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Unpriming: The Deactivation of Thoughts Through Expression

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Unpriming is a decrease in the influence of primed knowledge following a behavior expressing that knowledge. The authors investigated strategies for unpriming the knowledge of an answer that is activated when people are asked to consider a simple question. Experiment 1 found that prior correct answering eliminated the bias people normally show toward correct responding when asked to answer yes–no questions randomly. Experiment 2 revealed that prior answering intended to be random did not unprime knowledge on subsequent attempts to answer randomly. Experiment 3 found that exposure to the correct answer did not influence the knowledge bias but that exposure to the incorrect answer increased bias. Experiment 4 revealed that merely expressing the answer for oneself was sufficient to unprime knowledge. Experiment 5 found that each item of activated knowledge needs to be unprimed specifically, in that correctly answering 1 question does not reduce the knowledge bias in randomly answering another.

Keywords: priming, intelligence, knowledge, control, answering questions

When an experience primes a person to think about something, the person's behavior and judgment may be influenced by the prime. The passing mention of a burrito in conversation one day, for example, might incline the listener to seek out a Mexican restaurant for lunch—even though the listener has no explicit memory of the word or the mentioning. This effect is well-known in psychology and the focus of many studies demonstrating the welter of subtle primings that guide human thought and behavior every day. What is not clearly understood, however, is what draws the influence of a prime to a close. The question addressed in our studies was whether, when the primed thought is expressed in some way, it then becomes less likely to have such cascading effects. We tested whether *unpriming* occurs when a primed thought is acted on.

Priming Effects

The influence of priming was first observed experimentally by Storms (1958), who found that words presented for a subsequent memory test were often used by participants in an intervening indirect word-association task. This effect was named *priming* in a replication by Segal and Cofer (1960) and led to the seminal work of Neely (1977), who found that lexical decisions were completed with faster reaction times when a decision was preceded with a primed word that was semantically related. Ever since, many researchers have examined the properties of such unconscious influence (Toth & Reingold, 1996). Conceptual and perceptual primes presented subliminally or surreptitiously can influence the ease with which the prime itself is later recognized (e.g., Jacoby & Dallas, 1981), can facilitate use of the prime in answers to questions such as word completions (e.g., Tulving, Schacter, & Stark, 1982), and can enhance the use of associates of the prime in other tasks (e.g., Higgins & King, 1981)—all without the person's explicit awareness of the prime's influence (for reviews of the literature, see Roediger & McDermott, 1993; Schacter, Chiu, & Ochsner, 1993). Conceptual primes can operate across modalities (e.g., from auditory to visual) and involve the encoding of semantic meaning so that associates of the prime are also activated. Perceptual primes are modality specific and do not involve elaborative encoding (see Blaxton, 1989, for a discussion of the distinctions). Explicit memory systems may play more of a role in conceptual memory tasks (Mulligan, 1997), but it has been argued that priming tasks generally involve both conceptual and perceptual processing, which involve deactivations in differential brain areas (Schacter & Buckner, 1998).

When a prime is relevant to a possible behavior, it can increase the likelihood of that behavior (Bargh & Chartrand, 2000; Dijksterhuis & Bargh, 2001). Participants primed with the concept of hostility, for example, delivered more intense shocks to a person than did participants who were not primed (Carver, Ganellen, Froming, & Chambers, 1983). Similarly, participants primed with rudeness were more likely than others to interrupt someone engaged in conversation, and those primed with thoughts of the elderly were more likely to walk slowly while exiting from an experiment (Bargh, Chen, & Burrows, 1996). Other priming studies have found behavioral effects for primes of helpfulness (Macrae & Johnston, 1998), conformity (Epley & Gilovich, 1999), and even intelligence (Dijksterhuis & van Knippenberg, 1998). Priming can also unconsciously influence evaluations (Bargh, Chaiken, Raymond, & Hymes, 1996) and can prompt the nonconscious pursuit of goals (Chartrand & Bargh, 1996).

These various priming effects suggest a model of human behavior in which people are controlled by the happenstance array of

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environmental influences they encounter (cf. Bargh & Ferguson, 2000). In the course of a day, a person is exposed to a sequence of primes, each of which may or may not achieve some influence, and the person's primed path through the environment then determines which further primes will be encountered. This sounds like a workable model of human behavior—until the person reaches an environment that only primes one thing. The poor soul primed to get a burrito, for example, arrives at the Mexican restaurant and, further primed by the environment, ends up staying all day, unable to do anything but stand, transfixed and drooling, at the door of the *cocina*. Priming in experiments can sometimes indeed last for days (Squire, Shimamura, & Graf, 1987), so behavior and thought that reflect only the environment would regularly bring behavior to a perseverative cycle whenever priming occurs.

The realization prompted by this example is that an adaptive process of priming would need to have a natural endpoint to draw it to a close. This endpoint may be the occurrence of an influence of the prime. For priming to be an adaptive process, in other words, it should come to an end when the prime has been used. Once a primed thought or behavior occurs, there should be a relatively rapid reduction in the influence of the prime on subsequent thought or behavior. Just as a person playing the piano must rapidly overcome the influence of each past note on the sheet music for the song to move forward, a person responding (even unconsciously) to a changing array of environmental primes would perform most effectively if each prime's potential influence was curtailed when that prime had indeed registered a change in the person's thought or action. To be effective in guiding behavior, priming should no longer guide behavior once the behavior has occurred. Prime-based behavior should result in unpriming.

Varieties of Unpriming

The history of psychology features many descriptions of unpriming, when unpriming is defined broadly as the reduction in the influence of a prime that occurs when the prime has been acted on. Versions of the idea of unpriming can be found in literatures focusing on *catharsis*, *completion*, and *updating*—emphasizing, respectively, the emotional, motivational, and cognitive ways of understanding this phenomenon.

Emotional catharsis was perhaps the earliest of these ideas and can be found in Aristotle's (trans. 1961) *Poetics* in the hypothesis that the negative emotions of pity and fear are reduced through the viewing of tragedy. The related view rendered by Breuer and Freud (1893–1895/1955) was that the expression of pathological emotions might serve to dissipate those emotions. Modern research on catharsis involving a simple venting of emotion—such as expressing aggression through hitting a punching bag—has not found that the emotion is deactivated by such activities (e.g., Bushman, Baumeister, & Stack, 1999). However, other studies of catharsis, such as Pennebaker's diary studies (Pennebaker, 1989; Pennebaker & Beall, 1986), have found that expressing thoughts and feelings accrues health benefits and decreases subsequent thoughts of trauma.

The motivational approach to unpriming suggests that behaving on the basis of a prime can achieve a sense of goal completion that renders the prime less active. Much has been written about people's tendency for enhanced memory for incomplete over completed intentions (Zeigarnik, 1935) and the motivating quality of incomplete intentions (Lewin, 1939, 1951; Martin, Tesser, & McIntosh, 1993). Indeed, much of the work on Zeigarnik-type effects has focused on the importance of completing important tasks (Martin et al., 1993) or goals specifically relevant to the self (Gollwitzer & Wicklund, 1982, 1985). Such work has suggested that intention is itself a prime, an urge toward behavior that must be fulfilled before the thought can be unprimed. In this regard, Förster, Liberman, and Higgins (2005) found that conscious goals enhance the accessibility of goal-related words over nonrelated words in a lexical decision task but that this accessibility is inhibited over time once the goal has been achieved.

The idea that completing the pursuit of a goal can yield unpriming is particularly evident in discussions of the reliability of the measurement of motivation. Critiques of measures of motivation such as the Thematic Apperception Test (TAT; Morgan & Murray, 1935) revolved around the repeated finding of low internal consistency of such tests (Entwistle, 1972). The fact that the motivation to achieve waxes and wanes over the course of describing a series of pictures was embraced by Atkinson, Bongort, and Price (1977), however, who viewed this inconsistency as a natural result of the reduction in a motive that results when the motive is expressed in fantasy. In this analysis, the unreliability of the TAT occurs because an answer to a TAT item relevant to a motive reduces the psychological influence of that motive and so undermines the effect of that motive on subsequent items. Behaving in response to an accessible psychological influence, in other words, unprimes that influence.

Notions like that of unpriming have surfaced in the cognition literature to explain the updating of cognitive representations or memories that occurs when new information becomes available. In studies of perception, for example, researchers have examined the inhibition of return in attention (Posner & Cohen, 1984)—a reduction in attention toward previously attended visual areas. Researchers in studies of executive function, in turn, have examined how the inhibition of previous task sets can facilitate task switching (e.g., Allport, Styles, & Hsieh, 1994). In this regard, Mayr and Keele (2000) found that shifts of intention between differing goal states may reduce the previous goal state in a process they term *backward inhibition*. Memory researchers also have examined effects of old memory retrieval on the updating of old memories with new memories (e.g., when one parks one's car in a different place) in studies of retrieval inhibition (e.g., Bjork & Landauer, 1978). Cognitive studies of semantic satiation also suggest a kind of updating, in that priming may occasionally be slowed as a result of multiple repeated exposures of a prime, although the conditions under which this occurs are not clear (Esposito & Pelton, 1971). Semantic satiation appears to occur only when participants are engaged in a task that requires explicit use of knowledge of a target's category membership (Smith, 1984).

The literatures on catharsis, completion, and updating suggest that psychological theorists have often recognized that behavior prompted by a stimulus can naturally reduce the propensity toward subsequent stimulus-related behavior. The question of whether a thought deactivation process ensues when people behave on the basis of a primed thought, however, remains to be tested.

The Random Answering Paradigm

Our interest in unpriming was prompted by the unusually robust priming effects observed in the random answering paradigm by Wegner, Fuller, and Sparrow (2003). In this paradigm, respondents were asked to answer a series of simple yes–no questions as randomly as they could. These studies did not pursue the problem of whether people can make response sequences that resemble random sequences in details such as run length or nonredundancy (e.g., Baddeley, Emslie, Kolodny, & Duncan, 1998; Nickerson, 2002). The focus was on participants' response correctness when correctness was not mentioned and participants were explicitly instructed to answer randomly. Participants were instructed not to use prearranged strategies but rather to listen to each question and "flip a coin in your head" to determine whether to answer "yes" or "no." In other words, participants were asked to respond to each question randomly, without trying to be correct or incorrect. They were not asked to attempt to produce a pattern of responses that would appear random. With the correctness of "yes" and "no" responses balanced, truly random responding would be expected to produce correct responses 50% of the time, but respondents almost never achieved this low level of correctness and instead answered questions correctly on average at rates far higher than chance. Primed by their knowledge of the correct answers, participants in these studies seemed unable to control this intelligence in the pursuit of random answering.

Further evidence collected by Wegner et al. (2003) suggests that the influence of primed knowledge activation in this paradigm was indeed uncontrollable. Extra financial incentives to be random did not undermine the primed knowledge effect, and extra time to establish a random response was also ineffective. The incentive did lower participants' postexperimental estimates of their correctness, showing that they were under the mistaken impression that they could overcome the tendency to answer questions correctly. It is also worth noting that responses made quickly (in under 1,000 ms) were correct nearly 50% of the time or random, whereas questions answered in over 1,000 ms were more likely to be answered correctly. The only strategy participants seemed to be able to use to achieve random answering, in other words, was to respond preemptively before fully registering the question they were asked.

Drawing from past research, we can suggest several possible explanations for why knowledge may act as a prime to generate correct responses in the random answering paradigm. These explanations follow from the general idea that the knowledge is activated by the questioning and cannot be deactivated by attempts at voluntary mental control. Higgins (1996) theorized that knowledge stores may vary in their potential to be activated. The context may increase accessibility or a history of recent knowledge use may create activation. Beyond this, there is the possibility that people feel compelled to answer questions correctly because there are implicit rules of communication, such as those Grice (1975) described, which would prompt an answer to a question if the answer is known. Random answering may be difficult because of the deeply established social norm to provide correct information in response to questions.

The idea that knowledge can be activated by a goal state (to answer a question) suggests that the difficulty of random answering may involve the activation of thoughts by the goal. In this Zeigarnik-like view, a motivational process brings the answer to mind until the goal of answering correctly is complete (Goschke & Kuhl, 1993; Marsh, Hicks, & Bink, 1998; Martin et al., 1993). Alternatively, it may be easier for the person to provide a correct answer to a question than to try to overcome thoughts of the correct answer and come up with a random answer. It has been shown that beliefs are expressed quickly and automatically, whereas the rejection of an idea is a more effortful process (Gilbert, 1991; Wegner, Coulton, & Wenzlaff, 1985). Trying to suppress the thoughts generated by the knowledge of the right answer may lead to a counterproductive increase in these same thoughts, which may block a random response (Wegner, Schneider, Carter, & White, 1987). There are yet other potential explanations for the random answering effect (see Wegner et al., 2003), and the exploration of unpriming may shed some light on these.

The Present Research

In these studies, we examined the effects of answering a question correctly on the subsequent ability to answer the question randomly. Prior correct answering in the random answering paradigm involves behaving on the basis of the knowledge primed by the question and so provides a basic test of whether the use of primed knowledge can induce unpriming. Experiment 1 tested whether answering questions correctly before attempting to answer them randomly would result in successful random answers. In Experiment 2, we explored whether correct answer unpriming is only a result of answering each question twice, regardless of the correctness of the first response. In Experiment 3, we explored whether simple exposure to correct or incorrect answers prior to the random answer task might explain unpriming effects. In Experiment 4, we investigated the minimal level of response that would allow unpriming by testing whether, if participants answer questions correctly only to themselves, this expression would be sufficient to deactivate the thought and allow random responding. Experiment 5 tested whether answering any question correctly prior to random responding would allow a generalized expression of correctness that would result in unpriming.

Experiment 1: Prior Correct Answering and Random Response

This study tested the unpriming effect of correctly answering a question. Participants in two conditions were asked to answer a series of easy yes–no questions randomly. Those in one condition were asked to answer each question correctly before answering it randomly, whereas those in the other condition were asked to provide only a random answer. Correctness of the random answers was assessed for both.

Method

Participants. Forty-eight undergraduates at Harvard University (31 women and 17 men) participated for course credit in the psychology department study pool or for monetary compensation. All participants in this and the following experiments gave informed consent for participation.

Questions. Participants answered a series of 60 questions with "yes" or "no" responses. All of the questions asked were easy (e.g., "Does 2 plus 3 equal 5?" "Does a triangle have three sides?"), so all participants were assumed to have knowledge of the correct answers. The correct answer was "yes" for half the questions and "no" for the other half (participants were unaware both of this and of the total number of questions they would answer). Questions were presented in a predetermined random order so that correct "yes" and "no" responses would be presented with no particular pattern.

Design and procedure. Participants were run individually at a computer that had a pair of keys labeled *yes* and *no*. Participants in a *random-only* condition were told that they were to answer a series of questions and that they were to try to answer each question randomly. Participants in a *correct–random* condition were told that they were to answer a series of questions, for which each question would be presented twice in succession. For the first appearance of the question, they were instructed to try to answer the question correctly. For the second appearance of the question, they were to attempt to answer the question randomly. Participants in both conditions were then left alone to read through instructions presented on the computer and to begin the experiment when they were ready.

The instructions on the computer regarding random response, shown to participants in both correct–random and random-only conditions, were as follows:

> Try not to generate a predictable pattern of yes/no/yes/no or yes/yes/yes, but try to generate a random response when answering each question. One way to think about this is to try to mentally flip a coin in your head when each question is asked.

Participants in the correct–random condition received the additional instruction, "Please try your best to answer the question correctly the first time it is asked, and then try to answer randomly the second time that it is asked."

Questions were presented on a PC monitor and answers were recorded through the program DirectRT (Jarvis, 2000). Participants saw each question in the center of the screen along with the words *yes* and *no* along the bottom of the screen and heard the question read through the computer speakers. The interval between question presentations was 2 s. For participants in the correct–random condition, for each first presentation of a question, an instruction appeared at the top of the screen asking participants to "try to answer the question correctly." For the second presentation of the question, participants were instructed to "try to answer the question randomly." Sixty individual questions were shown twice each, for a total of 120 trials. Participants in the random-only condition saw each question once, for 60 trials, with the instruction "try to answer each question randomly" appearing on the top of the screen. Participants in this and all of the following experiments were debriefed prior to dismissal.

Results and Discussion

Participants who were allowed to answer only once, randomly, exhibited a significantly higher mean proportion of correct responses ($M = .58$, $SD = .15$) than did correct–random participants ($M = .49$, $SD = .12$), $t(46) = 2.07$, $p < .05$, $\eta^2 = .09$ (see Figure 1). Participants in the random-only condition answered at correctness levels significantly greater than chance ($M = .58$ tested against a statistic of .50), $t(24) = 2.53$, $p < .02$. Participants in the correct–random condition ($M = .49$) were no different from chance, $t(22) = 0.23$, $p = .82$. Thus, it appears that allowing participants to express the correct response first significantly reduces the tendency to provide a correct response when it is not appropriate—that is, when a random response is requested. It is worth noting that for correct–random participants, the mean proportion correct when a correct response was requested was .98 ($SD = .03$), significantly greater than the total mean proportion for random responses from these same participants ($M = .49$, $SD = .12$), $t(22) = 18.18$, $p < .001$, $\eta^2 = .94$.

Perhaps participants who successfully performed near chance correctness levels had a strategy to answer systematically and thus were not actually unprimed per se. The 60 questions had half "yes" and half "no" correct responses, although participants did not know this, nor did they know how many questions they would have to answer. The best strategy, therefore, to reach .50 would be to answer all questions with "yes" or all questions with "no." Not a single participant in either the random-only or correct–random conditions used this strategy for their random responses; the highest number of "yes" answers from any participant was 35 out of 60 and the lowest number was 26. If participants came up with a strategy for successful random responding, it would be expected that they would begin the task with such a strategy (e.g., trying to flip a coin in their head as suggested in the instructions) or that they would perfect a strategy as they went along. Thus, one might expect either a random response strategy that is more successful early, with the strategy breaking down over the course of the trials, or, alternatively, a random response strategy that is more successful later, when compared with earlier trials. However, there was no difference when looking at the first half and second half of the questions separately from mean proportions correct reported above for the responses overall.

These findings suggest that responding to a question may deactivate knowledge of the answer, allowing the respondent to answer the question randomly later on. However, several other possible interpretations need to be examined, and these are taken up in turn in the subsequent experiments.

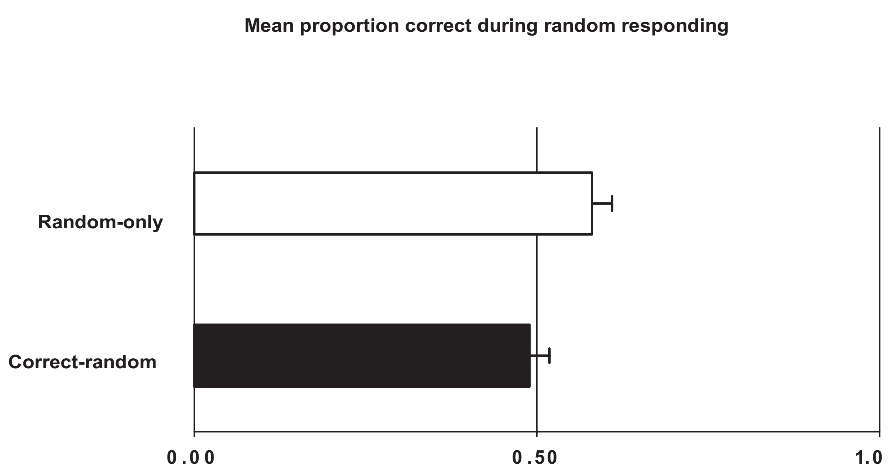

Figure 1. Mean proportions correct for participants in the random-only and correct–random conditions in Experiment 1. Error bars represent standard errors of the mean.

Experiment 2: Prior Random Answering and Random Response

One possible interpretation of the results of Experiment 1 is that any prior answering of a question might reduce knowledge activation and allow later random responding. This experiment assessed whether an initial random response might serve the same unpriming function as an initial correct response on subsequent random responding.

Method

Forty-five participants (34 women and 11 men) were recruited as in Experiment 1 and randomly assigned to one of three conditions: random only and correct–random, as in Experiment 1, and *random–random*, which was added for this study. The procedures for the random-only and correct–random conditions paralleled those of the prior study. The procedure for the random–random condition departed from the procedures of the other conditions only in that participants were asked to answer each question randomly twice in a row. In the random–random condition, instructions to "try to answer the question randomly" appeared at the top of each presentation screen. Participants in all conditions were then left alone to read through a series of detailed instructions presented on the computer and to begin the experiment when they were ready. Questions and instructions otherwise replicated those of Experiment 1.

Results and Discussion

Comparing the first appearance of each question (the only appearance for random-alone participants) reveals that participants asked to answer these questions correctly exhibited a significantly greater mean proportion correct ($M = .94$, $SD = .06$) than either random group ($M = .64$, $SD = .22$, for the random–random condition and $M = .69$, $SD = .20$, for the random-alone condition), $F(2, 42) = 12.84$, $p < .001$, $\eta^2 = .40$. Responses in the correct–random condition significantly differed from responses in both random conditions, although the random conditions did not differ from each other ($p < .05$, Newman–Keuls). Participants in neither random condition answered at chance levels, as a test value of .50 was significantly exceeded by the correctness of both random–random participants ($M = .64$, $SD = .22$), $t(14) = 2.51$, $p < .03$, and random-alone participants ($M = .69$, $SD = .20$), $t(14) = 3.65$, $p < .005$. These results indicate that participants in the correct–random conditions were answering their first question correctly and that the first response of participants in the random–random condition was like the random-only condition in that participants could not answer randomly.

The key issue for this experiment was the random–random participants' second random response. If merely answering a question randomly once unprimed the answer, we would expect there to be no difference between the correctness of the second responses in the random–random and correct–random conditions. This was not the case, however, as correctness of the second response was significantly greater in the random–random condition ($M = .66$, $SD = .20$) than in the correct–random condition ($M = .48$, $SD = .13$), $t(28) = 2.85$, $p < .01$. Second random response correctness was also significantly greater than a test value of .50, $t(14) = 3.00$, $p < .01$, whereas random response correctness after correct responses was not, $t(14) = 0.63$, $p = .55$. A paired comparison between first and second random responses for random–random participants also showed no significant difference, $t(14) = 0.83$, $p = .42$. Thus, it appears that answering a question twice, in and of itself, was not sufficient to unprime knowledge of the correct answer.

Experiment 3: Exposure to Correct and Incorrect Answers and Random Response

In this experiment, we manipulated exposure to knowledge independent of the participant's response to determine whether mere knowledge activation might be effective in unpriming. One aspect of answering a question correctly, after all, is simply that the correct answer comes to mind, and we wanted to ascertain whether the participant's correct response would yield unpriming above and beyond any effect produced by mere external reminding of the knowledge. We were also curious about the influence of exposure to incorrect answers: Might such exposure influence the effectiveness of attempts to respond randomly? To test these influences, we included in this experiment the usual random-only and correct–random conditions but also included other conditions in which participants were supraliminally primed with either the right answer to each question or the wrong answer to each question prior to their attempt to answer the question randomly. These *correct-prime–random* and *incorrect-prime–random* conditions allowed us to assess the relative influence of internally generated correct answers and externally provided correct and incorrect answers on random responses.

Method

One hundred three participants (61 women and 42 men) were recruited as in the prior experiments and randomly assigned to one of four conditions: the random-only, correct–random, correct-prime–random, and incorrect-prime–random conditions. The procedures for the random-only and correct–random conditions paralleled those of the prior studies. Participants heard the questions presented by the computer through DirectRT as before (Jarvis, 2000), but, in this experiment, the question did not appear on the screen so that correct and incorrect answers for the two answer presentations could appear in the middle of the screen when participants heard the question. Instructions for answering the question appeared at the top of the screen, and *yes* and *no* appeared on the bottom of the screen. For the correct-prime–random condition, participants heard each question only once and were asked to answer each question randomly. Included in the task instructions shown before the question trials began was a request for participants to "please keep your eyes on the computer screen at all times." This was because as each question was being heard through the speakers, the correct answer (either *yes* or *no*) to each question was displayed in the middle of the screen for 1,000 ms. In the incorrect-prime–random condition, participants heard each question only once and were asked to answer each question randomly. Participants received the same request to "please keep your eyes on the computer screen at all times." As each question was being heard through the speakers, the incorrect answer to the question (either *yes* or *no*) was displayed in the middle of the screen for 1,000 ms.

Results and Discussion

There was a main effect of condition on mean proportion correct, $F(3, 99) = 8.93$, $p < .001$, $\eta^2 = .21$. Participants who answered questions correctly first in the correct–random condition showed a significantly lower ($M = .47$, $SD = .07$) mean proportion correct on random responses than did participants who answered randomly only ($M = .59$, $SD = .19$), randomly with the correct answer prime ($M =$

.59, $SD = .18$), and randomly with the incorrect answer prime ($M = .70$, $SD = .18$), $p < .05$ in each case (Newman–Keuls; see Figure 2). Participants with the incorrect answer prime showed a significantly greater mean proportion correct on random response ($M = .70$, $SD = .18$) than participants in every other condition, $p < .05$ in each case (Newman–Keuls). The random-only ($M = .59$, $SD = .19$) and correct-prime–random conditions ($M = .59$, $SD = .18$) did not differ significantly, indicating that simple exposure to the correct answer does not yield any notable degree of unpriming. This observation suggests that the mere thought of the correct response is not sufficient to initiate unpriming and that the actual response may be required to produce an unpriming effect. Random responses in all conditions were also significantly greater than a test value of .50: For the random-only condition, $t(25) = 2.51$, $p < .02$; for the correct–random condition, $t(26) = 2.38$, $p < .05$; for the correct-prime–random condition, $t(24) = 5.70$, $p < .001$; for the incorrect–prime–random condition, $t(25) = 2.57$, $p < .02$. Correctness for random responses following correct responses ($M = .47$) was not significantly different from .50.

It is interesting that providing the incorrect answers to participants increases their subsequent tendency to provide nonrandom, correct responses to questions. It may be that when participants see the incorrect answer, their own knowledge of the correct answer is made particularly salient and more likely to defeat their subsequent attempt to answer the question randomly. To be sure, the exposure to the incorrect answer does not unprime the answer. Rather, such exposure may prompt motivations such as psychological reactance (Brehm, 1966) or a desire to suppress thoughts of the incorrect answer (Wegner, 1994; Wenzlaff & Wegner, 2000) that may then increase the influence of the known correct answer on subsequent attempts to produce random responses.

Experiment 4: Components of Correct Answering and Random Response

This experiment was designed to determine whether some subcomponent of correctly answering a question suffices to produce the unpriming of the answer. To understand such a subcomponent, it is useful to recognize that the correct answering of a question has several consequences in this experimental context. The most encompassing consequence is that the correct answer is a full communication from the participant to the experimenter. In such full communication, the participant expresses the answer, this expression communicates the content of the answer to the experimenter, and the communication also serves as a self-presentation to the experimenter that the participant indeed knows the answer.

By this analysis, full communication might not be necessary for unpriming, because either the self-presentation of knowledgeableness (without communication of the answer to the experimenter) or the mere expression of the answer for oneself (without communication of the answer to the experimenter and also without self-presentation of knowledgeableness to the experimenter) might be sufficient to produce the unpriming effect. This study was designed to determine whether full communication; self-presentation; or, at minimum, mere expression of the answer for oneself is sufficient for the unpriming of knowledge in the random answering paradigm.

Method

Participants. Eighty-one participants were recruited as in the prior experiments. A programming error rendered results for 3 incomplete, so the final sample consisted of 78 participants (52 women and 26 men).

Design and procedure. Participants were run in one of four conditions. Two of these replicated Experiment 1: a random-only condition and a correct–random condition that involved full communication of the participants' answers to the experimenter. The additional conditions of *self-presentation* and *mere expression* involved decompositions of the correct–random condition that limited communication of the participants' answers to the experimenter.

In the self-presentation condition, participants were shown each question twice in succession. For the first presentation, participants were asked to indicate whether they knew the answer to the question. On the bottom of the screen for the first presentation of each question

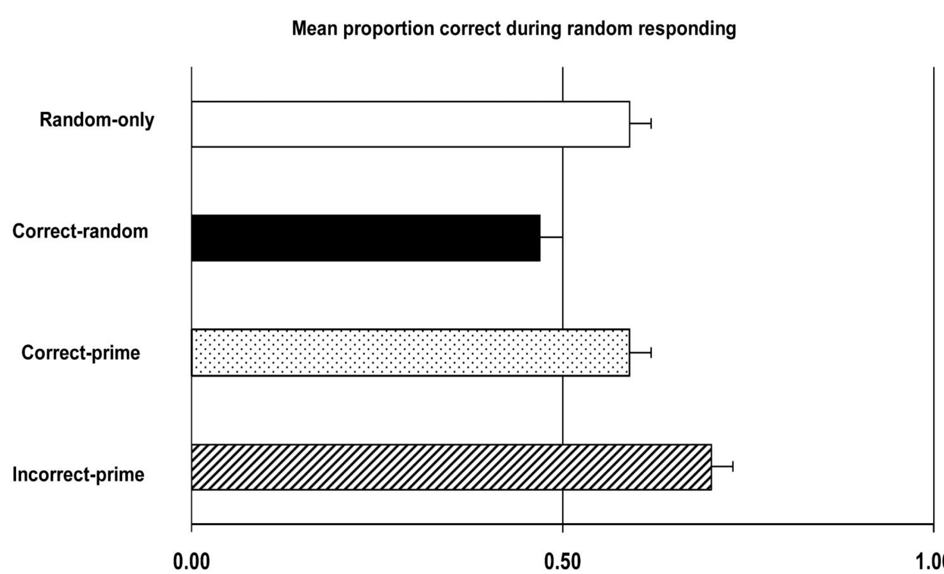

Figure 2. Mean proportions correct for participants in the random-only, correct–random, correct-prime–random, and incorrect-prime–random conditions in Experiment 3. Error bars represent standard errors of the mean.

were the response options *Know* and *Don't Know* corresponding to the keys to be pressed. For the second presentation, participants were asked to respond randomly, following the usual random response instructions. For this presentation, the bottom of the screen indicated the response options *yes* and *no*.

In the mere-expression condition, participants were also shown each question twice in a row. For both the first and the second presentations, on the bottom of the screen were the response options *yes* and *no*. For the first presentation of the question, participants were asked to press underneath the table below the keys designated *yes* and *no* to answer the question correctly (but privately in a way only they would know). They were then asked to press the space bar to move on to the second presentation of each question. For the second presentation, participants were asked to answer the question randomly using the keys designated *yes* and *no* on the computer keyboard, following the usual random response instructions.

Participants in all conditions answered 56 questions. To make the self-presentation issue (of whether the participant knew the answer to the question) a bit more equivocal than in the prior studies, these questions included both easy items and hard ones. Forty questions were easy (e.g., "Does 2 plus 3 equal 5?" "Does a triangle have 4 sides?") and 16 were hard (e.g., "Are more babies born in February than in any other month?" "Did Alfred Hitchcock eat meat?"). The correct answer was "yes" for half of the total questions and "no" for the other half.

Results and Discussion

Responses were computed for easy questions only. (The experimental groups did not differ from one another significantly in the mean proportion of hard questions answered correctly.) Analysis of response correctness during the random answering portion of the experiment revealed a significant main effect for condition, $F(3, 74) = 3.67$, $p < .02$, $\eta^2 = .13$. Participants in the random-only condition were less able to overcome primed correctness ($M = .62$, $SD = .16$) than were those in either the correct–random (communication) condition ($M = .47$, $SD = .11$) or the mere-expression condition ($M = .51$, $SD = .17$), both $ps < .05$ (Newman–Keuls). Participants in the random-only condition ($M = .62$, $SD = .16$) were also marginally more correct than were self-presentation participants ($M = .55$, $SD = .16$), $p < .07$, and participants in the self-presentation condition were marginally more correct ($M = .55$, $SD = .16$) than were those in the correct–random (communication) condition ($M = .47$, $SD = .11$), $p < .07$ (see Figure 3).

Mean correctness during random responding in the various conditions was also compared with a test value of .50. Random responses in the random-only condition were significantly more correct than a test value of .50, $t(21) = 3.55$, $p < .003$. Correctness levels were not significantly greater than .50 for random response in any of the conditions in which participants offered a prior expression of the answer: correct–random, $t(17) = 1.24$, $p = .24$; self-presentation, $t(19) = 1.30$, $p = .20$; mere expression, $t(18) = .27$, $p = .79$.

These results thus do not provide a strong conclusion regarding the influence of differing forms of expression on the effectiveness of unpriming. It appears that participants in the two groups who provided a correct answer (the correct–random and mere-expression conditions), whether the answer was conveyed to the experimenter through the computer or simply expressed privately through pressing their fingers under the table, were more successful at unpriming knowledge-based random responses than were participants in the other groups, although this comparison was only marginally significant for the mere-expression group. The actual correct answer should be expressed, whether to the self or to the experimenter, to provide maximum unpriming of activated knowledge. The action used to fully deactivate a prime may have to be specific to the knowledge activated—such as a report of that knowledge—rather than a more global indication simply that the knowledge is known.

Unpriming imparted by a correct response was not merely an issue of communication and presentation to the experimenter. The lowest level of expression tested—simply expressing knowledge privately to oneself—showed a tendency to remove the biasing impact of answer knowledge for subsequent random responses. The next experiment was designed to examine two possibilities raised by these results: whether each individual prime needs to be specifically deactivated and whether, as suggested by the somewhat reduced correctness levels in the self-presentation condition, a general display of knowledge might be enough to yield unpriming.

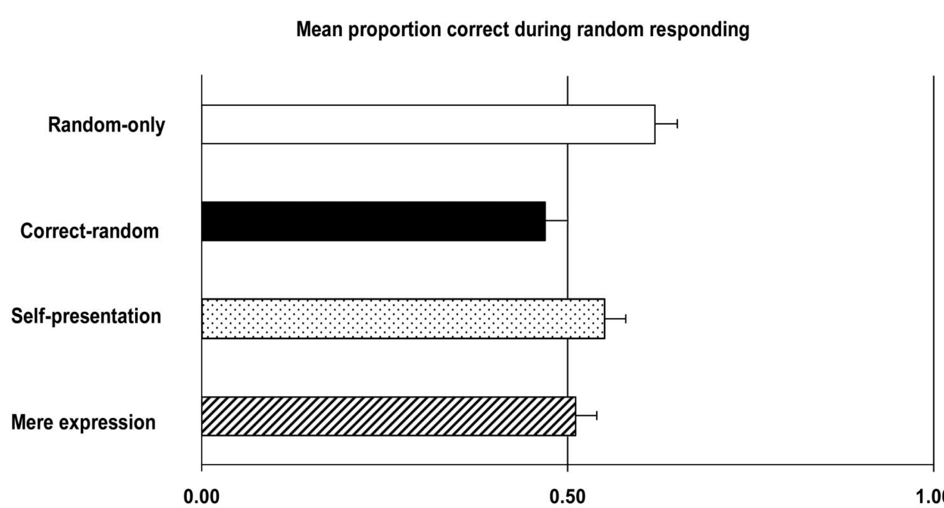

Figure 3. Mean proportions correct for participants in the random-only, correct–random, self-presentation, and mere-expression conditions in Experiment 4. Error bars represent standard errors of the mean.

Experiment 5: Correctly Answering a Different Question and Random Response

It may be that the opportunity to answer some questions correctly and thus unprime the activation created by knowledge will generalize to other questions, allowing a general unpriming effect. This possibility was suggested by the (marginal) unpriming afforded in the prior experiment by the self-presentation of knowledgeableness. However, it may be that deactivation has to be specific for each subsequent random response. Each answer generated by each question may yield the priming of that answer knowledge, and each such prime may thus need to be to be deactivated through expression to allow for an overall proportion correct to be at chance or unprimed levels. This experiment gauged whether unpriming in the random answering paradigm is general or item specific.

Method

Forty participants (25 women and 15 men) recruited as in the prior studies answered the series of 60 easy questions with "yes" or "no" responses as in Experiment 1. Participants were run in one of two conditions: a random-only condition, conducted as in the prior studies, and a *correct-unrelated-random* condition. For participants in the correct-unrelated-random condition, for the presentation of the first 30 questions (Questions 1–30), an instruction appeared at the top of the screen asking participants to "try to answer the question correctly." Participants answered the first 30 questions correctly but did not also answer these same questions randomly. Subsequently, for the second 30 questions (Questions 31–60), participants were instructed to "try to answer the question randomly." There were an equal number of "yes" and "no" correct responses across the two blocks, presented in the same randomly determined order as in previous experiments.

Participants in the random-only condition answered 30 questions (Questions 31–60), the same 30 questions to which participants in Condition 1 responded randomly. They received detailed instructions for how to answer randomly prior to beginning the task, as did participants in the previous studies. With each question presentation, participants in the random-only condition received the instruction to "try to answer randomly" on the top of the screen. Thus, participants in both conditions responded randomly to the same questions, but participants in the correct-unrelated-random condition responded correctly to other questions first.

Results and Discussion

Random responses from participants who had previously answered other questions correctly ($M = .57$, $SD = .19$) and from participants who answered questions randomly only ($M = .61$, $SD = .18$) did not significantly differ from one another in mean proportion correct, $t(38) = 0.92$, $p = .36$. However, the mean for each group of participants was significantly different from a test statistic of .50 (the mean proportion expected from random response) when compared individually: For the correct-unrelated-random condition, $t(19) = 2.02$, $p < .05$; for the random-only condition, $t(19) = 2.54$, $p < 03$. Thus, it appears that answering unrelated questions correctly does not lead to successful random responding any more than answering randomly only does. Deactivation of a knowledge prime may need to be specific before knowledge can be overcome. This finding also suggests that the self-presentation of knowledgeableness is not critical for the production of unpriming. Participants in the correct-unrelated-random condition achieved the usual high rate of correctness in answering the first 30 questions ($M = .96$), but this display of knowledgeableness did not significantly reduce their knowledge-primed responding to the subsequent different set of questions.

General Discussion

In these studies, we found that expressing the answer to a question can help a person overcome the unwanted influence of that answer on subsequent responding. In each study, we examined such influence in the random answering paradigm: People were asked to make random responses to simple yes–no questions, for which the correctness of the two answers had been balanced at 50%. Correct responses indicating bias toward the known answer occur commonly and appear to be uncontrollable (Wegner et al., 2003), but, in our studies, this bias was easily overcome when participants followed instructions to answer each question correctly before attempting to give their random answer.

In Experiment 1, participants who were allowed to answer easy yes–no questions correctly first before answering each one randomly had a significantly lower mean proportion correct for random responses than did participants who responded randomly alone. This unpriming effect was not attributable to mere repetition of answering, as participants in Experiment 2 who answered each question randomly twice in a row exhibited mean proportions correct that were significantly greater than chance for both first and second random responses. These proportions were comparable to single random responses and significantly greater than random responses that occurred after correct responses. Experiment 3 exposed participants to right and wrong answers provided by the computer to see whether such exposure might underlie the unpriming produced by correct responding. Having the computer supply the right answer to each question with a supraliminal prime, however, was not sufficient to unprime answer knowledge in subsequent random responding. External generation of the incorrect answer even had the curious effect of enhancing correctness during subsequently attempted random answering rather than acting to unprime the answer and decrease correctness.

In Experiment 4, we examined three versions of correct answering to see what the minimal circumstances might be to produce unpriming. The study was designed to test whether unpriming requires full communication of the question's answer, only the self-presentation that one knows the answer (not the content of the answer itself), or only the mere expression of the answer (without any communication of the answer or self-presentation of knowledgeableness). In line with the prior experiments, full communication of correct answers (to the experimenter via the computer) successfully unprimed answer knowledge. However, mere expression of the answer to oneself (by tapping beneath the desk) had the same unpriming effect. Participants who reported that they had the knowledge of the correct responses (self-presentation) but did not use the knowledge itself by reporting the correct answer achieved a modicum of unpriming but were only marginally more successful at answering randomly than were participants given no unpriming manipulation.

This moderate success, however, suggested that self-presentation of knowledgeableness might play some role in unpriming knowledge, so Experiment 5 was conducted to examine the influence of self-presentation of knowledge more completely. In this study, it was found that each piece of activated knowledge needs to be expressed specifically, through answering the same questions correctly prior to answering randomly, for random responses to be free of answer-knowledge influence. Answering some questions correctly first and then other questions randomly does not provide a generalized expression of correctness or self-presentation of knowledgeableness that allows subsequent behavior to be free of the influence of answer knowledge.

Taken as a whole, these findings indicate that the expression of the answers to questions can often eliminate the influence of answer knowledge on a later response. This is not a trivial achievement, because people who are given time and incentives to try to eliminate such influence cannot do it voluntarily (Wegner et al., 2003). Our observations of unpriming suggest that it is important to consider how unpriming may operate, how general such effects may be beyond the random answering paradigm, and how useful these results may be for psychological research or application.

Explanations of Unpriming

Our introductory comments on the variety of concepts that resemble unpriming in the history of psychology suggest that settling on one satisfactory explanatory framework for the present findings may be something of a challenge. Does unpriming result from processes of catharsis, completion, updating, or yet something else?

The present results do not arbitrate among these broad classes of explanation, as our studies were conducted to establish the characteristics of the unpriming phenomenon rather than to test explanations for it. However, the findings do offer some helpful insight that can inform attempts at explanation. For example, one of our initial ideas about the unpriming effect was to explain it in terms of Grice's (1975) principle of cooperation in conversation. According to this principle, when a speaker asks a question of a listener, the listener normally tries to cooperate by making the conversational contribution that is required—in this case, answering the question. It is interesting, after all, how powerfully a question brings to mind an answer, whether one is actively interested in providing the answer or not (Swann, Giuliano, & Wegner, 1982; Wegner, Wenzlaff, Kerker, & Beattie, 1981). This principle suggests that once a correct answer has been given, the impetus to continue cooperation is eliminated and any requirement to rehearse the answer or hold it in mind is relaxed. Our finding that unpriming occurs even when the participant merely expresses the answer privately (Experiment 4), however, suggests that analyses of unpriming based in norms of conversation might not be fruitful.

Another way of conceptualizing unpriming would be to say that the self-presentation of knowledge is important for the effect. Correctly answering a question involves the self-presentation of knowing, and the reduction of this concern due to providing the correct answer might create unpriming by allowing the person to move on to other concerns. This possibility was given some marginal support by our finding that simply reporting that one knows the answer can be partially effective in unpriming the answer (Experiment 4). The self-presentation hypothesis was undermined, however, by the finding that correct answering only unprimed that specific answer rather than producing a general sense of knowledgeableness that could unprime yet other answers (Experiment 5). The finding of Wegner et al. (2003) that random answering was just as biased by knowledge in a sample of participants drawn from outside a university setting as it was among participants in a university also suggests that the self-presentation of knowledgeableness is not an attractive explanation for effects in this paradigm.

Two other accounts of unpriming were noted earlier. These included the idea that expression satisfies a Zeigarnik-like motive instantiated by the question to express the correct answer and the idea that expression might reduce the effort the person must exert to keep the correct answer out of mind and therefore reduce the suppression-induced activation of the answer. The observed findings are generally consistent with both of these accounts and so do not aid in determining which might be a more satisfactory explanation.

Generality of Unpriming Effects

To what degree might the unpriming effects observed in these studies portend similar phenomena in other priming paradigms? Perhaps the most direct parallels might be found in other paradigms that yield knowledge-priming effects people find difficult to control. The difficulty of overcoming the Stroop (1935) interference effect has been well documented (MacLeod, 1991), for example, and it is also widely appreciated that responses to the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998) are hard to control. Might some expression of the uncontrollable knowledge in these paradigms release respondents from the biases that normally influence their responses?

Expression after a period of suppression has been shown to reduce the suppressed thought's subsequent accessibility (Liberman & Förster, 2000), and Förster et al. (2005) found that goal-related words are enhanced over non–goal-related words, but, over time, this accessibility is diminished once the goal has been achieved. One may unprime a thought without an explicit intention or goal, as may be seen in the simple satiation effects found by Smith (Smith, 1984; Smith & Klein, 1990), although the expression takes many trials before unpriming is achieved.

It is not clear that expression or action would necessarily have the same influence in these paradigms or that it might serve the purpose of unpriming in other behavior-priming paradigms (e.g., Bargh, Chen, & Burrows, 1996). What differentiates priming effects that linger for days or weeks from the unpriming effects found in our studies? Tulving, Schacter, and Stark (1982) showed that recognition memory was diminished for participants studied 7 days later as opposed to 1 hr later but that priming effects lingered. What if the participants had completed the same word fragments both 1 hr later and 7 days later in a within-subject design? If the unpriming effects found in the random response paradigm were to generalize to direct priming, the already completed word fragments would be expected to be unprimed.

The random answering paradigm presents a unique situation in which knowledge expression acts immediately to eliminate an otherwise hard-to-overcome priming effect of prior knowledge, and it is unclear whether expressive action might have similar effects across other priming paradigms. To the degree that our general account of unpriming is correct—and people indeed need some way to overcome the influence of primes if they are to move from one behavior setting to another and not get stuck in a primed behavior loop—it may well be that expression of some kind could foster unpriming in many circumstances.

Some limits on the generality of unpriming are suggested by our results. Unpriming does not occur when the action merely has surface features that resemble those of the knowledge-expressing action—merely responding in a random way, for example, does not eliminate subsequent bias toward knowledge (Experiment 2). Unpriming seems to require action based on the prime, not only reexposure to the priming influence (Experiment 3). Unpriming seems to require, at a minimum, some private expression of the knowledge (Experiment 4), and actions that will unprime knowledge must be specific to the knowledge (Experiment 5). Our findings thus circumscribe the generality of unpriming in a number of ways.

Implications and Applications

How could unpriming serve to reduce unwanted knowledge influences in everyday life or in conditions of psychopathology? People are often drawn to the rehearsal of undesired thoughts or to the intrusive recurrence of images or ideas that they cannot control (Clark, 2005). It may be that there is some role for procedures like unpriming in therapies designed to help people overcome such unwanted thoughts. Psychotherapeutic approaches based on exposure to unpleasant memories (Foa & Meadows, 1997), expression of traumatic experiences (Pennebaker, 1997), or acceptance of difficult circumstances (Hayes, Strosahl, & Wilson, 1999) might be useful because they encourage people to address unwanted thoughts by expressing these thoughts to themselves or to others. Expression might also aid people in overcoming unwanted prejudices, perhaps unpriming knowledge that is held in mind but that is inconsistent with the person's avowed explicit attitudes (Monteith, Sherman, & Devine, 1998; Sherman, in press). The range of potential uses for unpriming is substantial because behavior primed by a person's own knowledge may not always be the kind of behavior that person wants to perform.

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