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Gone Exercising: Mental Contrasting Promotes Physical Activity Among Overweight, Middle-Aged, Low-SES Fishermen

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Objective: Fantasy realization theory (Oettingen, 2012) proposes that fantasizing about a desired future or dwelling upon negative reality rarely changes behavior whereas mentally contrasting fantasy with reality can be an effective behavior change technique. This is because mental contrasting energizes people to overcome obstacles that stand in the way of their desired future. The present study tested whether mental contrasting promotes rates of physical activity among overweight, middle-aged, and low-SES men. ***Method:*** A randomized controlled trial was conducted with members of an angling club in the north of England (N = 467). At baseline, participants completed a postal questionnaire that measured cognitions about physical activity. The intervention was embedded in the questionnaire for relevant participants. Behavior was followed up via telephone at 1 month and 7 months postbaseline. The key outcome measure was a validated, self-report measure of physical activity (Godin, Jobin & Bouillon, 1986) taken at all three time-points. ***Results:*** Longitudinal, explanatory, and intention-to-treat analyses each indicated that mental contrasting was effective in enhancing rates of physical activity. Mental contrasting also aided the translation of beliefs about the value and worth of physical activity (instrumental attitudes) into action. ***Conclusion:*** Mental contrasting appears to be an effective self-regulatory intervention for promoting physical activity and warrants further tests in health psychology.

Keywords: mental contrasting, self-regulation, intervention, physical activity, exercise

Regular physical activity is known to reduce mortality and morbidity from many chronic diseases including coronary heart disease, diabetes, colon cancer, hip fractures, high blood pressure, and obesity (e.g., Fisher et al., 2011; Mokdad, Marks, Stroup & Gerberding, 2004; U.S. Department of Health and Human Services [USDHHS], 1996, 2002). Physical activity benefits not only individuals' health but also their well-being (U.S. Preventive Services Task Force, 1996), and reduces the financial burden on health care systems (USDHHS, 2002) and the wider economy (e.g., Opatz, 1994). However, approximately 25% of adults in both the U.S.A. and U.K. engage in no leisure-time physical activity (Centers for Disease Control & Prevention, 2010; NHS Information Centre, 2006). Rates of physical activity are lower for individuals who are older, have higher BMI scores, and have lower socioeconomic status (NHS Information Centre, 2006; USDHHS, 1996, 2002). Physical activity rates are especially low among overweight, middle-aged men of low SES (NHS Information Centre, 2006), and it is this group that constitutes the focus of the present research. We report findings from a randomized controlled trial that tested the impact of a promising self-regulation intervention—*mental contrasting* (Oettingen, 2000; Oettingen, Pak, & Schnetter, 2001; review by Oettingen, 2012)—in promoting physical activity among overweight, middle-aged, low-SES men.

Predictors of Physical Activity Specified by Health Behavior Theories

Several health behavior theories (HBTs) have been used to understand rates of physical activity including protection motivation theory (Rogers, 1983), social–cognitive theory (e.g., Bandura, 2001), and the theories of reasoned action and planned behavior (Ajzen, 1991; Ajzen & Fishbein, 1980). Meta-analyses of prospective correlational studies appear to offer support for the variables specified by these theories, with effect sizes in the medium-to-large range (sample-weighed r = .30−.50; e.g., Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). Findings indicate that people's evaluations of physical activity (attitude), their perceptions of social pressure to be active (subjective norm), and their confidence in their ability to become active (self-efficacy or perceived behavioral control) are each associated with setting physical activity goals (intentions), and that intentions and self-efficacy in turn are related to rates of physical activity.

Although correlational tests support the predictive validity of HBTs, efforts to increase physical activity levels by addressing the variables specified by the theories have proven less successful. For

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instance, a recent meta-analysis of physical activity interventions by Michie, Abraham, Whittington, McAteer, and Gupta (2009) included only studies that used (a) experimental or quasi-experimental designs, and (b) objective or validated self-report measures of physical activity. Michie et al. coded 26 behavior change techniques that were designed to change theoretically specified predictors of physical activity. Findings showed that techniques that targeted attitudes ("providing information about consequences"), subjective norm (e.g., "providing information about others' approval"), and self-efficacy (e.g., "prompting barrier identification," "setting graded tasks," "model/demonstrate the behavior," "providing feedback on performance") had negligible effects on physical activity. In fact, univariate analyses (Table S5 in the Supplementary Materials in Michie et al., 2009) indicated that none of the 26 behavior change techniques examined in the review significantly improved rates of physical activity. These findings suggest that (a) further research is needed to identify the best ways to address physical activity attitudes, norms, and self-efficacy in order to promote changes in physical activity (Rothman, Sheeran, & Wood, 2008), and (b) tests of new intervention strategies are warranted.

Fantasy Realization Theory and Mental Contrasting

Protection motivation theory, social–cognitive theory, and the theories of reasoned action and planned behavior each focus on *what* people should think in order to form healthful behavioral intentions. These theories are concerned with the content and valence of cognitions needed to promote the focal health behavior (e.g., positive attitudes, supportive norms, and strong self-efficacy feelings). Fantasy realization theory (Oettingen, 2000; Oettingen et al., 2001), on the other hand, focuses on *how* people think about their desired health behavior, and the type of self-regulatory thought that goes into setting one's goals.

Fantasy realization theory distinguishes three modes of self-regulatory thought: (a) fantasizing about a desired future, (b) dwelling upon a negative reality, and (c) mentally contrasting fantasy with reality. Fantasizing involves wishful thinking about desired outcomes (e.g., picturing the most positive aspects of attaining the desired future in one's mind's eye) whereas dwelling involves reflecting on the obstacles, barriers, and hindrances in one's current experience that stand in the way of attaining one's desired future. Both of these modes of thinking hamper goal pursuit—because the person is too wrapped up in thoughts about how wonderful the future will be or how terrible things are at present to effectively pursue the goal (e.g., Kappes & Oettingen, 2011, review by Oettingen, 2012). The third mode of self-regulatory thought, mental contrasting, involves juxtaposing one's fantasies about the future with obstacles from one's present reality that get in the way of realizing that future. Mental contrasting inductions ask participants to vividly imagine the best thing about attaining their desired future, then imagine the critical obstacle standing in their way, and then to repeat this exercise for the second best thing and a second critical obstacle. Engaging in mental contrasting is hypothesized to promote behavior change because people learn what features of reality (obstacles) impede the path to their desired future and feel impelled to overcome those obstacles in order to reach their goal (Oettingen et al., 2001).

Several studies indicate that mental contrasting promotes the realization of goals that are seen as feasible by participants (review by Oettingen, 2012). For instance, mental contrasting helped adolescents to improve their grades in math (Oettingen et al., 2001), schoolchildren to learn a second language (Oettingen, Hönig, & Gollwitzer, 2000), young adults to join a vocational program (Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005), and health care workers to provide better support to patients and their families (Oettingen, Stephens, Mayer, & Brinkmann, 2010). Mental contrasting also benefits the performance of health-related behaviors such as acting on the goal of reducing cigarette consumption (Oettingen, Mayer, & Thorpe, 2010) and, among college students, engaging in weight control behaviors (dieting, exercise; Johannessen, Oettingen, & Mayer, in press).

Progress has also been made toward understanding the mechanisms underlying mental contrasting effects. For instance, mental contrasting engenders high-quality goal commitment in terms of greater anticipated disappointment about not achieving one's goal and greater inclination to plan (Oettingen et al., 2001), and fosters adaptive responses to negative feedback on goal progress (Kappes, Oettingen, & Pak, in press). Mental contrasting also engenders two further processes that may be especially important for promoting behavior change: one pertains to changes in implicit cognition and the other to changes in motivation.

Regarding the changes in implicit cognition, when people engage in mental contrasting about a desired and feasible future, the future thereafter primes the obstacles to its realization. In other words, thoughts about the desired future activate thoughts about the present reality (obstacles) that stand in the way of goal attainment, and the impeding reality primes the means to overcome it. These processes were demonstrated in two series of studies using a sequential priming paradigm wherein subliminal presentation of future words produced faster responses to words related to the present reality, and words related to the present reality produced faster responses to words related to the instrumental means to overcome the reality (Kappes & Oettingen, 2011; Kappes, Singmann, & Oettingen, in press). This priming effect was not observed among two groups of control participants who either contrasted in reverse order (i.e., reality−future contrasting fails to make people perceive the reality as an obstacle to the desired future) or engaged in an irrelevant task. Importantly, the strength of the associations between the future and the reality as well as between the reality and the instrumental means mediated the relationship between expectations and (observer-rated) quality of performance for participants who had engaged in mental contrasting.

Regarding the changes in motivation, mental contrasting energizes people to overcome obstacles and strive for their desired future. This mechanism was tested in two studies that measured energization via physiological and self-report measures (Oettingen, Mayer, Sevincer, Pak, & Hagenah, 2009). Participants either merely fantasized about a desired and feasible future or they engaged in mental contrasting. Changes in cardiovascular response (systolic blood pressure) were assessed over the course of the mental contrasting or fantasizing exercise (Study 1) and subjective feelings of energization were reported in the wake of the exercises (Study 2). Findings showed that energization mediated mental contrasting effects on both goal commitment and (other-rated) quality of performance. In sum, mental contrasting should promote behavior change because wishful thinking about one's desired future

is no longer disconnected from reality—the person is sure to bring to mind the obstacles that stand in the way of goal realization whenever they think about the goal. Moreover, mental contrasting mobilizes energy, which means that the person is in a good position to tackle these obstacles and strive tenaciously for the goal.

The Present Research

The foregoing discussion suggests that (a) overweight, middle-aged, low-SES men constitute an important target for physical activity interventions, (b) the behavior change techniques used to date generally have not been successful in changing rates of physical activity (Michie et al., 2009) and tests of new approaches are warranted, and (c) mental contrasting is a self-regulation intervention that holds considerable promise for promoting physical activity but still awaits a formal test. The present study is a randomized controlled trial designed to assess the efficacy of mental contrasting in promoting physical activity among overweight, middle-aged, and low-SES men. The prediction tested is that physical activity rates will be higher at 1-month and 7-month follow-ups for participants who engage in mental contrasting compared to control participants. We also tested the idea that mental contrasting enables people to better translate their beliefs about the importance and worth of physical activity (instrumental attitudes) into action. Thus, we predicted that instrumental attitudes would be more strongly related to subsequent physical activity among mental contrasting, as compared to control, participants.

Method

Participants

Participants comprised the entire membership of an angling club based in a city in the north of England (N = 467). The sample was male and had mean age of 53.88 years (*SD* = 12.42). Participants were predominantly working class and were holding, or had held, unskilled (23%) or semiskilled jobs (49%) according to the U.K. Registrar General's Classification of Occupations. Sixty-nine percent of participants were currently employed; the remainder were retired (29.80%) or unemployed (1.00%). The sample was generally overweight with a mean BMI of 27.80 (*SD* = 3.72).

Design

Participants were randomly assigned to conditions (mental contrasting vs. control) using a random number generator. Participants were not aware that they were taking part in an experimental study, and the researcher was not aware of participants' condition during data collection. The ethics of the research were approved by the designated committee of the University of Sheffield.

Procedure

Participants completed questionnaires at three time-points. The baseline questionnaire was mailed to participants in the same envelope as the club newsletter. Participants were invited to take part in a survey concerning physical activity in exchange for entry to a lottery with two free annual memberships of the angling club. One month after receipt of the baseline questionnaires, participants were telephoned and asked to report their physical activity. Six months later (7 months postbaseline), participants were again telephoned to obtain a measure of their physical activity. At both follow-ups, participants were telephoned up to four times in order to obtain responses (i.e., we made repeated efforts to contact participants and recorded data as missing only when a participant had not responded after four phone calls).

Figure 1 shows the flow of participants through the phases of the trial. One hundred and four participants returned the baseline questionnaire (response rate = 22.27%). At the 1-month follow-up, 358 out of the original 467 participants assigned to conditions reported their physical activity (response rate = 76.66%), and 293 participants reported their behavior at the 7-month follow-up (response rate = 62.74%).

Baseline questionnaire. The baseline questionnaire began with background questions (age, occupation, BMI) followed by questions about physical activity, the mental contrasting induction (for relevant participants), and, finally, measures of theory of planned behavior variables with respect to "increasing my amount of physical activity in the next month."

Physical activity was measured via the scale developed by Godin, Jobin, and Bouillon (1986). Participants were first told that physical activity involved "any activity that you do during your leisure that causes your heart to beat faster," and then responded to the question "How often did you take part in any physical activity for at least 20 minutes at a time—during your leisure time—in the last month" (7-point scale; 1 = *never* to 7 = *4 or more times per week*). We used this scale because the angling club agreed to allow the research to go ahead if and only if participants were asked *one* question during the telephone follow-ups. Godin et al. (1986) showed that this single-item measure has good test–retest reliability (r = .64) and validity has been established against measures of maximum oxygen intake (VO2 max), body fat, and muscular endurance (Gionet & Godin, 1989; Godin et al., 1986).

To further check the validity of the measure, we included two items adapted from the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985) in the baseline questionnaire: "During a typical week, how often do you engage in any activity long enough to work up a sweat (heartbeats rapidly) in your leisure time?" (4-point scale; 1 = *never* to 4 = *often*) and "Last week, how many days during your leisure time were you active enough to work up a sweat (heartbeats rapidly)?" (8-point scale; 0 = *0 days* to 7 = *7 days*). The correlations between Godin et al.'s (1986) physical activity measure and these items were strong (rs = .78 and .69, respectively, $p < .001$), supporting the validity of the measure among the current sample.

Theory of planned behavior variables were assessed using multiple items so that internal reliability could be checked. All items were measured using 5-point response scales. *Intention* was measured with three items; "I intend to increase my amount of physical activity in the next month" (*definitely no*−*definitely yes*), "How likely is it that you will increase your amount of physical activity during the next month?" (*extremely unlikely*−*extremely likely*), and "I will definitely try to increase my amount of physical activity during the next month" (*strongly disagree*−*strongly agree*). Reliability was satisfactory (α = .88). *Perceived behavioral control* (PBC) was also measured by three items: "I feel confident that I will be able to increase my amount of physical activity in the next month" (*strongly disagree*−*strongly agree*), "How easy or diffi-

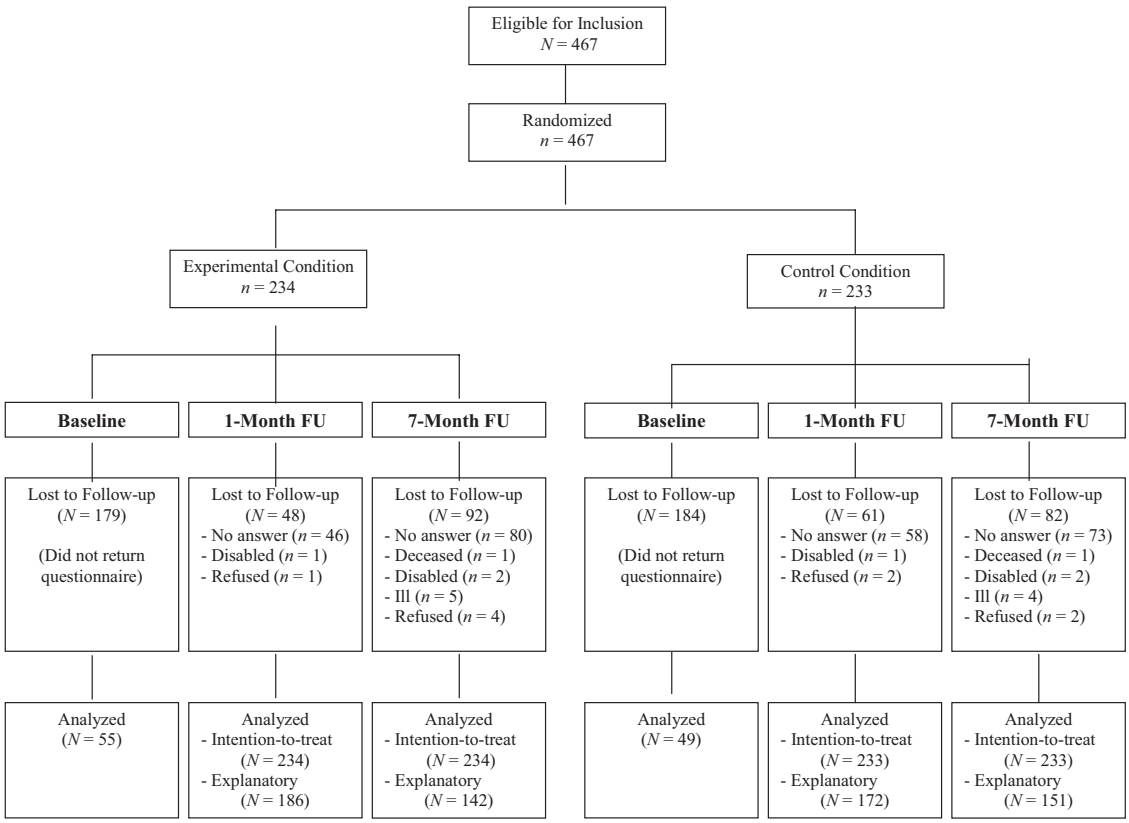

Figure 1. Flow of Participants through the Phases of the Present Trial. *Note.* FU = follow-up.

cult would it be to increase your amount of physical activity during the next month?" (*extremely difficult−extremely easy*), and "I am certain that I will be able to increase my amount of physical activity during the next month" (*strongly disagree−strongly agree*), and proved reliable ($\alpha = .80$). *Subjective norm* was measured using the single-item format recommended by Ajzen and Fishbein (1980), "People who are important to me think that I should increase my amount of physical activity during the next month" (*strongly disagree−strongly agree*). Finally, attitude was measured with 5 items: "Increasing my amount of physical activity during the next month would be worthwhile/important/enjoyable" (*strongly disagree−strongly agree*), and "Increasing your amount of physical activity during the next month would make you feel *displeased−pleased/dissatisfied−satisfied*". Principal components analysis with oblique rotation revealed two factors. Factor 1 had high loadings (values $> .80$) from the enjoyable, pleased, and satisfied items and was labeled *affective attitude* ($\alpha = .82$) whereas the worthwhile and important items loaded highly (values $> .85$) on the second factor, labeled *instrumental attitudes* ($r = .60$, $p < .001$). This distinction between thoughts versus feelings as component of attitudes is well established in the literature (e.g., Breckler & Wiggins, 1989; Trafimow & Sheeran, 1998).

The mental contrasting induction followed the procedure originally described by Oettingen, Pak, and Schnetter (2001). Participants first elaborated the most positive aspect of attaining their physical activity goal ("Please think about the *best* thing that would happen if you increased your amount of physical activity. Take time to picture this best thing in your mind. Write down what you are thinking below"). Typically, participants wrote about outcomes such as losing weight and feeling healthier. Next, participants identified the critical impediment to reaching their physical activity goal ("Please think about the *biggest obstacle* that stands in your way of increasing your amount of physical activity. Take time to picture what is standing in your way. Write down what you are thinking below"). Typical barriers to physical activity were finding the time to exercise and enlisting someone with whom to exercise. The mental contrasting exercise continued in the same manner with participants elaborating the "next best" outcome of goal achievement followed by identifying the "next biggest obstacle" that impeded their route. Participants in the control condition did not complete the mental contrasting exercise but proceeded directly to the theory of planned behavior items on the questionnaire.

Follow-up surveys. At the 1-month and 7-month follow-ups, Godin et al.'s (1986) measure of physical activity was read aloud to participants together with the specified response options. Participants chose the option that best described their physical activity, and were thanked for participating.

Results

Overview of Analyses

Data analyses proceeded in three stages. First, we examined participants' overall level of physical activity and checked whether (a) randomization of participants to conditions was successful, and

(b) whether participants assigned to the experimental condition undertook the mental contrasting exercise (i.e., a manipulation check). Second, the impact of mental contrasting on physical activity at 1 month and 7 months was assessed. Finally, we tested a potential mechanism by which mental contrasting promotes physical activity by investigating whether instrumental attitudes are better translated into behavior among mental contrasting as compared to control participants.

Rates of Physical Activity, Randomization Check, and Manipulation Check

At baseline, participants' mean score on Godin et al.'s (1986) physical activity scale was 4.25 (SD = 2.28) indicating that participants were active on average "about once a week." The modal number of days during the previous week that participants were "active long enough to work up a sweat" was zero (27.90%), and 53.80% of participants (n = 56) were active on zero days or one day. During a typical week, 70.10% of participants (n = 73) reported being "rarely" or "never" active long enough to work up a sweat. Thus, the present sample was relatively inactive.

Next, we compared mental contrasting versus control participants on background variables (age, BMI, SES), baseline physical activity (Godin et al.'s, 1986, scale), and theory of planned behavior variables (intention, PBC, subjective norm, affective and instrumental attitude). Univariate ANOVAs were used for this analysis because only 92 out of the 104 respondents (88.46%) to the baseline questionnaire provided information about their occupation (SES). (Missing data never exceeded four cases for the other variables.) There were no significant differences between the groups on age, BMI, SES, baseline physical activity, intention, or the attitude measures (all ps $> .11$). The groups differed significantly on subjective norm, $F(1, 100) = 4.26$, $p < .05$, $d = .41$, and there was a marginally significant difference on PBC scores, $F(1, 102) = 3.30$, $p < .08$, $d = .37$. Control participants reported greater social pressure to engage in physical activity (M = 3.44, SD = 1.30) and greater control over their physical activity (M = 3.15, SD = 1.08) compared to participants in the mental contrasting condition (Ms = 2.87 and 2.73, SDs = 1.45 and 1.09, respectively). Because these cognitive differences favor the control condition (and covarying these differences served only to increase the magnitude of differences between the conditions on physical activity), they do not unduly threaten the validity of analyzing the impact of mental contrasting on behavior.

Finally, we checked whether participants assigned to the experimental condition (n = 55) completed the mental contrasting exercise. All participants except one (1.8%) attempted the exercise, and 94.5% of participants (n = 51) mentally contrasted the most positive aspect of attaining their physical activity goal with the biggest obstacle standing in the way of their goal. Thus, the mental contrasting exercise had a high completion rate.

Impact of Mental Contrasting on Physical Activity at Follow-Ups

Three types of analysis were conducted to assess the impact of mental contrasting on physical activity at 1 month and 7 months (see Table 1). First, we examined data from the longitudinal sample, that is, participants who provided data at all three time-points (n = 84). At the 1-month follow-up, there was a marginally significant difference in physical activity that favored participants who had engaged in mental contrasting, $F(1, 82) = 3.77$, $p = .056$, $d = .43$. This difference became highly significant at the 7-month follow-up, $F(1, 82) = 15.50$, $p < .001$, $d = .87$. Compared to the rate observed among control participants, mental contrasting participants were physically active 38% more often during the previous month. Within-participant analyses of change in physical activity from baseline to the 7-month follow-up corroborated these findings. No significant change in physical activity was observed among control participants (M_{change} = .43), $F(1, 41) = 1.08$, ns, $d = .32$, whereas a significant, large increase in physical activity was observed among mental contrasting participants (M_{change} = 1.14), $F(1, 41) = 12.02$, $p < .001$, $d = 1.10$.

Second, we analyzed the data via explanatory analyses, that is, using the responses from all participants who provided follow-up data (n = 358 at 1 month, and n = 293 at 7 months). There were significant differences between the conditions at 1 month, $F(1, 356) = 3.92$, $p < .05$, $d = .21$, and at 7 months, $F(1, 291) = 7.54$, $p < .01$, $d = .32$. At both time-points, participants in the mental contrasting condition were more physically active compared to controls.

Finally, we conducted an intention-to-treat analysis, that is, we tested effects on behavior based on the original assignment of participants to conditions (n = 467). To this end, we imputed the mean baseline physical activity score for the entire sample (M = 4.25) whenever data were missing at follow-up. Even using this conservative analysis strategy, findings showed that mental contrasting engendered significant increases in physical activity at both the 1-month follow-up, $F(1, 465) = 3.84$, $p < .05$, $d = .18$, and the 7-month follow-up, $F(1, 100) = 3.30$, $p < .08$, $d = .24$. Thus, all three types of analyses indicate that mental contrasting engendered higher rates of physical activity compared to the control condition.

Moderation of the Relationship Between Instrumental Attitude and Physical Activity by Mental Contrasting

Next, we tested the hypothesis that mental contrasting participants would be able to better translate their instrumental attitudes into behavior compared to controls. Physical activity at 7 months was regressed on condition, instrumental attitude, and the condition by attitude interaction term. Condition was dummy coded

Table 1
Impact of Mental Contrasting on Physical Activity at 1-Month and 7-Month Follow-Ups

Condition	1 month		7 months	
	M (SD)	n	M (SD)	n
Longitudinal analysis				
Control	4.02 (2.38)	42	4.07 (2.13)	42
Mental contrast	4.91 (1.97)	42	5.64 (1.46)	42
Explanatory analyses				
Control	3.97 (2.20)	172	4.29 (2.14)	151
Mental contrast	4.41 (2.03)	186	4.94 (1.86)	142
Intention-to-treat analysis				
Control	4.05 (1.89)	233	4.28 (1.71)	233
Mental contrast	4.38 (1.82)	234	4.67 (1.49)	234

(0 = *control*, 1 = *mental contrast*) and instrumental attitude was mean-centered prior to computing the interaction to reduce potential multicollinearity (Aiken & West, 1991).

Findings showed that the three predictors explained 21% of the variance in physical activity ($R^2 = .21$), $F(2, 78) = 6.85$, $p < .001$. Mental contrasting had a significant beta ($\beta = .41$, $p < .001$), the interaction term approached significance ($\beta = .27$ $p < .08$), whereas the beta for instrumental attitude was not significant ($\beta = -.09$, *ns*). Given the modest sample size available for analysis ($n = 82$), and McClelland and Judd's (1993) recommendation that lower levels of statistical significance should be accepted when testing interactions in field research, decomposition of the interaction seemed justified. We, therefore, computed separate simple slopes for instrumental attitude for control and mental contrasting participants (see Figure 2). Instrumental attitude was not associated with behavior in the control condition ($B = -.17$, $SE = .35$, *ns*). In contrast, the slope was positive and significant for mental contrasting participants ($B = .53$, $SE = .21$, $p < .02$). As predicted, the more worthwhile and important that mental contrasting participants thought that it was to be active, the more physical activity they reported undertaking at the 7-month follow-up. There were no significant interactions between condition (mental contrasting vs. control) and other variables (theory of planned behavior variables or demographic characteristics).

Discussion

A randomized controlled trial tested whether mental contrasting promotes rates of physical activity. The trial included a relatively large sample (N = 467), involved a key target group—overweight, middle-aged, low-SES men—and examined rates of physical activity at both 1 month and 7 months postintervention. Findings from several analyses supported the utility of this self-regulation intervention in generating changes in physical activity. When participants who were retained throughout the entire period of the trial were examined, the results indicated that (a) rates of physical activity were greater among mental contrasting participants as compared to controls at both follow-ups, and (b) physical activity increased among mental contrasting participants from baseline to the 7-month follow-up whereas no such change was observed among control participants. Analyses of participants who provided responses at the 1-month and 7-month follow-ups (explanatory analyses) also indicated that physical activity rates were higher among mental contrasting participants at both time-points. Finally, intention-to-treat analyses pointed to the same conclusion. Even though the response rate to the baseline questionnaire was modest (22.27%), and the grand mean for baseline physical activity had to be imputed for 23.34% of cases at 1 month and 37.26% of cases at 7 months, significant between-groups differences in behavior were still observed at 1 month and 7 months. In sum, mental contrasting appeared to enhance rates of physical activity no matter how we analyzed the data.

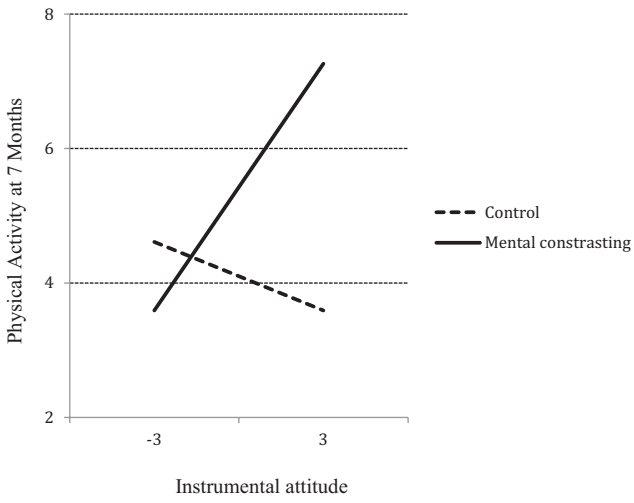

Figure 2. Simple Slopes for Instrumental Attitude by Condition.

We also obtained evidence that mental contrasting enabled participants to translate their beliefs about the importance and worth of physical activity (i.e., instrumental attitudes) into action. Whereas instrumental attitude was not associated with 7-month physical activity for control participants, a significant, positive relationship was obtained for participants who engaged in mental contrasting. Of interest, Lawton, Conner, and McEachan (2009) found that for most health behaviors—including physical activity—affective attitudes (feelings) are a much better predictor of behavior than instrumental attitudes (thoughts). Although personality factors and the type of behavior both influence the extent to which intentions and actions are guided by thoughts versus feelings (Trafimow et al., 2004), previous research does not indicate how individuals can control the extent to which their thoughts influence their behavior. Thus, improved guidance of behavior by instrumental attitudes would seem a valuable outcome of mental contrasting—undertaking this self-regulation intervention means that the more people think that a behavior is good for them, the more likely they are to perform it.

The present findings may be important in the light of Michie et al.'s (2009) meta-analysis of the impact of behavior change techniques on physical activity. Although the 26 techniques assessed in that review were derived from prominent health behavior theories, none of the individual techniques were found to improve rates of physical activity. In contrast, the present study indicates that a short (5–10 min) and easy-to-undertake exercise is helpful in this regard. Two reasons why mental contrasting proved effective in promoting physical activity may have to do with the engaging nature of mental contrasting interventions and the self-regulatory benefits that accrue from juxtaposing one's desired future with negative features of one's current reality.

Mental contrasting inductions are likely to be highly engaging because participants themselves specify the idiosyncratic content of their desired future and negative reality, that is, participants provide open-ended descriptions of the ideas and images that arise when they vividly imagine the most desirable outcomes of, and the greatest impediments to, acting. Unlike interventions based on traditional health behavior models, mental contrasting does not attempt to inculcate particular cognitive contents (e.g., positive attitudes, supportive norms, or strong self-efficacy feelings). Rather, mental contrasting interventions enable participants to juxtapose what they see as desirable with what stands in the way of obtaining those desirable outcomes. At issue is *how* people think about their health goal rather than *what* they think about (the content and valence of their goal-related thoughts). Neurological

evidence also supports the idea that mental contrasting is a cognitively engaging, problem solving process (Achtziger, Fehr, Oettingen, Gollwitzer, & Rockstroh, 2009). Continuous magnetoencephalographic (MEG) recordings showed that mental contrasting engendered greater activity in prefrontal, frontal, parietal, temporal, and occipital brain areas compared to either resting or indulging in positive fantasies about the future. These findings indicate that mental contrasting recruits both episodic and working memory, and entails the purposeful generation of mental images and the formation of strong intentions.

The second reason why mental contrasting was effective in promoting physical activity may be because this intervention confers important self-regulatory benefits—as mediation analyses have shown. Mental contrasting serves to tie thoughts about the desired and feasible future to thoughts about the obstacles to that future that characterize one's current reality (Kappes & Oettingen, 2011). When people merely indulge in their fantasies about the future or dwell upon the negative reality, they fail to appreciate how the desired future and the present obstacles *are related.* Similarly, they overlook how the present obstacles connect to the means to overcome these obstacles. Mental contrasting, on the other hand, enables people to see this relation—that obstacles stand in the way of their desires—and so galvanizes people to overcome those obstacles and make the desired future a reality. Moreover, as Oettingen et al. (2009) observed, engaging in mental contrasting increases both subjective feelings of vigor and cardiovascular indicators of energization, and thus promotes intensive efforts to reach one's goal. Traditional health behavior interventions may not confer these same self-regulatory advantages (strong future-reality associations, enhanced energy levels).

We were unable to measure whether the desired future primes obstacles to its realization or to assess energization in the wake of mental contrasting here, and this is an important limitation of the present research. Future research would do well to integrate laboratory tests of the mechanisms of mental contrasting with longitudinal field tests of the outcomes of mental contrasting. Another limitation of the current study was reliance on Godin et al.'s (1986) single-item measure of physical activity. Although evidence attests to the validity of this measure (Gionet & Godin, 1989; Godin et al., 1986), and the scale correlated highly with related physical activity indices among the present sample, only a subset of participants ($N = 104$) was available for the latter analysis. Clearly the use of a more comprehensive self-report measure or an objective indicator of physical activity (e.g., pedometer) would be desirable in future research. (Deployment of such measures was not feasible in the current study because access to the sample was granted on the condition that only a single question was asked during each of the 1-month and 7-month telephone follow-ups.) Finally, we acknowledge that the present study used a passive (no-intervention) comparison group, and that an active control condition would have afforded a sterner test of the impact of mental contrasting. However, a variety of comparison groups have been used in previous mental contrasting studies including indulging and dwelling (e.g., Oettingen et al., 2001; Oettingen et al., 2010), goal-irrelevant mental contrasting (i.e., elaborating positive and then negative past experiences), and reverse-contrasting (i.e., elaborating the negative reality followed by elaborating the desired future; review by Oettingen, 2012), and mental contrasting of desired and feasible futures always promoted greater goal commitment and goal attainment irrespective of the type of control condition. Nonetheless, further research is needed to ensure that a passive control condition did not influence findings in the present study.

The aforementioned limitations are important and qualify the results obtained here. At the same time, however, the findings underscore the promise of mental contrasting as a self-regulatory intervention for promoting the attainment of health goals. Mental contrasting appears to be effective even among a hard-to-reach sample such as the overweight, middle-aged, low-SES men studied here. The mental contrasting exercise used here was brief and apparently engaging for participants and so this intervention approach could prove valuable in time-limited contexts (e.g., while the person is waiting to see a medical practitioner) or among samples for whom a more didactic intervention strategy would be inappropriate (e.g., participants who score highly on measures of psychological reactance, see Brehm, 1966). Future studies may also want to combine mental contrasting with implementation intentions (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006) to see if even stronger effects emerge when participants first use mental contrasting to identify obstacles to their health goals and subsequently form if-then plans about how to deal with those obstacles (see, e.g., Adriaanse et al., 2010; Christiansen, Oettingen, Dahme, & Klinger, 2010; Stadler, Oettingen, & Gollwitzer, 2010).

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