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Subliminal priming and persuasion: Striking while the iron is hot

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Abstract

Three studies demonstrated that subliminally priming a goal-relevant cognition (thirst in Studies 1 and 2; sadness in Study 3) influenced behavior (in Study 1) and enhanced the persuasiveness of an ad targeting the goal (in Studies 2 and 3) when people were motivated to pursue the goal (when they were thirsty in Studies 1 and 2; when they expected to interact with another person in Study 3). These results suggest that subliminal priming can be used to enhance persuasion, but only when certain conditions are met. Both the priming of goal-relevant cognitions and the motive to pursue the goal were necessary for ads targeting the goal to be more persuasive. The implications of these results for the role of functionality in subliminal priming and for the use and abuse of subliminal priming in persuasion are discussed.

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In 1957, James Vicary, an advertising executive from New Jersey, claimed to have increased Coke sales by 18% and popcorn sales by over 50% by secretly flashing the words “EAT POPCORN” and “DRINK COKE” onto the movie screen at a local theatre. People were outraged and alarmed. In actuality, Vicary was lying about the increased sales. He had never flashed anything on the movie screen; it was just a hoax to save his floundering advertising company (Weir, 1984).

Despite this dubious beginning, does subliminal persuasion actually work? Many people seem to think so. Millions of people buy subliminal self-help tapes to help them lose weight, improve their self-esteem, or increase their assertiveness (Natale, 1988). Yet empirical studies suggest that these tapes are not effective. Greenwald, Spangenberg, Pratkanis, and Eskenazi (1991) tested the effectiveness of commercially available subliminal self-help tapes that claimed to increase either self-esteem or memory. After a month of use they found that neither of the tapes produced their claimed effects. More generally, Pratkanis and Aronson (1992) examined over 150 articles from the mass media and over 200 academic papers

on subliminal processes. They found no clear evidence that subliminal messages influence attitudes or behavior.

In contrast to these findings on subliminal persuasion, however, a large literature suggests that subliminal priming can be quite powerful. For example, Murphy and Zajonc (1993) have demonstrated that subliminal priming can be used to influence people's affective reactions to an unfamiliar object. In a series of experiments, Murphy and Zajonc found that participants liked Chinese ideographs that were preceded by a subliminally presented smiling face better than the same ideographs preceded by a subliminally presented scowling face. Using a similar paradigm, Krosnick, Betz, Jussim, and Lynn (1992) have even shown that the subliminal presentation of positive and negative images can classically condition people's impressions of others.

Previous research has also demonstrated that subliminal priming can even affect behavior (see Dijksterhuis & Bargh, 2001 for a summary). For example, Bargh, Chen, and Burrows (1996) found that participants who were subliminally primed with an African-American face responded with more hostility to a bothersome request made by the experimenter than participants subliminally primed with a Caucasian face.

If subliminal priming techniques can have such powerful influences on people's evaluations and behaviors, why have attempts at subliminal persuasion been

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largely ineffective?¹ We suspect that previous attempts at subliminal persuasion have not harnessed the power of subliminal priming techniques in seeking to persuade people. In particular, we propose that subliminal priming can be used to prime goal-relevant cognitions, and that this priming when combined with a motive to pursue the goal will make persuasive appeals targeting this goal particularly effective. For example, subliminally priming people with the concept of thirst should activate thirst-related cognitions, and if these people are thirsty, ads that appeal to the thirst-quenching properties of a beverage should be particularly persuasive. In this way, subliminal priming can be used to enhance the effectiveness of standard persuasive appeals.

One might wonder why subliminally priming a goal-relevant cognition does not always enhance the persuasiveness of an advertisement that targets this goal. Why, for example, would priming thirst-related cognitions not always enhance the effectiveness of an ad that highlights the thirst-quenching properties of a beverage? Why is being thirsty also necessary? In our view, it would not be adaptive for people to pursue every goal every time it is activated. Following Higgins' (1996) notion that activated cognitions primarily affect behavior in situations in which these cognitions are applicable, we propose that being primed with goal-relevant cognitions will only lead to enhanced effectiveness of an ad that targets the goal in situations in which they are motivated to pursue the goal. In our view, then, being primed with a goal-relevant cognition is necessary but not sufficient to increase the persuasiveness of an ad targeting the goal: one must not only be primed with the goal-relevant cognition but one must also have the motive to pursue the goal in order for the goal-relevant cognition to direct behavior.

One might also wonder why the motive to pursue a goal would not always enhance the persuasiveness of an advertisement that targets this goal. Why, for example, would being thirsty not always enhance the effectiveness of an ad that highlights the thirst-quenching properties of a beverage? Why is priming also necessary? At first blush it might seem that we would always be more persuaded by an ad that targets one of our goals, but we are complex organisms that have to manage many different goal pursuits. In our view, having a goal is necessary but not sufficient to increase the persuasiveness of an ad targeting the goal: One must not only have the goal but one must have goal-related cognitions activated as well to increase the priority of the goal.

In the present research, we plan to prime subliminally two different goal-relevant cognitions. In both cases we expect that this priming will influence goal-relevant behavior including the persuasiveness of an ad targeting the goal only in situations in which people are motivated to pursue the goal. In Study 1, we subliminally prime people with the words "thirst" and "dry" and measure how much they drink in a later task. We expect that these primes will increase drinking primarily when people are thirsty. In Study 2, we subliminally prime people who are thirsty with the words "thirst" and "dry" and assess the persuasiveness of an advertisement that highlights the thirst-quenching properties of a sports drink. We expect that priming will enhance persuasion. In Study 3, we subliminally prime people with a sad face when they are either motivated or not motivated to repair their mood and measure the persuasiveness of an advertisement that highlights the mood-restoring properties of a rock band. We expect that priming will enhance persuasion, but only among people who are motivated to repair their mood.

Study 1

To examine whether subliminal priming would affect people's behavior primarily when they were motivated, we examined whether subliminal thirst-related primes would lead to increased drinking among people who were thirsty. We also measured participants' explicit ratings of their thirst at three points in the experiment. These ratings were embedded in a larger mood scale in an attempt to prevent the supraliminal priming of thirst for all participants. The first measurement of thirst allowed us to demonstrate that there were no differences between conditions in participants' reported thirst when they came to the lab. The second measure of thirst allowed us to demonstrate that our manipulation of thirst was effective. Importantly, the third measure of thirst allowed us to determine whether our subliminal priming procedure had an effect on participants' explicit ratings of thirst. Although it is conceivable that the subliminal prime would influence participants' explicit ratings of thirst, an effect on drinking without an effect on explicit ratings of thirst would be consistent with the notion that the prime affected participants outside of their conscious awareness. We measured participants' drinking behavior in a taste-testing context in which the beverages were cloyingly sweet in an attempt to create a more sensitive measure of drinking behavior. Finally, in a preliminary subliminality check we tested whether our subliminal priming procedure was indeed subliminal.

Method

Participants and design. Participants were 81 undergraduates at the University of Waterloo (42 males and

¹ The research by Krosnick et al. (1992) on the subliminal conditioning of attitudes could also be conceptualized as a mechanism in which subliminal priming leads to persuasion. While noting the importance of this research, we feel that it does not address the arguments made by those who have argued against subliminal persuasion because it does not involve a persuasive appeal.

39 females). All participants received one experimental credit for their participation. The study was a 2 (thirst condition: thirsty vs. not thirsty) \times 2 (subliminal prime: thirst-related vs. neutral words) factorial design. The main dependent variable, the amount (in ml) of two beverages participants consumed, was unobtrusively assessed in the taste-testing phase of the experiment.

Procedure. Participants took part in the experiment individually. Before the experimental session, each participant was contacted and asked to participate in a marketing study in which they would eat and drink and then evaluate a number of different products. In line with the cover story, they were asked not to eat or drink anything for 3 h before the experimental session. This instruction ensured that all participants would be initially at least somewhat thirsty.

When participants arrived at the experimental session, we first confirmed that they did not have anything to eat or drink for 3 h, and then asked them to complete a mood scale ostensibly to control for the impact of their mood on their evaluations of the products. Embedded within this 9-item mood scale was an item that assessed their explicit level of thirst. Participants indicated how thirsty they felt on a 1–7 scale (“not at all thirsty” to “very thirsty”). Participants then performed a “taste test” on two different types of cookies. Following this taste test, thirst was manipulated by telling half of the participants “to cleanse your palate by drinking as much water as you want.” The other half of the participants did not receive any water. After this manipulation, participants again completed the mood scale that included the explicit measure of thirst.

Next, participants were instructed to complete a lexical decision task (LDT) that afforded us the opportunity to administer our subliminal priming manipulation. For this task, participants sat approximately 30 cm from a Macintosh LC computer with a screen resolution of 512×384 dots/in. and a refresh rate of 67 Hz. The color depth of the monitor was set to monochrome, and the background was set to white. Each trial began with a 1-second presentation of an asterisk on which participants were instructed to focus.

In the context of this computer task, half of the participants were subliminally primed with thirst-related words (i.e., thirst, dry) and the other half were subliminally primed with neutral words (i.e., pirate, won). As in all our studies, the experimenter was blind to the subliminal priming condition. The thirst-related primes and the neutral primes were matched for both length of word and frequency of use in the English language. The subliminal prime was flashed in the parafoveal field (i.e., at one of eight equally spaced locations 7.6 cm from the fixation point and subtended a visual angle of approximately 1° , cf., Bargh & Pietromonaco, 1982; Nelson & Loftus, 1980; Rayner, 1978) for approximately 16 ms.

Each of the primes appeared on 13 trials for a total of 26 trials in which a subliminal prime was presented. After the subliminal prime, a mask, consisting of a series of x's, appeared for 102 ms in the exact spot where the prime had been presented. Following the mask, participants saw a target letter string for the LDT. Participants indicated whether the letter string was a word or not and their response latency for this decision was measured. These target letter strings consisted of 22 words and 17 non-words. A subliminal prime was, therefore, presented before two-thirds of the trials. Only the mask was presented on the remaining trials to reduce the chance that participants would perceive the prime.

Following the LDT, participants again completed the mood scale that contained the explicit rating of thirst. Finally, they performed a second taste test in which they evaluated two different beverages. These beverages were actually Kool-Aid made with extra sugar so that they would be very sweet and therefore not overly thirst quenching. Participants were left alone in the room and told they could drink as much of the beverages as they wanted while they evaluated the beverages. Following this taste test, participants were debriefed and thanked for their participation. After participants had left, the experimenter measured how much of the beverages they had consumed.

Subliminality check. Following procedures similar to those used by Bargh and Pietromonaco (1982) and Devine (1989), we ran a separate set of 46 participants through a procedure similar to Study 1 to determine if our subliminal priming procedure was, indeed, subliminal. The procedure was the same as the thirsty conditions of Study 1 except that instead of performing the final taste test on the Kool-Aid beverages participants made on-line guesses about what primes were subliminally presented during the LDT.

Participants were told that they had two tasks to perform. The first task involved identifying the letter strings as words or not and the second task involved guessing what word had been quickly flashed immediately before the row of x's (i.e., the mask) appeared.

For this task, we had two types of matched trials: one set of trials in which a prime was presented subliminally and a matched set of trials in which a prime was not presented. After the subliminal prime was presented (or not presented in the matched trials) a mask appeared in the exact spot where the word had been presented (or would have been presented). Following the presentation of the mask, participants saw a target letter string for the LDT. Participants indicated whether the letter string was a word or not. Following the letter string, a multiple-choice question asked participants to identify the word that was flashed before the mask. In each trial, in which a prime was presented, the prime appeared, along with three distracter words. In each matched trial, in which a prime was not presented, participants re-

sponded to exactly the same multiple choice question. At the conclusion of the experiment, all participants were fully debriefed as to the purpose and design of the experiment and thanked for their participation.

Results and discussion

Subliminality check. To test whether participants could detect the primes, we compared the percentage of times the primes were chosen when the primes were presented with the percentage of times these same primes were chosen in the matched trials when primes were not presented. In the thirst-related prime condition, when primes were actually presented, participants chose the primes (i.e., thirst or dry) on average 24.6% of the time. On the matched trials when the primes were not presented, participants chose them 26.1% of the time. In the neutral prime condition, when primes were actually presented, participants chose the primes (i.e., pirate or won) 23.9% of the time. On the matched trials when the primes were not presented, participants chose them 27.4% of the time. These percentages are not significantly different from chance ($ts < 1.14$, $ps > .26$) or from one another ($ts < 1.26$, $ps > .22$). These results support the notion that the priming procedure was subliminal.

Explicit ratings of thirst. To determine whether participants were at least somewhat thirsty when they arrived, we had them rate their explicit thirst on a 1–7 scale, with higher numbers indicating higher levels of thirst. At the outset participants rated their explicit level of thirst as moderate ($M = 4.36$). There were no differences among the (yet to be manipulated) conditions ($F_s < 1$).

After tasting the cookies, half of the participants were given a glass of water and half were not, and then all participants rated their explicit thirst on the same 1–7 scale. A three-way ANCOVA with thirst condition, subliminal priming condition (yet to be manipulated) and sex as the three between-participants factors and level of thirst at the beginning of the experimental session as a covariate was conducted to determine if the manipulation of thirst was effective. Participant's initial level of thirst was a significant covariate ($F(1, 72) = 22.96$, $p < .001$).² As expected, the only other effect revealed by the ANCOVA was the main effect for thirst condition. Participants who had received water rated themselves as less thirsty ($M_{adj} = 3.45$, $SD = 1.72$) than participants who had not received any water ($M_{adj} = 4.86$, $SD = 1.58$) ($F(1, 72) = 16.56$, $p < .001$). Thus, our manipulation of thirst appears to have been effective.

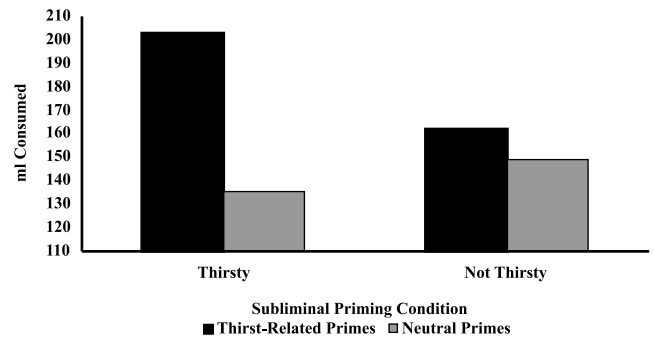


Fig. 1. Amount of liquid consumed as a function of thirst condition and subliminal priming condition.

Following the LDT, participants rated their explicit thirst for the last time. Participants who did not receive water again reported feeling significantly more thirsty ($M_{adj} = 5.03$, $SD = 1.46$) than participants who were given water ($M_{adj} = 3.95$, $SD = 1.61$) ($F(1, 72) = 17.93$, $p < .001$). Not surprisingly, participants who were subliminally primed with thirst-related words did *not* report greater explicit levels of thirst ($M_{adj} = 4.71$, $SD = 1.58$) than participants who were subliminally primed with neutral words ($M_{adj} = 4.43$, $SD = 1.61$) ($F < 1$).

Drinking behavior. Our hypothesis was that the subliminal priming procedure would affect how much participants drank when they were thirsty, but not when they were satiated. To test this prediction we conducted a three-way ANOVA with thirst condition, subliminal priming condition and sex of the participant as the between-participants factors. This ANOVA revealed a main effect of subliminal priming condition. Participants who received thirst-related primes drank significantly more liquid than participants who received the neutral primes when they were thirsty ($F(1, 73) = 5.60$, $p < .05$). In contrast, when participants were not thirsty, the subliminal priming condition had no effect ($F(1, 73) < 1$).

Moreover, a planned contrast testing our specific hypothesis that thirsty participants who received the thirst-related primes would drink significantly more than participants in the other three conditions was significant ($F(1, 73) = 4.37$, $p < .05$),³ and when the vari-

² For each of the ANCOVAs reported in the paper, we tested whether the homogeneity of regression assumption was met. It was in all of the analyses. In addition, we tested for treatment effects on the covariate and these were not significant except in one case in Study 2, in which this is noted.

³ All probability levels are reported as two-tailed, including all a priori planned contrasts.

ance accounted for by this contrast is removed, the residual variance is not significant ($F = 1.04$).

The results from Study 1 suggest that subliminal priming affects people's behavior primarily when they were motivated. Specifically, priming thirst-related cognitions affected people's drinking behavior primarily when they were thirsty, but seemed to have little effect when they were satiated. In Study 2, we want to extend these findings by examining how subliminal priming of thirst-related concepts affects persuasion.

Study 2

Study 1 demonstrated that thirst-related subliminal primes can affect people's drinking behavior when they are thirsty. But can such priming be harnessed to affect the persuasiveness of an advertisement? We think so. Given the results of Study 1, in this study we included only thirsty participants. We expect that when thirsty participants receive thirst-related subliminal primes they will be more susceptible to and more persuaded by an advertisement for a thirst-quenching sports beverage than by an advertisement for a similarly attractive electrolyte-restoring sports beverage. When thirsty participants receive neutral subliminal primes, however, we do not expect that they will be more persuaded by an advertisement for a thirst-quenching sports beverage than by an advertisement for a similarly attractive electrolyte-restoring sports beverage. Even though they are motivated to quench their thirst this is just one of the many motives they are likely to have in this situation and unless thoughts related to this motive are activated they are unlikely to pursue it.

Method

Participants and design. Participants were 35 undergraduates at the University of Waterloo (11 males and 24 females) who received one experimental credit for their participation. The experiment had two conditions. Thirsty participants received either thirst-related primes or neutral primes, and then viewed advertisements for two types of sports beverages: a thirst-quenching beverage called Super-Quencher and an electrolyte-restoring beverage called PowerPro. Participants' evaluations of these ads and their choice of price-reducing coupons for these beverages were the primary dependent variables.

Procedure. Participants were contacted under the same cover story, given the same pre-lab instructions, and followed the same procedures as the participants in the thirsty condition of Study 1, except that after the computer task they did not engage in the drinking taste test.

Instead, they were asked to examine and evaluate print advertisements for two sports drinks: Super-Quencher and PowerPro. Participants were informed that the marketing department at the University of Waterloo was pilot testing advertisements for two new sports drinks, soon to be available in stores. The Super-Quencher ad was designed to convey the message that Super-Quencher was the best thirst-quenching beverage ever developed. In contrast, the PowerPro ad was designed to convey the message that PowerPro was the best electrolyte-restoring beverage ever developed. These ads were pilot tested to ensure that participants rated Super-Quencher as more thirst-quenching and PowerPro as more electrolyte-restoring. This pilot test also revealed that participants had moderately positive and equivalent evaluations of the two sports drinks.

Participants evaluated these ads at the same time by completing two questionnaires: one for Super-Quencher and one for PowerPro. The questionnaires asked participants to indicate how strongly they agreed with statements on a 1–7 scale with higher numbers indicating greater agreement. Two statements served as manipulation checks. They were, "I think Super-Quencher (or PowerPro) will be very effective at quenching my thirst" and "I think Super-Quencher (or PowerPro) will be very effective at replacing my electrolytes." A final statement served as the main dependent variable. It was, "Overall, I think Super-Quencher (or PowerPro) is a great sports drink."

After evaluating the sports beverages, participants were told that the company that developed the beverages wanted to thank participants by giving them a total of nine coupons, each worth 50 cents off the purchase price of the beverages. Participants were told to indicate how many coupons they wanted for Super-Quencher and how many coupons they wanted for PowerPro. Participants were then debriefed and thanked for their participation.

Results and discussion

Explicit ratings of thirst. As in Study 1, participants indicated how thirsty they felt at three different times during the experimental session. When participants arrived for the session, there was a significant difference between the (yet to be manipulated) prime conditions ($F(1, 34) = 5.34, p < .05$). Participants randomly assigned to the thirst-related prime condition reported lower explicit ratings of thirst ($M = 3.65$) than participants randomly assigned to the neutral prime condition ($M = 5.05$). Because of this pre-existing difference, we controlled for initial ratings of explicit thirst in all of our analyses in which it was a significant covariate.

After the cookie taste-test participants again rated their explicit level of thirst. An ANCOVA of this measure with participants' initial explicit rating of thirst as a

covariate revealed that participants' initial rating of thirst predicted their second rating of thirst ($F(1, 33) = 74.7, p < .001$). Controlling for participants' initial rating of thirst, there was no difference between the (yet to be manipulated) prime conditions on participants' second explicit rating ($F < 1$). Participants randomly assigned to the thirst-related prime condition reported similar explicit ratings of thirst ($M_{\text{adj}} = 5.21$) to participants randomly assigned to the neutral prime condition ($M_{\text{adj}} = 4.95$).

Following the computer task in which participants received either thirst-related or neutral primes, participants rated their explicit level of thirst for a third time. An ANCOVA of this measure with participants' initial explicit rating of thirst as a covariate revealed that participants' initial rating of thirst predicted their third rating of thirst ($F(1, 33) = 45.09, p < .001$). Controlling for participants' initial rating of thirst, there was no difference between the (now manipulated) prime conditions on participants' third explicit rating ($F(1, 33) = 1.55, p = .22$). Participants who received thirst-related primes continued to report similar explicit ratings of thirst ($M_{\text{adj}} = 4.78, SD = .752$) to participants who received neutral primes ($M_{\text{adj}} = 5.38, SD = 1.09$).

Manipulation checks. Before testing the hypothesis that participants who received thirst-related primes would be more persuaded by the Super-Quencher ad than participants who received neutral primes, we had to ensure that participants believed that Super-Quencher was more thirst-quenching than PowerPro and that PowerPro was better at restoring electrolytes than Super-Quencher.

To test whether participants rated Super-Quencher as more thirst-quenching than PowerPro, we conducted a 2×2 mixed-model ANOVA with subliminal priming condition (thirst-related words vs. neutral words) as the between-participants factor and sports beverage (Super-Quencher vs. PowerPro) as the within-participants factor. Regardless of which subliminal priming condition they were in, participants rated Super-Quencher ($M = 5.40$) as more thirst-quenching than PowerPro ($M = 4.46$) ($F(1, 33) = 13.31, p < .01$).

To test whether participants rated PowerPro as more electrolyte-restoring than Super-Quencher, we conducted a 2×2 mixed-model ANOVA. Regardless of which subliminal priming condition they were in, participants rated PowerPro ($M = 5.29$) as more electrolyte-restoring than Super-Quencher ($M = 3.97$) ($F(1, 33) = 30.04, p < .001$).

Persuasiveness of the advertisement for the thirst-quenching beverage. To assess the overall persuasiveness of the Super-Quencher ad, we created an index by combining the difference between participants' ratings of Super-Quencher and PowerPro and the number of Super-Quencher coupons chosen. The two measures were highly correlated ($r = .71, p < .001$). In creating this

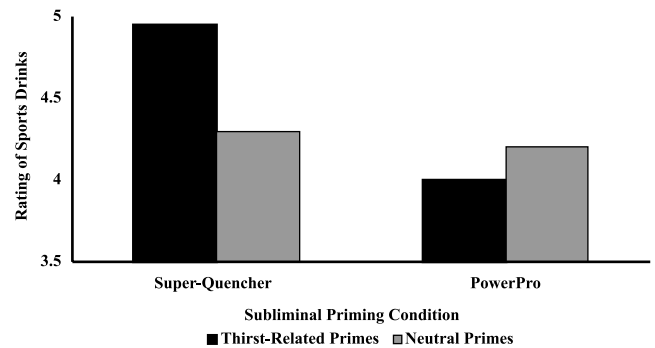


Fig. 2. Rating of sports drinks as a function of subliminal priming condition.

index, we standardized each of these variables after controlling for initial explicit ratings of thirst.⁴

To test our prediction that participants who received the thirst-related primes would be more persuaded by the Super-Quencher ad than participants who received the neutral primes, we conducted an ANOVA on this persuasion index. As expected, participants who received thirst-related primes ($M = .39$) were more persuaded by the Super-Quencher ad than participants who received neutral primes ($M = -.33$) ($F(1, 32) = 4.76, p < .05$). Because the two measures that contributed to the persuasion index were highly correlated, it is not surprising that they both were individually influenced by the subliminal priming manipulation. We now examine each of these measures separately.

Ratings of the sports beverages. To analyze the effect of the subliminal priming conditions on participants' ratings of the sports drinks we conducted a 2×2 mixed-model ANCOVA with subliminal priming condition (thirst-related vs. neutral primes) as the between-participants factor, with sports drink (Super-Quencher vs. PowerPro) as the within-participants factor, and with initial explicit rating of thirst as the covariate.

This analysis revealed that initial explicit rating of thirst was a marginally significant covariate ($F(1, 32) = 2.40, p < .15$). There was also a marginally significant interaction between subliminal priming condition and type of sports drink ($F(1, 32) = 3.76, p < .06$).

As can be seen in Fig. 2, participants who received the thirst-related primes rated Super-Quencher as a better sports drink than PowerPro ($F(1, 32) = 6.89, p = .01$), whereas participants who received neutral primes rated these beverages similarly ($F < 1$). In addition, participants who received thirst-related primes tended to rate Super-Quencher more positively than participants who received neutral primes ($F(1, 32) = 3.04, p < .10$).

Coupon choice. Because participants' choice of Super-Quencher and PowerPro coupons were not independent, to analyze the effect of the subliminal priming conditions

⁴ One participant was removed from these analyses because he asked for more than nine coupons for the sports beverages.

on participants' coupon choice, we conducted an ANCOVA with subliminal priming condition as the sole factor, initial explicit rating of thirst as the covariate, and the number of Super-Quencher coupons chosen as the dependent variable.

This analysis revealed that participants' initial explicit rating of thirst was a marginally significant covariate ($F(1, 32) = 3.09, p < .10$), and as expected, participants who received thirst-related primes chose more Super-Quencher coupons ($M_{\text{adj}} = 5.31$) than participants who received neutral primes ($M_{\text{adj}} = 4.27$) ($F(1, 32) = 4.28, p < .05$).

We also analyzed the coupon data nonparametrically by comparing the number of participants who chose more Super-Quencher coupons to the number of participants who chose more PowerPro coupons. When participants received thirst-related primes, 76% chose more Super-Quencher coupons than PowerPro coupons showing a clear preference for the Super-Quencher beverage ($\chi^2(1) = 4.76, p < .05$). In contrast, when participants received neutral primes, 42% chose more Super-Quencher coupons than PowerPro coupons, showing no systematic preference ($\chi^2(1) = .24, ns$). Thus, participants who received thirst-related primes chose more Super-Quencher coupons than participants who received neutral primes ($\chi^2(1) = 4.36, p < .05$).

Follow-up studies. We also conducted two follow-up studies to test the reliability and generalizability of our findings. One study ($N = 69$) employed the same basic design and procedure as Study 2, but also manipulated whether the primes were subliminal or supraliminal. The subliminal primes again appeared for 16 ms, whereas the supraliminal primes appeared for 300 ms. When participants received neutral primes, regardless of whether they were subliminal or supraliminal, participants choice of coupons did not reflect a preference for Super-Quencher over PowerPro ($\chi^2(1) = .03, ns$). In contrast, when participants received thirst-related primes, regardless of whether they were subliminal or supraliminal, participants choice of coupons did reflect a clear preference for Super-Quencher over PowerPro ($\chi^2(1) = 5.73, p < .05$). This preference for Super-Quencher was virtually identical in the subliminal and supraliminal conditions. Of the participants who received subliminal thirst-related primes, 64% chose more Super-Quencher coupons. Of those who received supraliminal thirst-related primes, 66% chose more Super-Quencher coupons.⁵

⁵ This study also addressed whether subliminal priming could affect behavior in the absence of more explicit effects on attitudes. Participants were told not to let anything from the prior tasks, which included the explicit ratings of thirst and the LDT, influence their ratings of the products in the experiment. In fact, we found no influence of the subliminal priming manipulation on participants ratings of the sports beverages (almost all participants rated the two sports beverages exactly the same) even though there were reliable effects on our more subtle measure of behavior.

This lack of difference between the subliminal and supraliminal primes is consistent with arguments made by Bargh (1992) and by Wilson and Brekke (1994). These authors suggest that what is critical about a prime is not whether it is subliminal or supraliminal, but rather whether people realize that the prime is influencing them and whether they have the ability to control this influence. Given this line of reasoning, it is not surprising that we did not find differences between the subliminal and supraliminal primes in our follow-up study—in the supraliminal prime condition the 300 ms exposure probably afforded participants little chance to appreciate the possible influence of the primes and even less ability to control this influence.

This reasoning, however, does not suggest that supraliminal and subliminal primes will always produce the same effects. If a supraliminal prime allows people to understand its influence and allows them to control this influence, whereas a subliminal prime does neither, then supraliminal and subliminal primes should lead to different results. For example, if people perceive a supraliminal prime to be part of a persuasive maneuver and have the ability to resist this persuasion, then supraliminal primes might create reactance and eliminate the effect of the persuasive appeal, whereas subliminal primes might still enhance the effect of the persuasive appeal.

We also conducted a study ($N = 57$) to rule out the possibility that collecting participants' explicit ratings of thirst enhanced the effect of the subliminal primes. Even though participants' explicit ratings of thirst were embedded in a larger mood scale, it is conceivable that the subliminal primes could have been more powerful because participants responded to these measures. Therefore, we conducted a replication of Study 2 in which we eliminated the explicit ratings of thirst from the mood scale.⁶ The results of this study were essentially the same as Study 2. Participants who received the sad-face prime rated the music as significantly more sad and gloomy ($M = 6.38$) than participants who received the thirst-related primes rated Super-Quencher ($M = 4.71$) more positively than PowerPro ($M = 4.35$) ($F(1, 56) = 3.93, p = .05$) and more positively than participants who received the neutral primes ($M = 4.13$) ($F(1, 56) = 4.40, p < .05$). In addition, exactly 50% of the participants who received neutral primes chose more Super-Quencher coupons ($\chi^2(1) = 0$). In contrast, 71% of participants

⁶ In addition to the explicit ratings of thirst we also replaced five words used in the LDT that were related to thirst with words unrelated to thirst. We included the thirst-related words in the LDT in the previous studies to explore the relation between subliminal priming, motivation and the activation of thirst-related cognitions. Although preliminary, analyses of the response latencies to these words suggest that people are more likely to activate thirst-related cognitions when subliminally primed and thirsty than in any of the other conditions.

who received thirst-related primes chose more Super-Quencher coupons ($\chi^2(1) = 5.76, p < .05$).

Meta-analyses. Across all three studies (i.e., Study 2, plus the two follow-up studies) participants who received the thirst-related primes rated Super-Quencher more positively than PowerPro ($z = 2.43, p < .02$) and more positively than participants who received the neutral primes ($z = 1.95, p = .05$).⁷ A meta-analysis also indicates that participants who received the thirst-related primes chose more Super-Quencher coupons (70%) ($z = 3.60, p < .0005$), whereas exactly 50% of the participants who received the neutral primes chose more Super-Quencher coupons. The difference between these conditions suggests that subliminal priming increased Super-Quencher's "market share" by 20% ($z = 3.02, p < .005$). Finally, a meta-analysis that combined both attitude and behavior measures indicates that overall there is strong evidence that subliminal priming enhanced persuasion. Participants who received the thirst-related primes were more persuaded by the Super-Quencher ad than participants who received the neutral primes ($z = 2.86, p < .005$).

Taken together the results of Studies 1 and 2 demonstrate subliminal priming influences people's behavior primarily when people are motivated. When people were thirsty, subliminal priming led to increased drinking in Study 1 and enhanced persuasion in Study 2. But the question remains, are these results unique to the domain of thirst? In Study 3, we attempt to conceptually replicate these results in a different domain.

Study 3

In the current study, we plan to test whether subliminally priming people with a sad face can activate the concept of sadness and whether such priming will enhance the persuasiveness of an ad for a mood-restoring product primarily in situations in which people are motivated to restore their mood. One such situation seems to be when people expect to interact with another person. Research by Erber, Wegner, and Therriault (1996) suggests that when people expect to interact with another person they are motivated to restore their mood, but when they expect to be alone they are not so motivated. Specifically, these researchers found that sad participants, who thought they would interact in the near future with another person, were much more likely to read cheerful newspaper stories in an attempt to re-

store their mood than sad participants who expected to be alone. Based on this research, we expect that when people are primed with a sad face and they expect to interact with another person (i.e., they are motivated to restore their mood) they will be more persuaded by an ad for a mood-restoring product.

In contrast, if people are primed with a neutral stimuli, even if they expect to interact with another person, there is little reason to expect that sadness would be activated and, hence, that mood restoration would play any role in their evaluation of the product. Likewise, if people are primed with a sad face, but do not expect to interact with others, following Erber et al. (1996), we do not expect that people will be motivated to restore their mood and therefore the activation of the concept of sadness will not be applicable to their evaluation of products in this situation. If these expectations are correct, then ads that feature mood-restoring characteristics of a product should be more persuasive primarily when people receive a subliminal sad-face prime in situations in which they expect to interact with another person.

Method

Participants and design. Participants were 90 undergraduates at the University of Waterloo (49 males and 41 females). All participants received one experimental credit for their participation in the study. The study was a 2 (subliminal priming condition: sad-face prime vs. neutral prime) \times 2 (future task expectation: expect to interact with another person vs. alone) factorial design. Participants' evaluations of the compact discs (CDs) by an upbeat, mood-restoring band and a musically innovative band, and the number of songs they chose to listen to from each CD were the primary dependent variables.

Procedure. Upon arrival at the experimental session, participants were told that they would be participating in three decision-making experiments: an LDT study, a marketing study and a problem-solving study. In describing these experiments, we manipulated participants' future task expectation by telling them that they would be completing the problem-solving study either alone or with another person. In actuality, participants never engaged in the problem-solving study and completed the entire experiment individually.

The first study that participants actually engaged in was the LDT. Before beginning this task, they were asked to complete a mood scale under the guise that the LDT was sensitive to mood. Embedded within this 9-item scale were two items that measured participants' explicit ratings of sadness and happiness, respectively, on 7-point scales.

The LDT was similar to the one described in Study 1 and 2 except the primes were different. In the context of

⁷ If we exclude our first follow-up study in which we told participants not to let anything from the prior tasks influence their ratings of the products in the experiment, the results are even stronger. Participants who received the thirst-related primes rated Super-Quencher more positively than PowerPro ($z = 3.13, p < .002$) and more positively than participants who received the neutral primes ($z = 2.60, p < .01$).

the LDT half the participants received a sad-face prime (a black and white photograph, taken from Eckman & Friesen, 1982). The other half of the participants received a neutral prime (i.e., an oval). The subliminal prime was presented in the parafoveal field (i.e., at one of eight equally spaced locations 7.6 cm from the fixation point and subtended a visual angle of approximately 1°) for approximately 16 ms followed immediately by a mask that contained many scribbled lines (cf., Spencer, Fein, Wolfe, Fong, & Dunn, 1998) that was presented for 102 ms. The subliminal prime was presented before 26 of the 39 lexical decisions. Following the LDT, participants completed the mood scale for a second and final time.

Next, participants completed the marketing study in which they were asked to evaluate ads for two debut CDs. One ad described the music of a band called “Tweed Monkeys” as energetic, upbeat, and lively. It included the claim, “If you are looking for a CD that will put you in a good mood, this is the CD for you.” In contrast, the other ad described the music of a band called “Crystal Hammer” as vibrant, strong, and musically creative. It included the claim, “If you like music with a strong sound, you will love this CD.” These ads were pilot tested to ensure that participants rated the Tweed Monkeys CD as more likely to restore their mood and the Crystal Hammer CD as more musically creative. This pilot test also revealed participants had moderately positive and equivalent overall evaluations of the two CDs.

Participants evaluated these ads at the same time by completing two questionnaires: one for the Tweed Monkeys and one for Crystal Hammer. The questionnaires asked participants to indicate how strongly they agreed with statements on a 1–7 scale with higher numbers indicating greater agreement. Two statements served as manipulation checks. They were, “I think listening to this CD would put me in a positive mood” and “I think this band would be very creative.” Two other statements served as measures of the persuasiveness of the ads. They were, “I think I would enjoy listening to this CD” and “I would want to buy this CD.”

After evaluating the CDs, participants were told they could listen to the CDs, but due to time constraints they could only listen to seven songs. Participants indicated the number of songs by Tweed Monkeys and the number of songs by Crystal Hammer to which they wanted to listen. After making this choice they were informed that the experiment was over, were debriefed, and thanked for their participation.

Does a subliminal sad-face prime activate sadness implicitly? In Studies 1 and 2, we primed participants with thirst-related words and assumed, based on previous research, that these primes would activate thirst-related concepts. In Study 3, however, it is less clear that a subliminal sad-face prime will activate sadness implic-

itly. To test this proposition, we subliminally primed a separate set of 49 participants with a sad face or an oval and had them rate a sad and gloomy piece of music (i.e., Prokofiev’s *Russia Under the Mongolian Yoke*). We subliminally primed participants using the LDT task described above and then had them rate the sad piece of music on the following 7-point, bipolar dimensions: sad–happy and gloomy–cheerful. Our assumption is that asking people about how sad and gloomy a piece of music is constitutes an implicit measure of mood, and would be more sensitive to the effect of a subliminal sad-face prime than an explicit measure, in which people were asked directly about their mood. If subliminally priming a sad face can activate sadness implicitly, then participants who received the sad-face prime should rate the sad music as more sad and gloomy than participants who receive the neutral prime.

Results and discussion

Does a subliminal sad-face prime activate sadness implicitly? To test whether the subliminal sad-face prime activated sadness implicitly, we computed an index of implicit sadness by combining participants’ ratings of the sad piece of music as sad and as gloomy. These two measures were highly correlated ($r = .62, p < .01$). An ANOVA revealed that participants who received the sad-face prime rated the music as significantly more sad and gloomy ($M = 6.38$) than participants who received the neutral prime ($M = 5.85$) ($F(1, 48) = 3.98, p < .05$). Thus, our subliminal sad-face prime appeared to activate sadness implicitly in this separate set of participants.

Explicit ratings of mood. Participants in the main study rated their explicit happiness and their explicit sadness at two different times during the experiment. When participants arrived for the session, they rated themselves as moderately happy ($M = 4.81$) and as not at all sad ($M = 1.86$). There were no differences between the future task expectation conditions or the (yet to be manipulated) subliminal priming conditions ($F_s < 1$).

Following the LDT in which the subliminal prime was manipulated, participants again rated their explicit happiness and their explicit sadness. Not surprisingly, there continued to be no differences between participants in the various experimental conditions ($F_s < 1$). Thus, neither the future task expectation manipulation nor the subliminal priming manipulation had an effect on participants’ explicit ratings of their mood.

Manipulation checks. To ensure that participants rated the Tweed Monkeys CD as more likely to restore their mood and the Crystal Hammer CD as more musically creative, we conducted a $2 \times 2 \times 2$ mixed-model ANOVA with subliminal priming condition (sad-face prime vs. neutral prime) and future task expectation (expect to interact with another person vs. alone) as the between-participants factors and CD (Tweed Monkeys

vs. Crystal Hammer) as the within-participants factor. Regardless of which subliminal priming condition they were in and whether they expected to interact with another person or be alone, participants rated the Tweed Monkeys CD as more likely to restore their mood ($M = 4.89$) than the Crystal Hammer CD ($M = 4.34$) ($F(1, 80) = 18.27, p < .001$), and rated the Crystal Hammer CD as more musically creative ($M = 4.97$) than the Tweed Monkeys CD ($M = 4.13$) ($F(1, 80) = 48.94, p < .001$).⁸

Persuasiveness of the advertisement for the mood-restoring CD. To assess the overall persuasiveness of the ad for the mood-restoring CD (i.e., Tweed Monkeys), we created an index by combining the difference between participants' two ratings of the Tweed Monkeys CD and the Crystal Hammer CD and the number of Tweed Monkeys songs to which participants chose to listen. In creating this index, we standardized each of the variables. The Cronbach α for this index was .74.

To test our prediction that participants who received the sad-face prime and expected to interact with another person would be more persuaded by the ad for the Tweed Monkeys CD than participants in the other three conditions, we conducted an ANOVA on this persuasion index with subliminal priming condition and future task expectation condition as the factors. This analysis revealed only a significant interaction between the subliminal priming condition and the future task expectation condition ($F(1, 80) = 8.20, p < .01$). Participants who received the sad-face prime and expected to interact with another person were more persuaded by the ad for the Tweed Monkeys CD ($M = .46$) than participants who received the neutral prime and expected to interact with another person ($M = -.31$) ($F(1, 80) = 10.48, p < .01$), and than participants who received the sad-face prime and expected to be alone ($M = -.17$) ($F(1, 80) = 7.34, p < .01$). In addition, the test of our specific hypothesis that participants who received the sad-face prime and expected to interact with another person would be more persuaded by the ad for the Tweed Monkeys CD than participants in the other three conditions ($M = -.16$) was significant ($F(1, 80) = 10.24, p < .01$). Because the three measures (the two attitude ratings and the choice of songs) that contributed to the persuasion index were related with one another, it is not surprising that both the attitude ratings and the choice of songs were individually influenced by our manipulations. We now examine attitudes and behavior separately.

Participants' ratings of the CDs. We combined the two attitude ratings of the Tweed Monkeys CD and the two ratings of the Crystal Hammer CD. These measures

were highly correlated for both CDs (r 's .74 and .76, respectively). To analyze the effect of our manipulations on participants' ratings of the CDs, we conducted a $2 \times 2 \times 2$ mixed-model ANOVA with subliminal priming condition (sad-face prime vs. neutral prime) and future task expectation condition (expect to interact with another person vs. alone) as the between-participants factors and with CD (Tweed Monkeys CD vs. Crystal Hammer CD) as the within-participants factor.

This analysis revealed a marginally significant effect of the subliminal prime ($F(1, 80) = 3.59, p < .10$) and a marginally significant difference in the ratings of the two bands ($F(1, 80) = 2.94, p < .10$). Both of these effects, however, were qualified by a significant 3-way interaction ($F(1, 80) = 4.70, p < .05$). In interpreting this interaction, we first analyzed the effect of our manipulations on participants' ratings of Crystal Hammer CD. This analysis revealed only a marginally significant main effect for subliminal prime ($F(1, 80) = 3.38, p < .10$), such that participants who received the sad-face prime ($M = 4.43$) tended to rate the Crystal Hammer CD more positively than participants who received the neutral prime ($M = 4.05$).

Next, we analyzed the effect of our manipulations on participants' ratings of the Tweed Monkeys CD. In contrast to their ratings of the Crystal Hammer CD, participants' ratings of the Tweed Monkeys CD revealed a significant interaction between the subliminal priming condition and the future task expectation condition ($F(1, 80) = 3.74, p = .05$). As can be seen in Fig. 3, participants who received the sad-face prime and expected to interact with another person rated the Tweed Monkeys CD more positively than participants who received the neutral prime and expected to interact with another person ($F(1, 80) = 5.54, p < .05$), and than participants who received the sad-face prime and expected to be alone ($F(1, 80) = 5.59, p < .05$). In addition, the test of our specific hypothesis that participants who received the sad-face prime and expected to interact

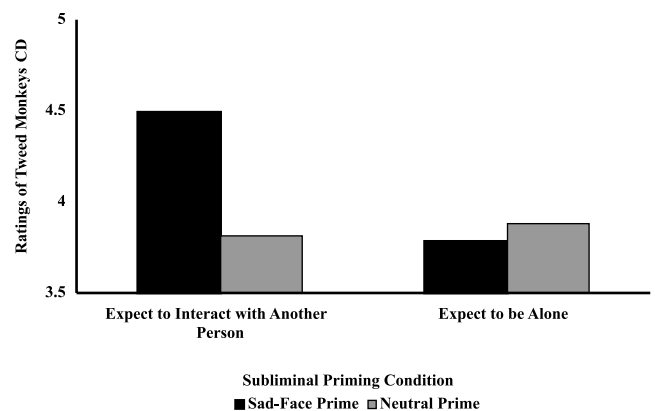


Fig. 3. Rating of Tweed Monkeys CD as a function of future task expectation condition and subliminal priming condition.

⁸ Six participants were removed from this and following analyses because they reported that they thought the Crystal Hammer CD would put them in a better mood than the Tweed Monkeys CD.

with another person would rate the Tweed Monkeys CD more positively than participants in the other three conditions was significant ($F(1, 80) = 6.13, p = .01$).

Choice of songs. Because participants' choice of Tweed Monkeys and Crystal Hammer songs were not independent, to analyze the effect of our manipulations on participants' choice of songs we conducted an ANOVA with subliminal priming condition (sad-face prime vs. neutral prime) and future task expectation condition (expect to interact with another person vs. alone) as the factors and the number of Tweed Monkeys songs chosen as the dependent variable.

This analysis revealed a significant interaction between the subliminal priming condition and the future task expectation condition ($F(1, 80) = 6.57, p = .01$). As can be seen in Fig. 4, participants who received the sad-face prime and expected to interact with another person chose significantly more Tweed Monkeys songs than participants who received the neutral prime and expected to interact with another person ($F(1, 80) = 7.43, p < .01$), and marginally more Tweed Monkeys songs than participants who received the sad-face prime and expected to be alone ($F(1, 80) = 3.56, p < .10$). In addition, once again, the test of our specific hypothesis that participants who received the sad-face prime and expected to interact with another person would choose more Tweed Monkeys songs than participants in the other three conditions was significant ($F(1, 80) = 5.24, p < .05$).

We also analyzed participants' choice of songs non-parametrically by comparing the number of participants who chose more Tweed Monkeys songs to the number of participants who chose more Crystal Hammer songs. When participants received the sad-face prime and expected to interact with another person, 76% chose more Tweed Monkeys songs than Crystal Hammer songs showing a clear preference for the Tweed Monkeys band ($\chi^2(1) = 5.76, p < .02$). In contrast, participants in each of the other three conditions showed no systematic preference ($\chi^2s(1) < 1$). Moreover, more participants

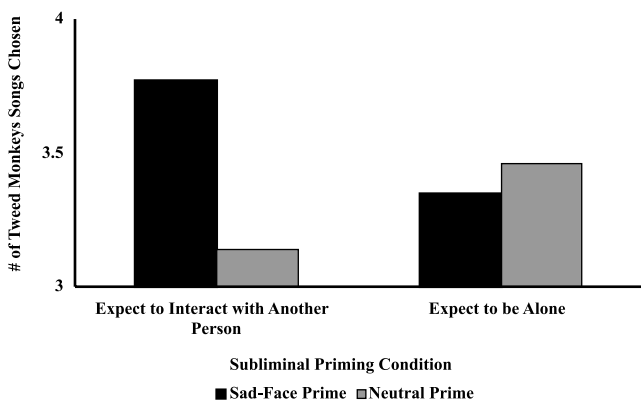


Fig. 4. Mean number of Tweed Monkeys songs chosen as a function of future task expectation condition and subliminal priming condition.

who received the sad-face prime and expected to interact with another person preferred to listen to more Tweed Monkeys songs than participants who received the neutral prime and expected to interact with another person (40%) ($\chi^2(1) = 5.53, p < .02$), and than participants who received the sad-face prime and expected to be alone (45%) ($\chi^2(1) = 4.25, p < .05$). Finally, the test of our specific hypothesis that more participants who received the sad-face prime and expected to interact with another person would prefer to listen to more Tweed Monkeys songs than participants in the other three conditions (46%) was significant ($\chi^2(1) = 5.76, p < .02$).

These results suggest that when people are subliminally primed with the concept of sadness and are in a situation in which they are motivated to restore their mood they will be more persuaded by an ad that targets this motive.

General discussion

Taken together these studies suggest that subliminal priming can enhance persuasion. We have found, however, that it does so only when certain conditions are met. Specifically, subliminal priming goal-relevant cognitions only influenced behavior and enhanced the persuasiveness of an ad targeting the goal when people were motivated to pursue the goal. In Study 1, we found that subliminally priming thirst increased the amount that people drank when they were thirsty but not when they were satiated. In Study 2, we found that thirsty people who were subliminally primed with thirst were more persuaded by the ad for the thirst-quenching beverage than were thirsty people subliminally primed with neutral words. In Study 3, we found that subliminally priming sadness enhanced the persuasiveness an ad for a CD with mood-restoring music when people expected to interact with another person (and were presumably motivated to repair their mood). Subliminally priming sadness did not effect the persuasiveness of the ad for the mood-restoring CD when people expected to be alone (and were presumably unmotivated to repair their mood), and subliminally priming a neutral stimulus did not effect the persuasiveness of the ad for the mood-restoring CD even when people expected to interact with another person.

Importantly, these findings generalize across quite diverse domains (quenching thirst vs. restoring mood), types of subliminal primes (words vs. photos), and motivational situations (physiological thirst vs. the expectation of interacting with another person). In addition, the results hold for both attitudes and behavior.

Together these results suggest that both priming goal-relevant cognitions and the motive to pursue the goal are necessary for ads that target the goal to be more persuasive. Subliminal priming per se had no effect. Rather,

subliminal priming only in combination with a relevant motivational state influenced the pursuit of the goal.

One explanation for this pattern of results could draw upon Schachter's (1964) position that both arousal and cognitive cues are necessary for emotion. For example, in our thirst studies neither a moderate physical need for water nor subliminally priming thirst increased drinking (Study 1) or enhanced persuasion (Study 2). It is only when moderately thirsty (or aroused in Schachter's terms) participants are subliminally primed (or exposed to a cognitive cue in Schachter's terms) that these effects occur. Although appealing, this explanation does not seem to be as compelling of an account of the data from Study 3, because it is unclear why the sad-face prime would act as a cognitive cue that would label whatever arousal occurs from expecting to interact with another person as happiness.

Another explanation for why multiple conditions may be necessary for our results draws upon Higgins' (Higgins, 1996; Higgins & Brendl, 1995) notion that for primes to influence behavior they must be both accessible and applicable. In other words, priming alone does not always automatically determine behavior. There are motivational constraints in the form of situational applicability. Thus in our studies we only found actual goal pursuit when concepts were accessible (i.e., when they were primed) and applicable (i.e., when participants were motivated to pursue the goal). This functional constraint on the power of priming would seem to make adaptive sense. For example, it would not be adaptive if priming "suicides" led to suicidal behavior in most people. Assuming that the usual situation is that people want to live, such primes (e.g., in the media) should only lead to suicide among those who are desperately depressed.

The idea that accessibility and applicability are necessary for primes to influence behavior can also offer an alternative conceptualization for some recent findings on the relation between priming and behavior. For example, Macrae and Johnston (1998) have shown that priming helpfulness leads to helping behavior unless people are late for an appointment. One interpretation (the so-called inhibitor account) of these results is that priming automatically leads to behavior, it is just that when the participants were late this automatic priming-behavior link was inhibited (cf., Dijksterhuis & Bargh, 2001). An alternative account suggested by our findings is that priming leads to helpfulness when people are not late because (given the norm of social responsibility) most people are chronically motivated to be helpful. When they are late, however, their situational motivation to be on time renders the motive to be helpful inapplicable. One could also imagine that not all people are motivated to be helpful. For example, we might suggest that Ebenezer Scrooge (or possibly the Grinch) would not be helpful when primed with helpfulness even when they are not late. In our own research (Strahan,

Spencer, & Zanna, 2001), we have found that non-restrained eaters are unaffected by the primes "eat" and "binge," whereas restrained eaters (who are chronically hungry) drink more of a high caloric beverage when they are exposed to these same primes. Thus, we believe that future research should carefully consider the functionality of primes both in terms of their situational and dispositional applicability in investigating their influence on behavior.

Finally, we believe that this research has important practical implications. Although our exact procedures may not lend themselves to the real world of advertising, we suspect that practitioners of persuasion could develop clever techniques that utilize our ideas in an effort to enhance their persuasive messages. Thus, even though previous research has failed to find evidence for subliminal persuasion, suggesting that we need not worry about the possibility that people could be persuaded subliminally, this conclusion is perhaps a bit too optimistic. Our research suggests that people might be exploited by subliminal priming procedures. Thus, we believe that the results of these studies suggest that there should be a renewed debate about the potential use and abuse of subliminal procedures in persuasion.

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