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The Effect of Subconscious Performance Goals on Academic Performance

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ABSTRACT

We investigated the impact of subconscious goals on academic performance in two field experiments. We show that unobtrusive priming of goals with regard to achievement motivation by means of a photograph improves performance in different educational contexts. High-school students who were exposed to an achievement-related photograph achieved higher grades than students in two control conditions. This effect was not affected by students' prior performance. University students exposed to a photograph representing a specific, difficult goal reached even higher performance than students taking the exam with a general achievement photograph. For practice, subconscious goals may form a powerful, cost-effective tool to enhance academic performance. However, varying results across the experiments also prompt the need for further investigations of such effects.

KEYWORDS

Academic performance; goal specificity; subconscious goals; supraliminal priming

HUMAN BEHAVIOR IS goal oriented, and the goals people have determine how they perceive, think, and act (Bargh & Chartrand, 1999; Dijksterhuis, Chartrand, & Aarts, 2007; Kunde, Elsner, & Kiesel, 2007). One likes to think of humans as goal-directed agents with the ability to orchestrate their lives and decide what they want. However, considerable evidence suggests that goals and corresponding motivations can be activated by unobtrusive stimuli of which actors need not even become aware. For example, people talk more softly after having seen a library picture (Aarts & Dijksterhuis, 2003) or display increased effort and performance after being exposed to achievement-related words (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trötschel, 2001). These effects not only occur with simple tasks in laboratory settings but also generalize to complex behaviors in real-life situations. Shantz and Latham (2009, 2011), for example, showed that subconsciously¹ activated goals enhance performance of call-center employees. These preliminary findings from social and industrial/organizational psychological research suggest that subconscious goals may serve as powerful tools for stimulating human performance without those involved even being aware of their influence. This may have far-reaching implications for the many types of high-stakes-achievement settings people are facing in their lives, not only at work, but also at school and at university. Therefore, more insight is needed into the theoretical basis and potential effects of subconscious goals in field settings. Such insight may contribute to the development of simple, cost-effective interventions aimed at automatic activation of motivational processes and practical and ethical guidelines for their application.

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The overall objective of our current study is to examine the effect of subconscious goals on complex behaviors in real-life settings and to support the development of interdisciplinary explanation models in this research field (cf. Locke, 2015). We investigated whether subconscious goals that target achievement motivation via photographs can enhance performance in the academic setting for various groups of students, and we provide insights into mechanisms involved in such an effect. More specifically, the goal of the experiments presented in this paper is threefold. First, by investigating the effect of subconscious goals in an academic context, we shed light on the effect of subconscious goals for complex tasks in real-life achievement situations. Also, failures to replicate the positive performance effects of subconscious goals in the laboratory (Harris, Coburn, Rohrer, & Pashle, 2013) call for a deeper investigation of the effects of subconscious goals in field settings. Second, we explore potential boundary conditions for the effects of subconscious goals in practice, by testing whether prior performance moderates the effects of subconscious goals on academic performance. Third, we examine whether subconscious goal effects can be further enhanced by implementing a core principle from conscious goal-setting theory (cf. Locke & Latham, 2002). Sitzmann and Ely's (2011) meta-analysis on self-regulation in training and education corroborated that a core principle from goal-setting theory, the positive relation between self-set goal level and performance, can be applied to academic performance. They found that self-set goal level was the strongest predictor of self-regulated learning ($\rho = .44$). In the current study, we investigated whether this well-established conscious goal-level effect can be transferred to the effect of subconscious goals in the academic field.

Subconscious goals

Subconsciously activated goals have been shown to influence a person's perceptions, moods, decisions, and behavior in nearly all aspects of life (Bargh & Chartrand, 1999; Chartrand & Bargh, 2002). Subconscious goals can be activated through *priming*: the temporary activation of cognitive representations outside of a person's awareness. Priming can be supraliminal or subliminal. In supraliminal priming, participants are aware of the priming stimuli, but not of the activated goals. In subliminal priming, participants are unaware of both the prime stimuli and the activated goal itself. Research has demonstrated that the processes involved do not have to exceed the awareness threshold in order to be effective (Bargh & Chartrand, 2000).

Subconscious goals and performance

Prior research has documented an effect of subconsciously activated goals on achievement outcomes in lab and work settings. However, to our knowledge, their effect (with potentially far-reaching practical implications) has not yet been explored in the educational context. Moreover, it is still unclear to what extent subconscious goals differ in their impact on performance and what the boundary conditions are for priming effects in practice. Initially, several studies documented an effect of subconscious goals on performance on rather simple laboratory tasks. For example, Bargh et al. (2001) identified an effect of subconscious goals on performance in a word-search puzzle, with participants who first completed an achievement-related task finding more targets than participants who first completed a neutral task. In addition, via a scrambled-sentences test that included achievement-related words, Stajkovic, Locke, and Blair (2006) found in a brainstorming task that subconscious goals enhanced the effects of conscious specific, difficult goals and do-your-best goals.

Shantz and Latham (2009) transferred those initial findings to a specific field setting, demonstrating that call-center employees primed with a photograph of a woman winning a race reached higher performance than employees in a no-photograph control condition. Shantz and Latham (2011) replicated the performance effect of this supraliminal priming method in the work context with an average effect size of $d = 0.56$ ($k = 3$ experiments). Although those studies provide support for the effect of subconscious goals on work performance, it is yet unknown whether those rather simple interventions can also be successfully used to influence motivation and, therefore, achievement outcomes in other contexts, such as the educational domain. Moreover, the exploratory mechanisms behind these effects are still rather unclear. Current theoretical developments suggest various cognitive, affective, or motivational variables

to explain how subconscious goals affect behavior (Aarts, Custers, & Veltkamp, 2008; Latham & Piccolo, 2012). More insights are needed into the roles of potential explanatory variables, for instance, in terms of core relationships between prime stimuli and performance outcomes and moderators of the effect, to help build a comprehensive theoretical model (cf. Latham, Stajkovic, & Locke, 2010).

Subconscious goals and motivation

Although there is substantial empirical evidence that subconscious goals direct behavior, it is rather unclear how these effects transpose into behaviors (Latham, et al., 2010; Locke, 2015). At least five theoretical approaches have been suggested to explain such effects (Friedman, 2013). For example, Bargh's (1990) auto-motive theory states that through repeated activation in specific situations, conscious goals become habitualized. By forming mental representations, such automated goals can later be activated and operate outside a person's awareness. Also, subconscious goal effects may be explained by associations between environmental cues and specific behaviors, comparable to classic conditioning (Shah, 2005). A third explanation involves the ideomotor principle, by which activated goals directly lead to the execution of behavioral programs through the pre-programmed mind (Dijksterhuis & Aarts, 2010).

Two explanation approaches refer to motivational needs. First, priming effects have been suggested to be the result of the interplay of environmental cues that push specific goals and the pull of an individual's motivational needs (Moskowitz & Gesundheit, 2009). Second, especially McClelland's theory of implicit motives has received considerable attention in explaining priming effects, at least with regard to achievement outcomes. McClelland was among the first to postulate and provide empirical support for the idea of two distinct systems in terms of explicit motives (self-attributed, e.g., self-reported) and implicit motives (functioning outside of awareness, e.g., measured by the Thematic Apperceptions Test [TAT]; Pang, 2010). With regard to effects of subconscious performance goals, especially the *need for achievement* (*nAch*) as implicit motive has been shown to be of high relevance for explanatory processes. Definitions of *nAch* refer to the need to accomplish a (difficult) task, to do something better, to outperform others in a competition, or to perform a unique accomplishment. Numerous research findings support the effect of *nAch* in various applied settings, for example, with regard to the preference of school children to approaching moderate or difficult tasks or with regard to performance in the classroom (cf. Pang, 2010).

Implicit needs have been shown to be aroused by stimuli in the environment and automatically affect behavior without the person being aware of them (McClelland, 1987). Therefore, priming of achievement-related goals has been suggested and been shown empirically to act via the implicit *nAch* as a motivational state on performance outcomes. Prior research findings consistently demonstrate that pictures that activate a person's implicit *nAch* also increase performance. For example, participants who had been exposed to the picture of the women winning a race used more achievement-related words in a picture-story exercise than control group participants (e.g., Shantz & Latham, 2009; Chen & Latham, 2014). Furthermore, Latham and Piccolo (2012) reported that this photograph led to the use of more achievement-related words in the TAT compared to control conditions.

Subconscious goals and academic performance

To date, there is only a limited empirical basis that supports that subconscious goals can successfully be used in the educational context to enhance achievement, for example, by stimulating the retrieval or reproduction of previously learned information. The few prior studies that have investigated priming effects in the educational context have demonstrated an impact of subconscious goals on nonperformance outcomes, for example, on implicit learning in a novel environment (Eitam, Hassin, & Schul, 2008). With regard to performance, Radel, Sarrazin, Legrain, and Gobance (2009) showed that subliminal priming of autonomous versus controlled motivation can be used to stimulate performance in the learning context, at least for specific student groups—that is, less mindful students, who follow routines or act more automatically. Also Gramzow, Johnson, and Willard (2014) reported findings about the

relevance of individual responses to achievement-related primes for academic performance in the long run. However, support for a direct performance-enhancing effect of supraliminal priming of goals on performance in the educational context is lacking.

One might expect that findings about the effects of subconscious goals at work generalize to the academic context, as performance in both settings has been suggested to substantially overlap (Lounsbury, Gibson, Sundstrom, Wilburn, & Loveland, 2004). However, with reference to theoretical models of job performance (Campbell, McCloy, Oppler, & Sager, 1993), performance in school or at the university refers more to learning processes and outcomes, with a focus on the acquisition of skills and retrieval of (especially declarative) knowledge. In contrast, job performance typically refers to task completion or the fulfilling of work duties encompassed in specific job descriptions (such as those of call-center agents, the only type of employees studied so far in applied priming research). Therefore, the suggested similarities are not strong enough to generalize performance effects of subconscious goals to the educational context without further investigation.

Overview of present research

We examined the effects of subconscious goals primed via a photograph on exam performance in two samples of high-school and university students. The use of photographs as primes was based on findings by Aarts and Dijksterhuis (2003), who demonstrated the usefulness of this priming method. Although studies have shown that images presented on the subliminal level can influence behavior (e.g., Gibson & Zielaskowski, 2013), displaying photographs naturally in the field seems more easily applicable in practice compared to subliminal priming (cf. Shantz & Latham, 2009).

First, we designed Experiment 1 to test whether some participants are more susceptible to the effects of subconscious goals than others. In detail, we investigated whether and how prior performance in terms of grades serves as a moderator of the performance-enhancing effect of subconscious goals in the academic context. On the one hand, findings from a number of studies suggest that subconscious goals influence behavior via similar motivational mechanisms as conscious goals (e.g., effort and persistence; cf. Custers & Aarts, 2005). Subconscious goals might therefore boost academic performance of all students by stimulating their current motivation in an achievement situation. On the other hand, research on both conscious and subconscious goals has corroborated that personal characteristics, such as skills and abilities, act as a moderator of goal effects. For example, Locke, Frederick, Buckner, and Bobko (1984) showed that if conscious goals exceed a person's ability level (in terms of prior performance on a specific task) they do not stimulate performance. With regard to subconscious goals, Ferguson (2008) demonstrated a moderating effect of prior performance on the goal performance relationship in the laboratory. She showed that compared to low-skilled students readiness to pursue a subconscious academic goal was higher for more highly skilled students (based on their grade point average). Ferguson explained this finding with the automatic activation of a positive attitude toward goal-relevant (in this case academic) stimuli of students with high average grades.

Second, with Experiment 2 we aimed to transfer the well-established performance-enhancing effect of specific, difficult performance goals from conscious goal-setting research to subconscious priming effects. Convincing empirical evidence has demonstrated that specific difficult (conscious) goals lead to higher performance compared to nonspecific "do-your-best" instructions, vague, or easy goals (Locke & Latham, 2002). Although goal-setting theory originates from the work domain, study results confirm the effects of conscious goals also in the academic context (e.g., Acee, Cho, Kim, & Weinstein, 2012; Sitzmann & Ely, 2011). If indeed, as suggested by prior research, conscious and subconscious goals tap into the same (e.g., motivational) mechanism, then specific, difficult subconscious goals should have a superior performance effect above the effect of general-achievement-related primes.

Experiment 1

In Experiment 1, we tested whether subconscious goals activated by a photograph impacted academic performance of students in high school. Prior studies that used photographs as a priming technique

always identified performance-enhancing effects by comparing priming stimulus conditions to a non-stimulus condition (e.g., Shantz & Latham, 2009). As such, it is unclear whether the effects on achievement motivation and performance were caused by the content of the photograph or rather its mere presence. Therefore, before the main study with high school students taking an exam, we conducted a pilot study in a similar setting—namely, university students in a learning situation—to identify a neutral control photograph with no achievement-enhancing effects to be included in our subsequent studies.

Pilot study

Sixty-eight students from a German university, 45 of them male, performed a simple brainstorming task, which is a widely applied task in research on conscious goal setting. They were asked to generate as many uses for a coat hanger as they could think of in 2 minutes. The number of generated ideas served as the dependent variable. Participants were recruited in two ways. Right before taking an exam, psychology students ($n = 38$) were asked to participate in the pilot study. To increase power, we recruited 30 additional students from various study programs while they were studying in the library during an exam period. To control for potentially distorting effects alone or in combination with priming, we included setting (exam versus library) in the analyses. Participants were randomly assigned to one of three experimental conditions, with the variation of the display on the task sheet. Twenty students conducted the task with an achievement-related photograph on the top of the instruction page and in the backdrop of the response form. The photograph used, displaying a woman winning a race (cf. Shantz & Latham, 2009, p. 15), has been successfully used to enhance performance by increasing the implicit achievement motive. Twenty-eight students conducted the task with a more neutral, but also sports-related, photograph displaying a person—that is, a resting mountain climber on the top of a mountain (see Figure 1A). This photograph had not been tested before. We chose it because it represented no distinct achievement moment but was quite similar to the achievement prime in that it featured a person and had a reference to sports. In the second control group ($n = 20$), participants conducted the task with no photograph at all.

Results of a 2 (setting: exam versus library) \times 3 (prime, control, no photograph) ANOVA supported one significant effect—namely, for the priming factor: $F(2, 62) = 3.29, p = .04, \eta^2 = .10$. A Scheffé post hoc test revealed a significant difference ($p \leq .05$) in the number of generated ideas for the two photograph conditions ($p = .04$). Participants who were exposed to the photograph of the runner generated significantly more ideas ($M = 4.85, SD = 2.21$) than participants completing the task with the photograph of the mountain climber ($M = 3.36, SD = 1.89$). No significant differences emerged between the two control conditions (control versus no photograph, $M = 3.85, SD = 1.79; p = .69$) or the runner versus no photograph condition ($p = .28$). Therefore, we may conclude that the photograph of the mountain climber did not enhance or diminish performance.

To gain more insight into the associations that participants had with the two photographs, we asked participants to complete a brief post-task survey with a question about what first came to mind when recalling the photograph they had been exposed. In the prime photograph condition, eight of 20 participants provided comments; all referred to success, reaching a goal, or competition. In the mountain-climber condition, 15 participants provided comments, 12 of which included words associated with freedom, silence, recreation, holidays, or sports in general. Only three participants indicated general-achievement-related content (to overcome obstacles, motivation, positive results). On the basis of the results of the pilot study, we retained both control conditions in the following experiments.

Main study

In a field experiment, we tested whether subconscious goals would yield higher academic performance (exam grades of high school students) than a control or a no-stimulus group and whether prior performance acts as moderator. To test the generalizability of the effects, we included two different school courses (German and math).



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B

Figure 1. Photographs used for control condition (A, © Getty Images) and for priming of a specific, difficult goal (B, see Experiment 2).

Method

Setting and participants

The sample was a complete 10th grade cohort from a German school preparing children for vocational school or university (*Gesamtschule*). The sample consisted of 127 students (71 female, 56 male) with a mean age of 16.12 years (range: 15–17). Participation in the study was voluntary, and all students participated. Because participants were underage, an informed consent had been obtained from their parents one month prior to the study. After data collection, students and parents were informed about the study purpose and results.

Procedure

Participants were randomly assigned to one of the three experimental conditions (prime, control, no photograph). Right before the start of the exams, students filled out a short survey about their preparation for the exam. The photographs were printed in the backdrop of the front page of this survey and were repeated in the headers of the following pages. The surveys were handed back to the teacher before the start of the exam.

After the students handed in their exams (duration: 90–150 minutes), a written post-experimental awareness check was administered, asking students what they thought the purpose of the study was and whether they had noticed something during the exam. In addition, we wanted to know if participants were aware of any connection between the photograph and their performance. The questions were adapted from the debriefing procedure for supraliminal priming by Bargh and Chartrand (2000).

Measures

Performance

At the end of 10th grade, students in Germany are obliged to take central exams in all main courses. In preparation for those central exams, trial exams are usually administered one month before the central examinations. Grades obtained in the trial exams are fully included in the calculation of the overall course grades at the end of the school year, which supports the relevance of these exams for the students and therefore their motivational basis to take the exams seriously. The exam grades in the trial exams for German ($n = 66$) and math ($n = 61$) were the main dependent variable. Approximately one week after the exams, the school provided anonymized report cards for all students. In Germany, “1+” indicates outstanding achievement and “6” indicates complete failure.² Grades were reversed to facilitate interpretation of the results. As such, in our results, 1 stands for the worst and 6.3 stands for the best possible performance. As an indicator of prior performance, we were able to obtain the individual grade of students of the last exam before the current exam in the corresponding course (German or math). To control for potential differences between the two courses, we included course content (German versus math) as control variable in our analyses.

Results and discussion

Manipulation check

First, we examined the awareness check. A small majority (58%) of the participants in a photograph condition reported that they had noticed the photograph on the survey before the exam. Of this group, only three students indicated an explicit link between the photograph and their performance or awareness of the hypothesis (e.g., “performance increase via photo”). Following the guidelines outlined by Bargh and Chartrand (2000), these three students were excluded from further analysis (cf. experimental procedure applied by Stajkovic et al., 2006). None of the students indicated a potentially distorting or negative effect of the picture afterwards.

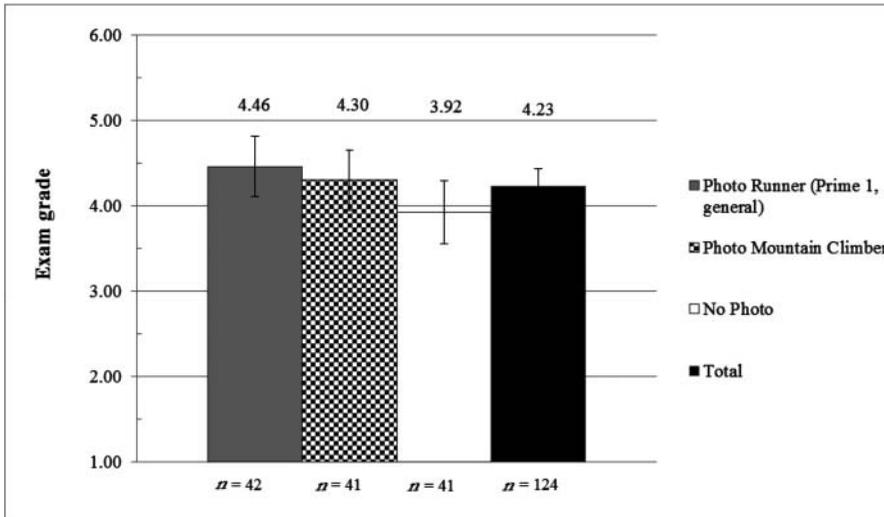


Figure 2. Descriptive statistics (number of participants, observed means, 95% confidence interval) of grades according to experimental conditions in Experiment 1 (main study).

Data analysis

Figure 2 displays (unadapted) means and 95% confidence intervals for students' grades according to the experimental conditions. To test our prediction about the effects of subconscious goals, we performed a moderated regression analysis (Table 1). Course content (German versus math) was entered as covariate in Step 1. Prior performance was entered in Step 2. The two dummy code variables for the full experimental design were entered in Step 3; dummy 1: prime photograph versus two control conditions, dummy 2: control photograph versus other two conditions. Finally, the product terms of prior performance and the experimental conditions (based on centered scores; Aiken & West, 1991) were entered in Step 4. Inspection of the data revealed that no standardized residuals exceeded a value of |3|, indicating no severe outliers in the data set.

Course content was a significant predictor of exam performance, with students obtaining better grades in German than math ($R^2 = .23$). In Step 2, prior grades were a good predictor of current grades: students with high prior grades also reached higher grades in the current exam ($\beta = .55$, $p < .001$). In Step 3, there was a main effect of the experimental conditions with regard to the prime photograph ($\beta = .16$, $p = .03$). Students who had been presented with the marathon runner obtained

Table 1. Summary of the hierarchical regression analysis for variables predicting exam grades in Experiment 1.

Variable	Grades			
	Model 1 β	Model 2 β	Model 3 β	Model 4 β
Course content ^a	.48**	.35**	.34**	.35**
Prior performance		.55**	.56**	.55**
Dummy 1 ^b			.16*	.16*
Dummy 2 ^c			-.01	-.02
Dummy 1 \times prior performance				-.02
Dummy 2 \times prior performance				.05
R^2	.23**	.52**	.54**	.54**
ΔR^2		.29**	.03*	.00

Note. $N = 124$; * $p < .05$ ** $p < .01$. Coding variables: ^aCourse content: German = 1, math = 0; ^bDummy 1, prime photograph condition: prime photograph = 1, other two conditions = 0; ^cDummy 2, control photograph condition: control photograph = 1, other two conditions = 0.

higher grades than students in the two other, control conditions (mountain climber, no photograph).³ Both regression steps significantly improved the amount of variance accounted for in academic performance. Together, all variables explained 54% of the variance in exam grades in the third regression step. In Step 4, adding to the regression equation the interaction terms of prior performance with the experimental conditions on the basis of the two dummy coded variables did not result in a significant improvement of the amount of explained variance in academic performance. None of the interaction terms reached statistical significance (cf. Table 1).

In sum, we found a positive effect of subconscious goals on exam performance, which supports the prediction that subconscious goals would enhance academic performance in two different school courses. However, this effect was not influenced by students' prior performance, which does not support the anticipated role of prior grades as moderator of the effect of subconscious goals. This seems to stand in contrast to research findings from Ferguson (2008), who reported an interaction effect of prior grades and primed *academic* goals on the evaluative readiness of participants measured by an automatic attitude test. Furthermore, conscious goal-setting theory (Locke & Latham, 2002) suggests that ability in terms of prior performance defines the boundaries of goal effects. However, we were not able to corroborate an interaction effect of prior grades with subconscious goals with regard to academic performance. This lack of support for the moderating role of prior performance may be attributable to the fact that interaction terms tend to have lower power and are less likely to be detected in field settings than in lab settings (Schneider, 1978). However, power analysis showed that our sample size would have been large enough to detect at least medium-sized effects ($1 - \beta = .98$) so that our results allow at least the conclusion that this variable does not have a medium or large impact on the relationship between subconscious goals and performance. Another explanation might be found in the measure of prior performance we used, as we were just able to get information from the school about the grades in the prior exam and, for example, not on students' GPA for the corresponding course, which might have been a more reliable indicator of task-specific ability.

As was done in all previous studies involving subconscious goals, we used nonspecific achievement primes in our experiment to stimulate performance. Goal-setting theory (cf. Locke & Latham, 1990, 2002), however, convincingly demonstrated that optimal motivation and performance require goals that refer to specific and challenging levels of performance. As such, we conducted a second experiment to investigate whether the effects of subconscious goals on performance can be further enhanced by priming a specific, difficult goal.

Experiment 2

In Experiment 2, we tested grade differences between four different conditions: a general achievement photograph (the marathon runner), a task-specific/difficult-goal photograph (a mark of a high grade on the task sheet of the exam), a control photograph (the mountain climber), or no photograph at all. In detail, our hypotheses for the second experiment were as follows. First, we expected students exposed to an achievement photograph (general or specific) to show higher performance than students in the control (no-prime) conditions. Second, in line with goal-setting theory, we expected students exposed to a photograph of a specific, difficult goal to perform better than students in a general subconscious goal condition.

Method

Setting and participants

The sample consisted of first-year psychology students at a Dutch university, taking an introductory course in work psychology. At the end of a 5-week course period with lectures and work groups, a 3-hour exam was administered. Participation in the exam was mandatory. The full sample included 156 undergraduates (118 female, 38 male), with an average age of 21.30 (range: 19–43) years. Participation in the study was voluntary and no incentives were provided.

Procedure

Students were randomly assigned to one of four experimental conditions. Besides the three conditions from Experiment 1 (general prime photograph of marathon runner, control photograph of mountain climber, no photograph), we included an additional specific, difficult prime condition with a photograph displaying a specific, high grade at the top-right part of an answer sheet that was the same as the answer sheet used for the exam (see [Figure 1B](#)). In line with prior (conscious) goal-setting research, we wanted this photograph to represent a difficult but attainable goal that approximately 10% of the participants would be able to reach (Kalnbach & Hinsz, 1999). In the Netherlands, grades range from 1 to 10, with 10 indicating outstanding performance.⁴ On the basis of past experience, we displayed a score of 9 (out of 10). In the current sample, 10.6% of the participants attained this grade, which confirms that the displayed goal met the objective goal–difficulty criterion.

The photographs were printed below the instructions on the first page of the exam booklet and were repeated in the headers on the following pages containing the exam questions. No information about the photographs was provided before or during the exam. Students provided their answers to the multiple choice questions on a separate scoring sheet.

After completion of the exam, participants were asked to fill out a short questionnaire that contained the course evaluation and questions about their motivation to take part in the exam. Four students were identified as outliers and therefore excluded from the original data set. Their exam grades (very low, 3 *SD* below the mean) and their responses to the questions about motivation to make an effort in preparing for the exam indicated that they had not taken the exam seriously. The data set was therefore reduced to 152 participants. The survey also included a post-experimental awareness check. Students were asked whether they had noticed something during the exam, in particular, whether they had seen a photograph (and if yes, what had been in the picture), and what came to mind when seeing the photograph. The vast majority of the participants in the three conditions with a photograph (94.2%) indicated that they had noticed the photograph and could correctly describe it.

Measures

Performance

We used the grades students obtained in the exam to measure performance. Grades were made available anonymously via the lecturer of the class approximately two weeks after the exam.

Results and discussion

Manipulation check

Although the answers provided in the postexam survey indicated that the majority of participants had been aware of the presence of the picture on the question sheet, the awareness check indicated that only a few participants explicitly linked this picture to their own performance. Following the guidelines for debriefing provided by Bargh and Chartrand (2000), we excluded those participants from the analysis whose responses to the post-experimental awareness check indicated that they had been aware of the activation of a performance goal, made a connection of the displayed picture with their own performance, or expressed insight into the research hypothesis. Using these guidelines, three raters independently rated all answers provided in the awareness check (nine participants did not provide any comment). The raters unanimously recommended exclusion of four participants. Twenty other participants were recommended for exclusion by one or two raters. On the basis of the above specified criteria, the three raters discussed the responses of these participants until consensus was reached. This discussion led to the exclusion of another seven participants. Examples of comments are “picture stimulated my motivation; is this an attempt to increase our performance?” (participant excluded) and “why was there a picture on the exam?” (participant retained). Based on the awareness check, in total, 11 participants were excluded from the sample for the analysis, seven of them in the specific, difficult goal condition. Although almost half of the participants in this condition provided post hoc comments that were completely unrelated to achievement (14 out of 29), the responses of 12 other participants

supported our attempt of the activation of a specific, difficult goal by this photograph, as they provided task-specific comments or an acknowledgment of the difficulty of the displayed grade (e.g., “good grade”).

Data analysis

The final data set consisted of 141 participants. Given that not all students who had initially registered showed up for the exam, the number of participants was not completely homogeneously spread across the four experimental conditions. Figure 3 displays (unadapted) means and 95% confidence intervals for students' grades according to the experimental conditions. The average grade was 6.71 ($SD = 1.50$), indicating an average performance well above the level to pass the exam, which is generally set at 5.5 in the Netherlands. On a descriptive level, students in the specific prime condition earned the highest grades and students in the mountain-climber-control condition earned the lowest grades.

First, we conducted an ANOVA with the priming factor (general prime, specific/difficult prime, control, no photograph) to exploratorily examine the effect of our manipulation on students' exam grade in the full experimental design. The analysis revealed a significant main effect; $F(3, 137) = 3.97$, $p = .01$; $\text{Eta}^2 = .08^4$. Results of the Scheffé post hoc test supported a performance-enhancing effect of the specific prime photograph compared to the photograph of a mountain climber ($p = .01$) and a trend for an effect comparing performance of students in the specific prime to the no-photograph condition ($p = .07$).⁵

Second, to test for the expected effect of the achievement prime photographs, we compared the grades of students in the two priming conditions (general and specific, difficult prime photograph; $n = 62$, $M = 7.07$, $SD = 1.26$) to students' grades in the two control conditions (control and no photograph; $n = 79$, $M = 6.42$, $SD = 1.62$). Results of an ANOVA revealed again a significant main effect for priming, $F(1, 139) = 6.84$, $p = .01$, $\text{Eta}^2 = .05$, with students in the priming conditions reaching a significantly higher grade than students in the two control conditions.

Third, to test for the expected superior effect of the specific-prime condition based on goal-setting theory, results of an ANOVA comparing the two subconscious goals conditions (general versus specific, difficult prime photograph) revealed—contrary to the post hoc test of the general ANOVA—a highly significant effect, $F(1, 60) = 6.75$, $p = .01$, $\text{Eta}^2 = .10$. When specifically comparing performance of students in these two conditions, we found that higher grades were obtained in the specific-prime condition than with the picture of a marathon runner.

In general, the results of this experiment indicate that subconscious goals (activated via a photograph) can enhance academic performance in a sample of university students. The photograph that represented a high level of academic performance yielded the highest exam grades, which supports the

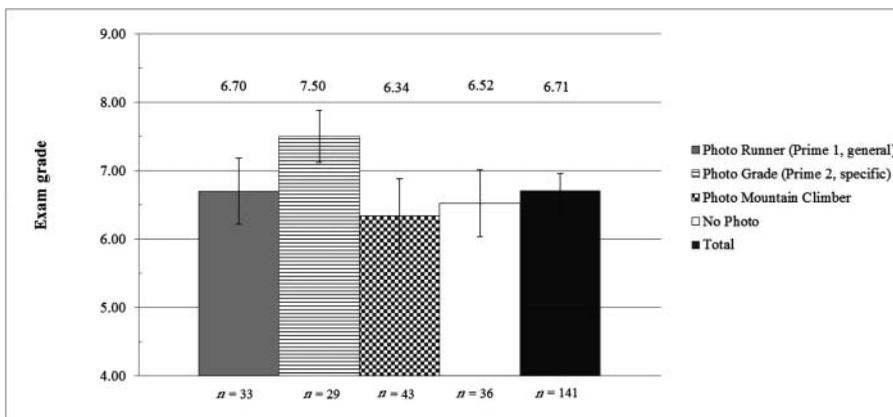


Figure 3. Descriptive statistics (number of participants, observed means, 95% confidence interval) of grades according to experimental conditions in Experiment 2.

expected performance-enhancing effect of a specific, difficult goal compared to the effects of a general goal prime with regard to achievement. It is yet unclear how tangible the goal is that is activated by the photograph of the runner (e.g., an unspecific goal, such as “do-your-best”). However, our results demonstrate that, compared to general-achievement primes, specific, difficult goals can be activated subconsciously in the academic context to realize even larger performance effects. In contrast to findings from Latham and Piccolo (2012), who did not find significant differences with regard to performance of general versus context-specific prime photographs, our results enhance current knowledge about priming effects by establishing on the basis of goal-setting theory what kind of photographs in terms of goal content may be used as successful primes. Future research should also investigate the performance effects of varying goal levels on the subconscious level (e.g., a goal of a 6, level to pass, versus an 8, also a good grade) or their effects in combination with conscious goals. It is not clear yet to what extent the performance effects of goals in terms of specificity and difficulty outlined in conscious goal theory add up between awareness levels and how both techniques of goal setting might efficiently be used in practice to support academic performance.

We have to note that we did not directly assess the activation of subconscious achievement motives in our study but used the answers participants provided after finishing the exam as an indirect check of the activation of goals. Although a slightly higher percentage of participants in the specific prime condition indicated awareness of the prime than participants in the general subconscious goal condition, all participants included in the analyses were unaware of an effect of the picture on their own performance. In addition, the reactions listed at this stage of the experiment indeed tapped into the achievement motive domain and support the idea of the activation of a task-specific, difficult goal. Nevertheless, we recommend that in future research the effects of priming photographs on the distinct dimensions of the (implicit) achievement motive (cf. Pang, 2010) be investigated more in depth.

The findings of our second experiment do not replicate the effect of the marathon-runner photograph obtained in Experiment 1. This indicates that the replication of the performance-enhancing effect of achievement-related photographs and its generalization to various settings is not that straightforward. Although, given the present data, we cannot comprehensively explain why an effect of the runner photograph (compared to the control photograph) was not visible in both of our experiments, possible explanations for our result pattern might be of both a statistical and a theoretical nature. Although we had enough power to detect large effects (post hoc power calculation $\geq .87$), especially smaller- or medium-sized effects may have been harder to detect while comparing specific conditions with each other (power $\leq .57$). Furthermore, explanations might be found in different experimental designs and sample characteristics or point toward other factors beyond the ones studied here that influence priming effects in terms of moderation (e.g., culture, age). Furthermore, the picture of the specific, difficult goal might represent a stronger cue that aligns participants' behavior in the current achievement situation, whereas the effect of the picture of the marathon runner might vary more due to, for example, situational or personal characteristics (e.g., affinity with sports, course content). Such potential moderators of the effects of subconscious goals should be studied in detail in future research in various applied fields.

General discussion

To our knowledge, this study is the first to directly show that, compared to control conditions, priming via an achievement-related photograph enhances academic performance of high school and university students. The effect held across different time points of prime presentation (before or during an exam), course contents, and backgrounds of the participants. However, given the varying results across the studies especially for the photograph of the runner, we also should acknowledge that the effects of subconscious goals might not be easily replicated in different settings. In this respect we refer to the current discussion regarding reliability and validity of priming effects (Harris et al., 2013; Locke, 2015). Still, our findings do offer a number of relevant insights into the effects of supraliminal priming on performance in an applied context and we, therefore, would like to highlight three contributions of the current study.

First, our findings support the effect of subconscious goals for complex tasks in real-life achievement situations (cf. Gramzow et al., 2014). Furthermore, because of the inclusion of a neutral control photograph in our studies, we may conclude that the performance effect is not just due to the mere presence of a visual stimulus.

Second, regarding our aim to contribute to theory building, our results indicate that subconsciously activated performance goals enhance academic performance of students with both high and low levels of prior performance. Assuming that students in Experiment 1 were highly motivated for the exam, given its contribution to their overall course grade, our results in the field did not confirm findings from the lab showing that GPA moderates the effect of primed academic goals (cf. Ferguson, 2008). As such, the motivational effect of priming subconscious performance goals at the moment of recall or reproduction does not seem to be specific for high- or low-skilled students. Future research is urged to explore the effect of other potential moderators especially in field setting. For example, studies have shown that both stable person factors (e.g., Hart & Albarracin, 2009; Radel et al., 2009) and situational constraints can influence priming effects (MacRae & Johnston, 1998).

Third, our second experiment represents the successful approach to transfer a core finding from conscious goal-setting theory to the field of subconscious priming, indicating that subconscious, specific, difficult goals lead to higher performance than general performance goals (cf. Latham, Brcic, & Steinhauer, in press). Therefore, our results corroborate that also on the subconscious level goal content (in terms of specificity or difficulty) has a major impact on the regulation of behavior in achievement situations.

In sum, our findings seem to support the external validity of the effects of supraliminally activated goals on performance reported for call-center agents (cf. Shantz & Latham, 2011) for performance outcomes in the academic context. However, on the basis of the varying performance effects of the runner photograph, we also have to note that the pictures used so far may not be equally effective for different contexts or applied settings. It is unclear whether, for example, context-specific photographs may stimulate performance in the academic context even more. However, given the unclear underlying mechanism involved in such task-specific stimuli, Latham and Piccolo (2012) were not able to establish a superior effect of a context-specific prime photograph compared to the runner photograph at work. Our current study forms an important starting point for investigating priming effects in the application field and testing theoretical models of subconscious goals effects. However, in general, more knowledge about when and why exactly performance-enhancing effects occur (or fail to occur) is required to provide more clarity in the complex domain of performance priming, shed light on the underlying mechanisms, better inform future efforts for replication and generalization, and enable applications in practice (cf. Locke, 2015).

Theoretical and practical implications

In terms of practical and theoretical relevance, we would like to stress that the experimental variation of subconscious goals alone accounted for between 5% and 8% of the variance in academic performance. First of all, we exposed students to the stimuli right before or while taking an exam and therefore did not influence the learning process before the exam (cf. Paris & Paris, 2001). Thus, our manipulation only impacted the process of retrieval or reproduction of previously acquired knowledge. More remarkably, we found an effect on performance that was independent of the individual preparation (and prior performance) for the exam on a rather complex task that lasted between 1.5 and 3 hours with a brief, inexpensive intervention by way of a photograph in the backdrop of a page. Our results are therefore in line with research findings that have demonstrated that brief interventions in the academic context can cause performance-enhancing effects (e.g., Ramirez & Beilock, 2011).

Second, compared to the effects of conscious goal-setting or feedback interventions in academic settings (cf. Schunk, 2003), the effects we found seem quite substantial, especially because priming interventions such as the one we used in the current study do not rely on cost-intensive methods, time-consuming preparation, or extensive personalized training (e.g. time-management interventions). In the field, a whole training industry focuses on enhancing performance based on findings in the field of

educational psychology. Although results should be replicated, our results seem to imply that transferring findings from fundamental research in social psychology, corroborated for rather simple tasks in laboratory studies, to this application field may lead to an equivalent boost in performance.

Third, our findings in the educational setting are in line with other successful approaches to implement priming effects outside the lab and also provide an answer to the question of what kinds of pictures do or do not prime effectively. Therefore, our findings support the notion that conscious processes have their limitation in explaining the regulation of behavior (Becker, Cropanzano, & Sanfey, 2011) and call for a deeper investigation of implicit motives or subconscious (motivational) processes with regard to performance in applied settings.

Fourth, with regard to theory building (cf. Locke, 2015), the research field on subconscious goals has mainly been inductive and it still lacks an overall accepted theory. Although various theoretical approaches have been suggested based on different research traditions (cf. Friedman, 2013), especially McClelland's theory of implicit achievement motives seems to offer much potential to explain the effects of subconscious achievement goals on performance. On the basis of the activation of implicit achievement needs, and by employing a deductive approach in which we aimed to transfer mechanisms outlined in conscious goal-setting theory to subconscious goal effects, we provide insights into the effects of goal content and a potential moderator of priming effects in the field. We have been able to show a superior effect of a specific, difficult goal prime, which implies that the positive relationship of conscious goals with performance might be transferable to the context of subconscious goals. The finding that prior performance does not influence the effect of subconscious goals in the academic setting contributes also to theory development in this field by eliminating, at least large effects of, one possible moderator.

If one starts to utilize priming to increase motivation in practice, it should be accompanied by a critical ethical debate. Is a teacher allowed to "manipulate" his (underage) students to maximize their performance by means of motivation-enhancing stimuli without their knowledge? Then again, other motivational interventions used in applied settings—for example, based on conscious goal-setting or feedback (cf. Pritchard, Harrell, DiazGranados, & Guzman, 2008)—could be interpreted as some sort of manipulation to provide the best possible conditions for individuals or groups to perform at a high level.

Limitations and future research directions

A limitation of this study was that we were only able to study the effects of priming for a short period, namely, the 3-hour exam period. It would be very interesting to investigate long-term effects—for example, spillover effects to other courses or the transfer of knowledge. Furthermore, due to restrictions in the applied setting, we were not able to manipulate conscious goals in our studies, as assigning goals to students in a classroom might cause distortions via differences in goal acceptance. Even though it is known from the results of Stajkovic et al. (2006) that subconscious goals can enhance performance under do-your-best instructions, those results showed that especially the effects of difficult goals are enhanced via subconscious goals. Furthermore, with respect to achievement-goal theory (Kaplan, Middleton, Urdan, & Midgley, 2002), it is yet not clear which kinds of goals—with respect to goal content or levels in the goal hierarchy (De Shon & Gillespie, 2005)—were activated by the different photographs we used in our experiments. It is known that the (conscious) activation of performance versus mastery goals (and the corresponding approach versus avoidance facets; e.g. Elliot & McGregor, 2001) leads to differential performance effects. For example, mastery goals have been linked to the preference for challenging courses in the educational context (Bong, Woo, & Shin, 2013), and Chen and Latham (2014) found that subconscious learning goals can have main effects with regard to performance for complex tasks.

In our experiments, we applied a written awareness check, which may represent a superior form of questioning for awareness given the potential problem of socially desirable responses in personal questioning (cf. Stajkovic et al., 2006). However, on the basis of this debriefing procedure, some participants (2.4% in Study 1, 7.2% in Study 3) had to be excluded, as their replies raised suspicion that they had

been consciously aware of the impact of the photograph on their performance. It might be that some photographs are more prone to raise awareness of the intended effects than others (as indicated for the specific goal condition in Experiment 2), and future researchers are urged to find an answer to the question to what extent the effects actually depend on the degree of awareness. It is yet not clear whether the performance-enhancing effect holds true when students know what the intended effects of the photographs are, or whether the detection of such an intervention and the perception of being manipulated would result in counterproductive behavior. Verwijmeren, Karremans, Bernitter, Stroebe, and Wigboldus (2013) showed that priming effects diminish when people are warned of the presence of such a (in their case, subliminal) stimulus. And it is still unknown whether priming techniques can be used without adaptation effects (Helson, 1964) or if habituation occurs. Do the same pictures still work when used several times or do the motivational processes activated by them change over time?

Future research clearly needs to investigate the underlying mechanisms in depth—for example, in terms of (sub)conscious mediators—to provide a deeper understanding of how priming influences the way one behaves in achievement situations and to specify the effect of subconscious goals at the individual and team level (cf. Aarts, Custers, & Holland, 2007; Locke, 2015). Although we can rule out that the effects we have found are due to the mere presence of a photograph, we cannot be sure which specific processes were stimulated by the different photographs used in our experiments. As with prior studies in this research field, the question arises as to what kinds of goals were activated by the photographs used, although goal-setting theory did offer a clear theoretical basis for our expectations in the second experiment. McClelland's theory seems to offer a possible explanation for the effects found (Friedman, 2013). However, research failed to support an effect of, at least, semantic achievement primes on implicit nAch (Engeser & Baumann, 2014). Nor does existing research answer the question of which of the different dimensions McClelland suggested for nAch (hope of success or fear of failure; cf. Pang 2010) are affected by which prime stimuli. Besides the (implicit) achievement motive, the prime photographs used in our study may have also impacted more-specific motivational process variables, such as self-efficacy beliefs of students to master the exams, or effort and persistence in finding answers to the questions or solutions to the problems presented to them during the exams. Other theoretical approaches suggest that associations built between environmental cues and behaviors or automatically activated motoric, sensory, or perceptual programs can explain priming effects (cf. Friedman, 2013). Therefore, we recommend, that in future research different explanation approaches will be explored—for example, by investigating potential motivational underpinnings, cognitive states, or affective variables that have been suggested as potential explanatory mechanisms for the effects of priming on behavior (Aarts et al., 2008).

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Notes

1. Although various terms have been suggested in the literature to describe goal effects on the subconscious level (e.g., preconscious, unconscious, implicit, primed, automatic), in line with Latham and colleagues (e.g., Shantz & Latham, 2011), we use in the current paper the term *subconscious goals* for the effects investigated here with regard to the activation of goals outside of a person's awareness.
2. Grade conversions German to U.S. system (Study 1): 1+ (0.7) and 1 = A+; 1- (1.3) = A; 2+, 2, and 2- = A; 3+, 3, and 3- = B; 4+ and 4 = C; 5 = D; 6 = F (Academic grading in Germany, n.d.; World Education Services, n.d.). Grade conversions Dutch to U.S. system (Study 2): 8.5–10 = A+; 7.5–8 = A; 6.5 = B; 6 = C; 5.5 = D; ≤ 5 = F (Nuffic, 2013).
3. Results of an ANCOVA in the full experimental design showed a main effect for subconscious goals, $F(2, 119) = 3.30, p = .04, \eta^2 = .05$. In detail, when we compared exam grades among the three experimental conditions with ANCOVAs (covariates: course content, prior performance), the following results occurred: Students presented with the runner photograph earned higher grades compared to both students in the condition with the mountain climber,

$F(1, 79) = 5.03, p = .03, \eta^2 = .06$; and students working on the exam without a photograph, $F(1, 79) = 4.68, p = .03, \eta^2 = .06$. Grades in the mountain-climber condition did not differ significantly from grades obtained in the no-photograph condition, $F(1, 78) = .03, p = .87$. In addition, we tested for a potential interaction effect between course content and the experimental factor with an ANCOVA (covariate: prior performance). Results revealed again main effects for the experimental condition, $F(2, 117) = 3.46, p = .04$; course content, $F(1, 117) = 28.47, p < .001$; but no significant interaction, $F(2, 117) = 1.01, p = .37$.

4. Results of mean comparisons carried out in the original samples (without the exclusion of participants who showed signs of awareness of the subconscious goals or the study hypothesis), resulted for both studies in a main effect for subconscious goals; Study 1 ANCOVA, $F(2, 122) = 3.56, p = .03$; Study 2 ANOVA, $F(3, 148) = 2.96, p = .03$.
5. Including age as an ordinal control variable (with four age groups: 19, 20, 21, or 22 years and older) did not reveal a significant effect for this variable, $F(1, 134) \leq 2.31, p \geq .13$; but did still reveal an effect for priming, $F(3, 134) = 4.05, p = 0.01$.

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