Automaticity of Exercise Self-Regulatory Efficacy Beliefs in Adults With High and Low Experience in Exercise Self-Regulation

Jude Buckley and Linda D. Cameron
University of Auckland

Guided by social cognitive theory (SCT), we investigated whether exercise self-regulatory efficacy beliefs can be activated nonconsciously in individuals experienced and inexperienced in exercise self-regulation, and whether these beliefs are automatically associated with exercise self-regulation processes. The study used a 2 (Exercise Self-Regulation Experience Group) × 3 (Prime Condition) between-subjects design in which individuals experienced and inexperienced in exercise self-regulation were randomly assigned to receive subliminal, supraliminal, or no priming of exercise self-regulatory efficacy beliefs. Participants completed hypothetical diary entries, which were assessed for exercise self-regulatory efficacy and self-regulation expressions using content analyses with a SCT coding system and the Linguistic Inquiry and Word Count (LIWC) text analysis program. For both exercise self-regulation experience groups, self-efficacy priming led to more expressions of low exercise self-regulatory efficacy and dysfunctional exercise self-regulation strategies compared with the control prime. For participants experienced in exercise self-regulation, supraliminal priming (vs. control priming) led to more expressions of high exercise self-regulatory efficacy and functional exercise self-regulation strategies. For the experienced groups, priming led to automaticity of exercise expressions compared with the control condition. For inexperienced participants in the subliminal prime condition, priming led to automaticity of self-regulatory efficacy beliefs and work-related goals compared with the control condition. Automatic activation of exercise self-regulatory efficacy and exercise self-regulation processes suggests that self-regulation of exercise behavior can occur nonconsciously.

Keywords: automaticity, self-efficacy, self-regulation, exercise, experience

The exercise psychology literature documents a curious paradox: On the one hand, most individuals know that regular exercise confers profound health benefits (Penedo & Dahn, 2005) and many individuals report confidence in their ability to exercise (Abraham, 2008; Brawley & Poag-DuCharme, 1992). Yet a majority
of individuals remain inactive (Schlicht, Kanning, & Bos, 2006). Research (e.g., Sheeran, 2002; Sniehotta, Scholz, & Schwarzer, 2005) has shed light on some factors that partially account for this apparent discrepancy between exercise-related beliefs and behavior but, to date, the focus has been primarily on the role of exercise-related thoughts and beliefs that are processed nonautomatically—that is, they are consciously elicited in response to self-report measures. Research has established the importance of automatic thought processes in health behavior (Goldman, Reich, & Darkes, 2006; Sheeran et al., 2005). Moreover, automatic and nonautomatic measures have been found to tap related but distinct aspects of mental representations and explain unique variance in behavior (De Houwer, 2006). Identifying the automatic thought processes involved in the selection of goals and strategies that promote or interfere with exercise may provide an important means of better understanding key factors that promote or inhibit regular exercise.

**Self-Regulation, Automaticity and Representations of Exercise Self-Regulatory Efficacy**

Exercise behavior can be conceptualized as a dynamic process of self-regulation, which may be defined as the management of cognitive, emotional, motivational, and social processes to make decisions, engage in behavior, and process stimuli in the pursuit of goals (Cameron & Leventhal, 2003). According to social cognitive theory (SCT; Bandura, 1986, 1997), self-regulation of goal pursuit encompasses both automatic and nonautomatic systems of self-observation, judgment, behavior initiation, and self-reaction processes. These self-regulation processes can be employed in either a functional or a dysfunctional manner. Functional self-regulation refers to the use of these processes in ways that promote successful goal achievement (e.g., setting specific goals and plans to exercise). Dysfunctional self-regulation refers to use of these processes in ways that undermine goal achievement (e.g., vague intentions, wishing to exercise, or procrastination).

Social cognitive theory and related research identifies the critical role of self-efficacy beliefs in guiding the self-regulation of behavior, including behaviors involved in exercise initiation and maintenance (Fletcher & Banasik, 2001; Schwarzer & Renner, 2000). A representation of self-regulation efficacy for exercise is a configuration of beliefs about one’s abilities to carry out the steps involved in exercise, such as overcoming barriers to exercise, scheduling regular exercise sessions, and setting exercise goals. Self-efficacy beliefs have been shown to govern exercise behavior indirectly through their influence on the selection of self-regulation strategies. High self-efficacy has been linked with greater use of functional self-regulation skills, which, in turn, predict higher exercise rates (Dishman et al., 2006; Rovniak, Anderson, Winett, & Stephens, 2002). Conversely, low self-efficacy can lead to self-regulation strategies that impede or deter exercise; for example, it has been demonstrated that low self-efficacy is associated with procrastination in carrying out health behaviors (Sirois, 2004).

Our construal of exercise self-regulatory efficacy builds on research showing that beliefs and goals are represented as complex conceptual structures (as opposed to a single concept) that can be activated both deliberatively and automatically (Bargh, 1997, 2006; Tetlock, 2002). Once activated, these structures can guide a
Automaticity and Exercise Self-Regulatory Efficacy Beliefs

variety of self-regulation processes without awareness, intention, or control (i.e., automatic self-regulation; Fishbach & Trope, 2008; Fitzsimons & Bargh, 2004). Because exercise decisions are made repeatedly over time and often need to be made quickly in the face of multiple cues, demands, temptations, and barriers, it is likely that representations of exercise self-regulatory efficacy are frequently activated automatically. Once activated, they can automatically elicit self-regulation strategies that either promote or undermine the initiation and maintenance of regular exercise. As of yet, this proposition has not been empirically tested. However, there is evidence that automatic associations exist between self-regulation processes, such as automatic associations between goals and strategies. For example, Shah and Kruglanski (2003) found that the goals for education and fitness and beliefs about the means to attain them (i.e., studying, exercising) were automatically associated, as indicated by greater accessibility of goals when primed with stimuli reflecting means versus unrelated activities.

According to SCT, representations of self-efficacy emerge from experiences in self-regulation (Bandura, 1986, 1997). Building on this SCT perspective, we propose that, with greater experience in exercise self-regulation, representations of self-efficacy and other self-regulation processes become more integrated, coherent, and accessible, with stronger associations among representational contents and to related constructs and processes (Gill, Swann, & Silvers, 1998). Degree of representational integration is important for automatic self-regulation, as it has been shown to facilitate information processing and reduce the need for attentional focus to elicit beliefs and actions (Beilock & Carr, 2001; Smith, 1998). Evidence shows that experience influences the configurations of mental associations that are activated automatically (Aarts & Dijksterhuis, 2000a, 2000b).

We propose that exercise self-regulation experience can be conceptualized as the extent to which one thinks about exercise, attempts to exercise, and engages in exercise. The dimensions of self-regulatory thought, effort (i.e., attempting exercise), and action have independently proven useful in accounting for variance in self-efficacy beliefs and health outcomes (Affleck et al., 2001; Bandura, 1997; Karoly et al., 2005). Many individuals who do not exercise regularly nevertheless report having enduring goals to exercise (Seppo & St.Clair, 2000). For these individuals, representations relating to exercise self-regulation (e.g., self-efficacy) can emerge because they frequently think about fitting exercise into their lifestyles even though they may not regularly engage in exercise. Experience in exercise self-regulation may lead to the development of representations of exercise self-regulatory efficacy that, although highly integrated, nevertheless include seemingly contradictory beliefs of high and low self-efficacy. Conflicting self-efficacy beliefs can emerge as individuals accumulate experiences of both successful and unsuccessful exercise attempts; for example, they may develop beliefs of high self-efficacy in scheduling exercise yet low efficacy in overcoming particular barriers (Showers & Kling, 1996).

For individuals low in exercise self-regulation experience, representations of exercise self-regulatory efficacy may not only be poorly integrated, but they may be linked with other goal pursuits—particularly those that commonly preempt exercise, such as work goals or social activity goals (Kruglanski et al., 2002; McCulloch, Aarts, Fujita, & Bargh, 2008). Evidence suggests that inexperienced exercisers invest fewer of their self-regulatory resources in their exercise goals than their competing goals (Karoly et al., 2005). For these individuals, cues relating to
self-regulatory efficacy may trigger mental contents relating to work or other goals, increasing the salience and accessibility of those goals, which, in turn, motivate one to direct attention toward those activities.

**Assessing the Automaticity of Exercise Self-Regulatory Efficacy Beliefs**

We adopt a dynamic view of automaticity in which automatic processes can be context dependent. Specifically, automatic activation of a representation is dependent on particular configurations between activated exercise self-regulatory efficacy knowledge structures (via priming) and particular exercise contexts (diary scenarios) in which this information is embedded (Bargh, 1989; Krank & Wall, 2006; Wittenbrink, Judd, & Park, 2001a, 2001b).

Subliminal and supraliminal priming techniques can be used to evaluate whether the construct of exercise self-regulatory efficacy manifests the automaticity property of nonconsciousness. Nonconsciousness refers to mental processes that occur outside of awareness. Priming refers to the activation of knowledge structures in memory (Bargh & Chartrand, 2000). Evidence demonstrates that subliminal and supraliminal priming techniques can have different effects on responses to a given prime stimulus (Gillath, Mikulincer, Birnbaum, & Shaver, 2008; Spiering, Everaerd, & Janssen, 2003). Mental constructs with strong associations with the prime stimulus may be more susceptible to subliminal priming (i.e., indicative of subtle nonconscious activation), whereas mental constructs with weaker associations may require more blatant activation procedures through supraliminal priming (Hess, Hinson, & Stratham, 2004; Levy, 1996). For example, both techniques appear to be effective in priming constructs with stimuli that are highly self-relevant, but only supraliminal priming may activate constructs with stimuli that are less self-relevant—presumably because self-relevant stimuli trigger mental constructs with stronger associations (Dijksterhuis, Chartrand, & Aarts, in press; Shih, Ambady, Richeson, Fujita, & Gray, 2002). Further, evidence suggests that supraliminal exposure to socially sensitive stimuli such as exercise can generate conflicted responses due to the spreading activation of a broader range of associations among mental contents (including potentially conflicting beliefs and self-presentation concerns), and thus may result in weaker or mixed priming effects on a particular construct or process compared with subliminal exposure to such stimuli (Gillath et al., 2008; Meijboom, Jansen, Kampman, & Schoute, 1999). Testing for automaticity using both priming techniques affords the opportunity to better evaluate the strength of automatic links between self-efficacy representations and other exercise-related beliefs and self-regulation strategies. Stronger links can be automatically activated nonconsciously through both subliminal and supraliminal priming, whereas weaker links can be automatically activated only through supraliminal (blatant) priming.

**Study Aims and Predictions**

This study had two primary objectives: (1) to determine whether self-regulatory efficacy beliefs manifest the automaticity property nonconsciousness in individuals experienced and inexperienced in exercise self-regulation and (2) to determine whether
automatic activation of these self-efficacy beliefs facilitates the activation of different exercise self-regulation strategies for individuals experienced versus inexperienced in exercise self-regulation. A secondary aim was to compare priming responses with self-report measures of exercise self-regulatory efficacy and exercise self-regulation to evaluate the degree of correspondence between automatic and controlled responses.

We tested predictions that both subliminal and supraliminal priming of exercise self-regulatory efficacy (relative to the priming of control stimuli) would lead to greater use of words and contents relating to exercise, self-efficacy, and functional and dysfunctional exercise self-regulation for participants experienced in exercise self-regulation, but not for participants inexperienced in exercise self-regulation. We also tested the contrasting predictions that both subliminal and supraliminal priming of exercise self-regulatory efficacy (relative to the priming of control stimuli) would lead to greater use of words relating to work (a key goal competing with exercise goals) for individuals inexperienced in exercise self-regulation, but not for individuals experienced in exercise self-regulation. Finally we assessed whether experienced individuals would report high self-efficacy and exercise self-regulation on self-reports as well as respond to self-efficacy primes with responses of high self-efficacy and functional self-regulation strategies, whereas inexperienced individuals would report low self-efficacy and exercise self-regulation on self-reports as well as respond to self-efficacy primes with responses of low self-efficacy and dysfunctional self-regulation strategies.

Method

Participants

A total of 186 (116 female, 70 male) students and staff (age \( M = 27.13, \ SD = 11.07 \)) at the University of Auckland, New Zealand, participated in the study. Eligibility requirements, determined on the basis of response to self-report measures in a preliminary survey included age between 17 and 65 years, English as a first language, and perceived ability to be physically active. The latter criterion was based on our interest in exercise self-regulatory efficacy among participants who believed they could be active if they chose; having a disability (such as a recent surgery or injury) that prevented them from being active may have altered exercise self-regulatory efficacy judgments or responses to the primes. The majority of participants were New Zealand European (\( n = 128, 68.8\% \)), with the rest identifying their ethnicity as Māori/Pacific Island (\( n = 8 \)), Asian (\( n = 23 \)), or other (\( n = 27 \)). The mean body mass index (BMI) was 22.88 (\( SD = 4.11 \)) for female participants and 24.48 (\( SD = 4.54 \)) for male participants. Participants were categorized into groups of experienced and inexperienced exercise self-regulatory efficacy based on a median split of scores on a measure of exercise self-regulation experience. Within each group, participants were matched on BMI, gender, and ethnicity and then randomly assigned to one of three prime conditions: subliminal, supraliminal or control primes.

Subliminal Priming and Control Manipulations

Two factors are jointly needed for a stimulus to reach consciousness (Kouider & Dehaene, 2007). First, the input stimulus must have sufficient strength (which can
be prevented by masking). Second, the input stimulus must receive top-down attention (which can be prevented by drawing attention to another task). To present the prime stimuli subliminally and to prevent these stimuli from reaching consciousness we used the following priming criteria.

In the subliminal prime and control prime conditions, participants completed a vigilance computer task that was designed according to specifications detailed by Bargh and Chartrand (2000). Stimuli were presented outside of conscious awareness in the parafoveal vision field (2°–6°), and a single shape was displayed at the center of the screen at all times and served as the fixation point. To ensure that attention was focused at the fixation point at all times, a shape change task was performed concurrent with the computer vigilance task. Participants were instructed to keep track of whether the shape of the fixation point changed, and if it did, to count how many times the shape changed. Throughout the 100 stimuli trials, there was 5% chance that the shape would change. There is evidence that under conditions of inattention (e.g., drawing participants’ attention to the shape change task) the prime stimulus can be presented for longer duration yet remain outside of awareness (Kouider & Dehaene, 2007). Each participant had 100 exposures to stimulus (exercise self-regulatory efficacy or control) phrases. Each stimulus phrase was “flashed” in one of four locations for 168 ms and was immediately followed by a 168 ms masking string of letters (e.g., XQFBZRMQWGBX) in the same location. A series of pilot studies (total n = 128) confirmed that the optimal exposure duration for subliminal prime and masking presentation was 168 ms and the optimal location of the prime stimuli was 5.188 cm from the center of the computer screen (i.e., the fixation point).

**Primaging Stimuli**

We used multiword stimuli (phrases) such as “Can I Exercise?” to prime exercise self-regulatory efficacy, as these stimuli capture the meaning of exercise self-regulatory efficacy whereas single words (e.g., “can” or “exercise”) are too ambiguous in that they are relevant to many constructs. Evidence shows that subliminal processing of similar types of multiword stimuli (e.g., to win and can be demanding) nonconsciously activate self-regulatory representations (e.g., achievement goals; Bongers, Dijksterhuis, & Spears, 2010; Glassman & Andersen, 1999).

**Subliminal Priming Stimuli.** Exercise self-regulatory efficacy was primed using a series of four phrases that were paired to activate the focal concept of exercise self-regulatory efficacy: CAN I EXERCISE?, CAN I?, AM I ACTIVE?, and AM I CONFIDENT? The phrases were punctuated with a question mark to reflect appraisals of exercise self-regulatory efficacy.

**Subliminal Control Stimuli.** The subliminal control condition was identical to the subliminal prime condition except that the four phrases used were neutral words that were not self-relevant and had no meaning relevant to the study: WAS AN ELEMENT?, THAT IS?, HAD AN ANCHOR?, and AT A CAMPAIGN?

**Subliminal Prime and Control Manipulation Check**

The manipulation check task (24 trials) was adapted from Bargh and Chartrand (2000). In the first 8 trials, participants were probed for awareness of the content
of the “flash.” In the next 16 trials, participants made a forced-choice judgment between prime stimuli and similar distracter stimuli.

Supraliminal Priming Technique and Stimuli

An adaptation of the scrambled sentence task by Srull and Wyer (1979) was used to supraliminally prime exercise self-regulatory efficacy. The 40-item task required participants to use sets of words in scrambled order to construct either grammatically correct, four-word questions (14 items) with words related to self-efficacy (e.g., “can am confident really I?” = Am I really confident?), four-word sentences (14 items) with words related to exercise (“caution snow proceed exercise in” = Exercise caution in snow), or filler questions and sentences (12 items) that contained words with no meaning related to the study (e.g., “are tickets where the paper” = Where are the tickets?).

Measures

Diary Task. In studies of priming and content accessibility, responses to an ambiguous task, such as free responses to ambiguous scenarios (Fenigstein & Levine, 1984) or a story completion tasks (Norris & Devine, 1992), have been successfully used as dependent measures for identifying priming effects. For this study, we used SCT principles to devise a diary completion task consisting of five ambiguous diary scenarios to provide a laboratory analog of the complex and stimulus-rich, “real world” environments in which exercise self-regulatory efficacy judgments are made.

Each of the five diary entries provided stimulus information that was salient and applicable to exercise decisions, and included other potentially salient goals that influence the ability to exercise, including university or work, finances, health, friends, and family. The scenarios were designed to stimulate processing of information relevant to (1) exercise as a lifestyle priority, (2) interpretations of somatic states that accompany physical exertion, (3) managing stress and competing priorities, (4) overcoming barriers to exercise (e.g., bad weather, resuming exercise after illness) and (5) reappraisal of exercise behavior and revision of future exercise goals. An example of a diary entry (number 4) is as follows.

Thursday 29 August

I’m absolutely freeeeezing! . . . this winter seems to be the coldest yet . . . thank goodness I’m finally over the flu . . . at least I’ve got Shona’s lecture notes and have made a start on catching up . . . also . . . with being laid so low it feels like all my muscles have turned to jello! . . . I hate being sick . . . it’s really disrupted my routine. . . . ** PLEASE WRITE THE REST OF TODAY’S DIARY ENTRY, NOW IN THE SPACE PROVIDED. THERE ARE NO RIGHT OR WRONG ANSWERS.

The instructions provided were, “This task investigates how reading comprehension is influenced by role taking. This story is a series of diary entries made by a university student throughout the year, as you read the diary entries; imagine that you are the character referred to as ‘I’ in the diary entries. Every time you read the
word, ‘I’, put yourself in this person’s shoes. Imagine that you are experiencing what this person is thinking and feeling.

Two coding techniques were used to analyze the diary texts: (1) The Linguistic Inquiry and Word Count text analysis program (LIWC; Pennebaker, Francis, & Booth, 2001) and (2) a set of four SCT-based content measures. The LIWC uses a word count strategy whereby it searches for words or word stems within a text file and calculates the proportion of those words relative to the total word count. Three dictionary categories captured words that related to (1) exercise (e.g., active, gym, jog), (2) self-efficacy (e.g., capable, can, able), and (3) work (job, study). Words in each category were selected by the researchers and then coded by three independent raters. Interrater reliability was high, ranging from .89 to .92. The few discrepancies were resolved through consensus. The five entries were analyzed as a whole segment.

The SCT content measures assessed expressions of high and low exercise self-regulatory efficacy, and functional and dysfunctional exercise self-regulation strategies. The measure of high exercise self-regulatory efficacy (8 items) coded expressions such as confidence that one can adhere to exercise plans and beliefs that one can achieve exercise-related goals. The low self-regulatory efficacy measure (9 items) coded expressions such as doubt in one’s abilities to fit exercise into one’s life and low inherent ability (e.g., “I’m not sporty”). The measure of functional self-regulation strategies (12 items) coded expressions such as creating incentives to exercise, monitoring progress in exercise efforts, and making exercise a priority goal. The measure of dysfunctional self-regulation strategies (9 items) coded expressions such as minimizing the importance of exercise, questioning the value of exercise, and avoiding exercise. The diary texts were coded for each phrase that reflected exercise self-regulatory efficacy and self-regulation. The frequency of each item in each of the four coding measures was calculated. Two additional raters each coded a sample of 40% of the diaries. Interrater reliability coefficients for the four measures ranged from $r = .87$ to $r = .91$. Discrepancies were resolved through consensus.

**Exercise Self-Regulation Experience.** Exercise self-regulation experience was assessed with a four-item measure developed by the authors ($\alpha = .82$): (1) “How often in the past 12 months have you thought about fitting regular exercise into your lifestyle?” (A= almost everyday to G = at no time), (2) “How often in the past 12 months have you actually attempted to fit regular exercise into your lifestyle?” (A = no attempts to G = greater than 10 attempts), (3) “In the last week on which days have you exercised?” (0 days to 7 days) and (4) “How many times in the past week have you exercised?” (free response of exercise frequency). Responses to the first two items were recoded from 0 to 7, with higher ratings reflecting higher experience, and the responses to the four items were averaged to generate scores ranging from 0.33 to 7.08. Use of this measure in a previous study with a comparable sample of 124 individuals confirmed that the measure had acceptable internal consistency ($\alpha = .75$) and test–retest reliability over 12 weeks ($r = .81$) (Buckley, in press). A median split ($Mdn = 4.33$) was used to classify participants into groups.

**Exercise Self-Regulatory Efficacy.** Two measures of exercise self-regulatory efficacy were employed (DuCharme & Brawley, 1995). A measure of schedule efficacy (11 items; $\alpha = .93$) was adapted to assess beliefs in one’s abilities to
organize and schedule regular exercise. Here are example items: “I can plan in advance the days I will exercise during the week,” “I can plan my exercise session around my social commitments” and “I can reschedule exercise into my day/week if I miss my planned exercise session.” Barrier efficacy (15 items; \( \alpha = .93 \)) assessed beliefs in one’s abilities to overcome barriers to exercise. Example items include “I can exercise when: ‘I haven’t reached my exercise goals’; ‘there are competing interests (like favorite TV show etc)’; ‘slightly sore from the last time I exercised’ and ‘during bad weather’.” On both measures, ratings ranged from 1 (I cannot do it at all) to 7 (certain I can do it) and they were averaged to generate scores.

**Exercise Self–Regulation.** An 11-item measure was devised to assess the use of functional exercise self-regulation strategies. Participants rated the extent to which they engage in each of 11 strategies for prioritizing exercise, goal setting and reinforcement, monitoring, regulating mood, and evaluating exercise progress. Examples are as follows: “praise myself for my exercise achievements,” “monitor my exercise progress,” and “evaluate my exercise plans and goals.” Ratings ranged from 1 (to no extent at all) to 7 (to a great extent), and they were averaged to generate scores (\( \alpha = .90 \)).

**Debrief Questionnaire.** Two debrief questionnaires adapted from Bargh and Chartrand (2000) were used. The first questionnaire was tailored for use in the subliminal and control conditions and probed for awareness of the content of the computer “flash” (1 item) and the study purpose (1 item), asked whether the study tasks were related (2 items) and whether performance on one task affected performance on another task (1 item) and assessed whether the participant related to the scenarios presented in the diary (1 item). The second questionnaire was tailored for use in the supraliminal condition. It was identical to the questionnaire for the subliminal and control conditions except that the item about awareness of the computer flash was replaced with items asking whether the participant had ever completed a scrambled sentence task before (1 item), whether words in the scrambled sentence task were distinctive or unusual (1 item) and whether the participant could recall any of the words from the scrambled sentence task (1 item).

**Procedure**

The study was approved by the University of Auckland Human Participants Ethics Committee. An informed consent form was obtained from each study participant. All participants were blind to the study purpose and were told that the study was designed to explore the unique ways in which individuals process information about daily activities. Participants completed the self-report measures of exercise self-regulation experience, exercise self-regulatory efficacy and exercise self-regulation 4–7 days before the priming session to avoid any temporary priming of exercise self-regulatory efficacy. Participants completed the priming sessions individually. Participants in the subliminal and control conditions completed the computer vigilance task, which lasted 21–23 min. Participants in the supraliminal prime conditions completed the scrambled sentence task, which lasted 21–24 min. Participants completed the diary task immediately following the priming task. The diary task took on average 24 min to complete. They then completed the prime manipulation awareness checks and debriefing questions, after which they were fully debriefed.
Results

Validity of the Exercise Self-Regulation Experience Classification

ANOVAAs confirmed that the exercise self-regulation experience groups differed on key aspects of exercise self-regulation experience. Relative to the inexperienced group, the experienced group exercised more often each week, $M = 3.77$, $SD = 1.84$ vs. $M = 0.84$, $SD = 1.13$, $F(1, 184), = 170.50, p < .001$, partial $\eta^2 = .48$. The experienced group (relative to the inexperienced group) also reported higher levels of schedule self-efficacy, $M = 5.19$, $SD = 1.14$ vs. $M = 4.18$, $SD = 1.21$, $F(1, 184), = 34.40, p < .001$, partial $\eta^2 = .16$; barrier self-efficacy, $M = 4.58$, $SD = 1.24$ vs. $M = 3.18$, $SD = 0.90$, $F(1, 184), = 87.30, p < .001$, partial $\eta^2 = .32$; and exercise self-regulation, $M = 4.11$, $SD = 1.24$ vs. $M = 3.20$, $SD = 1.27$, $F(1, 184), = 27.66, p < .001$, partial $\eta^2 = .35$.

Manipulation Awareness Checks

Responses to the debrief questionnaires confirmed that all participants were blind to the purpose of the study and that no participant reported awareness of priming stimuli or drew a connection between the priming task and the diary task. For the manipulation check completed by the subliminal and control groups, two ANOVAAs assessed the effects of Exercise Self-Regulation Experience and Prime Condition on (1) number of prime (vs. distractor) phrases chosen and (2) number of control (vs. distractor) phrases chosen. There were no main or interaction effects in either analysis ($Fs < 1$). The effects of the priming stimuli on the diary task appear to have occurred outside of conscious awareness, even though the debrief task required participants to view the flashes a second time, after having viewed them for a first time during the computer vigilance task. For the manipulation check completed by the supraliminal groups the majority of participants (98%) had not completed a scrambled sentence task before. There was no consistent pattern in the type of words participants recalled from the scrambled sentence task; recalled words were distributed across self-efficacy, exercise and filler word categories. The majority of participants (94%) reported that they related to the diary scenarios.

Comparability of LIWC and SCT Content Analyses

Pearson correlational analyses established that the LIWC word categories and the SCT content categories were tapping related aspects of representations of exercise self-regulatory efficacy and self-regulation. LIWC frequencies of exercise–related words were associated with the SCT content codings of functional self-regulation strategies ($r = .26, p < .01$), dysfunctional self-regulation strategies ($r = .27, p < .01$), and high self-efficacy ($r = .16, p < .05$). LIWC frequencies of self-regulation words was associated with codings of functional self-regulation strategies ($r = .20, p < .01$). Among content codings, use of high self-efficacy phrases was associated with use of phrases relating to functional self-regulation strategies ($r = .37, p < .01$), whereas use of low self-efficacy phrases was associated with use of phrases relating to dysfunctional self-regulation strategies ($r = .36, p < .01$).
Analyses of Priming Effects

Univariate ANOVAs and ordinal logistic regression analyses were conducted to assess the main and interactive effects of Exercise Self-Regulation Experience and Prime Condition on phrases about exercise self-regulatory efficacy and exercise self-regulation used in the diary task. ANOVAs were used to assess group differences in LIWC frequencies of words relating to exercise and work, and SCT content codings of functional and dysfunctional self-regulation strategies. Prime Condition main effects were followed up with simple effects analyses of differences among the prime conditions; significant Exercise Self-Regulation Experience \( \times \) Prime Condition interactions were followed up with simple effects analyses assessing differences among the Prime Conditions within each of the Exercise Self-Regulation Experience groups. Ordinal logistic regressions were used to assess group differences in LIWC frequencies of self-efficacy words and SCT content codings of high and low self-efficacy because, for these variables, responses fell into a limited number of levels or more than 25% were “0” values and thus the distributional assumptions of ANOVA were violated. Sets of dummy variables were created to assess the main effects of Prime Condition and the Exercise Self-Regulation Experience Group \( \times \) Prime Condition interaction effects. Significant interaction effects were followed up with simple effects analyses assessing Prime Condition effects within each of the Exercise Self-Regulation Experience groups.

**Priming Effects on Expressions of Self-Efficacy**

Table 1 presents the percentages of participants within each condition for whom self-efficacy words constituted 0% through 4% or more of their diary entries, as calculated by LIWC. The selection of the range for self-efficacy words was based the distribution of the data with 98.7% of responses falling below 4%. Table 2 presents the results of the ordinal logistic regression, which yielded a significant Exercise Self-Regulation Experience \( \times \) Prime Condition interaction. Simple effects analyses revealed that this interaction was due to contrasting patterns of prime condition effects for experienced and inexperienced participants. For experienced participants, there was a significant prime condition effect in which participants in the supraliminal prime condition tended to use more self-efficacy words compared with those in the control prime condition (indicating that the supraliminal prime activated self-efficacy representations) whereas there were no differences in self-efficacy words between the subliminal and control prime conditions. For inexperienced participants, those in the supraliminal and control prime conditions did not differ in use of self-efficacy words but there was a trend for those in the subliminal prime condition to use more self-efficacy words compared with those in the control prime condition.

Table 1 also presents the proportions of participants within each condition who had 0–4 or more phrases relating to high self-efficacy and 0–3 or more phrases relating to low self-efficacy, as identified by the SCT content codings. The selection of the range for phrases relating to high and low self-efficacy was based the distribution of the data with 97.5% of responses falling below 4 for high self-efficacy and 98% of responses falling below 3 for low self-efficacy. Table 2 presents the results of the ordinal regression analyses of these variables.
Table 1  Proportions of Participants Using Self-Efficacy Words and Phrases in the Diary Task for Exercise Self-Regulation Experience Groups and Prime Conditions

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<th>Exercise Self-Regulation Experience</th>
<th>Experienced</th>
<th>Inexperienced</th>
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<tr>
<td>Subliminal (n = 33) %</td>
<td>Supraliminal (n = 25) %</td>
<td>Control (n = 31) %</td>
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<td>LIWC: Proportion of Self-Efficacy Words</td>
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<td>4% or more</td>
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<td>SCT Coding: High Exercise-Self-Regulatory Efficacy Phrases</td>
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<td>2</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4 or more</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>SCT Coding: Low Exercise-Self-Regulatory Efficacy Phrases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>46</td>
<td>56</td>
</tr>
<tr>
<td>1</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>3 or more</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

Note. LIWC = Linguistic Inquiry Word Count text analysis program; SCT Coding = codings from a content analysis for factors delineated by social cognitive theory.
Table 2  Ordinal Regressions of Priming Effects on Self-Efficacy Words and Phrases

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wald</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIWC: Self-Efficacy Words</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience Group</td>
<td>1.15</td>
<td>0.74 (0.43–1.28)</td>
</tr>
<tr>
<td>Prime Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>1.09</td>
<td>1.43 (0.73–2.80)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>0.64</td>
<td>1.31 (0.68–2.54)</td>
</tr>
<tr>
<td><strong>Experience Group × Prime Condition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple Effects: Experienced Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>3.33†</td>
<td>2.41 (1.06–6.17)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>0.37</td>
<td>0.76 (0.31–1.87)</td>
</tr>
<tr>
<td>Simple Effects: Inexperienced Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>0.01</td>
<td>0.98 (0.36–2.66)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>3.44†</td>
<td>2.56 (1.05–6.88)</td>
</tr>
<tr>
<td><strong>SCT Coding: High Self-Efficacy Phrases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience Group</td>
<td>3.30</td>
<td>0.61 (0.35–1.04)</td>
</tr>
<tr>
<td>Prime Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>2.72</td>
<td>1.74 (0.90–3.35)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>0.69</td>
<td>0.76 (0.39–1.46)</td>
</tr>
<tr>
<td><strong>Experience Group × Prime Condition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple Effects: Experienced Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>10.20**</td>
<td>4.93 (1.85–13.06)</td>
</tr>
<tr>
<td>Subliminal vs Control Prime</td>
<td>0.22</td>
<td>1.23 (0.51–2.97)</td>
</tr>
<tr>
<td>Simple Effects: Inexperienced Group</td>
<td></td>
<td></td>
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<tr>
<td>Supraliminal vs. Control Prime</td>
<td>0.45</td>
<td>0.73 (0.29–1.84)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>2.75</td>
<td>0.43 (0.16–1.17)</td>
</tr>
<tr>
<td><strong>SCT Coding: Low Self-Efficacy Phrases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience Group</td>
<td>0.46</td>
<td>1.16 (0.75–1.76)</td>
</tr>
<tr>
<td>Prime Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supraliminal vs. Control Prime</td>
<td>3.78*</td>
<td>1.77 (1.00–3.15)</td>
</tr>
<tr>
<td>Subliminal vs. Control Prime</td>
<td>5.57*</td>
<td>1.96 (1.12–3.44)</td>
</tr>
<tr>
<td><strong>Experience Group × Prime Condition</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. N = 186. OR = odds ratio; CI = confidence intervals.

*χ² = 10.06, df = 2, p < .01; b χ² = 6.08, df = 2, p < .05; χ² = 5.20, df = 2, p = .07; d χ² = 7.08, df = 2, p < .05; χ² = 12.12, df = 2, p < .01; f χ² = 7.26, df = 2, p < .05.

†p < .10; *p < .05; **p < .01.
For phrases of high self-efficacy, the analysis revealed a significant Exercise Self-Regulation Experience × Prime Condition interaction. The simple effects analyses revealed that, for experienced participants, those in the supraliminal prime condition used more phrases reflecting high self-efficacy compared with those in the control condition, indicating that representations of high exercise self-regulatory efficacy required blatant nonconscious activation. In contrast, experienced participants in the subliminal prime condition did not differ from those in the control condition in expressions of high self-efficacy. For the inexperienced group, the number of phrases reflecting high exercise self-regulatory efficacy did not differ across prime conditions. For expressions of low exercise self-regulatory efficacy, ordinal regression analysis revealed a trend toward a Prime Condition main effect. Participants in the supraliminal and subliminal prime conditions tended to use a greater number of expressions reflecting low self-efficacy compared with those in the control prime condition. Although not statistically significant, the pattern suggests a trend for the self-efficacy primes to automatically activate low self-efficacy representations for both experience groups. The main and interaction effects of Exercise Self-Regulation Experience were not significant.

**Primbing Effects on Expressions of Exercise and Work**

Table 3 presents the means and standard deviations of the proportions of words relating to exercise and work as calculated by LIWC. For LIWC proportions of exercise words, an ANOVA yielded the predicted Exercise Self-Regulation Experience × Prime Condition interaction, \( F(2, 180) = 8.26, p < .001, \text{ partial } \eta = .08. \) For participants experienced in exercise self-regulation, those in the subliminal and supraliminal prime conditions used more exercise words compared with those in the control prime condition, \( F(2, 180) = 7.83, p < .001, \text{ partial } \eta = .08, \) indicating that exercise representations were automatically activated for this group. For participants inexperienced in exercise self-regulation, there was a trend for priming effects resulting in a lower use of exercise words in the subliminal prime condition than in the control prime condition, \( F(2, 180) = 2.71, p < .07, \text{ partial } \eta = .03, \) and no differences between supraliminal and control prime conditions.

For LIWC proportions of work-related words, an ANOVA yielded an Exercise Self-Regulation Experience × Prime Condition interaction, \( F(2, 180) = 5.14, p < .01, \text{ partial } \eta = .05. \) The simple effects analyses revealed, that inexperienced participants in the subliminal prime condition used a greater number of work-related words compared with those in the control prime condition, indicating that the subliminal priming of self-efficacy nonconsciously activated representations of work-related goals, \( F(2, 180) = 3.52, p < .01, \text{ partial } \eta = .04. \) For the experienced group, the use of work-related words did not differ across the prime conditions.

Table 3 presents the means and standard deviations of the proportions for the SCT content codings for functional and dysfunctional self-regulation. For SCT content codings for functional exercise self-regulation strategies, an ANOVA revealed a main effect of Exercise Self-Regulation Experience, \( F(2, 177) = 6.16, p < .05, \text{ partial } \eta = .03. \) The experienced participants used more expressions of functional self-regulation strategies compared with the inexperienced participants. A significant Prime Condition effect showed that participants in the supraliminal prime condition used more expressions of functional self-regulation strategies.
Table 3 Means and Standard Deviation for Words and Phrases Used in the Diary Task for Exercise Self-Regulation Experience Groups and Prime Conditions

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Exercise Self-Regulation Experience</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Experienced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subliminal M (SD)</td>
<td>Supraliminal M (SD)</td>
<td>Control M (SD)</td>
<td>Subliminal M (SD)</td>
<td>Supraliminal M (SD)</td>
</tr>
<tr>
<td>LIWC: Proportions of Words</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise-Related Words</td>
<td>9.41 (2.61)</td>
<td>10.41 (3.05)</td>
<td>7.55 (2.43)</td>
<td>7.72 (3.04)</td>
<td>8.62 (2.69)</td>
<td>9.48 (3.35)</td>
</tr>
<tr>
<td>Work-Related Words</td>
<td>4.99 (2.03)</td>
<td>5.38 (1.89)</td>
<td>5.88 (2.41)</td>
<td>6.02 (2.34)</td>
<td>5.38 (1.57)</td>
<td>4.61 (1.53)</td>
</tr>
<tr>
<td>SCT Codings: Number of Phrases</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Self-Regulation</td>
<td>2.13 (2.17)</td>
<td>4.28 (3.78)</td>
<td>2.06 (3.07)</td>
<td>1.93 (1.78)</td>
<td>1.97 (1.89)</td>
<td>1.73 (2.24)</td>
</tr>
<tr>
<td>Dysfunctional Self-Regulation</td>
<td>2.38 (2.00)</td>
<td>2.64 (1.80)</td>
<td>1.49 (1.31)</td>
<td>2.32 (2.37)</td>
<td>2.17 (1.59)</td>
<td>1.50 (1.53)</td>
</tr>
</tbody>
</table>

*Note. LIWC = Linguistic Inquiry Word Count text analysis program; SCT Coding = codings from a content analysis for factors delineated by social cognitive theory.*
compared with control prime participants $F(2, 177) = 4.16, p < .05$, partial $\eta = .05$. The main effects were superseded by an Exercise Self-Regulation Experience $\times$ Prime Condition interaction; $F(2, 177) = 3.21, p < .05$, partial $\eta = .04$. The simple effects analysis revealed, that experienced participants, in the supraliminal prime condition used more functional self-regulation strategies compared with those in the control prime condition, indicating that blatantly priming exercise self-regulatory efficacy facilitated nonconscious activation of functional exercise self-regulation strategies; $F(2, 177) = 6.75, p < .01$; partial $\eta = .07$. Unexpectedly, experienced participants in the supraliminal prime condition also used more functional exercise self-regulation strategies compared with those in the subliminal prime condition. For the inexperienced group, the use of functional self-regulation strategies did not differ across the prime conditions.

For dysfunctional self-regulation strategies, an ANOVA revealed a main effect of Prime Condition, $F(2, 177) = 6.75, p < .01$, partial $\eta = .05$. For both experienced and inexperienced participants, those in the subliminal and supraliminal prime conditions used a greater percentage of phrases indicative of dysfunctional strategies compared with those in the control prime condition. This main effect indicates that, regardless of exercise self-regulation experience, priming exercise self-regulatory efficacy facilitated activation of dysfunctional self-regulation strategies. The main and interaction effects of Exercise Self-Regulation Experience were not significant.

**Discussion**

The present research investigated the automatic activation of exercise self-regulatory efficacy beliefs in individuals experienced and inexperienced in exercise self-regulation. Considered together, the results provide support that exercise self-regulatory efficacy beliefs are represented as integrated and complex conceptual structures that can be automatically activated; moreover, they facilitate the activation of self-regulation strategies and exercise-related considerations that promote or deter regular exercise.

Both subliminal and supraliminal priming of exercise self-regulatory efficacy (relative to priming of control stimuli) had the predicted effects of increasing the use of words relating to exercise in the diary entries for individuals experienced in exercise self-regulation, but not for inexperienced individuals. For experienced individuals, representations of exercise self-regulatory efficacy appear to be coherently integrated with strong links to other exercise constructs; that is, exercise contents were activated by both subtle (subliminal) and blatant (supraliminal) cues of exercise self-regulatory efficacy (Dijksterhuis et al., in press). For these individuals, exercise self-efficacy representations appear to be activated nonconsciously.

In addition, supraliminal priming (compared with priming of control stimuli) elicited more expressions of high self-efficacy and functional self-regulation strategies in the diary task for the experienced group, but not for the inexperienced group. It appears that experienced individuals have self-efficacy representations with automatic associations involving high self-efficacy beliefs and functional self-regulation strategies. This finding contributes to evidence that self-efficacy representations are linked to flexible use of self-regulation strategies (Bandura, 1997) and to greater use of self-regulation strategies to exercise (King et al., 1992). These supraliminal
priming effects contrast with the nonsignificant effects of subliminal priming on expressions of high self-efficacy and functional self-regulation strategies for this experienced group. It may be that, on average, these links are sufficiently strong to be elicited nonconsciously through blatant priming, but not strong enough to be elicited nonconsciously through subliminal priming.

Regardless of exercise self-regulation experience, both subliminal and supra-liminal priming of exercise self-regulatory efficacy elicited the activation and expression of low self-efficacy beliefs and dysfunctional self-regulation strategies in the diary completion task. For both experience groups it appears that evaluations of low self-efficacy and use of dysfunctional self-regulation strategies are nonconsciously elicited by both subtle and blatant exercise self-regulatory efficacy cues in ways that may influence responses when faced with challenges to exercise (such as those presented in the diary completion task) (Shih et al., 2002). For the experienced group, these expressions conflict with their conscious, controlled appraisals of high self-efficacy and high use of functional self-regulation strategies as expressed in the self-report measures. In making self-report responses, it seems that experienced participants consciously move away from their automatic evaluations of low self-efficacy, and instead access representational contents of high self-efficacy and functional self-regulation strategies, potentially to maintain positive self-evaluations or enhance positive appraisals from others. This pattern of contrasting expressions of self-efficacy and self-regulation strategies suggests that in making their self-report responses, experienced participants may have inflated judgments of their exercise self-regulation abilities to surmount challenges to exercise. The pattern of findings cohere with the SCT principle that when self-presentation concerns become more important than how one performs on future occasions, self-flattery tends to take precedence over accurate appraisals of one’s capabilities (Bandura, 1986, 1997). The pattern of findings converge with prior evidence to indicate that automatic and controlled measures tap related but distinctive aspects of conceptual representations (De Houwer, 2006).

For participants inexperienced in exercise self-regulation, that priming led to automatic activation of low self-efficacy beliefs and dysfunctional self-regulation strategies was not expected; instead, we predicted that self-regulatory efficacy representations would not be sufficiently integrated with strong associative links to be sensitive to subliminal priming. These findings suggest that exercise self-regulatory efficacy representations may be reasonably developed for this group as well, potentially because many are likely to have engaged in exercise self-regulation experiences in the past. Representations relating to past activities can remain influential even though individuals no longer engage in them (Moyer, 2007). It appears that inexperienced participants have sufficiently integrated representations of (low) self-efficacy to be sensitive to subliminal priming. As such, their low self-efficacy beliefs may be nonconsciously activated when they encounter subtle exercise cues in their daily lives, automatically triggering decision processes that lead them to avoid taking steps to engage in physical activity. Their expressions of low self-efficacy and dysfunctional self-regulation strategies in the diary task match their low levels of exercise use, as evidenced by their exercise frequency of 0.85 day per week.

For inexperienced participants, subliminal priming (relative to priming of control stimuli) also led to increased use of words relating to work, indicating that there is an automatic association between their self-efficacy beliefs and work-
related goals. It appears that the effects of priming exercise self-regulatory efficacy among individuals who do not hold exercise goals increased the accessibility of a competing goal (work). Similarly, there was a trend for subliminal priming of self-efficacy to induce a relatively lower use of exercise-related words for these inexperienced individuals. Considered together, these results are consistent with theory and evidence that goals operate within systems that include inhibitory as well as facilitative links between interconnected goals, such that the activation of constructs related to one goal may influence the activation of competing goals (Kruglanski et al., 2002; McCulloch et al., 2008; Shah & Kruglanski, 2002). The findings suggest that inexperienced individuals may automatically invest more self-regulatory resources in pursuit of goals (e.g., work) that interfere with exercise (Karoly et al., 2005), and they converge with evidence that accessibility of competing goals may disrupt the development of self-regulation strategies for a focal goal (Shah & Kruglanski, 2003). Individuals inexperienced in exercise self-regulation who want to start exercising regularly may be prone to automatic processes that undermine their exercise efforts.

An alternative explanation for these results derives from SCT’s hypothesis that self-efficacy representations contain both generic and specific components because situations that require self-regulation are seldom alike. For inexperienced participants, it is possible that priming exercise self-regulatory efficacy activated generic aspects of these representations, and the inexperienced group may have automatically drawn upon their self-regulation experiences in general or from self-regulation contexts in which they do have experience (e.g., work).

The finding that, for experienced participants, supraliminal priming activated both high and low self-efficacy as well as functional and dysfunctional self-regulation strategies provides further evidence that supraliminal exposure to socially sensitive stimuli, such as exercise, generates conflicted responses that may be revealed in mixed priming effects (Gillath et al., 2008). For experienced participants, it appears that seemingly contradictory beliefs about the self coexist within representations (Showers & Kling, 1996). It is likely that, across the five diary scenarios, different configurational patterns of beliefs about exercise self-regulatory efficacy and features of the various contexts were activated. Whereas some contexts may have been linked with high self-efficacy and functional strategies, others may have been associated with representational configurations that included low self-efficacy and dysfunctional strategies.

The study findings should be considered within the context of the methodological constraints. First, although both the subjective (funneled debriefing) and objective (forced choice task) measures of awareness demonstrated that participants were unaware of the prime stimuli and its influence on subsequent information processing during the diary task, a signal detection analysis may have provided a more sensitive measure of awareness than the measure we used. It is possible that our subliminal manipulation checks do not exhaustively assess all information that could reach consciousness. However, this problem exists for the majority of studies on nonconscious processes, as no measure of awareness is sensitive to all aspects of conscious perception (Glassman & Andersen, 1999; Jacoby, Toth, Lindsay, & Debner, 1992; Wiens, 2007). Future research using behavioral and brain imaging methods may offer a more reliable method to index nonconscious and conscious processes (Cleeremans, 2006; Kouider & Dehaene, 2007). Second, we did not con-
control for all possible alternative interpretations of the differential priming effects. For example, participants in the subliminal condition may have processed only single words that appeared at the beginning middle or end of the phrase.

This study is one of only a few to use multiword strings as priming stimuli. Although research indicates that multiword stimuli can be subliminally processed (Bongers, Dijksterhuis & Spears, 2010; Glassman & Andersen, 1999), little is known about how nonconscious knowledge is activated by such stimuli (Glassman & Andersen, 1999). Research using fMRI methods demonstrates that subliminal repetition priming of words activates abstract levels of meaning in representations (Nakamura, Dehaene, Jobert, Le Bihan, & Kouider, 2005). With our priming strategy, individuals may be extracting the meaning or gist of exercise self-regulatory efficacy knowledge from the multiword stimuli; that is, gist processing may be a mechanism by which multiword stimuli are nonconsciously processed. The plausibility of this idea is supported by research showing fast parallel processing of meaning that occurs independently of the processing of words surface forms (Brainerd & Reyna, 2004; Brainerd, Wright, Reyna, & Payne, 2002). Further research is needed to clarify the effects of multiword priming stimuli on the activation of representations of self-regulatory efficacy.

Another consideration arises from our decision to examine automaticity of exercise self-regulatory efficacy across five scenarios depicting a variety of challenges to exercise self-regulation. Future research examining the effects of exercise self-regulatory efficacy priming for each of the specific contexts depicted by the scenarios can add further insights into the links between self-efficacy representations and contextual factors involved in exercise self-regulation. In addition, the study was conducted with university staff and students the majority of whom were New Zealand European, and so the results may only generalize to this population. Finally, the multiple analyses increased the probability of Type 1 errors. Stringent controls were not used based on considerations that, as this is the first study to investigate automaticity of exercise self-regulatory efficacy and one of few studies assessing priming effects on self-regulation processes, it is preferable to maintain sufficient power to explore potential influences. Future studies using more stringent controls to replicate and extend these findings are warranted.

In terms of implications for interventions, the findings identify potential targets for cognitive restructuring aspects of exercise promotion interventions. For example, they identify the importance of reducing links between exercise self-regulatory efficacy and work-related goals for individuals who are inexperienced in exercise self-regulation. In addition, they highlight the potential interference of automatically elicited beliefs of low self-efficacy and dysfunctional self-regulation strategies for individuals regardless of their exercise experience. The automaticity of these low self-efficacy beliefs, dysfunctional self-regulation strategies, and work goals poses clear challenges for interventions because, once ways of thinking and acting are automated, individuals tend to pay little attention to the informative aspects of their environment. In light of these findings, we suggest that interventions aimed at enhancing exercise self-regulatory efficacy and functional self-regulation strategies might increase their effectiveness if they include components that identify and restructure associations between automatically elicited representations of exercise self-regulatory efficacy, environmental cues, and self-regulation strategies. One approach for achieving automaticity of health goals (Achtziger, Gollwitzer, &
Sheeran, 2008) is suggested by research on implementation intentions (if–then plans; Gollwitzer & Brandstatter, 1997). Adapting this paradigm to exercise self-regulatory efficacy, exercise practitioners could help individuals formulate if–then plans to link in memory a critical exercise situation (if) with an appropriate exercise self-regulatory efficacy or self-regulation response (then). For example, “If I encounter exercise situation Y, then I can perform exercise self-regulation plan Z.” Repeated rehearsal, both behaviorally and through mental simulations, could heighten the accessibility of situational exercise cues strategically linked to high self-efficacy beliefs and functional self-regulation strategies, thereby ensuring that they would be triggered at the appropriate time and place in the future.

In summary, this research showed that, for individuals experienced and inexperienced at exercise self-regulation, priming exercise self-regulatory efficacy elicited multiple exercise-related expressions that, in parallel, may have facilitating or undermining influences on exercise self-regulation. Moreover, priming effects were influenced by the manner in which they were activated (subliminally or supraliminally). For both experienced and inexperienced individuals, self-efficacy representations had strong enough links to some beliefs and strategies that they were nonconsciously activated by subtle as well as blatant priming. For experienced individuals, links between self-efficacy representations and some exercise-related beliefs and strategies appeared to be weaker and required blatant supraliminal priming; to be activated nonconsciously. That supraliminal priming activated conflicting self-efficacy and exercise self-regulation expressions (in experienced individuals) offers evidence that nonconscious activation in a blatant manner may also activate motivational processes (e.g., self-presentation) that increase accessibility of positive self-evaluations. Future research investigating whether the predictive information provided by supraliminal (conscious) primes influences other motive systems (e.g., self-presentation / social desirability concerns) is warranted. Finally, comparisons of responses to the automatic priming measures and controlled, self-report measures revealed some conflicting patterns, particularly for experienced individuals.

Taken together, these results add to evidence that employing automatic measures of exercise self-regulatory efficacy may provide a valuable independent index of self-efficacy beliefs (Červone, Orom, Shadé, & Kassel, 2007). As a phenomenon, the automaticity of exercise self-regulatory efficacy beliefs is of considerable importance. Although individuals can say they are confident in their exercise self-regulation abilities, it is the automaticity of these beliefs that is the crucial marker of believing it to be so.

References


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