Effect of compatibility between conscious goal and nonconscious priming on performance

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INTRODUCTION

Goal pursuit can involve deliberate and conscious processes but can also occur outside of awareness, intent and control (Chartrand & Bargh, 1996; Bargh, Gollwitzer, Lee-Chai, Barndollar & Trötschel, 2001; Shah & Kruglanski, 2002). Thus, goal pursuit can be influenced or triggered by a conscious act of will as well as external and nonconscious factors. This paper aims to explore the interplay between nonconscious goal-compatible or goal-incompatible priming and a conscious (i.e., explicitly assigned) goal in the case of a motor performance task.

Nonconscious Goal Activation and Pursuit

Knowledge structures (e.g., schemas, stereotypes, traits) stored in memory can be activated automatically and significantly change behavior (see Dijksterhuis & Bargh, 2001 for a review). Like other knowledge structures, goals can also be automatically activated (Bargh, 1990; Chartrand & Bargh, 2002; Kruglanski, Shah, Fishbach, Friedman, Chun, & Sleeth-Keppler, 2002). Evidences indicate that priming words or concepts highly related to a specific goal can in turn nonconsciously activate this goal in memory (e.g., Chartrand & Bargh, 1996). Thus, for instance, priming words such as "succeed, win, compete, etc." activates the goal of performing well (Bargh et al., 2001). Once activated, either consciously or nonconsciously, goals operate effectively and "guide a person's goal-relevant cognition, affect, and behavior from that point on" (Bargh et al., 2001; p. 1015). A growing number of studies indicate that using goal priming and explicitly given instructions produce similar outcomes and influence a broad range of behaviors (e.g., judgment, Fitzsimons, & Bargh, 2003; anagram resolution, Shah & Kruglanski, 2002; memory performance, Chartrand & Bargh, 1996; voice intensity, Aarts & Dijksterhuis, 2003). However, an important issue remains unclear: how do nonconsciously activated contents and conscious goals interplay? Do they contribute additively or non-additively to performance?

Competition Between Nonconscious Priming and Conscious Goals

When people, at a given moment, encounter conscious conflicting goals, they generally solve the conflict by consciously and willingly arranging the goals according to a hierarchy (Emmons, King, & Sheldon, 1993). They select a primary goal on the basis of motivational factors or of the characteristics of the goals. When a goal is subjectively important, specific in its definition or challenging, it leads to commitment, involvement and high performance (Locke & Latham, 1990). In sum, in the case of conscious goals conflict, the goal selection process relies on conscious and deliberate factors. But, what happens when a conscious goal is conflicting with nonconsciously activated cognitions? Few studies have explored experimentally the interplay between nonconscious priming and conscious goal pursuit. Moreover, these studies provide contradictory results.

MacRae and Johnston (1998) observed that nonconscious priming effects disappeared when people have an intentional goal. In their study, in the absence of a competitive conscious goal, participants primed with words related to helpfulness displayed more helping behavior (i.e., picked up items dropped by the experimenter) than non-primed participants. However, when participants had a competing goal in mind (they were late for the next experimental session),

priming effects disappeared. So, priming effects were eliminated in presence of a competing conscious goal.

Other results indicated that conscious goal pursuit does not systematically eliminate nonconscious goal pursuit or goal-related priming. For instance, Bargh et al. (2001; Exp. 2) observed that participants were more cooperative when they had been previously primed with words related to "cooperation" either in presence or in absence of an assigned cooperation goal. Interestingly, when cooperation was activated both nonconsciously (through priming) and consciously (through assigned instructions), the result pattern was additive.

Kruglanski et al. (2002) also explored the interplay between priming and conscious goal pursuit in the framework of their Theory of Goals Systems (Kruglanski et al., 2002). More specifically, they observed that while a conscious goal is pursued, the accessibility of an alternative primed goal undermined persistence and performance in a task. This effect was greater when the two goals were perceived as unrelated than possibly related.

In Bargh et al. (2001) the interplay between nonconscious priming and conscious goals concerned primes and goals that were similar in terms of contents, that is highly compatible. Conversely, in MacRae and Johnston (1998), as well as in Shah and Kruglanski (2002), nonconsciously primed content and conscious goal's content were not only incompatible but also clearly referred to different objectives. It suggests that the interplay between nonconscious priming and conscious goals depends on the compatibility between the primed content and the conscious goal. When the nonconsciously activated content is compatible with the conscious goal (Bargh et al., 2001), the priming effect seems to add to the effect of the conscious goal. Conversely, when the primed content is incompatible (MacRae & Johnston, 1998), the conscious goal seems to override or eliminate the influence of priming.

Present Study

How can nonconscious priming and conscious goal pursuit be combined as a function of their compatibility? What happens when conscious goal and primed contents refer to the two extremes of a same continuum and are applicable to the same task? Our study was an attempt to test the interplay between conscious goal pursuit and compatible or incompatible nonconscious priming in the case of an unskilled motor task. We also aimed to explore the effects of a manipulation of the conscious goal's characteristics on the outcome of this interplay. Indeed, depending on its characteristics, a conscious goal is perceived as more or less important or salient and, consequently, is more or less efficiently pursued (Locke & Latham, 1990). Thus, manipulating conscious goal's characteristics, such as the level of specificity of the instructions, was a way of strengthening the conscious goal and, consequently, experimentally increasing or decreasing the compatibility or incompatibility between this goal and the previously primed content.

We assumed that the outcome of the interplay between nonconscious priming and conscious goal pursuit depends on their compatibility. Depending on whether compatibility between the conscious goal and the primed content is high or low, different patterns of means, strategies and response programs (corresponding to the nonconscious priming and to the conscious goal)

should be activated. Depending on the degree of matching, the pursuit of a conscious goal should be facilitated or impeded by a compatible or incompatible primed content. When priming and goal are compatible, the pursuit of the conscious goal should be facilitated by the priming and the effects of priming and conscious goal should be added to each other (see Bargh et al., 2001; Exp. 2). When priming and goal are incompatible, two hypotheses compete. The first assumes that incompatible priming and conscious goal cannot coexist. In other words, conscious goal pursuit should eliminate priming effects (see MacRae & Johnston, 1998). The second hypothesis assumes that primed content and conscious goals are processed in a relatively independent manner. In this case, the effect of nonconscious priming should decrease (but not necessarily disappear) in the presence of an incompatible conscious goal. So, we would expect to find main effects of priming and conscious goals, but not an interaction between the two.

METHOD

An Unskilled Motor Task: The Wire Game

Principles and Characteristics

The aim of the "wire game" is to move a ring along a wire avoiding contact between the ring and the wire. This task requires a high level of motor control as well as good hand-eye coordination. The apparatus featured a wire, 115 cm long and 2.5 mm in diameter. The ring was 1.2 cm in diameter. The wire was twisted into a shape that provided a real challenge in terms of difficulty.

Pre-Experiment

We ran a pre-experiment to: 1) test the instructions concerning the manipulation of the specificity of the conscious accuracy goals and 2) test the task and provide a standard level of performance. Thirty-three right-handed students participated in the pre-experiment. They were randomly assigned to one of three conditions. In the first condition, they performed the task with a high level of focus on accuracy (high specificity). In the second condition, participants applied an intermediate level of focus on accuracy (moderate specificity). Finally, in the third condition, participants were only informed that they had to move the ring along the wire (low specificity). We measured the number of times the ring touched the wire and the time to complete the task.

We performed a one-way ANOVA to assess the effect of the conscious accuracy goal specificity (high, moderate, low) on dependent measures. The mean of the contact made between the ring and the wire was lower when the requested level of accuracy was high ($M = 11.00$) than when it was moderate ($M = 14.54$) or low ($M = 24.18$), $F(2, 32) = 12.46$, $p < .001$. The manipulated factor also yielded a main effect on the time spent performing the task, $F(2, 32) = 6.68$, $p < .004$. Participants spent more time when the specificity of the accuracy goal was high ($M = 66.10$ s) than when it was moderate ($M = 52.09$ s) or low ($M = 32.10$ s).

Participants and Design

The between subjects factorial design crossed 2 nonconscious priming (accuracy vs. inaccuracy) by 3 conscious accuracy goal specificity (high, moderate, low). Sixty-six right-handed

undergraduates (10 men, 56 women; mean age 20.6 years), unskilled in the task, participated in the experiment. Their participation was volunteered and they did not receive credits or money in return. Gender effects, found to be non significant, will not be discussed.

Materials

Nonconscious Priming

We used a Scrambled Sentence Task as the priming manipulation (e.g., Chartrand & Bargh, 1996; Srull & Wyer, 1979). Participants were requested to produce a sentence using words presented in a scrambled order. Two versions of the task were constructed. The first one intended to prime "accuracy", the other to prime "inaccuracy". In the priming conditions, 20 out of the 30 sentences contained a word or an expression related to accuracy (e.g., sharpshooter; detailed; thoroughness) or inaccuracy (e.g., clumsy; inaccurate; approximate). The remaining sentences, used in both versions, were neutral (e.g., book; soup; pen).

Conscious Goal Implementation

We used three sets of instructions to implement a conscious accuracy goal in participants. The instructions differed as a function of their level of specificity. The high specificity condition maximized the accuracy goal by instructing the participants to focus intently on accuracy and make no errors. Participants were told: "Your task is to move the ring around and along the wire from point A to point B. During the task really pay attention not to touch the wire." Instruction of the moderate specificity condition pushed the accuracy goal into the background by permitting some errors: "Your task is to move the ring around and along the wire from point A to point B. During the task, avoid touching the wire too much. " Finally, the low specificity condition did not explicitly mention any accuracy goal: "Your task is to move the ring around and along the wire from point A to point B. "

Dependent Measures

Dependent measures were the number of times contact was made between the ring and the wire (collected by a hidden electronic sensor) and the time spent completing the task (extracted from a video recording).

Procedure

Participants were informed that they would be taking part in two out of three separate unrelated tasks: a language test, a logic test, and a motor-skill test. After a fake random assignment, all participants were informed that they would first have to complete the language test (i.e., the Scrambled Sentence Task) and then to perform the motor-skill test. Participants were then randomly handed one of the versions of the scrambled sentence task. After the completion of the "language test", they were instructed to move to another desk where the wire game was held. Participants then read one of the three accuracy instructions and performed the task. Finally, they were debriefed and thanked. As a part of the debriefing the experimenter probed carefully for any suspicions regarding the relationship between the priming manipulation and the motor

task. More specifically, a funneled questionnaire (Bargh & Chartrand, 2000) included questions concerning what the participants thought the experiment was about and whether they thought one part or task in the experiment might have affected another part or task. No participant indicated any awareness or suspicion that the words used on the priming task were related to the subsequent task.

RESULTS

Performance

The number of times contact occurred between the ring and the wire was analyzed by a 2 nonconscious priming (accuracy vs. inaccuracy) x 3 conscious accuracy goal specificity (high, moderate, low) between subjects analysis of variance (ANOVA). There was a significant main effect of the nonconscious priming, $F(1, 60) = 18{,}78, < .001$ (Eta square = .24). Participants primed with accuracy produced less contact ($M = 9.27$) than participants primed with inaccuracy ($M = 19.94$). The main effect of the conscious accuracy goal specificity, $F(2, 60) = 5.28$, $p < .008$ (Eta square = .15), revealed that the number of times contact occurred was greater when the conscious goal specificity was low ($M = 19.57$) than when it was moderate ($M = 15.09$) or high ($M = 9.61$). The interaction was not significant, $F(2, 60) = 0.04$. Thus, nonconscious priming and conscious goal manipulations produced an additive effect on performance. Whatever the specificity of the conscious goal was, planned comparisons indicated that differences between accuracy priming and inaccuracy priming conditions were significant (respectively, $F(1, 60) = 6.72$, $p < .013$ for high specificity, $F(1,60) = 6.49$; $p < .014$ for moderate specificity and $F(1, 60) = 5.63$, $p < .03$ for low specificity). Comparing these results with the results obtained in a separate control condition in which we did not use accuracy related primes, it appeared that conscious goal pursuit tends to be facilitated by a goal-compatible priming and impeded by a goal-incompatible priming (see Table 1).

Table 1: Mean Number of Contacts Made Between the Ring and the Wire (and Standard Deviation) as a Function of Nonconscious Priming and Conscious Goal

	Conscious Accuracy Goal Specificity		
Nonconscious Priming	Low	Moderate	High
Accuracy	14.30 (5.73)	9.82 (7.51)	4.58 (4.42)
Inaccuracy	24.36 (13.50)	20.36 (13.17)	15.09 (10.09)
No Prime (Control Condition)	24.18 (5.38)	14.54 (7.60)	11.00 (6.03)

Task Completion Time

A 2 nonconscious priming (accuracy vs. inaccuracy) by 3 conscious accuracy goal specificity (high, moderate, low) ANOVA yielded a main effect of nonconscious priming on task performance time, $F(1, 60) = 5.93$, $p = .018$ (Eta square = .09). Participants performed the task

quicker when they were primed with inaccuracy (M = 54.35 s) than with accuracy (M = 68.18 s). There was a significant main effect of the conscious goal, $F(2, 60) = 11.81$, $p < .001$ (Eta square = .28). Task performance time was longer when the conscious accuracy goal specificity was high (M = 77.27) than when it was moderate (M = 59.72) or low (M = 45.36). Planned comparisons indicated significant time differences between high and moderate specificity conditions, $F(1, 60) = 7.33$, $p = .009$, and between low specificity condition and the two former ones; respectively, $F(1, 60) = 23.44$, $p < .001$ and, $F(1, 60) = 4.60$; $p < .03$. The interaction was not significant $F(2, 60) = 0.84$. Comparing these results with those obtained in absence of priming (separate control condition), performance time tends to be increased by a goal-compatible priming (see Table 2).

Table 2: Mean Time of the Motor Task Performance (and Standard Deviation) as a Function of Nonconscious Priming and Conscious Goals (in seconds)

	Conscious Accuracy Goal Specificity		
Nonconscious Priming	Low	Moderate	High
Accuracy	50.79 (24.51)	70.87 (33.83)	80.22 (13.70)
Inaccuracy	40.42 (23.54)	48.57 (15.04)	74.05 (10.71)
No Prime (Control Condition)	32.10 (25.91)	52.09 (18.28)	66.10 (17.83)

Note that when the high accuracy goal faced the inaccuracy priming, the time required by participants to complete the task was relatively long (the second longest of all conditions). This result could reflect an inhibition process caused by the high degree of contents' incompatibility. This attempt to inhibit nonconscious incompatible content would result in a higher cognitive load, leading participants to longer time to completion as well as to more mistakes.

DISCUSSION

We investigated the influence of compatibility between nonconscious priming and explicit instruction (i.e. conscious goal) on the performance on an unskilled motor task. The main objective was to disentangle results obtained in the case of priming and conscious goal pursuit. Indeed, whereas some results indicated that nonconscious priming effects are eliminated when a conscious goal is available, other results imply that both nonconscious priming and conscious goals influence behavior. We assumed that the compatibility between the primed content and the conscious goal was a key factor in the understanding of the interplay between nonconscious priming and conscious goal pursuit.

Results indicated that nonconscious goal-related priming influences performance in an unusual and unskilled motor task, shaping consciously goal directed behaviors even when the primes are incompatible with the assigned instructions. Interestingly, incompatible primes produced an effect even if conditions to maximize efficiency of conscious goal pursuit (high specificity and challenge) were satisfied. Concerning the interplay between priming and conscious goal pursuit,

an additive pattern appeared. This result was expected in the case of compatibility between primes and goal, and confirmed Bargh et al. (2001; Exp. 2) findings. However, it was rather unexpected in the case of primes that were incompatible with the conscious goal (see MacRae & Johnston, 1998). In our study, effects of nonconscious priming and conscious goal added to each other when primes and goal were compatible (leading to higher performances and longer times to perform the task) and subtracted each other when they were incompatible (leading to lower performances). Results also strengthened the idea that compatibility is a key factor in the understanding of the interplay between nonconscious priming and conscious goal pursuit.

In terms of processes, we suggest that on the one hand priming influences the allocation of available motivational resources, promoting a focus of the resources on a single goal in the case of compatibility between priming and conscious goal and on the other hand priming leads to a sharing of resources in the case of incompatibility between primes and goal. Another plausible explanation is that goal-related primes do not influence the distribution of motivational resources but rather the sharing of attentional resources. So, when priming and conscious goal are compatible, priming would promote an attentional focus, whereas incompatibility between primes and goal would lead to divided attention. This is also compatible with the idea of an automatic attempt to inhibit the goal-incompatible content in memory. These explanations, as well as our results, are globally in line with recent work from Shah and Kruglanski (2002), and extend their research to compatible/incompatible priming and conscious goals belonging to a same continuum, as well as to a new kind of task: a difficult motor task. In Shah and Kruglanski (2002) nonconscious priming and conscious goals corresponded to different and unrelated tasks (solving anagrams and finding as many uses as possible for a box). On the contrary, nonconscious primes and conscious goals we used were clearly linked – as they corresponded to different degrees on the accuracy continuum – and were related to the same task. In this case, performance in a goal directed task tended to be improved by primes compatible with the conscious instructions and deteriorated by primes opposed to assigned explicit instructions. This implies that resources attributable to a goal could be nonconsciously increased or decreased as a function of the compatibility of priming and conscious goals. Thus, priming could be an interesting way to nonconsciously improve the motivational and/or attentional focus on a task thus improving performance. Moreover a big advantage of priming is that it relies on unconscious and automatic processes that are quick and have a low cognitive cost (Meier, Morger & Graf, 2003). On the contrary, self-regulation of conscious goals relies on limited resources and its costs are well-known and far higher (Muraven & Baumeister, 2000).

Implications

Results have implications in terms of self-regulation of behaviors. They indicate that the pursuit of a conscious goal can be influenced by external factors that nonconsciously regulate behaviors outside of people's awareness. Our data indicate that the direction of this influence rely on the compatibility between nonconscious priming and conscious goals. In our study, consciously goal-directed execution of a complex motor behavior was partly regulated by processes triggered by a nonconscious priming manipulation. The task used in this research is minimally social. Nevertheless results can easily be extended to more social situations and tasks. Thus, using a priming procedure in addition of goal setting could be a way to modify performance in a broad range of tasks, but also modify the way of acting in social situations (e.g., by using primes

related to cooperation or affiliation). In an applied perspective, one could imagine, in addition of an accuracy instruction, to apply an accuracy priming procedure to witnesses before they begin to testimony. In sports, priming of cooperation-related words or of competition-related words before a competition could constitute a means to improve team cooperation or, on the contrary, increase competition mindset. Obviously, applications in terms of marketing, advertising and consumer behavior are also numerous. In sum, regulation of behavior by nonconscious priming opens a wide range of perspectives.

Limits

A potential limit of our study is the lack of a fully integrated control group. Nevertheless, such a group was not necessary given our main objective, which was to test the interplay of compatible and incompatible nonconscious priming and conscious goals. Trends concerning the direction of the effects are provided by comparisons between the results and the standard level of performance obtained in the pre-experiment. They indicated that an incompatible nonconscious priming tends to hinder performance whereas a compatible nonconscious priming tends to improve performance.

Concluding remarks

Results support the idea that compatibility between primed contents and conscious goals constitutes an important factor regarding the interplay of priming and conscious goal pursuit. They also raise new research questions. Do priming directly regulate performance? Are these effects mediated or moderated by factors related to conscious goals characteristics, task perception or intra-individual factors? It may be fruitful to examine the mediator/moderator impact of variables that are representative of conscious goal pursuit such as perceived difficulty, commitment, challenge level, self-efficacy (Bandura & Locke, 2003), or affect (Aarts, Custers, & Holland, 2007) on the interplay between nonconscious priming and conscious goals. Focusing on motivational measures will also be important to determine whether or not the effects can be attributed to the sharing of motivational rather than attentional resources.

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APPENDIX 1: CORRELATION MATRIX (PEARSON CORRELATIONS)

	Mean	SD	1	2
1	14.60	11.45	1.00	-0.42*
2	61.27	25.61	-0.42*	1.00

* significant at $p < .05$ level.
1 = Number of contacts
2 = Time to perform the task (in s)

APPENDIX 2: FUNNELED QUESTIONAIRE

What do you think this experiment was trying to study?

For each of the following questions, subject responds with "Yes" or "No." If "Yes" response is given, then the subject is probed to explain.

Do you think that any of the tasks you performed during the experimental session were related in any way?

If you answered "YES", please explain in what way you think they were linked.

Do you think that anything you did on one task has affected what you did on any other task?

If you answered "YES", please explain how exactly it affected you.

When you filled in the language test, did you notice anything strange or unusual about the words?

If you answered "YES", please explain what was unusual.

Did you notice a particular pattern or theme to the words that were included in the language test?

If you answered "YES", please explain what it was.

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