Journal of Personality and Social Psychology
2002, Vol. 83, No. 2, 406–424

0022-3514/02/$5.00 DOI: 10.1037//0022-3514.83.2.406

The Nonconsciousness of Self-Consciousness

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Five studies demonstrated that private self-consciousness is associated with nonconscious, automatic behaviors. In 2 studies, high but not low self-conscious individuals walked more slowly following exposure to an implicit elderly prime. In a 3rd study, high but not low self-conscious individuals showed improved performance following exposure to a subliminal success prime relative to a subliminal failure prime. In a 4th study, subliminal exposure to an angry prime was shown to increase blood pressure relative to a relax prime. In a final study, the latter effect was shown to be true only for high self-conscious individuals and only for subliminal presentations. Results are discussed in terms of their implications for understanding a variety of effects associated with self-consciousness and self-awareness.

The self is often conceptualized in terms of conscious, reflective processes. Indeed, in his highly influential *Principles of Psychology*, James (1890/1950) stated, "passing thought . . . is itself the thinker, and psychology need not look beyond" (p. 401). James, then, defined analysis of the stream of consciousness as the proper domain for the scientific study of self. He identified one aspect of self as that associated with consciousness itself (i.e., the *I*) and another with the parts of consciousness that are specifically associated with thoughts about the self (i.e., the *me*), but he denied that psychologists need to look beyond these states to understand the nature of the self. In particular, he rejected the claims of Immanuel Kant (1787/1965), who stated in the *Critique of Pure Reason* that "I have no knowledge of myself as I am but merely as I appear to myself. The consciousness of self is thus very far from being a knowledge of the self" (p. 169). With respect to this logic, James (1890/1950) stated, "I prefer to stick by the common sense assumption that we have successive conscious states . . . because one does not see how there can be a Psychology written which does not postulate such thoughts as its ultimate data" (p. 370).[1]

Modern research appears to support Kant's (1787/1965) claim that much of self-knowledge is indirect, based as it is on post hoc reasoning applied to self-observations (see Nisbett & Wilson, 1977; Wegner & Bargh, 1998). Research from numerous sources using a variety of experimental paradigms supports the corollary that much of one's mental life takes place outside of one's awareness. Within social psychology, Bargh and his colleagues (e.g., Bargh, Chen, & Burrows, 1996; Chartrand & Bargh, 1996; Chen & Bargh, 1997) have repeatedly demonstrated that individuals respond to implicit and subconscious cues despite the fact that they are unaware of the nature of the cue or even that the cue was presented to them. In a modern classic, Bargh et al. (1996) demonstrated that implicit priming of stereotypes can bias an individual's behavior in a stereotype-congruent manner even though the individual remains unaware of both the stereotype activation and its association to his or her own behavior. Thus, individuals who are exposed to words that share a common association with the elderly stereotype (e.g., *wrinkle*, *Florida*, *bingo*, *retired*) subsequently walk more slowly than do individuals who were exposed to control words. Similarly, individuals exposed to professor-related words subsequently perform better on tests of knowledge compared with individuals exposed to secretary-related words (Dijksterhuis & van Knippenberg, 1998). Equally striking are repeated demonstrations that an individual's behavior is altered in meaningful ways following presentation of primes in such a manner that the individual cannot accurately identify their presence. These effects have been shown with a variety of experimental tasks. With respect to social behavior, Bargh and Pietromonaco (1982) demonstrated that following presentation of hostile primes, participants perceived an ambiguous target as more hostile; Bargh et al. (1996) and Chen and Bargh (1997) demonstrated that following exposure to a subconscious African American prime, Caucasian American participants responded with greater hostility; and Chartrand and Bargh (1996) demonstrated that participants who were subconsciously primed with an impression formation versus memorization goal acted similarly to participants who were explicitly told to form an impression or memorize information (see also Bargh, Gollwitzer, Lee-Chai, Barndollar, Troetschel, 2001). Similar and related effects have been shown by Carver, Ganellen, Froming, and Chambers (1983); Macrae, Bodenhausen, and Milne (1998); Dijksterhuis and van Knippenberg (1998); Fazio, Jackson, Dunton, and Williams (1995); and Murphy and Zajonc (1993).

One difficulty in explaining these effects concerns the objective inapplicability of some of the primes. Traditionally, it has been argued that for a prime to influence processing, it must be applicable to the target (e.g., Banaji, Hardin, & Rothman, 1993; Higgins, 1989). Yet in studies by Bargh et al. (1996), elderly stereo-

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Study 4 was supported in part by an honors thesis grant to Amanda R. Matthews from the Rockefeller Center for the Social Sciences. Thanks go to Peter Bastian for his assistance in collecting the data in Studies 2 and 3.

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[1] See Weinberger (2000) for an alternative interpretation of James's (1890/1950) statements regarding conscious and nonconscious processes.

type primes influenced the behavior of youthful participants, and in the study by Chen and Bargh (1997), African American primes influenced the behavior of Caucasian participants. Why? One possibility is that to bias behavior, the prime must be processed as self-relevant. Wheeler, Jarvis, and Petty (2001) provided some support for this hypothesis. These authors found that Caucasian participants who wrote an essay about a student they presumed to be African American from a first-person point of view subsequently performed worse on a standardized test than did participants who wrote about the same student from a third-person perspective. In recent reviews of the literature, Dijksterhuis and Bargh (2001) and Wheeler and Petty (2001) both acknowledged relevance as a possible moderating variable on implicit priming effects. In addition, Hull (2002) argued that it is precisely because objectively inapplicable primes are processed as self-relevant that they influence behavior.

The Moderating Effects of Self-Awareness and Self-Consciousness

Psychological research has thus gone a long way toward demonstrating that at least some behavior is guided by factors that are not only unknown but apparently unknowable. Although most current psychologists are willing to accept this claim, they typically do not identify these factors as aspects of self and certainly would not define them as part of self-awareness or self-consciousness. Thus, most adopt the viewpoint of Baumeister (1999) that "there is the experience of reflexive consciousness. The conscious human mind can turn its inquiring attention back toward its own source and seek the self. In plain terms, people are self-aware" (p. 2). Such a position is central to most theories of self-awareness. According to Duval and Wicklund (1972), in the self-aware state, "consciousness is focused exclusively upon the self and consequently the individual attends to his conscious state, his personal history, his body, or any other aspect of himself" (p. 2).

From this perspective, one might expect that self-aware individuals are especially likely *not* to be influenced by external primes, particularly if these primes are inconsistent with personal standards. Indeed, Carver and Scheier (1981, 1998) identified private self-consciousness with self-regulation using personal standards. Although self-awareness manipulations have regularly been observed to increase behaviors that are consistent with experimenter-provided standards of behavior (e.g., Batson, Thompson, Seuferling, Whitney, & Strongman, 1999; Carver, 1974), this fact is generally not discussed in literature reviews or is dismissed with the characterization that participants have momentarily adopted the salient situational standard as their own personal standard. But what if the situationally primed standard is inapplicable to the self? If these theories predict any moderating effect of self-consciousness under these conditions, it seems to be that increased self-consciousness should lessen the influence of such nonself-primes.

We have argued for a different definition of self-awareness. Specifically, we have argued that self-awareness involves encoding information in terms of its self-relevance (Hull, 2002; Hull & Levy, 1979; Hull, Van Treuren, Ashford, Propsom, & Andrus, 1988). Such self-referent processing may result in reflexive consciousness, or it may not; it may result in self-evaluation (Duval & Wicklund, 1972) and attempts at controlled self-regulation (Carver & Scheier, 1981, 1998), or it may not. What it is predicted to do consistently is increase the individual's sensitivity and responsivity to cues according to the cues' relevance for the self. Whether this results in self-evaluation and controlled self-regulation is proposed to depend on the nature of those cues and the ways they are referenced to the self, not on the fact that they are referenced to the self per se. Specifically, Hull and Levy (1979) have stated,

> The present distinction between encoding and focal attention/comparison processes is common to several recent theories of cognition . . . . feature encoding corresponds to the automatic activation of specific cognitive structures in response to a particular input configuration and as such operates through a set of associative connections in long-term memory. On the other hand, controlled processing corresponds to a capacity-limited comparison or search process dependent on focused attention and under the control of the individual. Since feature encoding defines the form of information available to the individual, it need not be associated with different kinds of controlled processes to lead to different behavioral effects. Thus, encoding may be associated with automatic responses that do not require controlled processing, or, by its inherently constructive nature, encoding may determine the outcomes of those controlled processes that do occur . . . . Self-awareness as a greater sensitivity to such information will be associated with a greater responsivity to the evaluative and affective connotations of the information. (pp. 757–758)

We continue to hold this position (e.g., Hull, 2002) and recently have begun investigating one of its more ironic implications: Self-consciousness may be associated with effects that occur outside of and that are unavailable to consciousness.

To understand the approach we have adopted, it is helpful to consider the ways self-consciousness and self-awareness are typically studied in experimental social psychology. Within the experimental literature, *self-awareness* is usually associated with randomly assigning an individual to be exposed to a self-symbolic cue versus a control cue. For example, in high self-aware conditions, individuals are assigned to work in front of a mirror versus at the back of a mirror (e.g., Duval & Wicklund, 1972), with an image of themselves versus an image of another person on a video monitor (e.g., Wicklund, 1975), or following presentation of their own name versus presentation of someone else's name (e.g., Macrae et al., 1998). Within the personality literature, *self-consciousness* is associated with individual differences in reports of self-symbolic thoughts (Fenigstein, Scheier, & Buss, 1975). But what precisely characterizes the essential psychological processes that underlie the effects of these independent variables? It is our contention that

> situational manipulations of self-awareness function as cognitive primes to increase the level of activation of knowledge about self. Individual differences in self-consciousness are associated with differences in the activation level of self-relevant knowledge (either by defining a chronically higher activation level of self-relevant knowledge or by defining a more elaborated network of associative connections that function to spread activation to knowledge about self). (Hull et al., 1988, p. 454)

As a consequence, both forms of independent variable are claimed to increase the tendency of individuals to encode information according to its self-relevance. Because (a) such encoding processes are understood to be automatic and (b) such automatic processes do not require conscious awareness, (c) differences in self-consciousness may affect behavior outside of conscious awareness. Furthermore, if processing primes according to their self-relevance increases the likelihood of actions based on those cues (e.g., Wheeler et al., 2001), increases in self-consciousness should be associated with increases in such automated behavior. On the other hand, if private self-consciousness is associated with self-regulation to personal standards, it should be associated with decreased influence of primes that are inconsistent with personal standards or inapplicable to the self.

Studies 1a and 1b

Below we report five studies that test our somewhat ironic contention regarding the nonconsciousness of self-consciousness. Using the Self-Consciousness Scale (Fenigstein et al., 1975), we examine the differential influence of priming on individuals who are high versus low in private self-consciousness. Studies 1a and 1b use a paradigm developed by Bargh et al. (1996) to examine the behavioral consequences of an implicitly primed elderly stereotype. Bargh et al. (1996) told participants to unscramble strings of words to form meaningful phrases (see Srull & Wyer, 1979, 1980). Participants were randomly assigned to one of two forms of this task. In the elderly prime condition, the word strings contained terms typically associated with the elderly: *gray*, *wise*, *bingo*, *lonely*, *retired*, *wrinkle*, and so on. In the control condition, these words were replaced with nonstereotypic, neutral terms. Bargh et al. (1996) then observed that the elderly-primed participants subsequently walked more slowly down a hallway than did control participants. On the basis of these findings, they argued that the elderly primes functioned to activate automatic behaviors associated with the elderly stereotype. In our own Studies 1a and 1b, we attempt to replicate these effects and test the hypothesis that they are greatest among individuals who are high in private self-consciousness. As noted earlier, it is possible to generate precisely the opposite prediction from other theories of self-aware processes. Thus, if self-awareness increases awareness of internal states, high self-conscious individuals should, if anything, be *less* influenced than should low self-conscious individuals by external primes of standards, particularly standards that are clearly inapplicable to the self (e.g., elderly primes among young participants). Given the possibility of generating opposite predictions, we adopted the conservative strategy of replicating any observed effects before proceeding with alternative paradigms.

Method

Overview

Two independent studies were conducted, both of which (a) randomly assigned participants to receive either an elderly stereotype prime or a neutral prime, (b) assessed individual differences in private self-consciousness, and (c) measured walking speed over a predetermined distance. The two studies differed in terms of (a) the method of recruitment of participants, (b) the experimental setting, and (c) the number of tasks intervening between the prime and the main dependent measure of walking speed. Study 1a recruited participants from an experimental pool associated with introductory psychology class and compensated them with extra course credit; Study 1b recruited participants from the public at large and did not compensate them for participation. Study 1a was conducted in a typical laboratory setting; Study 1b was conducted on a public walkway in the local community. In Study 1a, one task intervened between the prime and walking speed measure; in Study 1b, no tasks intervened.

Participants

Study 1a. Thirty-one undergraduates participated in return for extra credit in an introductory psychology course. To enroll in the study, participants were required to have completed a multiple questionnaire booklet during the 1st week of classes. The Private Self-Consciousness subscale of the Fenigstein et al. (1975) Self-Consciousness Scale was included in this booklet. For additional information on the correlates of private self-consciousness, the interested reader is referred to Turner, Scheier, Carver, and Ickes (1978); Carver and Scheier (1981, 1998); and Trapnell and Campbell (1999).

Study 1b. Forty pedestrians were stopped on a central, grassy area in the local community and asked to participate in a class project. Only those who appeared to be under 50 years of age were asked to participate (to exclude anyone for whom the elderly stereotype might be considered applicable). All completed the Self-Consciousness Scale (Fenigstein et al., 1975) as an initial task.

Materials

For both studies, the priming manipulation took the form of a scrambled sentence task (Bargh et al., 1996; Srull & Wyer, 1979). This task consists of 30 five-word items. The five words are presented in scrambled order (e.g., “is desk he usually studying”). Participants are told to use four out of the five words to construct a grammatically correct sentence (e.g., “he is usually studying”). Participants were given as much time as they needed to complete the task.

Two versions of the scrambled sentence task were used. One was identical to that used by Bargh et al. (1996) to prime the elderly stereotype (see Bargh & Chartrand, 2000). Words in this task included *Florida*, *gray*, *wise*, *bingo*, *forgetful*, *lonely*, *retired*, and *wrinkle*. The task did not make any direct references to slowness, a quality stereotypically associated with the elderly. Target words in the task were selected by Bargh et al. (1996) on the basis of previous research on the contents of the elderly stereotype (e.g., Brewer, Dull, & Lui, 1981; McTavish, 1971; Perdue & Gurtman, 1990). The neutral prime task replaced the words of the elderly stereotype with nonage-specific neutral words (e.g., *songs* in place of *bingo*).

Procedure

Study 1a. On entering, participants were seated and told that the study involved the completion of two short verbal tasks. They were then given brief verbal instructions on how to complete the scrambled sentence task, handed the task itself, and told to let the experimenter know when they were done. The experimenter was unaware of the version of the task completed by the participant.

Following completion of the scrambled sentence task, participants were introduced to a lexical decision task. For this task, they were seated at a computer keyboard. They were told that strings of letters would appear on the computer screen and that they were simply to identify whether the letters formed a correctly spelled English word by pressing one of two letter keys. They were told to respond as quickly as possible during this task. Twenty words and 20 nonwords were then presented on the computer in random order (see Dijksterhuis, Spears, & Lepinasse, 2001, for a similar paradigm).

Following completion of the lexical decision task, participants were thanked for their cooperation, given their extra credit slip, and dismissed. They were then covertly timed as they covered a predetermined length of the laboratory hallway (15.9 m).

Study 1b. Participants were greeted on a walkway at the center of a large green space in the community and asked whether they would participate in a short survey as part of a class project. No compensation was offered. Those who agreed to participate were handed a packet that included the Self-Consciousness Scale (Fenigstein et al., 1975) and the scrambled sentence task. Following completion of the Self-Consciousness Scale, participants were given brief verbal instructions for the scrambled sentence task. Following completion of the latter, participants were thanked and allowed to continue on their way. As they covered a measured distance (81.7 m) down the walkway, they were covertly timed by a second experimenter who was seated about 30 yards (27.4 m) away. Participants who did not proceed directly down the walkway without stopping were excluded from the study.

Results

For the purpose of conducting analyses, participants were classified as high or low in private self-consciousness on the basis of a median split applied to the combined data.

Study 1a

A 2 (high vs. low private self-consciousness) × 2 (elderly vs. neutral prime) analysis of variance was conducted on the measure of walking speed in Study 1a. The prime main effect approached significance in the predicted direction, $F(1, 27) = 2.47$, $p = .13$, whereas the self-consciousness main effect did not approach significance, $F(1, 27) < 1.00$, *ns*. More important for the present hypotheses, the Self-Consciousness × Prime interaction was significant, $F(1, 27) = 4.44$, $p < .05$, such that high self-conscious individuals walked down the hallway more slowly following the elderly prime ($M = 11.1$ s) than following the neutral prime ($M = 8.9$ s). Although the latter two-cell comparison was significant according to a least-significant-difference post hoc criterion ($p < .05$), it did not achieve significance with our preferred post hoc test: the Student–Newman–Keuls. Low self-conscious individuals fell between these extremes (low self-conscious elderly prime, $M = 9.5$ s; low self-conscious neutral prime, $M = 9.8$ s) and did not differ from each other or from the other two conditions.

Study 1b

A 2 (high vs. low private self-consciousness) × 2 (elderly vs. neutral prime) analysis of variance revealed a significant Self-Consciousness × Prime interaction, $F(1, 36) = 6.77$, $p = .01$, of the same form observed in Study 1a: High self-conscious individuals walked more slowly following the elderly prime ($M = 22.3$ s) than following the neutral prime ($M = 19.8$ s). Low self-conscious individuals fell between these extremes (low self-conscious elderly prime, $M = 20.4$ s; low self-conscious neutral prime, $M = 20.9$ s). Post hoc analyses revealed that high self-conscious, elderly-primed participants walked more slowly than did both high self-conscious, neutral-primed participants and low self-conscious, elderly-primed participants (Student–Newman–Keuls, $p < .05$). As in Study 1a, the prime main effect approached significance, $F(1, 36) = 2.95$, $p = .09$, whereas the self-consciousness main effect did not, $F(1, 36) < 1.00$, *ns*.

Combined Analyses

To investigate effects combined across studies, we standardized walking time within each study (there were large differences in the distance traveled in Study 1a vs. Study 1b). These standardized walking times were then analyzed in a 2 (high vs. low private self-consciousness) × 2 (elderly vs. neutral prime) × 2 (experiment) design. These analyses revealed a prime main effect, $F(1, 60) = 5.35$, $p < .03$, that replicates effects reported by Bargh et al. (1996) and a significant Prime × Self-Consciousness interaction, $F(1, 60) = 10.85$, $p < .01$. This interaction is depicted in Figure 1. No other effects or interactions attained significance (all Fs < 1.00). Post hoc analyses on these combined data reveal that the high self-conscious, elderly-primed participants walked significantly slower than did all three of the other groups, which did not differ among themselves (Student–Newman–Keuls, $p < .05$).

We conducted additional analyses that treated standardized private self-consciousness as a continuous variable in a simultaneous regression analysis along with a standardized prime variable, a standardized experiment variable, and their multiplicative interaction terms. Consistent with previous analyses, this analysis yielded a significant prime main effect, $F(1, 60) = 4.75$, $p = .03$, and a significant Prime × Self-Consciousness interaction, $F(1, 60) = 5.95$, $p < .02$. Within the elderly prime condition, self-consciousness was significantly correlated with standardized walking time, $r(N = 36) = .34$, $p < .05$, whereas an opposite, nonsignificant pattern was observed in the neutral prime condition, $r(N = 32) = -.26$, *ns*.

Discussion

Across two studies, individuals who were high in private self-consciousness but not those who were low in self-consciousness showed greater responsivity to a manipulation that is typically interpreted as affecting behavior in an automatic fashion. This was true despite the fact that the content of the stereotype that was primed was not applicable to the individuals in the study: All of the participants were in their late teens and early 20s and could not be regarded as fitting the elderly stereotype. It is our opinion that this pattern is a consequence of the fact that the prime is processed as self-relevant despite its apparent inapplicability, and, as a consequence, individuals who are more prone to process information as self-relevant are more likely to show the effect. Implicit in this conclusion is the interpretation that self-consciousness involves processing information in the environment as self-relevant and that this occurs relatively automatically. Presuming that young people do not hold personal standards of acting in an elderly manner, we believe that our finding also implies that self-conscious behavior does not require comparison against a personal standard. This does not mean that self-conscious behavior *cannot* involve comparison against a personal standard but rather that whether it involves such a comparison process is a consequence of the nature of the information that is processed and the task in which the individual is engaged, not a characteristic of self-awareness per se (see Hull & Levy, 1979).

Study 2

In the paradigm used in Study 1, behavior is understood to be a relatively automatic consequence of the content of the prime. In this form of implicit priming, participants are assumed to be unaware of the connection of the prime to the target behavior. Even so, participants in these paradigms *are* aware of the priming

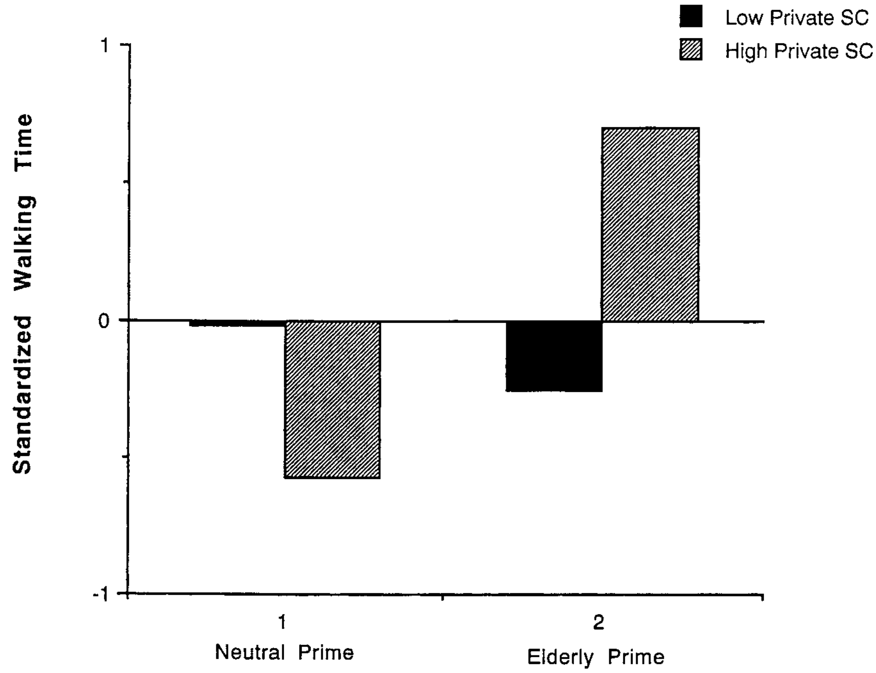

Figure 1. Studies 1a and 1b combined. SC = self-consciousness.

stimuli themselves. Alternative paradigms have demonstrated that behavior can follow as an automatic consequence of a prime even when participants cannot accurately report whether any stimulus appeared, much less characterize its implications (e.g., Bargh, 1982; Bargh et al., 1996; Dijksterhuis et al., 1998; Dijksterhuis & van Knippenberg, 1998, 2000).

If self-consciousness is associated with the automatic encoding of information as self-relevant, then it should moderate the behavioral consequences of priming stimuli even when participants are unaware of the presence of the primes. Study 2 was designed to test this hypothesis. Specifically, we hypothesized that for high self-conscious individuals, presentation of a success prime should facilitate subsequent performance on a simple decision-making task relative to the presentation of a failure prime. This should occur even when the primes are presented in such a manner that participants are unaware that they had been exposed to such primes. The same primes were predicted to have little effect on individuals who are low in private self-consciousness.

Method

Participants

Twenty-five undergraduates participated in return for extra credit in an introductory psychology course. To enroll in the study, participants were required to have completed a multiple questionnaire booklet during the 1st week of classes. The Private Self-Consciousness subscale of the Fenigstein et al. (1975) Self-Consciousness Scale was included in this booklet. One participant did not answer all of the questions on this scale and was excluded from the analyses.

Materials

Success–failure priming task. The priming task was run on a Power Macintosh 7300/180 computer using Superlab© software (Cedrus Corporation, 1991–1992). The priming task consisted of 20 practice trials and 100 experimental trials in which letter strings were judged as words or nonwords. For the practice trials, 10 letter strings were words, and 10 were nonwords. For the experimental trials, 50 letter strings were words, and 50 were nonwords. The structure of the priming task was adapted from Spalding and Hardin (1999). During each trial, participants were suboptimally exposed to a prime word. A given trial began by presenting a forward mask (i.e., *IDXFNBO*) for 17 ms, a prime for 17 ms, a blank screen for 17 ms, a backward mask (i.e., *IDXFNBO*) for 50 ms, a blank screen for 100 ms, and then a target that was left on the screen until the participant responded. For the 20 practice trials, all tasks included the word *NEUTRAL* as a prime. For the 100 experimental trials, participants were randomly assigned to receive either the word *SUCCESS* or the word *FAILURE* as a prime.

Target stimuli word lists. To create target stimuli, we selected 120 seven-letter nouns from the dictionary. Selection was arbitrary, with the exception that nouns with emotional associations (e.g., *funeral, ovation*) were excluded. These 120 nouns were then randomly ordered. One letter within each word was randomly selected to be altered to form a nonword counterpart. The replacement letter was chosen at random, with the exception that a vowel was replaced with another vowel and a consonant with another consonant. We then made a list by randomly selecting whether a particular stimulus was a word or a nonword, with the restriction that (a) an equal number of word and nonword targets were created and (b) 50 words and 50 nonwords were designated for the experimental trials, and 10 words and 10 nonwords were designated for a practice trials. We made a second, opposite list by replacing a word in the first list with its nonword counterpart and a nonword in the first list with its word counterpart. Participants were randomly assigned to receive one of these two lists.

Procedure

When the participant arrived, it was explained that they would be working on a computer-based decision-making task. They were told that they would make decisions about whether a particular stimulus was a word or a nonword by pushing computer keys. They were told that the nonwords looked very much like words and that the program would not proceed until they pushed the correct button, so that if they made a mistake they should push the correct button as soon as possible. It was explained that the computer would record the speed of their response along with whether it was correct. It was emphasized that they should try to be as fast as possible while being as accurate as possible. Finally, they were told that all stimuli, words and nonwords, were seven letters in length and that before the stimulus appeared a string of seven random letters would flash just to let them know where the stimulus itself would appear. After the experimenter answered any questions the participants had about the procedures, they completed 20 practice trials. The experimenter then answered any additional questions and left the room while the participant completed the 100 experimental trials.

Self-esteem and affect measures. After the lexical decision task, participants were asked to complete two scales to assess their current attitudes and feelings: the State Self-Esteem Scale (Heatherton & Polivy, 1991) and the state version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988).

Systematic debriefing. After participants had completed the self-esteem and affect measures, they were carefully and systematically debriefed. Specifically, the experimenter asked (a) whether they had any questions or comments, (b) whether there was anything about the task that they found unusual, (c) whether they noticed anything unusual about the words and nonwords, and (d) whether they noticed anything unusual about the string of letters that preceded the words and nonwords. If they made any comment in response to any of these questions, they were asked to elaborate. Several participants commented on the similarity of the nonwords to real words. Finally, participants were told that some actual words were embedded in the strings of letters that preceded the stimuli and asked whether they saw any such words. None reported being able to see any words presented with the masks.

Results

Reaction Times

All analyses of reaction times were conducted after we excluded responses in excess of 3,000 ms as outliers. Principal analyses were conducted on log-transformed reaction times. Where appropriate, analyses are also reported for nontransformed times to aid in interpretation of the results. For the sake of analysis, we divided the experimental trials into four periods (practice trials, first 33, second 33, and final 34 of the experimental trials). To investigate changes over time, within each period, we analyzed four sets of reaction time averages: average overall reaction times, average reaction times for first-attempt correct responses, average reaction time for incorrect responses, and average reaction times for second-chance correct responses. Finally, analyses were conducted on number of incorrect responses made in each experimental period. To conduct repeated measures analyses, we identified individuals as high or low in private self-consciousness using a median split.

Reaction times for all responses averaged within a period. We conducted an initial analysis by averaging all reaction times (correct, incorrect, and second chance) during the practice period, averaging all reaction times within each of the three experimental periods, and treating period as a repeated measure. This 2 (high vs. low private self-consciousness) $\times$ 2 (success vs. failure prime) $\times$ 2 (word list) $\times$ 4 (measurement period, including practice) mixed design analysis of variance revealed a main effect of measurement period, such that participants were faster in the experimental periods than in the practice period, $F(3, 48) = 14.90$, $p < .001$; a two-way interaction of success–failure prime and word list, $F(1, 16) = 6.36$, $p = .02$; and a three-way interaction of private self-consciousness, success–failure prime, and experimental period, $F(3, 48) = 2.85$, $p < .05$. The latter interaction conforms to predictions: High private self-conscious individuals who received a success prime were the fastest of all groups, high private self-conscious individuals who received a failure prime were the slowest, and low private self-conscious individuals fell between these extremes. Finally, this pattern held during the experimental periods but not during the practice period. A specific contrast of high self-conscious individuals who received a success prime versus those who received a failure prime was nonsignificant for the practice period, $t(20) = 0.40$, *ns*, and first experimental period, $t(20) = 1.21$, *ns*, but achieved significance for the second experimental period, $t(20) = 2.47$, $p = .02$, and was near significance for the third experimental period, $t(20) = 1.99$, $p = .06$. If the latter three analyses are conducted using practice period reaction times as a covariate, the statistical significance of these contrasts is slightly enhanced: $t(19) = 1.49$, $p = .15$; $t(19) = 3.22$, $p < .01$; and $t(19) = 2.32$, $p = .03$, respectively.

Different types of responses separated. In the previous analyses, reaction times for all responses were averaged within a period. Nevertheless, these averages included reaction times for (a) first-attempt correct responses, (b) wrong responses, and (c) second-attempt correct responses (i.e., corrections). Subsequent analyses were conducted for averages of each of these types of responses. Analyses of first-attempt correct responses for the most part paralleled those reported above. Thus, the 2 (high vs. low private self-consciousness) $\times$ 2 (success vs. failure prime) $\times$ 2 (word list) $\times$ 4 (measurement period) mixed design analysis of variance of log-transformed reaction times revealed a main effect of measurement period, $F(3, 48) = 17.36$, $p < .001$, and a three-way interaction of private self-consciousness, success–failure prime, and measurement period, $F(3, 48) = 3.49$, $p < .03$. The latter three-way interaction for nontransformed reaction times is depicted in Figure 2. Once again, specific contrasts of the effects of the success versus the failure prime for high private self-conscious participants were nonsignificant for the practice period, $t(20) = 0.25$, *ns*, and first experimental period, $t(20) = 0.97$, *ns*, but were significant for the second experimental period, $t(20) = 2.38$, $p < .03$, and near significance for the third experimental period, $t(20) = 2.01$, $p = .058$. Once again, the latter three effects are strengthened if practice period reaction times are used as a covariate: $t(19) = 1.26$, *ns*; $t(19) = 3.12$, $p < .01$; and $t(19) = 2.47$, $p < .03$, respectively. In addition, specific contrasts of high versus low private self-conscious individuals who received the success prime were nonsignificant for the practice period, $t(20) = 0.09$, *ns*, and first experimental period, $t(20) = 1.10$, *ns*, but significant for the second experimental period, $t(20) = 2.38$, $p < .03$, and near significance for the third experimental period, $t(20) = 1.98$, $p = .061$. Again, the latter three effects are strengthened if practice period reaction times are used as a covariate: $t(19) = 1.04$, *ns*; $t(19) = 2.81$, $p = .01$; and $t(19) = 2.09$, $p < .05$.

Analyses of wrong-response and second-attempt reaction times were restricted by the fact that some participants made no wrong responses during the practice period and very few wrong responses during the experimental periods. Repeated measures analyses were therefore inappropriate (given cells with zero variance). Regression analyses were conducted on average reaction times assessed

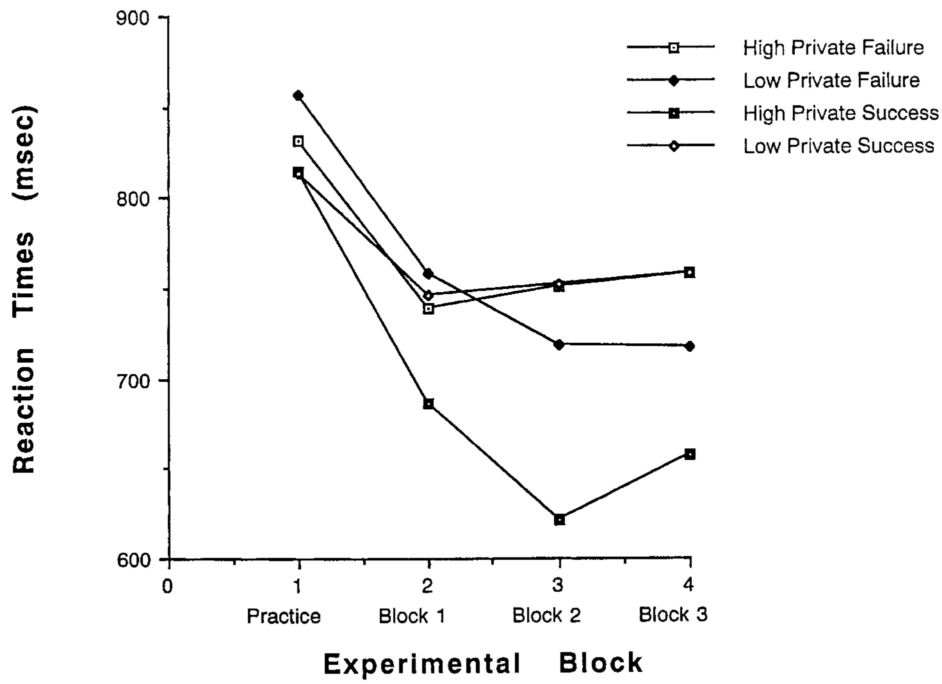

Figure 2. Study 2: Reaction times for correct responses.

during the experimental (i.e., nonpractice) period as a whole. These analyses simultaneously considered the effects of the success–failure prime, the word list, and private self-consciousness (as a continuous variable) and their interactions. Although a pattern was observed that was similar to that seen for first-attempt correct responses, the interaction of self-consciousness and success–failure prime was not significant for either wrong-response reaction times, $F(1, 20) = 2.61$, $p = .13$, or second-attempt reaction times, $F(1, 20) = 2.37$, $p = .14$.

Errors

A 4 (experiment period) × 2 (list) × 2 (high vs. low private self-consciousness) × 2 (success vs. failure prime) repeated measures analysis of variance on average number of errors (within a block) revealed only one significant effect: a main effect of trial block such that participants made more errors during the experimental phase of the task than during the practice phase of the task, $F(3, 48) = 6.34$, $p = .001$. Of particular interest, the Private Self-Consciousness × Success–Failure Prime × Experimental Period interaction did not approach significance, $F(3, 48) < 1.00$, *ns*.

Positive Affectivity, Negative Affectivity, and State Self-Esteem

There were no main effects or interactions of private self-consciousness and success–failure prime on measures of positive affectivity, negative affectivity, or state self-esteem. This was true regardless of whether the latter measures were analyzed as raw scores, analyzed as changes from baselines, or combined into various superscales. If all 20 PANAS items are analyzed individually as change scores from baseline, 3 (out of a possible 60) effects or interactions attain significance. There was (a) a main effect of the prime on self-reports of interest, $F(1, 15) = 8.64$, $p < .01$, such that failure-primed participants reported decreased interest relative to success-primed participants; and (b) a main effect of prime, $F(1, 15) = 7.62$, $p < .02$, and a Prime × Private Self-Consciousness interaction, $F(1, 15) = 4.61$, $p < .05$, on self-reports of being ashamed, such that participants reported increased levels of shame following the failure prime relative to the success prime, and this was only the case for high self-conscious participants. Treating self-consciousness as a continuous variable and reconducting these analyses as regressions yielded one additional effect: There was a significant interaction of private self-consciousness and success–failure prime on increased self-reports of being scared, $t(1, 15) = -2.96$, $p < .01$, such that relative to their responses on the initial introductory psychology questionnaire, high self-conscious participants reported the most reduction in being scared following the success prime and the least reduction following the failure prime. Obviously, such effects are tantalizing, but, just as obviously, they involve serious issues regarding capitalization on chance.

Discussion

Study 2 demonstrates that individuals who are high in private self-consciousness are more strongly influenced by situationally self-relevant success–failure primes than are low self-conscious individuals when those primes are masked to nonconsciousness. In addition, this effect appeared to strengthen with repeated presentations of the success–failure prime (i.e., during Experimental Blocks 2 and 3). Although it is not clear whether these effects are due to the impact of the primes on motivation, a sense of efficacy, sympathetic activation, affective experience, or automatic goal pursuit (e.g., Bargh et al., 2001), they are clearly linked to the meaning of success and failure, are outside of the participants' ability to report as a cause, and have few apparent effects on the limited self-reports of psychological states included in the study.

The results of Study 2 demonstrate the generality of the role of self-consciousness in automatic behaviors. Whereas Studies 1a and 1b demonstrate the effects of self-consciousness in moderating behavioral responses to implicit primes, Study 2 demonstrates a similar role of self-consciousness in moderating responses to primes presented outside of awareness. Given such results, we sought to extend these effects to different types of semantic primes and different forms of behavioral response. Specifically, in Study 3 we used the same paradigm developed in Study 2 to examine the impact of emotion word primes on physiological responses. Participants were randomly assigned to be suboptimally exposed to either the word *angry* or the word *relax*. Cardiovascular measures were taken at five discrete points in the experiment. In addition, self-reports of various emotions were obtained before and after exposure to the primes. We hypothesized that participants would show increased cardiovascular responses (particularly systolic and diastolic blood pressure) immediately following the task that contained the suboptimal angry prime and decreased cardiovascular responses following the task that contained the relax prime and that this would be true mainly for high self-conscious individuals. Unlike in Study 2, we made no specific predictions regarding the effects of the primes on task performance. Finally, given the weak effects observed in Study 2, we made no specific predictions regarding self-reports.

Study 3

Method

Participants

Forty-four undergraduates participated in return for extra credit in an introductory psychology course. To enroll in the study, participants were required to have completed a multiple questionnaire booklet during the 1st week of classes. The Private Self-Consciousness subscale of the Fenigstein et al. (1975) Self-Consciousness Scale was included in this booklet. Four participants did not answer all of the questions on this scale and were excluded from the analyses. Complete blood pressure and heart rate readings were unavailable for 7 participants, and complete heart rate readings were unavailable for an 8th participant because of equipment difficulties.

Materials

The priming task was identical to that used in Study 2 with two exceptions: Instead of being exposed to the prime *NEUTRAL* during the practice trials, participants were exposed to the prime *BLANK*. Instead of being exposed to the prime *SUCCESS* or *FAILURE* during the experimental trials, participants were exposed to the prime *ANGRY* or *RELAX*. Given that the new primes were two letters shorter than the primes used in Study 2, one space was left blank at the beginning and the end of the presentation of the prime. In all other respects (i.e., number of practice and experimental trials, timing, nature of the masks and target stimuli), the tasks were identical to those used in the previous experiment.

Procedure

When the participant arrived, the task was described, as in Study 2. In addition, participants were told that the research involved assessing the relation of physiological states to performance and that they would have their blood pressure and heart rate monitored throughout the study. These measurements were obtained using an Omron System 837 (Omron Healthcare, Inc., Vernon Hills, IL) automatic digital sphygmomanometer. After the participants completed the informed consent, the experimenter obtained an initial set of physiological readings. These were obtained simply to acclimate the participants to the cuff and the procedure of having their blood pressure taken and were not recorded. Participants were then told to clear their mind and relax and were left alone for 5 min. On returning, the experimenter took a baseline set of physiological readings and explained the task in detail. Following this instruction phase, a second set of physiological readings were taken. The participant then completed the practice phase of the task, and a third set of physiological readings were obtained. Participants were then left to complete the experimental phase of the study and told to ring a bell when they were finished so the experimenter would return. On returning, the experimenter obtained a fourth set of physiological readings, gave the participant the State Self-Esteem measure (Heatherton & Polivy, 1991) and PANAS–Moment (Watson et al., 1988) to complete, and once again left the participant with the instructions to ring the bell when he or she was finished. On returning, the experimenter told the participant to wait quietly for a final recovery phase of the study and then returned 5 min later to obtain a fifth and final set of physiological readings.

After participants completed all phases of the study, they were carefully and systematically debriefed, as in Study 2. Once again, very few participants expressed any suspicion about the task, and none reported being able to see any words presented with the masks.

Results

Physiological Responses

The two physiological readings of systolic blood pressure obtained within each measurement period were averaged for the purpose of analysis. The same was done for the readings of diastolic blood pressure and heart rate.

Systolic blood pressure. Of greatest interest in the present study were changes in physiological responses from the measurement that immediately followed completion of the practice task to the measurement that immediately followed the completion of the priming task. A 2 (high vs. low self-consciousness) $\times$ 2 (angry vs. relax prime) $\times$ 2 (postpractice vs. postprime measurement period) mixed design analysis of variance conducted on the measure of systolic blood pressure revealed a significant Prime $\times$ Measurement Period interaction, $F(1, 30) = 5.98$, $p = .02$, such that systolic blood pressure rose postpractice to postprime in response to the angry prime and dropped over the same interval in response to the relax prime. On the other hand, a mixed design analysis of variance using all five measurement periods (baseline, instructions, postpractice, postprime, and recovery) did not reveal any significant effects. There were no effects or interactions involving self-consciousness in any analysis. Results collapsed across individual differences in self-consciousness are plotted in Figure 3.

Diastolic blood pressure. A 2 (high vs. low self-consciousness) $\times$ 2 (angry vs. relax prime) $\times$ 2 (postpractice vs. postprime measurement period) mixed design analysis of variance was also conducted on the measure of diastolic blood pressure. This analysis also revealed a significant Prime $\times$ Measurement Period interaction, $F(1, 30) = 5.31$, $p = .03$, such that diastolic blood pressure rose postpractice to postprime in response to the angry prime and dropped over the same interval in response to the relax prime. The analysis using all five measurement periods revealed a near-significant Prime $\times$ Measurement Period interaction, F(4,

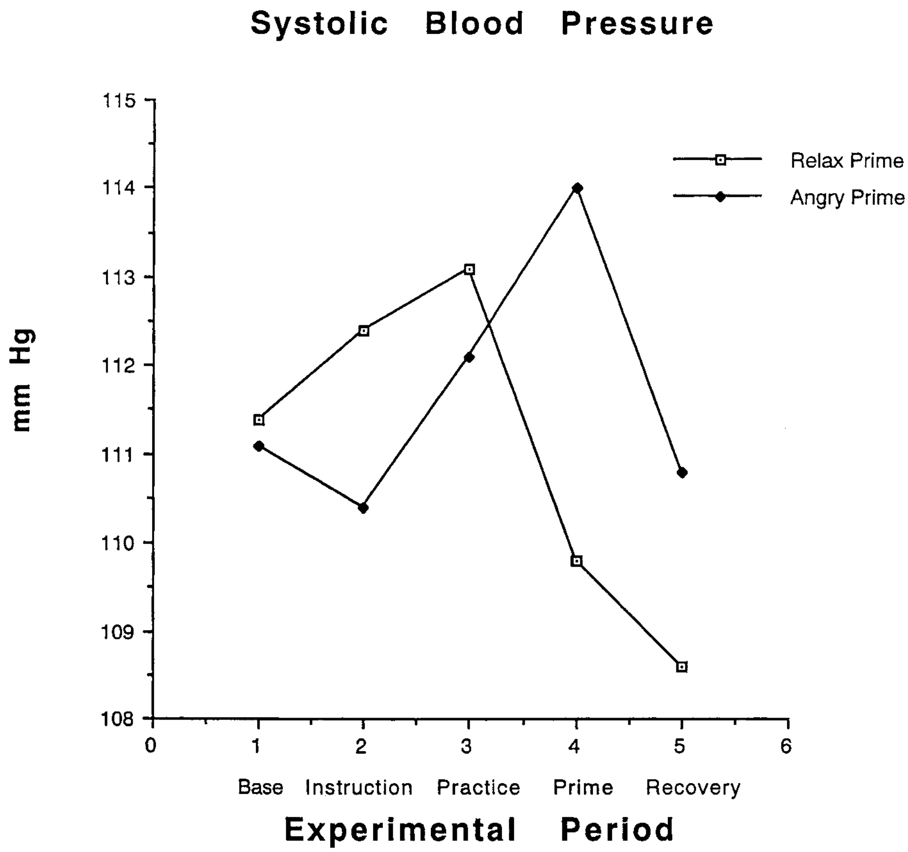

Figure 3. Study 3: Systolic blood pressure over measurement period.

120) = 2.26, p = .067. There were no effects or interactions involving self-consciousness in any analysis. Results collapsed across individual differences in self-consciousness are plotted in Figure 4.

Heart rate. A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (postpractice vs. postprime measurement period) mixed design analysis of variance was also conducted on the measure of heart rate. Although there were trends in the heart rate data that paralleled those observed for blood pressure, the Prime × Measurement Period interaction did not achieve conventional levels of significance, $F(1, 30) = 2.65$, $p = .11$. An analysis using all five measurement periods also failed to reveal any significant effects.

Reaction Times

Reaction times for all responses averaged within a period. Reaction times were analyzed as in Study 2. We conducted an initial analysis by averaging all reaction times (correct, incorrect, and second chance) during the practice period, averaging all reaction times within each of the three experimental periods, and treating period as a repeated measure. This 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (word list) × 4 (measurement period) mixed design analysis of variance revealed a main effect of experimental period, $F(3, 96) = 12.63$, $p < .001$, such that participants were faster during the experimental periods than the practice periods. The only other effect to achieve significance was an interaction of private self-consciousness and prime, $F(1, 32) = 4.21$, $p < .05$. However, given that this interaction was apparent even during the practice period (preprime) and was not qualified by an interaction with measurement period, it appears to be due to random differences in groups.

Reaction times for different types of responses separated. The same analyses that were conducted for all responses were subsequently conducted for reaction times associated with (a) first-attempt correct responses, (b) wrong responses, and (c) second-attempt correct responses. As in the previous analyses, analysis of reaction times on first-attempt correct responses yielded (a) a main effect of measurement period, $F(3, 96) = 18.56$, $p < .001$, such that participants were faster during the experimental than the practice periods, and (b) a significant interaction of self-consciousness and prime, $F(1, 32) = 5.01$, $p = .03$, that was apparent during the practice period and was not qualified by an interaction with experimental period. No effects achieved conventional levels of significance for either wrong response or second-chance reaction times.

Errors

A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (word list) × 4 (measurement period) mixed design analysis of variance applied to error rates revealed a main effect of

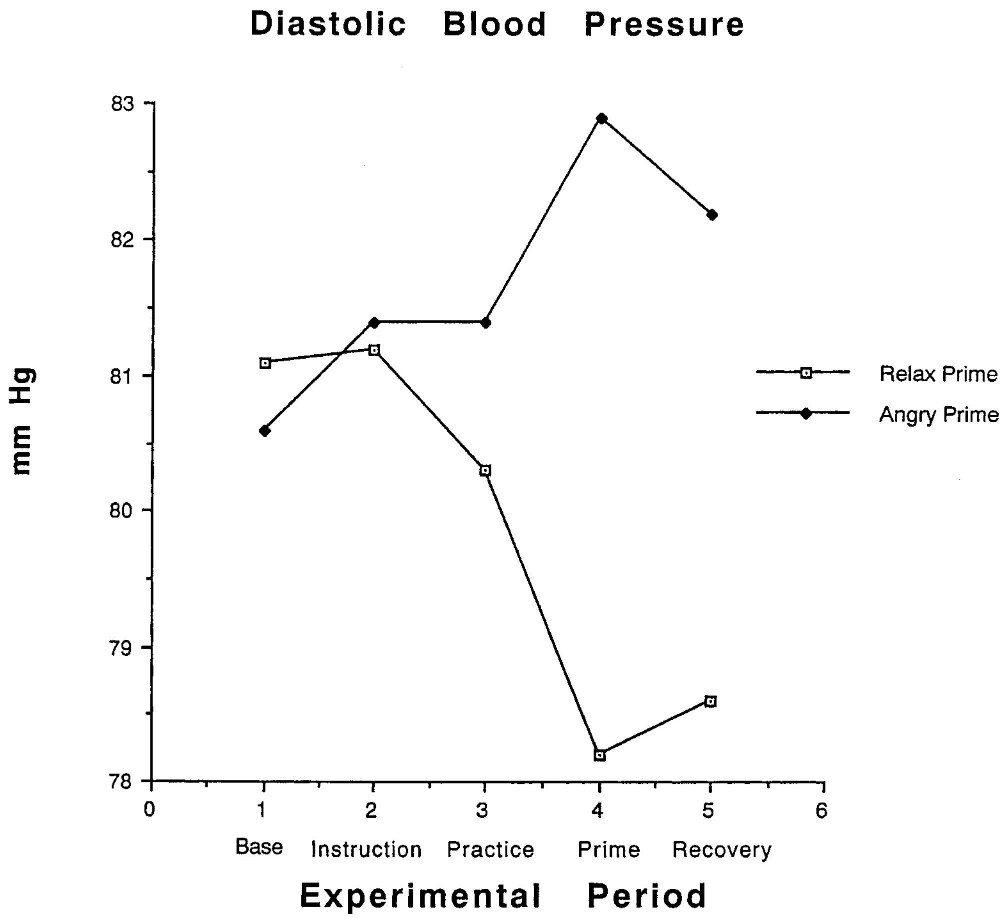

Figure 4. Study 3: Diastolic blood pressure over measurement period.

measurement period, $F(3, 96) = 17.13$, $p < .001$, such that participants made more errors during the experimental phases of the task than during the practice phase of the task. There were no other significant effects.

Self-Report Measures

Positive affectivity, negative affectivity, and state self-esteem. There were no main effects or interactions of private self-consciousness and the angry versus relax prime for analyses of variance conducted on self-reports of positive affectivity or negative affectivity regardless of whether these scales were analyzed as raw scores or changes from baseline or were combined into a superscale. On the other hand, a regression analysis that treated self-consciousness as a continuous variable did reveal a significant Prime × Self-Consciousness interaction for changes in state self-esteem, $t(34) = -2.14$, $p < .04$. Specifically, all participants reported greater self-esteem in the experimental setting than on the preexperimental questionnaire; however, high self-conscious participants reported a larger increase following the relax prime than the angry prime, whereas low self-conscious participants showed the reverse.

If all 20 PANAS items are analyzed individually as change scores from baseline, 2 out of a possible 60 effects or interactions attain significance in the analyses of variance: Relative to low self-conscious individuals, high self-conscious individuals reported reduced interest and reduced active feelings. One intriguing effect involved self-reports of "irritable." For this variable, the interaction of self-consciousness and the angry–relax prime approached significance, $F(1, 36) = 3.55$, $p = .068$, such that high self-conscious individuals reported greater reduction in irritability following the relax prime than the angry prime, whereas low self-conscious individuals showed the reverse pattern. This interaction remained near significance in the corresponding regression analysis, $t(36) = 1.92$, $p = .06$. As in Study 2, such effects and trends are tantalizing but obviously involve serious issues regarding capitalization on chance.

Exploratory analyses. We conducted an exploratory analysis that correlated change in systolic blood pressure, diastolic blood pressure, and heart rate with changes from baseline in each emotion item from the PANAS. Changes in cardiovascular responses were calculated as the difference in the postpriming measure from the average of the three prepriming measures (baseline, postinstruction, postpractice). Change in diastolic blood pressure was related to only one PANAS item: Increases in diastolic blood pressure were associated with increases in hostile self-reports, $r(N = 36) = .35$, $p < .05$. Increases in systolic blood pressure were associated with increases in self-reports of hostile, $r(N = 36) = .48$, $p < .01$, and inspired states, $r(N = 36) = .35$, $p < .05$, and decreases in alert, $r(N = 36) = -.49$, $p < .01$, and attentive states, $r(N = 36) = -.42$, $p < .02$. Change in heart rate was unrelated to change in any PANAS items. These effects were nonsignificantly stronger among low private self-conscious than among high private self-conscious participants.

Discussion

The results of Study 3 are encouraging insofar as they demonstrate the effectiveness of the experimental paradigm to affect physiological states despite the suboptimal nature of the stimuli. Indeed, the effects of the angry and relax primes on cardiovascular responses were both statistically significant and nontrivial in size (on the order of 5 mmHg for both systolic and diastolic blood pressure). The manipulations had no substantive effects on performance measures. Although these are null findings, they lend credence to the argument that the automatic behavioral effects observed in Study 2 are specifically linked to the semantic content of the primes used in that study. Finally, as in Study 2, the effects of the manipulations on self-reported emotional states suggest that participants' awareness of the consequences of the priming manipulation was limited at best. Exploratory analyses suggested that if subliminal primes affect self-reports, they may do so indirectly by virtue of their impact on somatic symptoms that are interpreted as indications of emotional states.

The results of Study 3 are somewhat discouraging insofar as the effects of the primes on physiological responses were not moderated by private self-consciousness. Although, relative to low self-conscious individuals, high self-conscious individuals showed greater increases in diastolic blood pressure and heart rate following exposure to the angry prime and greater decreases in these same measures following the relax prime, these interactions did not approach significance in either case.

We designed a fourth study with the intent of obtaining usable data from approximately twice as many individuals as those who participated in Study 3 to increase the power of the design to identify small but statistically reliable effects. In addition, we directly manipulated the length of the presentation of the primes to determine whether their effects on physiological responses were the same regardless of whether the participant was aware or unaware of their presence. Thus, whereas some researchers have found similar effects with optimal and suboptimal priming (e.g., Macrae, Milne, & Bodenhausen, 1994), others have found stronger affective consequences of suboptimal than optimal primes (e.g., Murphy & Zajonc, 1993). Finally, in addition to the self-report measures included in Studies 2 and 3, Study 4 included the Multiple Affect Adjective Checklist (MAACL; Zuckerman & Lubin, 1965). This scale contains multiple hostility-related items and therefore may allow for a more sensitive test of the effects of the priming manipulation on emotion self-reports that are specifically relevant to the semantic content of the primes. This allowed us to determine whether the association between self-reports of hostility and changes in blood pressure observed in Study 3 replicated for the single "hostile" item on the PANAS and generalized to the Hostility subscale of the MAACL.

Study 4

Method

Participants

Sixty-six undergraduates participated in return for $10 compensation. Participants were recruited through advertising in a student newspaper, signs posted around campus, and E-mail. Three participants provided incomplete responses to the Self-Consciousness Scale and were excluded from most analyses. Complete physiological readings were unavailable for 2 participants because of equipment difficulties.

Materials

The priming task was identical to that used in Study 3 except that length of the presentation of the prime was systematically varied: Half of the participants were randomly assigned to the same suboptimal prime presentation used in Studies 2 and 3 (17 ms), whereas the remaining half were exposed to an optimal prime presentation (250 ms). In all other respects (i.e., number of practice and experimental trials, timing, nature of the masks and target stimuli), the tasks were identical to those used in the previous experiment.

Procedure

After the participants completed an informed consent, they were asked to complete the Self-Consciousness Scale. The experimental task was then described to all participants, as in Study 3. In addition, participants in the optimal presentation conditions were instructed by computer that the word *angry* (or *relax*) would appear briefly on the screen before each trial. They were told to wait for it to disappear and then to rate the next stimulus. All other procedures followed those of Study 3, with the exception that participants completed the MAACL (Zuckerman & Lubin, 1965) as well as the PANAS–Moment (Watson et al., 1988) and the State Self-Esteem measure (Heatherton & Polivy, 1991) following the completion of the priming task.

After participants completed all phases of the study, they were carefully and systematically debriefed, as in Study 3. Once again, none of the participants in the suboptimal conditions reported being able to see any words presented with the masks.

Results and Discussion

Physiological Measures

Systolic blood pressure. As in Study 3, we assessed changes in physiological responses by comparing the measurement that immediately followed completion of the practice task with the measurement that immediately followed the completion of the experimental priming task. A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (suboptimal vs. optimal presentation) × 2 (postpractice vs. postprime measurement period) mixed design analysis of variance applied to measures of systolic blood pressure revealed a four-way interaction of Self-Consciousness × Prime × Presentation × Measurement Period, $F(1, 53) = 3.93$,

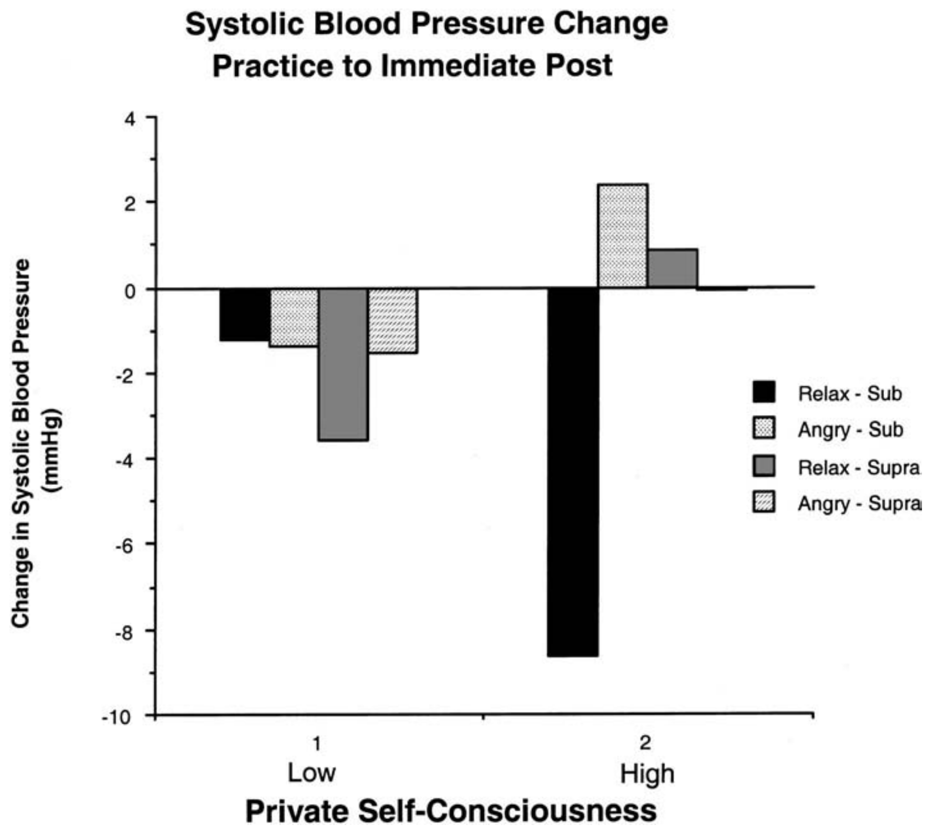

Figure 5. Study 4: Postpractice to postprime systolic blood pressure change. Sub = subliminal; Supra = supraliminal.

$p = .05$. This interaction is depicted in Figure 5 using change scores.[2]

As can be seen in Figure 5, when the prime was presented suboptimally, high self-conscious individuals primed with *relax* showed the greatest decreases in systolic blood pressure over the measurement interval, whereas high self-conscious individuals primed with *angry* showed the greatest increases in systolic blood pressure. Optimal presentation eliminated these effects. Responses by low self-conscious individuals fell between these extremes and did not differ as a function of prime or presentation. A variety of specific contrasts applied to these change scores bolster this account. Thus, a specific contrast that examined the interaction of Prime × Presentation within high self-conscious individuals was statistically significant, $F(1, 53) = 5.42$, $p < .025$, whereas the same interaction within low self-conscious individuals was not significant, $F(1, 53) < 1.00$, *ns*. Furthermore, a specific contrast that examined the effect of the prime when it was presented suboptimally to high self-conscious individuals was significant, $F(1, 53) = 9.03$, $p < .005$, whereas the effect of the prime when presented optimally to high self-conscious individuals was not significant, $F(1, 53) < 1.00$, *ns*. Finally, a specific contrast that examined the Prime × Self-Consciousness interaction within the suboptimal conditions was significant, $F(1, 53) = 5.18$, $p < .03$.

Diastolic blood pressure. A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (sub- vs. supraliminal presentation) × 2 (postpractice vs. postprime measurement period) mixed design analysis of variance was applied to measures of diastolic blood pressure. The only effect to approach significance involved a three-way interaction of Self-Consciousness × Prime × Measurement Period, $F(1, 53) = 3.30$, $p = .075$.

The interaction was similar in several respects to that observed for systolic blood pressure. Specifically, high self-conscious individuals subliminally primed with *relax* showed the greatest decreases in diastolic blood pressure over the measurement interval,

[2] If the systolic blood pressure data are analyzed using all five measurement periods, there is a main effect of measurement period, $F(4, 212) = 7.78$, $p < .001$, such that blood pressure increases from baseline through the task instructions and then declines through the remainder of the experiment. In addition, there is an interaction of Presentation × Measurement Period, $F(4, 212) = 3.15$, $p = .015$, and, once again, there is a significant four-way interaction of measurement period, presentation, self-consciousness, and prime, $F(4, 212) = 4.31$, $p < .01$. If the diastolic blood pressure data are analyzed using all five measurement periods, there is a significant main effect of measurement period, $F(4, 212) = 3.61$, $p < .01$, such that diastolic blood pressure rises from baseline to the instruction phase and then declines through the remainder of the experiment. The only other effect to attain significance was the four-way interaction of Self-Consciousness × Presentation × Prime × Measurement Period, $F(4, 212) = 3.54$, $p < .01$. If the heart rate data are analyzed using all five measurement periods, only the main effect of prime attains conventional levels of significance, $F(1, 53) = 5.95$, $p < .02$.

and high self-conscious individuals primed with *angry* showed the greatest increases in blood pressure. The same specific contrasts applied to the systolic blood pressure data were also applied to these diastolic blood pressure change scores. The contrast that examined the effect of the prime when it was presented suboptimally to high self-conscious individuals was significant, $F(1, 53) = 4.26$, $p < .05$. On the other hand, as a consequence of a similar but much weaker pattern among optimally primed high self-conscious participants, the Prime × Presentation interaction contrast that was observed for systolic blood pressure did not achieve significance for diastolic blood pressure, $F(1, 53) = 1.02$, $p > .25$. Finally, the contrast that examined the Prime × Self-Consciousness interaction within the suboptimal conditions was significant, $F(1, 53) = 5.04$, $p < .03$. This patterns of effects was essentially responsible for the weak three-way interaction observed in the overall analysis reported earlier.

Heart rate. A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (suboptimal vs. optimal presentation) × 2 (postpractice vs. postprime measurement period) mixed design analysis of variance applied to measures of heart rate revealed a significant main effect of prime, $F(1, 53) = 5.92$, $p < .02$, and a significant Prime × Presentation interaction, $F(1, 53) = 4.87$, $p = .03$, such that those who received the angry prime had lower heart rates than did those who received the relax prime *even before* the experimental task began, and this was particularly true for those who received the primes optimally. These effects are obviously due to random differences. Of substantive interest, there was a significant Prime × Measurement Period interaction, $F(1, 53) = 4.53$, $p < .05$, a significant Presentation × Prime × Measurement Period interaction, $F(1, 53) = 4.45$, $p < .05$, and a significant four-way interaction of Self-Consciousness × Presentation × Prime × Measurement Period, $F(1, 53) = 4.04$, $p < .05$. These effects are depicted in Figure 6 using change scores.

As can be seen in Figure 6, the significant effects were once again of the form that high self-conscious individuals who were suboptimally primed with *relax* showed the greatest decrease in heart rate over the measurement interval and high self-conscious individuals who were primed with *angry* showed the greatest increase in heart rate. This effect did not appear for low self-conscious individuals, and among high self-conscious individuals it was eliminated by the optimal presentation of the primes. The same contrasts applied in the earlier blood pressure analyses confirmed this account of the heart rate change data. Thus, a specific contrast that examined the interaction of Prime × Presentation within high self-conscious individuals was statistically significant, $F(1, 53) = 8.19$, $p < .01$, whereas the same interaction within low self-conscious individuals was not significant, $F(1, 53) < 1.00$, *ns*. Furthermore, a specific contrast that examined the effect of the prime when it was presented suboptimally to high self-conscious individuals was significant, $F(1, 53) = 13.81$, $p < .001$, whereas the effect of the prime when presented optimally to high self-conscious individuals was not significant, $F(1, 53) < 1.00$, *ns*.

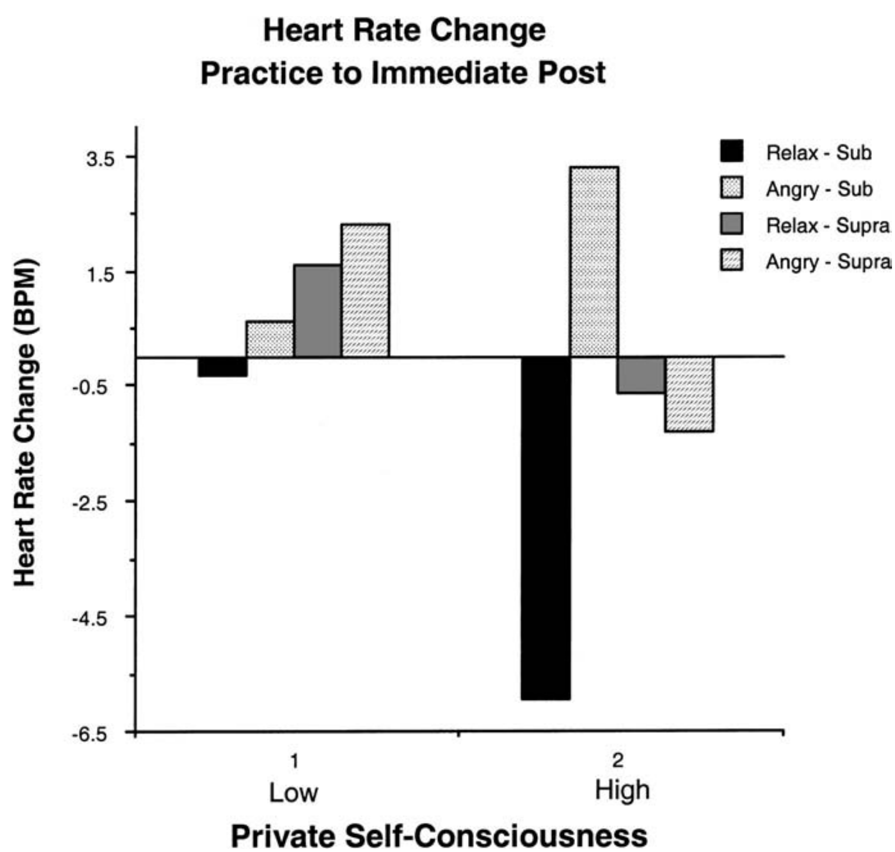

Figure 6. Study 4: Postpractice to postprime heart rate change. Sub = subliminal; Supra = supraliminal.

Finally, a specific contrast that examined the Prime × Self-Consciousness interaction within the suboptimal conditions was significant, $F(1, 53) = 6.26$, $p < .02$.

Reaction Times

Reaction times for all responses averaged within a period. Reaction times were analyzed as in Studies 2 and 3. We conducted an initial analysis by averaging all reaction times (correct, incorrect, and second chance) during the practice period, averaging all reaction times within each of the three experimental periods, and treating period as a repeated measure. This 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (suboptimal vs. optimal presentation) × 2 (word list) × 4 (measurement period) mixed design analysis of variance revealed a main effect of experimental period, $F(3, 141) = 37.21$, $p < .001$, such that participants were faster during the experimental periods than during the practice periods. The only other effect to achieve significance was an interaction of prime, presentation, and experimental period, $F(3, 141) = 2.95$, $p < .035$, such that in the optimal but not the suboptimal presentation conditions, the angry prime was associated with faster reaction times and the relax prime was associated with slower reaction times over measurement periods. Thus, if the analysis is restricted to the suboptimal conditions, the only effect to achieve significance is the main effect of measurement period, $F(3, 72) = 20.83$, $p < .001$ (as in Study 3); however, if the analysis is conducted within the optimal conditions, both the measurement period main effect, $F(3, 69) = 16.90$, $p < .001$, and the Prime × Measurement Period interaction, $F(3, 69) = 4.25$, $p < .01$, achieve significance. Essentially, the angry prime has a disruptive effect, and the relax prime has a facilitative effect, but only when participants are aware of their presence.

Reaction times for different types of responses separated. The same analyses that were conducted for all responses were subsequently conducted for reaction times associated with (a) first-attempt correct responses, (b) wrong responses, and (c) second-attempt correct responses. As in the previous analyses, analysis of reaction times on first-attempt correct responses yielded a main effect of measurement period, $F(3, 141) = 42.62$, $p < .001$, such that participants were faster during the experimental than during the practice periods. No effects achieved conventional levels of significance for either wrong-response or second-chance reaction times.

Errors

A 2 (high vs. low self-consciousness) × 2 (angry vs. relax prime) × 2 (suboptimal vs. optimal presentation) × 2 (word list) × 4 (measurement period) mixed design analysis of variance applied to error rates revealed a main effect of word list, $F(1, 47) = 4.24$, $p < .05$, and a main effect of measurement period, $F(3, 141) = 41.37$, $p < .001$, such that participants made more errors during the experimental phases of the task than during the practice phase of the task. Of greater substantive interest, there was a significant Prime × Measurement Period interaction, $F(3, 141) = 2.86$, $p < .04$, such that participants made more errors following the angry prime than the relax prime, and a four-way interaction of Prime × Presentation × Self-Consciousness × Measurement Period, $F(3, 141) = 7.05$, $p < .001$, such that this was mainly true among low self-conscious individuals in the optimal condition.

Positive Affectivity, Negative Affectivity, and State Self-Esteem

There were no main effects or interactions of self-consciousness, prime, or presentation for analyses of variance conducted on self-reports of positive affectivity or negative affectivity regardless of whether these scales were analyzed as posttask scores or as changes from pretask measures or were combined into a superscale. Similarly, there were no effects or interactions on the measure of state self-esteem. Reanalyses using regressions that treated self-consciousness as a continuous variable only revealed one effect: Regardless of condition, high self-conscious individuals reported greater negative affectivity posttask than did low self-conscious individuals, $t(55) = 2.41$, $p < .02$.

If all 20 PANAS items are analyzed individually as change scores from baseline, 2 out of a possible 60 effects or interactions attain conventional levels of significance in the analyses of variance: There was a main effect of presentation on distress such that participants reported a reduction in distress in the optimal as opposed to the suboptimal conditions, $F(1, 55) = 5.67$, $p = .02$. There was a main effect of self-consciousness on nervousness such that low self-conscious individuals reported a decrease in being nervous, whereas high self-conscious individuals generally did not change, $F(1, 55) = 4.02$, $p = .05$. Finally, there was a Prime × Presentation interaction such that optimal presentation of the angry prime increased and optimal presentation of the relax prime decreased participants' reports of being jittery, $F(1, 55) = 4.42$, $p = .04$. Similar effects are observed (and no new effects are added) if all of these analyses are reconducted using continuous self-consciousness scores to form main effects and interactions in a regression analysis.

One intriguing effect that approached significance involved self-reports of "hostile." For this variable, the interaction of self-consciousness and the angry–relax prime was $F(1, 55) = 3.17$, $p = .08$, such that high self-conscious individuals reported greater increases in hostility following the (optimally or suboptimally presented) angry prime and reduced feelings of hostility following the (optimally presented) relax prime, whereas low self-conscious individuals were unaffected by either prime at either presentation. This effect parallels a near-significant interaction on self-reports of "irritable" in Study 3 ($p = .068$). As in Studies 2 and 3, such effects and trends are tantalizing but obviously involve serious issues regarding capitalization on chance.

MAACL

Study 4 also included the MAACL as a checklist measure of multiple emotion terms. We formed six subscales by separately summing endorsements of (a) hostile items, (b) nonhostile items, (c) depression items, (d) nondepression items, (e) anxiety items, and (f) nonanxiety items. Of greatest interest were the hostile and nonhostile reports. There were no significant effects or interactions for the composite measure of hostile-related emotions, all ps $> .15$. For the nonhostile emotions, there was a main effect of prime such that the angry prime was associated with *increased* reports of nonhostile emotions, $F(1, 55) = 4.56$, $p = .04$.[3]

Exploratory Analyses

As in Study 3, an analysis was conducted that correlated change in systolic blood pressure, diastolic blood pressure, and heart rate with changes from baseline in each emotion item from the PANAS. An initial analysis of combined data revealed only 3 significant correlations (out of 60), and none of these replicated those observed in Study 3 (increases in diastolic blood pressure were associated with increased interest but decreased attentiveness; increases in heart rate were associated with decreased reports of being upset), $rs(n = 64) = .27, -.33, -.26$, $ps < .05$, respectively. On the other hand, if analyses are restricted to the suboptimal conditions (the only conditions used in Study 3), the associations previously observed between blood pressure and self-reports of hostility replicate. Thus, increased systolic and diastolic blood pressure were both associated with increased self-reports of feeling hostile, $r(N = 34) = .45$, $p < .01$, and $r(N = 34) = .44$, $p < .01$, respectively. As implied by this pattern, these correlations were not significant in the optimal conditions, $rs(N = 30) = -.08$ and $.11$, $p > .50$, respectively. In addition, none of the correlations of cardiovascular responses with inspired, alert, or attentive states observed in Study 3 were significant in any analysis in Study 4. Finally, similar analyses were conducted on the subscale of the MAACL that involved reporting hostile-related emotions. For the subliminal priming conditions, both increased systolic and increased diastolic blood pressure were associated with increased likelihood to endorse these emotions, $r(N = 34) = .43$ and $.34$, respectively, $p < .05$. Neither of these effects were observed in the optimal priming conditions, $r(N = 30) = .21$ and $.07$, respectively, $p > .25$. These effects were nonsignificantly stronger among high private self-conscious than among low self-conscious participants.

General Discussion

In four studies, we have found that individual differences in private self-consciousness moderate the effects of implicit and suboptimal primes on overt behavior and physiological responses. Given previous research by Bargh et al. (1996), Dijksterhuis and van Knippenberg (1998), and others, it is reasonable to assume that participants exposed to the implicit priming paradigm used in Studies 1a and 1b remained unaware of the content of the stereotype prime and its effect on behavior. It is certainly the case in Studies 2–4 that all participants remained unaware of the presence of the primes.

Implications for Conceptualizations of Self-Consciousness and Self-Awareness

Beyond the irony that *consciousness* and *awareness* are included in the variable labels *self-consciousness* and *self-awareness*, what issues are raised by the present results for traditional accounts of these individual differences and manipulations? As noted in the introduction, Duval and Wicklund (1972) clearly associated the self-aware state with a conscious, reflective process when they described the nature of self-focused attention. Carver (1979) and later Carver and Scheier (1981) adopted Duval and Wicklund's (1972) term *self-focused attention* as defining the self-aware state. Although they explicitly distinguished self-attention from consciousness (Carver & Scheier, 1981, p. 139), they described self-awareness as involving awareness of various aspects of the self (e.g., Carver, 1979) and private self-consciousness as "the tendency to be aware of one's thoughts, feelings, private motives, and desires" (Carver & Scheier, 1998, p. 104). Indeed, it is hard not to describe individual differences in self-consciousness in these terms given the nature of the items that compose the scale (e.g., "I reflect about myself a lot," "I am aware of the way my mind works when it works through a problem," "I'm generally attentive to my inner feelings," "I'm alert to changes in my mood," "I'm constantly examining my motives"). Gibbons (1990) adopted the Duval and Wicklund (1972) definition of self-focused attention but linked this to a more general self-assessment process that includes awareness of internal states. In contrast to these theorists, we have consistently defined self-awareness in terms of automatic encoding processes (Hull & Levy, 1979) that "can have effects on affect and behavior independent of conscious self-perception" (Hull et al., 1988, p. 454).

Distinct from the issue of awareness, the current findings raise questions concerning the processes by which the priming manipulations used in these studies have their effects on self-conscious individuals. *Why* should differences in self-focused attention increase the effectiveness of such primes in guiding behavior? Most accounts of self-awareness associate its behavioral consequences with self-regulation using personal standards (e.g., Carver & Scheier, 1981, 1998; Duval & Wicklund, 1972; Gibbons, 1990). Again, in contrast to these theorists, we have maintained that self-awareness and self-consciousness are associated with an increased tendency to encode information as self-relevant. Situational manipulations have this effect because they function as cognitive primes to increase the level of activation of knowledge about the self. Individual differences in self-consciousness have this effect because they are associated with chronic differences in the level of activation of such knowledge. Such a claim directly links the self-awareness and self-consciousness literatures to empirical literatures on encoding processes, the function of primes, and the consequences of activated knowledge. In addition, this

[3] For the remaining subscales, there was a prime main effect on reports of anxiety-related emotions such that participants reported greater anxiety following the angry than the relax prime, $F(1, 55) = 4.33$, $p < .05$. On the other hand, there was a Prime $\times$ Presentation interaction for nonanxiety emotions such that participants reported more nonanxious emotions following the angry than the relax prime, but only when the primes were presented suboptimally, $F(1, 55) = 5.22$, $p = .03$. Finally, there were no effects or interactions for participants' reports of nondepressed emotions. On the other hand, for depression-related emotions, there was a Self-Consciousness $\times$ Presentation interaction such that optimal presentation of either prime was associated with increased reports of depressive affect among high self-conscious but not low self-conscious individuals, $F(1, 55) = 5.31$, $p = .025$. In sum, then, relative to the relax prime, the angry prime appeared to have the effect of increasing self-reports of (a) nonhostile, (b) anxious, and (c) nonanxious emotions. These emotion reports appeared to be affected even when the primes were presented suboptimally. On the other hand, hostile, depressive, and nondepressive emotions were either unaffected or affected in a manner that did not depend on the specific content of the prime.

claim implies that the ultimate consequences of self-awareness follow from *what* is being encoded and *how* it is self-relevant. Just as priming effects are understood to bias behavior in a manner that does not require (or lead to) reflexive consciousness and controlled behavioral regulation, so self-awareness manipulations and individual differences in self-consciousness can bias behavior in such a manner.

The distinction between an account of self-awareness effects in terms of self-referent encoding versus self-regulation using personal standards is most sharply drawn in Studies 1a and 1b. In what sense is an elderly stereotype prime relevant to a personal self-standard? Young adults are not retired, with wrinkles, playing bingo in Florida. Indeed, why should this prime bias the behavior of *anyone* in this age group, much less individuals who are high in private self-consciousness? Within the stereotype literature, applicability of the prime to a target is traditionally understood as a boundary condition on the effectiveness of the prime to bias judgments (e.g., Banaji et al., 1993; Higgins, 1989, 1996). An elderly prime is at some level objectively inapplicable to young adults. Why should it bias their behavior? Similar questions can be raised about the effects of African American stereotype primes on Caucasian Americans (Chen & Bargh, 1997) and the effects of soccer hooligan, secretary, and professor primes on students who are ostensibly not soccer hooligans, secretaries, or professors (Dijksterhuis & van Knippenberg, 1998). We propose that these primes bias behavior because they are processed as self-relevant despite their apparent inapplicability to the self (see also Wheeler et al., 2001). High self-conscious individuals process these cues as self-relevant because they have chronically high levels of accessible self-knowledge (see Hull et al., 1988). As demonstrated by Higgins and Brendl (1995), contextual priming combined with high levels of chronic knowledge accessibility and short priming-to-stimulus delay is sufficient to overcome boundaries typically imposed by low applicability.

Theoretical Issues

Such an analysis raises multiple issues regarding standard assumptions about the effects of self-consciousness and self-awareness. For example, if self-awareness has effects on behavior that are *not* a consequence of greater awareness and self-regulation with respect to personal standards, (a) what mechanisms are responsible for the fact that self-awareness stimuli are sometimes associated with greater behavioral consistency and greater attitude–behavior correspondence? (b) what mechanisms are responsible for the fact that self-awareness manipulations are sometimes associated with greater self-report–physiological state correspondence? and (c) is it possible that situational manipulations of self-awareness and individual differences in self-consciousness have different consequences for automated behaviors?

Behavioral consistency. Several studies have shown that individual differences in private self-consciousness and situational manipulations of self-awareness are associated with greater attitude–behavior correspondence (e.g., Carver, 1975; Froming, Walker, & Lopyan, 1982; Gibbons, 1978; Pryor, Gibbons, Wicklund, Fazio, & Hood, 1977; Scheier, Buss, & Buss, 1978; although see Underwood & Moore, 1981) and more accurate self-assessments (e.g., Osberg & Shrauger, 1986). This is usually interpreted as evidence that self-aware individuals have greater self-knowledge of personal standards and that self-awareness entails regulation with respect to such standards (e.g., Carver & Scheier, 1981). Certainly, such an account can explain these patterns of effects. It is also apparent, however, that private self-consciousness and self-awareness can lead to behavior that is consistent with situationally manipulated standards (e.g., increased aggression; Carver, 1974; increased compliance; Beaman, Klentz, Diener, & Svanum, 1979; Swart, Ickes, & Morgenthaler, 1978). For example, Batson et al. (1999) found that self-awareness increased generosity when a statement was included in an information sheet that emphasized a generosity standard but that it increased selfishness when the statement was omitted. In addition, self-aware participants in the latter condition subsequently moved their personal moral standards toward their selfish behavior. Such standard shifting seems particularly contrary to accounts of self-awareness that identify behavioral regulation with respect to personal standards as the sine qua non of the self-aware state (see also Duval & Lalwani, 1999). Such an account becomes even more problematic when faced with the current findings that private self-consciousness is associated with increased behavioral responsivity to cues that remain outside of awareness and that are at best irrelevant to personal standards (e.g., elderly primes).

How does one reconcile (a) increased attitude–behavior correspondence with (b) increased sensitivity to environmentally salient cues that at times call for actions that are the opposite of the individual's natural predispositions (e.g., Batson et al., 1999)? First, it needs to be recognized that behavioral consistency does not require self-regulation with respect to personal behavioral standards. To account for consistency, it is only necessary that individuals process situations that are similar in meaning as in fact similar to one another and as a consequence engage in similar responses in each. Individuals who are sensitive to the similarity in meaning of various situations as a consequence of an increased tendency to process the various cues that define the situational context as relevant for one's actions (i.e., self-relevant) are more likely to show behavioral consistency (see Hull & Levy, 1979, p. 757). Such an account shares much in common with Fazio's (1990) arguments regarding the role of passive, automatic processes in attitude–behavior correspondence.

Elsewhere, we have noted that self-awareness *can* yield controlled processes, particularly those associated with self-perception and self-evaluation (Hull & Levy, 1979, p. 757–758). However, whether self-awareness is associated with such controlled processes is proposed to be a consequence of the nature of the cues that are encoded as self-relevant rather than a consequence of the self-aware state per se. Once again, these claims are quite consistent with arguments made by Fazio (1990) regarding cues that evoke deliberative, controlled processes versus passive, automatic processes (see also Hull, 2002).

Emotional awareness. The relationship of self-awareness and self-consciousness to emotion has been a subject of research for over 25 years, beginning with a demonstration by Scheier (1976) that self-awareness is associated with greater responsivity to angry cues. Similar effects have been observed with respect to induced attraction, elation, disgust, depression (Scheier & Carver, 1977) and fear (Scheier, Carver, & Gibbons, 1981). Gibbons and colleagues (Gibbons, Carver, Scheier, & Hormuth, 1979; Gibbons & Gaeddert, 1984) have also demonstrated that self-awareness is associated with less responsivity to nonarousing cues (i.e., less of a placebo effect; although see Levine & McDonald, 1981). In one of the relatively rare attempts to determine the psychological processes responsible for these effects, Kleinke, Peterson, and Rutledge (1998) showed a stronger link between facial expressions and self-reported affect among high self-conscious individuals. Finally, Hansen, Hansen, and Crano (1989) showed that self-reported arousal was more strongly associated with actual arousal among self-aware participants, although given that participants could see their facial expressions in these studies, it is not clear whether these findings were based on interoception or indirect judgments based on facial expressions of effort during an exercise task.

As noted in a recent review by Silvia and Gendolla (2001), multiple questions remain regarding exactly why these effects occur. Although most self-awareness researchers argue that self-awareness yields these effects because it is associated with greater awareness of internal states (e.g., Carver & Scheier, 1981; Gibbons, 1990; Scheier, 1976), much of the literature is amenable to the alternative hypothesis that self-awareness increases responsivity to emotion-evoking cues rather than increasing awareness of the emotional response itself. Certainly, the latter of these two hypotheses receives stronger support from the current studies than does the former. Thus, high and low private self-conscious individuals clearly differed in their physiological response to the experimentally manipulated emotion primes in Study 4. This was despite the fact that the two groups did not differ in terms of emotion report–physiological correspondence (see also Gillis & Carver, 1980) or awareness of the emotion primes themselves.

Given our theoretical analysis of the nature of self-consciousness, we propose that self-consciousness is associated with the process of encoding external (e.g., situational) and internal (e.g., physiological) cues in terms of their self-relevance. As specifically applied to emotional states, this analysis suggests that self-consciousness is associated with an increased physiological and behavioral responsivity to emotional cues and that any association of self-consciousness and increased reports of emotional states is mediated by the self-referent encoding of specific physiological states and the invocation of labeling processes that may themselves be subject to error.

Of measures and mirrors. Over 25 years of research has been conducted on self-consciousness and self-awareness. By and large, this research has consistently found that the effects associated with situational manipulations of self-awareness parallel the effects associated with individual differences in self-consciousness. Nonetheless, two recent studies by Dijksterhuis and van Knippenberg (2000) found that a self-awareness (mirror) manipulation was associated with decreased influence of a stereotype prime. How can this effect be reconciled with the current findings?

As noted, we define the differences between self-consciousness and self-awareness in terms of the chronic and acute activation of particular domains of self-knowledge. It may be that chronically activated self-knowledge has a general effect of increasing the likelihood that a broad range of situational cues will be processed as self-relevant, whereas acutely activated self-knowledge has a more narrow effect of increasing the likelihood that situational cues will be processed as self-relevant to the extent that they bear on the individual's current activities. In the Dijksterhuis and van Knippenberg (2000) studies, self-aware participants were exposed to images of themselves during both an initial priming task and a subsequent essay-writing (Experiment 1) or Trivial Pursuit (Experiment 2) task. It may be that the mirror self-awareness manipulation led participants to be more sensitive to the self-relevant aspects of each task individually but actually inhibited carry over between tasks. Although speculative, such an account is consistent with research reviewed earlier showing that self-awareness increases the influence of situational cues directly tied to the individual's current activities (e.g., norms) and raises interesting questions regarding the differential timing of self-awareness inductions.

Conclusion

The current studies yield consistent evidence that self-consciousness is associated with greater responsivity to implicit and suboptimal primes. As such, they raise a number of interesting and provocative issues regarding the basic nature of self-consciousness and its situational counterpart, self-awareness. The challenge is to account for the effects observed in these studies while providing a coherent account of a large body of existing research. We have tried to make clear that simply adopting a traditional account of self-awareness as self-regulation with respect to personal standards is inadequate. Rather, we have proposed that viewing self-consciousness and self-awareness in terms of an increased likelihood to encode information as self-relevant goes a long way toward understanding the diverse consequences of these independent variables.

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Received September 17, 2001
Revision received March 26, 2002
Accepted March 26, 2002 ■