirect effects. Traditional tests of mediation (e.g., Sobel's test) assume a large sample size and a normal distribution of total and indirect effects, whereas bootstrapping makes no such assumptions. Interpretation of the bootstrap data is done by determining whether zero is contained within the 95% confidence intervals (CIs; which would indicate lack of significance). Condition (*attention spreading* = 1, *control* = 0) significantly predicted exercise intention (path c: $\beta = 0.17$, $p = .023$), and forecasted enjoyment (path a: $\beta = 0.20$, $p = .005$; Figure 1). In turn, forecasted enjoyment significantly predicted exercise intention (path b: $\beta = 0.40$, $p < .001$). The effect of condition on exercise intention was sharply reduced and became statistically nonsignificant when controlling for the effects of forecasted enjoyment (path c': $\beta = 0.10$, $p = .193$). Bootstrapping analyses confirmed that the indirect effect of condition on exercise intention was significant (path ab: $\beta = .08$, 95% CI = [02, .15]). When we controlled for past exercise behavior, the model remained significant (path a: $\beta = 0.19$, $p = .007$, path b: $\beta = 0.31$, $p < .001$; path c: $\beta = 0.15$, $p = .021$; path c': $\beta = 0.09$, $p = .148$; path ab: $\beta = .06$, 95% CI = [01, .12]). Thus, the data support our hypothesis that by spreading attention to all phases of a workout, anticipated enjoyment increases, which in turn predicts an increased intention to exercise, even after controlling for past exercise behavior.

Study 4 provides evidence that for many people, the earlier stages of working out are perceived as less enjoyable than the later stages; notably, this effect emerged even though the warm-up and cool-down phases were identical in content. Furthermore, Study 4 supports the idea that people's affective forecasts for exercise can be made more positive—and their intentions to engage in exercise can be strengthened—simply by spreading people's attention away from the relatively aversive beginning of an exercise routine to the experience as a whole.

General Discussion

The studies reported here provide evidence for a novel form of forecasting bias that holds important implications for health. In Studies 1 and 2, participants enjoyed exercising more than they themselves predicted, demonstrating for the first time that people may systematically underestimate their enjoyment of exercise. This forecasting bias emerged across diverse forms of exercise, from aerobics and weight training to Pilates and yoga. Study 3 provided evidence that people place disproportionate weight on the beginning of an experience when making affective forecasts, such that people expect to enjoy their entire workout more if the most enjoyable component of the routine is moved to the beginning. Study 4 showed that people typically expect the beginning of a workout to be less enjoyable than the rest of the workout—even when the beginning and end of the workout are identical. As a result, prompting participants to consider all phases of the workout, thereby combating their myopic focus on this initial unpleasantness, increased expected enjoyment of the exercise routine as a whole. Furthermore, this simple manipulation influenced participants' intention to engage in exercise, an effect that was mediated by changes in expected enjoyment.

Taken together, the present studies suggest that people are *myopic forecasters*, tending to focus largely on the very beginning when imagining how much they will enjoy an entire event. This
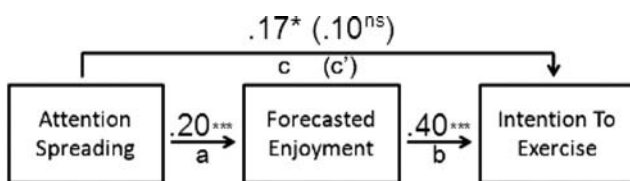

Figure 1. Proposed mediational model between attention spreading, forecasted enjoyment, and intent to exercise.

effect is distinct from the impact bias (Gilbert et al., 1998), whereby people overestimate the duration or intensity of future emotional responses. For example, people tend to overestimate the initial intensity of their reaction to romantic dissolution, leading to overly negative forecasts for several months following the breakup (Eastwick, Finkel, Krishnamurti, & Loewenstein, 2008). We have identified a related, but distinct bias, in which people's forecasts for short, discrete events are driven by the event's beginning. Of course, it is possible that mechanisms other than forecasting myopia may also contribute to the tendency for people to underestimate their enjoyment of exercise. Past research on *hot-cold empathy gaps* has shown that people have trouble foreseeing the influence of "hot" states such as physical arousal when they are in a "cold" state (e.g., Loewenstein, 2005). Because exercise creates arousal and triggers the release of endorphins, noradrenaline, serotonin, and dopamine (Meeusen & De Merleir, 1995; Thorén, Floras, Hoffmann, & Seals, 1990), hot/cold empathy gaps may contribute to affective forecasting errors regarding exercise. Whereas hot/cold empathy gaps are notoriously difficult to overcome, we have shown that forecasting myopia can be combated or even harnessed to increase expected enjoyment of exercise, suggesting that this mechanism represents the most promising avenue for positive change.

Consistent with this perspective, Azjen and Fishbein's (1980, 2005) Theory of Planned Behavior posits that attitudes toward a given behavior, along with subjective social norms and perceived behavioral control, shape behavioral intentions, which in turn guide behavior. Although altering perceived social norms and behavioral control may be relatively difficult, we have demonstrated that a simple intervention designed to overcome people's forecasting myopia can increase their expected enjoyment, and in turn, increase their intentions to exercise. From engaging in exercise to quitting smoking or cooking healthier meals, knowledge about forecasting myopia may allow for the creation of interventions to improve affective forecasts and strengthen intentions to engage in health-promoting activities that people may otherwise be reluctant to initiate.

As a first investigation of a previously unexplored phenomenon, the present research has several limitations, including our use of a single-item measure of forecasted enjoyment in three of our four studies. Affective forecasting studies commonly utilize broad single-item measures (e.g., Dunn, Wilson, & Gilbert, 2003; Wilson et al., 2000; Lam, Buehler, McFarland, Ross, & Cheung, 2005), which Wilson and Gilbert (2003) argue have adequate psychometric properties for comparing predicted and experienced feelings. In Study 4, we obtained the same critical effect of condition on forecasts regardless of whether we used a single or multi-item measure of forecasted enjoyment, consistent with past research comparing single and multi-item forecasting measures (Dunn & Ashton James, 2008). Important support for the validity of our expected enjoyment measure comes from Study 4, which showed that forecasted enjoyment significantly predicted behavioral intentions, as assessed by an intention measure that has been shown to predict actual exercise behavior (Blue et al., 2001); the correlation between forecasts and intentions was roughly equivalent regardless of whether we used a single-item measure of expected enjoyment ($r = .43$, $p < .001$) or a multi-item measure ($r = .38$, $p < .001$). Supporting the reliability of our enjoyment measure, we observed a con-

sistent and theoretically coherent pattern of effects across our four studies (which would be unlikely with an unreliable measure). It is, however, conceivable that something about our enjoyment scale might lead people to underestimate the enjoyment of any given activity. Therefore, we asked 30 UBC students to use the same scale to predict and report their enjoyment of eating a candy bar. Within-subject analyses showed that forecasted and actual enjoyment did not significantly differ, Mdiff $= .06$, $F(1, 29) = .03$, $p = .860$, $d = .04$, indicating that people are capable of making accurate predictions on our scale.

Another potential limitation is that our first three studies used relatively small sample sizes. Because our previous research has shown that people tend to make large, systematic affective forecasting errors (e.g., Dunn et al., 2007; Kawakami, Dunn, Karmali, & Dovidio, 2009), we expected moderate-to-large effect sizes. Given these expected effect sizes, and because consistent replication with small sample sizes provides a more conservative test than does one large sample (Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007), we chose to conduct a series of studies with samples ranging from 30 to 60 participants. As smaller sample sizes increase the chances of Type II errors, but does not affect the likelihood of Type I errors (Selke, Bayarri, & Berger, 2001), the fact that the same results emerge repeatedly speaks to the robustness of our effects. Still, it is reassuring that we also obtained effects consistent with our theoretical perspective with the larger sample size used in Study 4 ($N = 154$).

An additional limitation of the present studies is that we did not include an extensive battery of individual difference measures related to physical health and fitness. Given that random assignment was used in all studies, however, it is unlikely that individual differences could account for the consistent between-groups differences that emerged. A final limitation of our studies is that we did not specifically assess past exercise behavior in our first two studies, and across our studies, we largely sampled people who were active gym members, as evidenced by the fact that they were making use of gym facilities on the day of the study. Thus, future research should assess participants' past exercise behavior and investigate whether the forecasting myopia demonstrated here can help to explain why sedentary individuals eschew exercise.

Conclusion

The current work suggests that biased affective forecasts may be an impediment to engaging in exercise. In contrast to many other barriers to exercise, affective forecasts are readily amenable to change. Because expected enjoyment shapes intention to exercise (e.g., French et al., 2005), modifying affective forecasts may provide a pathway for changing exercise behavior. Thus, by documenting a systematic bias in expected enjoyment of exercise, and demonstrating that these affective forecasts can be easily altered, our findings provide the first step for the creation of simple interventions to increase people's desire to engage in the kinds of physical activity that are critical for maintaining health.

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Appendix

Selected Materials

Study 4: Spin Class Description

You start your time at the gym by going with the other class attendees to the cycling room and getting on a stationary exercise bike. You warm up your muscles by pedaling with light resistance for 10 minutes—imagine riding on a flat road.

The main workout begins with a climb. You will remain seated in your saddle the entire time as the resistance on your pedals increases to a moderate level and holds for 5 minutes in total to reach the top of a hill. Then, reduce the resistance and act like you are cycling downhill with less resistance but a higher leg speed. After this, you will reach a longer hill. The resistance will increase every minute, and by 5 minutes, it will be high enough that you will not be able to push them in a seated manner. You will feel the need to stand on the pedals, by doing a standing climb for the remaining 5 minutes. You then will head downhill again by reducing the resistance and increasing the pedal speed. Continue for 2 minutes. Now, as the race is almost complete, you will attempt to "pass other riders". This involves sprinting in short intervals. You will stand up and try to sprint as hard as you can for 1 minute and then sit down and recover (easy resistance and pedal speed) for 1 minute. This will continue 5 times. As the race finish approaches, you increase your pedaling stroke and sprint as fast as you can for one last minute, trying to pass as many people in the end in order to finish first.

After the main workout, you cool down your muscles by pedaling with light resistance for 10 minutes- imagine riding on a flat road.

Study 4: Multi-Item Enjoyment Measure

Overall, how much do you think you would enjoy the exercise routine?

Overall, how much do you think you would like the exercise routine?

Overall, how pleasurable do you think you would find the exercise routine?