Emotion Regulation and Memory: The Cognitive Costs of Keeping One's Cool

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An emerging literature has begun to document the affective consequences of emotion regulation. Little is known, however, about whether emotion regulation also has cognitive consequences. A process model of emotion suggests that *expressive suppression* should reduce memory for emotional events but that *reappraisal* should not. Three studies tested this hypothesis. Study 1 experimentally manipulated expressive suppression during film viewing, showing that suppression led to poorer memory for the details of the film. Study 2 manipulated expressive suppression and reappraisal during slide viewing. Only suppression led to poorer slide memory. Study 3 examined individual differences in typical expressive suppression and reappraisal and found that suppression was associated with poorer self-reported and objective memory but that reappraisal was not. Together, these studies suggest that the cognitive costs of keeping one's cool may vary according to how this is done.

Western culture is decidedly ambivalent about emotions. On the one hand, emotions are seen as wanton marauders that supplant good judgment with primitive, immature, and destructive thoughts and impulses (Young, 1943). On the other hand, emotions are seen as indispensable guardians of our well-being that direct our responses to life's challenges (Leeper, 1948).

As is so often the case with intractable ambivalence, each side of the "emotions are harmful–emotions are helpful" divide captures part of the truth. Recognizing this fact, emotion researchers have begun to examine how individuals go about regulating their emotions and have begun to document what consequences such attempts at emotion regulation have (Gross, 1998b). There are countless ways of regulating emotions (Parrott, 1993), but one particularly common form of emotion regulation is down-regulating negative emotions. Examples include construing a critical remark as helpful rather than hurtful or simply maintaining the appearance of having taken no offense (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996; Gross & Richards, 2000).

Despite the fact that researchers, philosophers, and laypersons alike have had an age-old fascination with emotional control, empirical data regarding the consequences of emotion down-regulation are of relatively recent vintage (e.g., Eisenberg, Fabes, & Losoya, 1997; Gross, 1998a; Thayer, Newman, & McClain, 1994). Most of these data concern the affective consequences of emotion regulation. This is natural enough. Feeling bad and looking worse are no fun, and it stands to good reason that we would often want to soften these negative feelings and expressions. If one major aim of emotion regulation is to influence emotions, then the first order of business certainly should be to figure out whether emotion regulation actually alters the experiential, behavioral, and physiological components of the emotional response.

However, feeling good and looking better are not one's only priorities during emotionally trying times. People also wish to function at their best cognitively. This comes as no surprise when one considers that emotions frequently arise when important goals are at stake—and, thus, when peak cognitive performance is critical. In light of mounting evidence that emotional and cognitive processes are tightly interwoven in everyday life (Damasio, 1994) and that people often regulate their emotions to preserve cognitive functioning (Gross & Richards, 2000), we sought to extend the boundaries of emotion regulation research by asking two related questions. First, does emotion regulation lead people to remember events differently then they would have absent these processes, or are emotion regulatory processes so overlearned that they unfold with no cognitive cost? Second, if emotion regulation does have discernible cognitive consequences, are these consequences the same for all forms of emotion regulation, or do they vary according to how the emotion is regulated?

In the following sections, we first define what we mean by emotion regulation. We then consider whether emotion regulation might influence one's memory for the events that transpire while

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one is regulating emotion, and if so, whether there is reason to believe that different forms of emotion regulation should have different cognitive consequences.

Emotion Regulation

Emotion regulation refers to the evocation of thoughts or behaviors that influence which emotions people have, when people have them, and how people experience or express these emotions. Because emotions may be regulated in almost limitless ways, we have found it helpful to adopt a consensual model of emotion to provide an overarching framework for studying emotion regulation (Gross, 1998b, 1999). This model focuses on the processes by which emotion is generated and makes a distinction between two broad classes of emotion regulation. According to this model, emotion regulatory efforts may be directed at two different points in the emotion generative process. *Antecedent-focused emotion regulation* is evoked at the front-end, or very early on in the emotion-generative process, whereas *response-focused emotion regulation* occurs at the back-end, or after emotion response tendencies have been triggered. Thus, response-focused regulation mops up one's emotions; antecedent-focused regulation keeps them from spilling in the first place.

In the context of a potentially stressful situation, antecedent-focused emotion regulation might take the form of construing a potentially emotional situation in a way that decreases its emotional relevance (e.g., Beck, 1991; Lazarus, 1991; Scherer, 1984), a process that has been called *reappraisal* (Gross, 1998a). For example, appraising an upcoming task as a challenge rather than a threat (e.g., Tomaka, Blascovich, Kibler, & Ernst, 1997), construing an upcoming medical procedure as beneficial rather than painful (e.g., Lazarus & Alfert, 1964), and believing gory photographs of dead people to be pulled from a fictitious movie rather than police files (Kramer, Buckhout, Fox, Widman, & Tusche, 1991) can drastically reduce subjective emotion experience and concomitant emotion-expressive behavior. In other words, because reappraisal is antecedent to a potentially upsetting event, if effective, it actually preempts full-blown emotional responses.

By contrast, response-focused emotion regulation occurs much later in the emotion generative process. In the case of this back-ended form of emotion regulation, individuals do not nip emotion in the bud by virtue of construing an event up front in less emotional terms. Rather, response-focused emotion regulation is evoked after an event already has been appraised in emotional terms and thus has triggered emotional response tendencies. Frequently, this kind of emotion regulation takes the form of inhibiting the urge to act on emotional impulses that continually press for expression, as when one bites his or her lip to keep from crying or maintains a poker face despite having been dealt a great hand of cards. This process, which we term *expressive suppression*, has affective consequences that differ from reappraisal.[1] Whereas reappraisal leads to global reductions in emotional responding, expressive suppression appears to selectively decrease emotion-expressive behavior (Gross, 1998a; Gross & Levenson, 1993).

Emotion Regulation and Memory

What effects—if any—might emotion regulation have for cognitive processes? In the following section, we describe two quite different possibilities.

Emotion Regulation Is Effortless

One possibility is that emotion regulation allows one to look and feel better during emotional circumstances without any discernable cognitive costs. Emotion theorists have long emphasized that emotion regulation is widespread among adults in Western cultures, and some theorists have gone so far as to argue that it is rare to see adult emotion that is not regulated (Tomkins, 1962). Frontal brain structures that allow for emotion regulation are evident in infants as young as 9 months (Fox, 1994), and by age 6, children have developed a sophisticated arsenal of emotion regulatory strategies (e.g., Cummings, 1987; Harris, 1989; Saarni, 1984). By adulthood, managing how one looks and feels would seem a natural candidate for the growing list of automatic responses one draws upon in everyday life (Bargh, 1997; Greenwald & Banaji, 1995) and would seem so overlearned that it would have no impact on cognitive activities such as attending to information for later recall.

Emotion Regulation Is Effortful

A quite different possibility is suggested by Baumeister and colleagues' ego-depletion model (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998), which holds that any sort of self-regulation depletes mental resources. Linking this model to emotion regulation in particular, Muraven, Tice, and Baumeister (1998) conducted an emotional-film-viewing study in which an experimenter told some participants to "try to deny any emotions you may feel. . ..When I look over the videotape of your facial expressions, I don't want to be able to tell which videotape you are watching" (M. Muraven, personal communication, September 16, 1997). Results revealed that regulation participants (relative to no-regulation controls) persevered for a shorter period of time on a subsequent hand grip task. In a similar study testing the effects of this emotion-regulation manipulation on a subsequent anagram task, regulation participants were found to solve fewer problems than no-regulation participants (Baumeister et al., 1998).

Although these studies do not show that emotion regulation impairs performance on tasks coincident with emotion regulatory efforts, attentional models of self-regulation suggest that this should be the case (e.g., Carver & Scheier, 1981). Such models portray attention as a finite resource. Efforts to maintain or change behaviors evoke a negative feedback loop whereby an existing condition of a system is compared with some salient standard. If a discrepancy between the two is detected, an operating process is evoked to lessen this discrepancy and achieve the desired state or behavior (Macrae, Bodenhausen, & Milne, 1998). These self-monitoring processes serve important self-regulatory functions. However, they may do so at a cost. Strategically evaluating and modifying one's thoughts, feelings, or behaviors may have the effect of decreasing attentional

[1] The term *suppression* has been used to describe the inhibition of feelings (Freud, 1915/1957), emotion-expressive behavior (Gross & Levenson, 1993), vocalizations (Brandimonte, Hitch, & Bishop, 1992), and thoughts (Wegner, 1994). To avoid confusion, we use the term *expressive suppression* to refer to conscious efforts to inhibit overt emotion-expressive behavior.

resources available for other tasks (Ellis & Ashbrook, 1989). Much of the support for the idea that emotion regulation consumes cognitive resources derives from studies in which emotion regulation is the dependent variable (DePaulo, Blank, Swaim, & Hairfield, 1992; Wegner, 1994; Wegner, Erber, & Zanakos, 1993). For example, Wegner et al. (1993) found that mood regulation success was reduced by cognitive load. This research suggests that emotion regulation consumes cognitive resources, but it does not show that it does so at the expense of other concurrent tasks. Indeed, we are aware of only one report that has tested whether emotion regulation influences memory. This research, which examined women only, found that expressive suppression reduced memory for orally presented information accompanying emotion-eliciting slides (Richards & Gross, 1999).

Integration

Although the automaticity, ego-depletion, and attentional views differ in a number of ways, each offers a blanket prediction that lumps together different forms of emotion regulation. On the automaticity view, emotion regulation is overlearned and is thus cognitively inexpensive. On the ego-depletion and attentional views, emotion regulation is consumptive of finite self-regulatory energy or attentional resources. However, is it really reasonable to assume that all forms of emotion regulation are going to be either cognitively inexpensive or cognitively costly?

To address this question, we drew upon the consensual model of emotion discussed earlier, which makes a distinction between antecedent-focused emotion regulation and response-focused emotion regulation (Gross, 1998b, 1999). This distinction between emotion regulatory efforts that occur before (e.g., reappraisal) and those that occur after (e.g., expressive suppression) an event unfolds suggests that these forms of emotion regulation might have different cognitive costs due to differing self-regulatory demands. Emotion regulation that requires continual self-monitoring and ongoing self-corrective action during an emotional event, such as expressive suppression, should require a continual outlay of cognitive resources and thus should decrease the fidelity of memory. By contrast, emotion regulation that is evoked early on in the emotion generative process, such as reappraisal, should not require continual self-regulatory effort during an emotional event. Entering into a situation after having construed it in less emotional terms should preempt a full-blown emotional response and thus obviate the need for continual self-regulatory effort, leaving memory for the details of the events that transpire intact.

The Present Research

Typically, people form memories by simply experiencing events as they unfold around them and not by actively memorizing or rehearsing their details. For this reason, we tested our prediction that expressive suppression should lead to poorer memory for details of emotional events, whereas reappraisal should not, by conducting three studies in which incidental memory was assessed. In the first study, we experimentally manipulated expressive suppression in a controlled laboratory setting to test whether this specific form of emotion regulation had any discernible effects on memory for visual and auditory material presented during the suppression period. Once we were convinced that expressive suppression impaired memory, we conducted a second study in which we manipulated both expressive suppression and reappraisal and administered two different types of memory tests to explore the roles of self-focus and self-monitoring in producing any memory decrements. Finally, in a third study, we tested whether naturally occurring individual differences in suppression and reappraisal were associated with memory in everyday life.

Study 1: Does Expressive Suppression Impair Memory?

Three criteria must be met to test whether expressive suppression impairs memory: (a) Emotion must be elicited in a controlled situation, (b) participants' expressive behavior must be manipulated, and (c) convergent memory measures must be obtained. To meet these criteria, we used a short film clip known to elicit negative emotion. This permitted us to control the information presented during the emotion induction period. We manipulated emotion-expressive behavior by randomly assigning participants to one of two instructional conditions (Gross & Levenson, 1993, 1997). Half of the participants were given instructions to inhibit emotion-expressive behavior during the film clip (*expressive suppression condition*). The rest of the participants received no regulation instructions (*watch condition*). To assess the effects of suppression on memory, we used a verbal cued-recognition test for auditory and visual details contained within the film clip. We chose this type of test over a nonverbal recognition test involving photo spreads—a favorite of traditional emotion and memory research (e.g., Christianson & Loftus, 1987; Christianson, Loftus, Hoffman, & Loftus, 1991)—because we questioned whether a nonverbal test would be sensitive to memory differences resulting from decreases in depth of processing and verbal encoding (Craik & Lockhart, 1972) that should derive from the self-monitoring processes associated with expressive suppression.

Method

Participants

Fifty-three participants (45% men, 55% women) who had not seen our stimulus film before participated to fulfill a course requirement or to receive monetary compensation. On average, participants were 19.8 years old (SD = 1.7 years). The ethnic composition of this sample was 4% African American, 26% Asian American, 62% Caucasian, and 8% Hispanic.

Procedure

Participants were run in mixed-gender group sessions by a female experimenter (mean number of participants per group = 4.7; range = 1 to 8). After signing a consent form, participants completed a baseline self-report measure of emotion experience so that we could assess whether our subsequent emotion induction increased negative emotion levels above preinduction levels. Then, participants were told that they would view a brief film clip (described below). Immediately before viewing this clip, the entire group of participants was randomly assigned to one of two experimental conditions. Participants in the watch condition (N = 28) were told the following: "I will show you the film clip in just a moment. Please watch and listen to it carefully." Participants in the expressive suppression condition (N = 25) were told the following:

> I will show you the film clip in just a moment. Please watch and listen to it carefully. In addition, it is extremely important for the sake of this study that if you have any feelings as you watch the film clip, please try your best not to let those feelings show. In other words, as you watch the film clip, please try to behave in such a way that a person watching you would not know you are feeling anything at all. So, watch the film clip carefully, but please try to behave so that someone watching you would not know you are feeling anything at all.

Because we were interested in incidental memory, no mention was made of any forthcoming memory tests. After viewing the film clip, participants answered questions about their emotion experience and expression during the film clip. Participants then worked on a distractor task (verbal and math problems) for 10 min before taking a paper-and-pencil cued-recognition test of visual and auditory details contained in the film clip. Participants were allowed to take this test at their own pace; those who finished early filled out additional questionnaires until the last participant had finished. (These data were not analyzed.) Finally, participants were debriefed and thanked for their participation.

Film Stimulus

To elicit negative emotion, we showed a 140-s film clip in which a husband confesses to his wife that he has had an extramarital affair and that the other woman is pregnant as a result. Clearly heartbroken, the wife becomes agitated and upset. A shouting match and physical scuffle ensue. The couple's fight is witnessed by their young child, who begins to sob. Pretesting revealed that this clip reliably induces a negative affective state in both men and women, characterized by sadness, anxiety, and anger.

Measures

Emotion experience and expression. Participants used a 7-point Likert scale (0 = *not at all*; 6 = *a great deal*) to rate the extent to which they experienced negative emotion at two time points. Participants made their first (i.e., baseline) rating after signing the consent form; they made their second rating after viewing the film. The expressive suppression instructions used here have been shown to reduce emotion-expressive behavior in several studies that unobtrusively videotaped and coded participants' behaviors (e.g., Gross, 1998a; Gross & Levenson 1993, 1997). Logistics of the group viewing sessions did not allow us to obtain the close-up video recordings of each participant that would be necessary for behavioral coding. However, because it was important to confirm that participants in this experiment understood the suppression instructions, we had participants use a 7-point Likert scale (0 = *not at all*; 6 = *a great deal*) to rate the extent to which they showed negative emotion-expressive behavior during the film clip.

Memory. After viewing the film clip, participants answered 24 five-alternative, forced-choice memory questions that covered the entire duration of the film clip. Twelve of these items tapped into visual detail information (e.g., objects in the room, attire worn by the characters); the remaining items tapped into auditory detail information (e.g., what the characters said). Althougb we did not expect modality differences, we included equal numbers of visual and auditory items so that this possibility could be explored with separate objective memory scores. We also computed memory confidence scores for visual and auditory information by having participants rate how confident they felt about each of their 24 answers (0 = *not at all confident*; 5 = *very confident*) on the objective memory test.

Results

We present our analyses in two steps. First, we examine the affective consequences of expressive suppression. On the basis of our prior research in this area (Gross, 1998a; Gross & Levenson 1993, 1997), we expected that compared with watch participants, suppression participants would evidence decreased emotion-expressive behavior but comparable negative-emotion experience. Next, we examine the cognitive consequences of expressive suppression. As described above, we hypothesized that expressive suppression should impair memory for information concerning the film.[2]

Affective Consequences of Expressive Suppression

Emotion experience. We computed a repeated measures analysis of variance (ANOVA) on the negative-emotion-experience reports obtained before and after the film clip, with time as a within-participants factor and instructional condition (watch, expressive suppression) as a between-participants factor. The main effect for time indicated that negative-emotion experience reported for the film period ($M = 3.9$, $SD = 1.3$) increased significantly from prefilm levels, $M = 1.3$, $SD = 1.3$, $F(1, 50) = 123.00$, $p < .001$. This main effect for time showed that the film succeeded in eliciting negative-emotion experience. As expected, neither the main effect for instructional condition, $F(1, 50) = 0.18$, *ns*, nor the interaction term, $F(1, 50) = 0.19$, *ns*, attained significance, indicating that suppression did not influence negative-emotion experience.

Emotion expression. We computed a one-way ANOVA on participants' reports of their own negative-emotion-expressive behavior, with instructional condition (watch, expressive suppression) treated as a between-participants factor. As expected, expressive suppression participants ($M = 1.0$, $SD = 1.0$) reported less negative-emotion-expressive behavior during the film period than did watch participants, $M = 1.9$, $SD = 1.5$, $F(1, 51) = 7.28$, $p = .009$.

Cognitive Consequences of Expressive Suppression

Objective memory scores. We computed an ANOVA on participants' memory scores (i.e., proportion correct), treating information type (visual, auditory) as a within-participants factor and instructional condition (watch, expressive suppression) as a between-participants factor.[3] As predicted, results revealed a main effect for instructional condition, $F(1, 51) = 8.98$, $p = .004$. There also was an information type effect, $F(1, 51) = 7.31$, $p = .009$, but the Instructional Condition × Information Type interaction did not attain significance, $F(1, 51) = 1.00$, *ns*. As shown in Panel A of Figure 1, suppression participants remembered the emotion-eliciting film less well than watch participants, regardless of information type (visual, auditory). Additionally, regardless of instructional condition, participants recalled auditory information better than visual information.

Memory confidence ratings. We conducted a similarly structured ANOVA on auditory and visual memory confidence ratings. Results paralleled the pattern of relations found for objective

[2] All analyses were first computed including gender as a factor. Because gender did not interact with any of our other factors, we conducted our primary analyses without including this factor.

[3] We conducted secondary analyses using arcsine transformed proportions. Results were identical to those based on raw proportions.

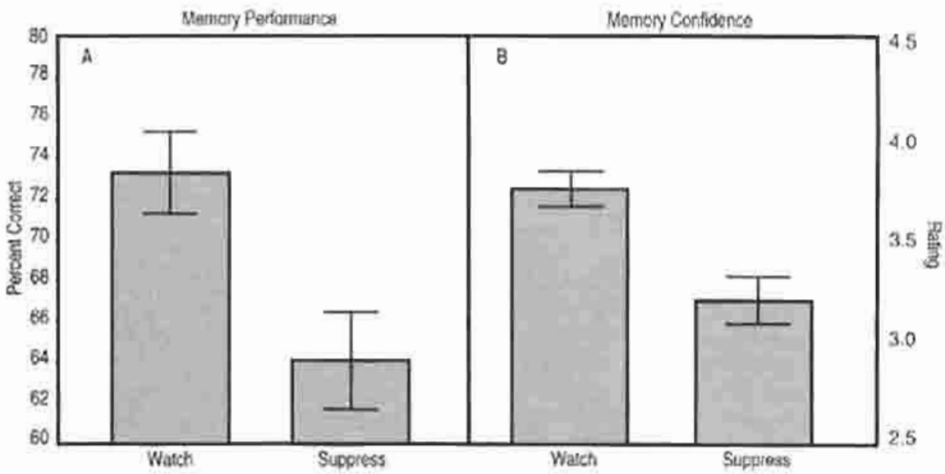

Figure 1. Memory performance (Panel A) and memory confidence (Panel B) by instructional condition (collapsed over information type) in Study 1.

memory scores. Suppression participants reported less confidence in their memory than watch participants, $F(1, 51) = 14.58$, $p < .001$, and regardless of instructional condition, participants reported less confidence in their memory for visual information than in their memory for auditory information, $F(1, 51) = 9.62$, $p = .003$. Once again, the Instructional Condition × Information Type interaction did not attain significance, $F(1, 51) = 0.02$, *ns*. Mean memory confidence ratings are presented in Panel B of Figure 1.

Summary and Limitations

Compared with participants who simply watched a negative-emotion-eliciting film, those randomly assigned to hide their feelings during the film showed poorer memory for its auditory and visual details. This study extends the memory effects of suppression reported previously (Richards & Gross, 1999) from women to a mixed-gender sample, from emotional slides to a dynamic film-viewing context, from a solitary to a social experimental setting, and from memory for words to memory for visual and auditory (i.e., conversational) details. Moreover, this study shows that the memory deficit associated with suppression was pronounced enough to be evident to suppression participants themselves, who reported less confidence in their memory than participants who simply watched the film.

These findings are encouraging, but several limitations of Study 1 should be noted. First, this study did not manipulate reappraisal. We are, therefore, unable to draw any support for our specificity prediction that suppression should impair memory but that reappraisal should not. Second, Study 1 made use of group-viewing sessions. We have no reason to believe that the group format influenced our findings, but because we did not systematically vary group size, we cannot directly test any impact of viewing format. Third, measures of emotion experience and expressive behavior were single-item self-report measures. A more robust approach would be to use multiple measures of emotion experience and to directly record participants' ongoing expressive behavior for the purposes of objective behavioral coding. Fourth, Study 1 elicited emotion at one intensity level, which precluded an assessment of the boundary conditions of the cognitive consequences of expressive suppression. Fifth, Study 1 did not address the question of how expressive suppression led to poorer memory. One possibility is that suppression leads to active avoidance of emotion-eliciting events, which could be tested by measuring whether suppression participants, relative to no-suppression participants, are more likely to look away from ongoing emotional stimuli. Another possibility stems from self-regulation theory (Carver & Scheier, 1981; Duval & Wicklund, 1972), which suggests that suppression should not lead to complete disengagement from ongoing events but rather evokes subvocal self-monitoring processes or heightened self-focus. Could one or more of these processes be linked to the effects of suppression on memory?

To address these issues, we conducted a second experiment. In this study, we (a) explicitly manipulated expressive suppression and reappraisal, (b) used single-subject sessions, (c) obtained multiple measures of emotion experience and videotaped expressive behavior, (d) used slides to elicit high and low levels of emotion, and (e) used memory measures expected to be differentially sensitive to the operation of self-monitoring and self-focus processes.

Study 2: Cognitive Costs for Expressive Suppression but Not Reappraisal?

We had three primary goals in Study 2. Our first goal was to show that experimentally manipulating reappraisal and expressive suppression in a controlled laboratory setting would differentially influence memory for information presented during the induction period. To this end, participants watched emotion-eliciting slides under one of three instructional conditions: watch, suppress, or reappraise. In this study, we refined the Study 1 expressive suppression instructions by more explicitly directing participants to engage in ongoing, response-focused emotion regulation. Our reappraisal instructions, by contrast, explicitly directed participants to engage in antecedent-focused—or front-ended—reconstrual of the upcoming event.

Our second goal was to determine whether suppression would lead to poorer memory even when low levels of emotion were elicited. To this end, participants viewed slides that elicited either

high or low levels of emotion. If the cognitive consequences of expressive suppression are proportional to the magnitude of to-be-suppressed emotional impulses, we might expect suppression to affect memory only for the high-emotion slide set. However, if—as we expected—expressive suppression takes its cognitive toll through continual monitoring of ongoing expressive behavior, cognitive impairments should be evident whenever participants try to suppress emotion-expressive behavior, whether under conditions of high or low emotion.

Our third goal was to examine mechanisms by which expressive suppression might affect memory. One mechanism was active avoidance, or looking away from the emotion-eliciting stimuli. A second mechanism was self-focus, which might decrease attention to external events while increasing attention to internally generated stimuli, such as sensations (e.g., emotional experience, physiological changes). To the extent that increased self-focus diverted attentional resources away from the environment (Ellis & Ashbrook, 1989), it should impair memory. A third mechanism was subvocalization, engendered by an internal self-regulatory dialogue. (e.g., "Am I showing emotion? I don't want to show emotion. Uh oh, I might be showing emotion. There, I just held back an impulse.") To the extent that subvocal self-monitoring decreased verbal elaboration of incoming information (Craik & Lockhart, 1972), it should hamper the refreshing of decaying representations of auditory information in the phonological store, limit the conversion of visual information into phonological representations (Gathercole & Baddeley, 1993), and thereby weaken memory.

Because participants were asked to attend to the stimuli, we did not expect active avoidance to be responsible for the memory effects. We tested this hypothesis by examining whether suppression participants were more likely to look away from the emotional stimuli than other participants. We thought it possible that self-focus might play a role, but because we had not seen any heightening of emotional response in suppression (which might be expected if self-focus led to increased awareness of sensations), we did not think that self-focus would play a decisive role. We did think it likely, however, that subvocal self-monitoring processes might be involved. To test the role of self-focus and subvocalization, we administered memory measures that would be differentially sensitive to these processes. We reasoned that if increased subvocal self-monitoring was responsible for the memory effects of suppression, much like articulatory suppression (e.g., Brandimonte et al., 1992; Macken & Jones, 1995), expressive suppression should lead to poorer performance on memory tests for information encoded verbally (Bartlett, Till, & Levy, 1980; Daniel & Ellis, 1972) but should not influence performance on memory tests for which verbal encoding is irrelevant or harmful (e.g., photo spread visual recognition; Schooler & Engstler-Schooler, 1990). On the other hand, if heightened levels of self-focus were responsible for the effects of expressive suppression on memory, we should see poorer performance not only on verbally based tests but even on tests for which verbal encoding is irrelevant. This is because self-focus should not selectively decrease verbal encoding but rather should impair all encoding, reducing performance on any kind of memory test. Our expectation was that suppression should impair verbal memory but should have little effect on nonverbal memory.

Method

Participants

Eighty-three female participants enrolled in this study to fulfill a course requirement or to receive monetary compensation.[4] On average, participants were 19.7 years old (SD = 1.3 years). The ethnic composition of this sample was 16% African American, 24% Asian American, 48% Caucasian, 7% Hispanic, 3% Native American, and 2% other.

Procedure

Participants were run in individual sessions by a female experimenter. After signing a consent form, participants were informed that the study was designed to understand how people use visual and biographical information when "forming impressions of people who have been injured." Specifically, participants were told that they would see several slides of people who had all been severely injured at one time or another and that they would hear each person's name, occupation, and type of accident. Some of the slides would show people who appeared healthy because their injuries had happened a long time ago (low-emotion slide set), but other slides would show people who appeared gravely injured because they had been photographed shortly after sustaining their injuries (high-emotion slide set). This cover story was used to allay any suspicions participants might have had regarding the real purpose of the study and to thereby decrease the likelihood that participants would attempt to strategically memorize information presented with each slide.

Just before viewing a set of nine individually presented slides, each of which was accompanied by orally presented biographical information, participants randomly assigned to the watch condition were instructed as follows (N = 41): "We will show you the slides in just a moment. Please view them carefully and listen to the accompanying background information."[5]

Participants randomly assigned to the expressive suppression condition (N = 20) were instructed as follows:

> We will show you the slides in just a moment. Please view them carefully and listen to the accompanying background information. In addition, we would like to see how well you can control your facial expressions. Therefore, it is very important to us that you try your best to adopt a neutral facial expression as you watch the slides. To do this, we would like for you to keep your facial muscles from moving. In other words, as you watch the slides, try to keep a straight face by keeping the muscles around your neck, your chin, your lips, your cheeks, your eyes, and your forehead very still. So, watch the slides carefully, but please try to keep your facial muscles still so that you don't make any expressions at all.

Participants randomly assigned to the reappraisal condition (N = 22) were instructed as follows:

> We will show you the slides in just a moment. Please view them carefully and listen to the accompanying background information. In addition, we would like to see how well you can control the way you view things. Therefore, it is very important to us that you try your best

[4] Two additional participants enrolled in the study but withdrew their participation during the experiment because they did not wish to see the high-emotion slides. Because Study 1 showed no reliable differences between male and female participants, we elected to enroll only women in Study 2 to decrease within-cell variance in expressive behavior.

[5] We included twice as many participants in the watch condition than were in each of the other two conditions for a companion study concerned with the effects of emotion on memory.

> to adopt a neutral attitude as you watch the slides. To do this, we would like for you to view these slides with the detached interest of a medical professional. In other words, as you watch the slides, try to think about them objectively and analytically rather than as personally, or in any way, emotionally relevant to you. So, watch the slides carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all.

After viewing the first set of slides, participants completed a self-report emotion experience measure. Participants were then reminded of their instructions and shown the second set of slides. Participants who viewed the low-emotion slides first viewed the high-emotion slides second, whereas participants who viewed the high-emotion slides first viewed the low-emotion slides second.[6] After the second slide set, all participants completed another emotion experience measure. A distractor task (solving anagrams) was then administered for 10 min, followed by a cued-recognition test of the slides and a cued-recall test of the orally presented biographical information (described below). Finally, participants were debriefed and thanked for their participation.

Slide Stimuli

Eighteen slides were presented in two sets of nine slides each on a 20-in. (50.8-cm) television monitor placed at a distance of 1.75 m from each participant (Richards & Gross, 1999).[7] One set of slides was composed of color photographic images of average-looking men who supposedly had been injured at an earlier point in time. These slides were intended to call forth low levels of negative emotion. Another set of slides was composed of color images of badly wounded men who supposedly had been injured shortly before they were photographed. These slides were intended to call forth high levels of negative emotion. As slides were presented, three bits of information— a name, an occupation, and a cause of injury—were presented using an audio recording. Injury information was presented to help focus participants' attention on the terrible things said to have happened to the people shown in the slides. Name and occupation were presented to heighten the emotionality of the slides by personalizing them. Slides were presented individually for 10 s; slides within each set were separated by 4 s.

Measures

Emotion experience. Participants used a 7-point Likert scale (0 = *not at all*; 6 = *extremely*) to rate the extent to which they felt each of four negative emotions (i.e., sadness, anger, revulsion, distress) during the low- and high-emotion slide sets. These ratings were used to create a four-item negative-emotion composite for each slide set. The alpha was .80 for the low-emotion slide set and .81 for the high-emotion slide set.

Emotion expression. Participants' behavioral responses to the slides were recorded unobtrusively by a remotely controlled, high-resolution video camera placed behind darkened glass on a bookshelf. After the experimental session, participants' behaviors were coded from videotape by two female coders who were blind to the slides participants were watching and to their experimental conditions. To assess negative-emotion-expressive behavior, coders used a 5-point (0–4) global coding system derived from (a) Ekman and Friesen's (1975) description of specific behavioral expressions of discrete negative emotions and (b) a specific coding strategy that takes into account expressive duration and intensity (Gross & Levenson, 1993). To assess participants' active efforts to withdraw their attention from the stimuli, coders counted the number of times each participant broke her line of vision from the television monitor during the slide-viewing period (e.g., shielding face with hands, looking away from the television, closing eyes for more than 1 s). Coding reliabilities were good (mean interrater reliability = .80). Final values for each of the codes were determined by averaging each of the coder's ratings for a given participant's expressive behavior. Composites were created to represent overall negative-emotion-expressive behavior and obscuring vision during the low-emotion slide set and the high-emotion slide set.

Nonverbal memory. Participants were shown 18 photo spreads, one corresponding to each of the 18 slides they saw in the first phase of the experiment. For each photo spread, participants were asked to identify which of four alternatives most closely resembled the slide they had seen earlier. The correct alternative was the same image participants had seen earlier, with the only difference being that it was reduced in size. Incorrect alternatives were generated by (a) horizontally rotating the original image so that elements on the left-hand side of the slide would appear on the right-hand side, (b) slightly modifying the original image in Adobe Photoshop (1996; e.g., removing a pair of glasses, moving the location of a scar, changing the shape of a nose), and (c) horizontally rotating the slightly modified image. The presentation order of the photo spreads matched that of the original slides. Participants had 8 s to view each photo spread and to give their answer. All answers were then transcribed from videotape. Two nonverbal memory scores were derived: mean proportion of correctly chosen alternatives for the low- and high-emotion slide sets.

Verbal memory. After viewing the photo spreads, participants viewed the original slides one more time. This time, they were asked to write down the information that had been paired with each slide during the initial slide-viewing phase (i.e., name, occupation, injury). Two verbal memory scores were derived: mean proportion correct for information presented with the low- and high-emotion slides. Participants were allowed to take this cued-recall memory test at their own pace.

Results

Our analyses were designed to address six questions. First, did our low- and high-emotion slide sets successfully elicit two levels of negative-emotion experience? Second, did expressive suppression produce selective decreases in behavior, and did reappraisal produce decreases in behavior and emotion experience? Third, did expressive suppression lead to active efforts to withdraw attention from the emotion-eliciting stimuli? Fourth, did expressive suppression (but not reappraisal) impair memory? Fifth, were the effects of expressive suppression specific to verbal memory? Sixth, were the effects of expressive suppression evident in both low- and high-emotion contexts?

Manipulation Check

We computed a repeated measures ANOVA on the negative-emotion-experience composite scores for the low- and high-emotion slide sets, treating instructional condition (watch, expres-

[6] We had no grounds for predicting that slide set order (low emotion first, high emotion first) should interact with instructional condition and thus counterbalanced across conditions. To confirm that order did not interact with our predicted instructional condition effect, we conducted a repeated measures ANOVA on the cued-recognition scores, with slide set (low emotion, high emotion) treated as a within-participants factor and instructional condition (watch, expressive suppression, reappraisal) and slide set order (high emotion first, low emotion first) treated as between-participants factors. Slide set order did not interact with instructional condition either for verbal memory, $F(2, 77) = 0.86$, *ns*, or for nonverbal memory, $F(2, 72) = 0.46$, *ns*.

[7] The first three and last three slides were used to absorb any possible primacy and recency effects and therefore were not included in the analyses. Slides were drawn from the International Affective Picture System (IAPS; Lang & Greenwald, 1988) and supplemented by other slides drawn from obscure sources.

sive suppression, reappraisal) as a between-participants factor. As expected, a main effect of slide set was revealed, $F(1, 80) = 134.88$, $p < .001$, indicating that across all three instructional conditions, negative-emotion experience was greater for the high-emotion slide set ($M = 2.4$, $SD = 1.4$) than for the low-emotion slide set ($M = 0.9$, $SD = 1.1$). The negative-emotion experience for the low-emotion slide set, averaged over watch ($M = 0.9$, $SD = 1.2$), expressive suppression ($M = 0.9$, $SD = 0.9$), and reappraisal ($M = 1.0$, $SD = 1.1$) instructional conditions, was significantly greater than zero, $t(82) = 7.85$, $p < .001$, indicating that the low-emotion slide set reliably elicited low levels of negative emotion.

Affective Consequences of Emotion Regulation

Consistent with prior research (Gross, 1998a) and the process conception of emotion described in the introduction to this article, we expected that reappraisal (i.e., construing a potentially upsetting event in less emotional terms) would decrease both emotion experience and behavior, whereas expressive suppression would decrease behavior only. In view of the low means and variability in negative emotion during the low-emotion slides, we expected that the affective consequences would be evident during the high-emotion slides only.

To examine the effects of emotion regulation on emotion experience for the high-emotion slides, we referred to the ANOVA described in the manipulation check section above. As predicted, we found a significant interaction of Instructional Condition × Slide Set, $F(2, 80) = 7.01$, $p = .002$. To trace the source or sources of this interaction, we conducted follow-up t tests. As expected, compared with watch participants ($M = 2.8$, $SD = 1.4$), reappraisal participants ($M = 1.9$, $SD = 1.5$) reported less negative-emotion experience in response to the high-emotion slides, $t(61) = 2.48$, $p < .05$. Importantly, this was not the case for expressive suppression participants, whose negative-emotion experience in response to the high-emotion slides ($M = 2.3$, $SD = 1.2$) did not differ from that of watch participants, $M = 2.8$, $SD = 1.4$, $t(59) = 1.56$, *ns*. Our finding that expressive suppression neither increased nor decreased negative-emotion experience is consistent with prior research (Gross & Levenson, 1993, 1997).

To confirm that the expressive suppression instructions diminished emotion expressive-behavior, we computed a similarly structured repeated measures ANOVA on our negative-emotion-expression measure with slide set (low emotion, high emotion) treated as a within-participants factor and instructional condition (watch, expressive suppression, reappraisal) treated as a between-participants factor. Consistent with the emotion experience findings, a significant interaction emerged, $F(2, 75) = 6.1$, $p = .004$.[8] To trace the source or sources of this effect, we computed follow-up t tests. As expected, expressive suppression participants, $M = 0.2$, $SD = 0.6$, $t(55) = 2.86$, $p = .006$, and reappraisal participants, $M = 0.4$, $SD = 0.7$, $t(58) = 2.49$, $p = .02$, showed reliably less negative-emotion-expressive behavior than watch participants ($M = 0.9$, $SD = 1.0$) during the high-emotion slides, and negative-emotion-expressive behavior did not differ significantly between reappraisal participants and suppression participants, $t(37) = 0.93$, *ns*. For the low-emotion slides, expressive suppression participants ($M = 0.01$, $SD = 0.03$) showed reliably less negative-emotion-expressive behavior than watch participants, $M = 0.14$, $SD = 0.38$, $t(55) = 2.06$, $p = .05$, and reappraisal participants, $M = 0.18$, $SD = 0.35$, $t(37) = 2.19$, $p = .04$; watch and reappraisal participants' mean levels did not differ significantly for the low-emotion slides.

To examine whether expressive suppression led to active avoidance behaviors, we computed a similarly structured repeated measures ANOVA on our behavioral avoidance measure with slide set (low emotion, high emotion) treated as a within-participants factor and instructional condition (watch, expressive suppression, reappraisal) treated as a between-participants factor. Results revealed a significant main effect for slide set, $F(1, 75) = 5.59$, $p = .02$. Not surprisingly, participants were more likely to look away from the high-emotion slide set, which was significantly more upsetting and graphic. However, the Instructional Condition × Slide Set interaction term did not attain significance, $F(2, 75) = 2.82$, *ns*, indicating that this effect did not vary as a function of instructional condition. Thus, suppression participants were no more likely to look away from the slides than watch participants. In fact, if anything, watch participants ($M = 0.32$, $SD = 0.49$) looked away from the high-emotion slides more frequently than did suppression participants ($M = 0.11$, $SD = 0.25$) or reappraisal participants ($M = 0.09$, $SD = 0.25$).

Cognitive Consequences of Emotion Regulation

We predicted that expressive suppression should be associated with ongoing, language-based self-monitoring whereas reappraisal should not and that this monitoring should lead to poorer memory during expressive suppression but not during reappraisal. We expected to find these cognitive costs of suppression under conditions of high and low emotion but only for verbal memory tests.

Verbal memory. To test whether reappraisal and expressive suppression influenced verbal memory, we conducted a repeated measures ANOVA on cued-recall test scores, with slide set (low emotion, high emotion) treated as a within-participants factor and instructional condition (watch, expressive suppression, reappraisal) as a between-participants factor. Results revealed significant main effects of slide set, $F(1, 80) = 14.46$, $p < .001$, and instructional condition, $F(2, 80) = 3.26$, $p = .04$, but no Instructional Condition × Slide Set interaction, $F(2, 80) = 0.20$, *ns*. The main effect for slide set indicates that, overall, verbal information was remembered less well if it accompanied high-emotion slides. To decompose the main effect of instructional condition, we conducted a one-way ANOVA, collapsing over slide set, and used follow-up t tests to test pairwise differences between means. As predicted, only suppression participants showed a reliable decrease in memory. Specifically, suppression participants performed less well on the memory test than watch participants, $t(59) = 2.47$, $p < .05$. No other significant pairwise differences emerged. Figure 2 shows verbal memory scores (collapsing over low-emotion and high-emotion slides) broken down by instructional condition.

Nonverbal memory. To test whether reappraisal and expressive suppression influenced nonverbal memory, we conducted a similarly structured ANOVA with nonverbal memory scores. Results revealed a near significant Instructional Condition × Slide Set interaction, $F(2, 75) = 2.93$, $p = .056$. To trace the source or

[8] Complete video records were available for 78 participants.

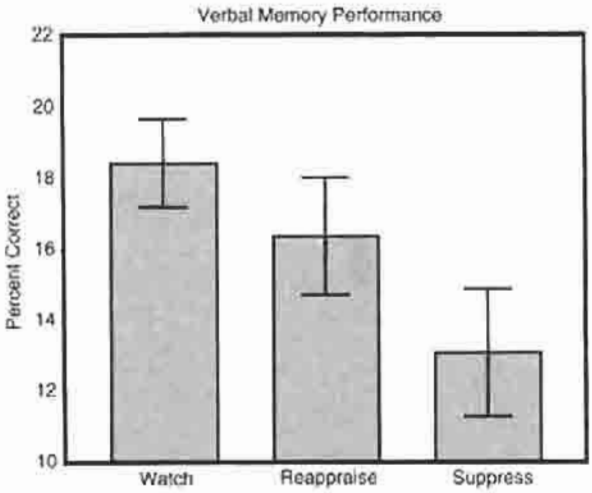

Figure 2. Verbal memory scores by instructional condition in Study 2.

sources of this interaction, we conducted follow-up t tests. Unexpectedly, reappraisal participants were more likely to correctly identify high-emotion slides they had seen earlier than watch participants, $t(59) = 2.11$, $p < .05$. As expected, expressive suppression participants' nonverbal memory was not reliably different from watch participants for either high-emotion, $t(54) = 0.49$, *ns*, or low-emotion, $t(54) = 1.38$, *ns*, slide sets. No other significant differences emerged. Figure 3 shows nonverbal memory scores broken down by instructional condition and slide set.

Summary

These findings permit three major conclusions. First, different forms of emotion down-regulation have different cognitive consequences. Compared with controls, participants who suppressed ongoing emotion-expressive behavior showed poorer memory for verbally encoded information presented during emotion-eliciting slides. By contrast, we found no evidence that reappraisal diminished memory. In fact, reappraisal actually enhanced nonverbal memory. One explanation for this unpredicted effect, albeit speculative, is that assuming the perspective of a medical professional activates a "doctor script" that directs attention to medically relevant (i.e., visual) aspects of the slides showing injuries. It is unclear, however, whether this reappraisal-induced memory enhancement will generalize to other contexts in which one's reconstrual of an event does not lead so naturally to preferential processing of a specific type of information. Second, changes in emotion experience and behavior do not seem to mediate the effects of expressive suppression. Suppression impaired verbally encoded memory without affecting emotion experience (Studies 1 and 2) or active attentional withdrawal (Study 2). Moreover, memory impairment was evident for both the low-emotion and high-emotion conditions, even though expressive suppression participants differed in their expressive behavior from the watch participants during only the high-emotion slide sets. Third, the cognitive consequences of expressive suppression appear to be specific to memory that is verbally encoded. Whereas we found that expressive suppression led to poorer verbal memory performance, it had no impact on nonverbal memory performance. This pattern of findings suggests that subvocal self-monitoring may play an important role in accounting for the effects of suppression on memory.

Study 3: Expressive Suppression and Reappraisal in Everyday Life

Studies 1 and 2 tested predictions about the cognitive consequences of emotion regulation under controlled laboratory conditions. For the cognitive consequences of emotion regulation to matter, however, they must be evident in everyday life. To examine the impact of emotion regulation on cognitive functioning in everyday life, we conducted a third study in which we used questionnaire and daily diary methodology to assess individual variation in the tendency to engage in expressive suppression or reappraisal and in the memory for contexts in which these forms of emotion regulation should manifest themselves.

We assessed the degree to which people engage in expressive suppression and reappraisal by administering self-report measures of emotion regulation. We assessed memory using two measures designed to tap contexts in which individual differences in emotion regulation tendencies might be evident. The first is a self-report measure that assesses how well one remembers conversations, a social context in which emotion regulation is common (Gross & Richards, 2000). The second is an objectively scored free-recall test for spontaneous emotion regulation episodes that occurred over a 2-week period (and that were recorded daily). We reasoned that participants would report episodes in which they engaged in their preferred form of emotion regulation. By asking them to later recall these episodes, we could derive an objective measure of memory for these episodes and thus assess the memory consequences of spontaneous emotion regulation. On the basis of Studies 1 and 2, we predicted that compared with individuals who typically express their emotions, those who suppress their emotion-expressive behavior would report poorer memory for conversations and be less likely to remember their own emotion-regulation episodes. By contrast, we expected that tendencies to

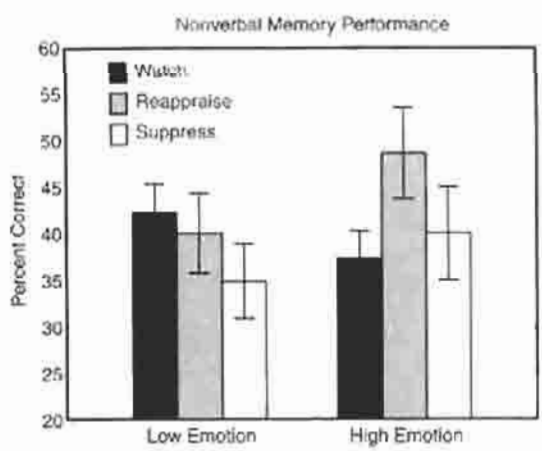

Figure 3. Nonverbal memory scores by instructional condition and slide set in Study 2.

engage in reappraisal would be uncorrelated with self-reported or objective memory.

Method

Participants

Eighty-six participants (31% men, 69% women) took part in this study to receive course credit. On average, participants were 19.8 years old (SD = 1.1 years). The ethnic composition of this sample was 6% African American, 32% Asian American, 45% Caucasian, 14% Hispanic, and 3% other.

Procedure

Participants completed a packet that included two measures of expressive suppression, one measure of reappraisal, and one measure of memory for conversations. One month later, participants kept a 2-week diary in which they described one situation per day during which they attempted to regulate their emotions. Finally, a week after the last diary entry, participants took a free-recall test of their memory for the emotion regulatory experiences they reported in their diaries.

Measures

Expressive suppression. Two measures were administered to assess expressive suppression. The four-item expressive suppression scale of the Emotion Regulation Questionnaire (ERQ–S; Gross & John, 2000) asks participants to rate the extent to which they typically try to inhibit their emotion-expressive behavior (1 = *strongly disagree*; 7 = *strongly agree*). The ERQ–S includes items sueh as "I keep my emotions to myself" and "I control my emotions by not expressing them." The four ERQ–S items (α = .77) were averaged to form a composite score. The short form of the Ambivalence Over Emotional Expression Questionnaire (AEQ; King & Emmons, 1990) consists of the 12 highest loading items on the full AEQ. This scale asks participants to rate how conflicted they feel about showing their emotions (1 = *I have never felt like this*; 5 = *I frequently feel like this*). The AEQ includes items such as "I try to suppress my negative feelings around others, even though I am not being fair to those close to me" and "I would like to be more spontaneous in my emotional reactions but I just can't seem to do it." The 12 AEQ items (α = .88) were averaged to form a composite score.

Reappraisal. One measure was administered to assess reappraisal. The six-item reappraisal scale of the Emotion Regulation Questionnaire (ERQ–R; Gross & John, 2000) asks participants to rate the extent to which they typically try to think about situations differently in order to change how they feel (1 = *strongly disagree*; 7 = *strongly agree*). The ERQ–R includes items such as "When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm" and "I control my emotions by *changing the way I think*." The six ERQ–R items (α = .75) were averaged to form a composite score.

Self-reported memory. One measure was administered to assess conversational memory. Participants completed the 11-item conversation scale of the Inventory of Memory Experiences (IME–C; Herrmann & Neisser, 1978), which asks participants to rate how frequently they forget what they have told other people or what other people have told them (1 = *once in a while*; 6 = *always*). The following is an example item from the inventory: "When someone says he has told you something already, how often do you find that you have no recollection of his telling you any such thing?" The 11 IME–C items (α = .82) were averaged to form a composite score. For ease of interpretability, reverse scoring was used.

Objective memory. At the end of each day over a 14-day period, participants were asked to "take a few minutes to think of a time today when you tried to influence your emotional experience and/or expression" and to "describe the situation so that someone who was not there could picture what the situation was like for you." Participants were given three fourths of an 8.5- × 11-in. (25.6- × 27.9-cm) page to describe this emotion regulatory episode, and pages were collected twice each week. Finally, a week after the last diary entry, participants came to our laboratory to take an unanticipated free-recall test of their memory for the emotion regulation episodes they reported in their diaries. Participants were asked to try to remember each of the episodes they had described over the reporting period and then to write down a brief description as each episode came to mind. Participants were given 20 min to complete the free-recall test. Their descriptions of each event typically were two sentences in length.

Our objective memory measure was derived by coding participants' recall protocols. A trained coder cross-referenced each participant's recall protocol against the original descriptions he or she provided during the daily reporting period. The coder then made a dichotomous decision as to whether or not an episode described during the reporting period was mentioned on the recall protocol. A second coder applied the same scoring procedure for 20% of participants. Coders were blind to all participant information. The kappa coefficient computed on coders' overlapping scoring revealed adequate agreement (κ = .76, $p < .001$). For subsequent analyses, the first coder's scoring was used to compute a proportion of original descriptions recalled correctly by each participant. We interpret this score as an aggregated measure of participants' typical ability to remember events during which they regulate their emotions and during which they would be expected to rely on their preferred form of emotion regulation.

Control Measures

The correlational approach taken in this study meant that any observed association between emotion regulation and memory might be attributable to some third variable. Two individual difference variables seemed particularly likely candidates in this regard. First, neuroticism is related to complaints about physical and mental functioning (Watson & Pennebaker, 1989). Neuroticism also is related to increased levels of negative emotion (Gross, Sutton, & Ketelaar, 1998), which might trigger increased attempts at emotion suppression. Conceivably, therefore, neuroticism could be responsible for any observed association between worse memory and expressive suppression. Second, social desirability is negatively related to reports of poor cognitive functioning (Bell, Gardner, & Woltz, 1997). Social desirability also might be negatively related to statements concerning the habitual control of powerful emotional impulses. If so, this pattern of hypothesized relations suggests that social desirability, too, might be responsible for any observed relation between memory and suppression.

We administered two control measures. First, we administered the neuroticism subscale of the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991), which asks participants to use a 5-point scale (1 = *very slightly or not at all*; 5 = *extremely*) to rate the extent to which they see themselves as someone who is "moody," "depressed, blue," "can be tense," and "worries a lot." Scores used in subsequent analyses were computed by averaging participants' responses to all eight items (α = .84). We also administered the Marlowe–Crowne Social Desirability Scale (MCSD; Crowne & Marlowe, 1960), which is a 33-item true–false questionnaire that measures participants' tendencies to respond in a socially desirable manner. Alpha was .74 in the present sample.

Results and Discussion

We first examined convergent (within-domain) and divergent relations among measures. Next, we tested the association between our three measures of emotion regulation and our two measures of memory. Finally, we introduced our two control measures to assess whether the obtained pattern of correlations could be explained by either neuroticism or social desirability.

Convergent Relations Among Measures

As expected, the AEQ and ERQ–S scales correlated positively with each other (r = .65, p < .001), indicating that people who report greater conflict over their tendency to inhibit emotion-expressive behavior also report that they try not to express their emotions. The AEQ (r = -.06, *ns*) and ERQ–S (r = .09, *ns*) did not correlate with the ERQ–R, providing evidence of discriminant validity. The cross-method correlation between the IME–C and the objective memory measure was modest but nonetheless positive and significant (r = .25, p = .02), indicating that people who report more frequent lapses in memory for conversations show poorer memory for their own emotion regulatory experiences as well. In each case, the correlations are not so large as to suggest that our measures of expressive suppression and memory are redundant; however, they do suggest that these measures are internally consistent to some degree and thus tap into common underlying constructs.

Expressive Suppression and Memory

The crucial question, of course, was whether self-ratings of typical expressive suppression and reappraisal would correlate with either self-reported or objective memory measures. On the basis of our two prior laboratory studies, we predicted that expressive suppression should be negatively correlated with both memory measures (indicating that greater suppression is associated with worse memory), whereas reappraisal should be unrelated to both memory measures.

As shown in Table 1, these predictions were entirely born out. Beginning first with self-reported memory, one can see that the IME–C is negatively related to both the AEQ and the ERQ–S but unrelated to the ERQ–R. Similarly, if one turns to objective memory, it can be seen that the objective diary measure is negatively related to both the AEQ and the ERQ–S but not to the ERQ–R. Although the magnitude of these findings is modest, the fact that expressive suppression is associated with worse self-reported and objective memory performance strongly suggests that the laboratory findings from Studies 1 and 2 do in fact generalize to expressive suppression in everyday life. Likewise, the finding that reappraisal is unrelated to either memory measure confirms that the cognitive costs of emotion regulation vary according to precisely how one goes about regulating one's emotions.

Control Analyses

To test the plausibility of neuroticism and social-desirability accounts of the correlations presented in Table 1, we first computed correlations between these two variables and our measures of expressive suppression and memory. As expected, neuroticism correlated positively with the AEQ (r = .43, p < .001) and negatively with the IME–C (r = -.28, p = .01). Social desirability correlated negatively with the AEQ (r = -.25, p = .02). No other significant relations emerged. This pattern of correlations does not provide strong grounds for the view that neuroticism or social desirability mediated the association between expressive suppression and memory. Nonetheless, we computed partial correlations, entering neuroticism and social desirability as covariates. As shown in the right half of Table 1, partialing for neuroticism and social desirability leaves the pattern of findings unchanged. This finding suggests that the obtained association between expressive suppression and memory cannot be accounted for by these potentially confounding individual difference variables.

Summary

Study 3 extended the laboratory findings from Studies 1 and 2 to everyday life. Compared with individuals who were low in expressive suppression, individuals who were high in expressive suppression (a) were more likely to report lapses in memory for the conversations they had and (b) were less likely to remember emotion regulation episodes that they had kept track of over a 2-week period. Neuroticism and social desirability could not account for these findings, and individual differences in reappraisal showed no such associations with memory. The fact that multiple measures of suppression and memory showed similar associations gives us confidence in the robustness of our findings.

General Discussion

The human capacity to self-regulate provides the cornerstone for adaptive success. One critical manifestation of this self-regulatory

Table 1
Correlations Between Two Forms of Emotion Regulation and Memory in Study 3

				Partialing BFI–N and MCSD[a]		
	Suppression		Reappraisal	Suppression		Reappraisal
Memory	AEQ	ERQ–S	ERQ–R	AEQ	ERQ–S	ERQ–R
IME–C	**−.40****	**−.27***	.17	**−.31***	**−.23***	.09
Diary	**−.27***	**−.23***	.03	**−.33***	**−.27***	.05

Note. N = 86. Poorer memory is denoted by lower memory scores. Predicted correlations are set in bold. IME–C = Inventory of Memory Experiences—Conversations subscale; Diary = Proportion of emotion episodes recalled; AEQ = Ambivalence Over Emotional Expressiveness Questionnaire; ERQ–S = Emotion Regulation Questionnaire—Suppression subscale; ERQ–R = Emotion Regulation Questionnaire—Reappraisal subscale; BFI–N = Big Five Inventory—Neuroticism subscale; MCSD = Marlowe–Crowne Social Desirability.
* p < .05. ** p < .001.
[a] N = 76.

capacity is the ability to regulate emotional responses. Given how widespread emotion regulation is among adults in Western cultures, it might seem unlikely that it should interfere with cognitive functioning. After all, it would be poor design indeed if humans' ubiquitous emotion-regulatory processes degraded ongoing and vital cognitive processes. This, however, seems to be just what happens, at least for certain forms of emotion regulation.

Cognitive Consequences of Emotion Regulation

The notion that there might be cognitive consequences of emotion regulation has been anticipated by several prior researchers. Baumeister's ego-depletion model (Baumeister et al., 1998; Muraven et al., 1998), in fact, makes the argument that any form of self-regulation is cognitively costly. This prediction meshes well with the tenets of self-regulation theory (Carver & Scheier, 1981; Duval & Wicklund, 1972), which suggests that self-monitoring requires an ongoing expenditure of cognitive resources as one compares the current state of a system (e.g., one's facial expression of anger) with a desired state of that system (e.g., a facial expression of calm concern) and then takes action to narrow the gap between the actual and the ideal.

On the basis of a process conception of emotion regulation, we offered a more specific prediction regarding the cognitive consequences of emotion regulation, namely, that reappraisal should have few if any cognitive costs but that expressive suppression should have clear costs. We made this differential prediction on the basis of a self-regulatory analysis of the demands of these two particular forms of emotion regulation. We expected that reappraisal, an antecedent-focused form of emotion regulation, should occur relatively early in the emotion generative process and should require relatively few cognitive resources. Once a situation is successfully reconstrued, its emotional "reality" is changed, and no further cognitive work should be necessary. By contrast, we expected that expressive suppression, a form of response-focused emotion regulation, should occur relatively late in the emotion-generative process and should require not only more resources but a chronic expenditure of these resources in order to monitor and successfully down-regulate ongoing emotion-expressive behavior throughout the course of an emotion-eliciting situation.

We tested these predictions in three studies that differed in induction procedure (films, slides), method (experimental, correlational), setting (laboratory, field), information modality (auditory, visual), and type of memory test (verbal, nonverbal). In Study 1, participants viewed a negative emotion-eliciting film either with instructions to hide their ongoing emotion-expressive behavior or with instructions to simply watch the film. Participants who were asked to suppress ongoing emotion-expressive behavior during the film had worse memory for the details of the film than participants who simply watched the film. In Study 2, participants viewed high- and low-negative-emotion slides under one of three instructional sets: suppression, reappraisal, or a just-watch control. As expected, expressive suppression led to worse performance on a verbal, cued-recall memory test, whereas reappraisal did not. These memory effects were evident in high- and low-emotion contexts but were specific to information that required verbal encoding; there were no suppression effects for a nonverbal memory test. In Study 3, we found evidence that our laboratory findings generalized to everyday life, a finding consistent with the growing evidence that laboratory and field estimates of effect sizes across a broad range of tasks converge to a greater degree than commonly thought (Anderson, Lindsay, & Bushman, 1999). Compared with individuals who were low in expressive suppression, individuals who were high in expressive suppression had worse self-reported memory and worse performance on an objective memory test for their own emotional experiences. Reappraisal had no effects on either self-reported or objective memory performance. Together, these replicated findings suggest that some forms of emotion regulation may be cognitively costly, whereas others are not.

Implications for Personality Processes, Individual Differences, and Social Functioning

Any self-regulating system—people included—must monitor ongoing processes in order to adjust them. Our findings suggest that the active self-regulation required by expressive suppression comes at a higher price than might be expected given the ubiquity of this form of emotion regulation. Drawing on the self-regulation literature (Carver & Scheier, 1981; Duval & Wicklund, 1972), we interpret these findings as supportive of the view that upon making the decision to hide their feelings, individuals instigate on-line comparisons between how they think they are behaving on the one hand and some salient standard on the other, such as a mental representation of an unemotional facial expression or the way the face feels when it is not expressing emotion. To make these comparisons, individuals need to monitor for lapses and correct them by dynamically adjusting ongoing behavior. Doing so apparently places special demands on language centers needed to verbally encode information, and we speculate that this competition may be responsible for the compromised verbal memory performance associated with expressive suppression. Interestingly, we are aware of relatively few studies carried out within the self-regulation tradition that have tested the tenets of self-regulation models by manipulating self-regulation directly. Typically, self-focus—not self-regulation—is manipulated, and the presence of self-regulatory activity is then inferred from increases in attention that is directed inward (Carver & Scheier, 1981). By taking a closer look at expressive suppression and other forms of ongoing emotion regulation, researchers might better delineate the precise workings of these and other basic forms of self-regulation.

Emotion regulation constitutes a basic personality process. There are, however, robust individual differences in preferred modes of emotion regulation. These differences are of great interest to anyone who wants to predict the behavior of another person. It should therefore come as no surprise that such differences are reflected in the language people use to describe other people. Thus, it is sometimes said that one person is "hot headed" and prone to "flying off the handle" while it is said of another person that she is "cool as a cucumber" and "keeps a lid on her emotions." These differences in emotion regulation have long been thought to have affective consequences both for the individual doing the regulating (or failing to do so) and for others with whom that individual is interacting. The present research shows that these individual differences in emotion regulation also have cognitive consequences. This suggests that we might want to add memory problems to the growing list of negative consequences associated with chronic efforts to inhibit emotional impulses, such as poorer health, adjustment, and coping responses (Pennebaker, 1990). Although the

research presented here cannot speak directly to the broader implications of regulating emotions in ways that compromise memory, it encourages speculation about how the suppression–memory relation might influence personality organization. Could it be that habitual reliance on expressive suppression leaves individuals with incomplete, impoverished memories of emotional events, which in turn increase reliance on such cognitive shortcuts as confabulation, scripts, biases, and schemas when forming judgments about themselves, other people, and the world? Might individual variation in expressive suppression help to explain why some people have differentiated, complex conceptions of the self, based on a rich store of memories, whereas other people have more simplistic, "gist-like" conceptions of the self? Previous research has linked individual differences in emotionality (e.g., depressive tendencies) to variation in "self-defining" autobiographical memories (Singer & Salovey, 1993). The present research suggests that certain emotion regulation tendencies may shape memory as well. An important next step is to understand whether these effects are specific to memories of emotional events or whether they generalize to nonemotional memories as well (e.g., grocery lists, mundane conversations).

Emotion regulation often occurs in social interactions, and these social interactions require memory processes to initiate and guide their successful execution. The finding that emotion regulation affects memory therefore suggests that emotion regulation might also have consequences for social functioning. We might speculate, for example, that the impoverished, incomplete memories stemming from cognitively costly emotion regulation could negatively affect relationships. Overreliance on expressive suppression during an argument could reduce memory for who said what and when they said it. Unfortunately, misunderstandings and ill feelings can be perpetuated when this happens and can aggregate over time to erode relationship satisfaction. Albeit speculative, this intersection between emotion regulation and memory also might shed light on gender differences in close relationships. For example, researchers have shown that men tend to be less expressive than women (Kring & Gordon, 1998) and that, more specifically, men are more likely to engage in expressive suppression during heated interchanges than women, a process referred to as *stonewalling* (Gottman & Levenson, 1988). On the basis of our findings, we might predict that men should remember the details of their conversations less well than women. This difference, in turn, might lead to very different memories of important conversations, and, potentially, to difficulty and frustration at the apparent mismatch between perceptions of these interactions.

Limitations and Future Directions

In three interlocking studies, we have demonstrated that expressive suppression impairs memory and that reappraisal does not. These studies break exciting new ground in the study of emotion regulation. They also provide tantalizing hints regarding the nature of the mechanisms underlying these effects. At this point, alterations in emotion experience do not seem likely mediators of the cognitive consequences. Reappraisal affected emotion experience but had no effect on memory, whereas expressive suppression had no effect on emotion experience but did impair memory. We find it more useful to interpret these findings using a cognitive resource allocation perspective, which asserts that expressive suppression impairs memory because it consumes cognitive resources that are necessary for verbal encoding of memories. We recognize, however, that much more must be done to fully understand the mechanisms by which this form of self-regulation affects memory. In the following paragraphs, we consider several limitations of the present studies and describe three directions for future research, including (a) assessing other forms of emotion regulation, (b) studying other emotions, and (c) examining richer social contexts.

Adults regulate their emotions and moods with a dizzying array of emotion regulatory strategies (e.g., Lyubomirsky & Tucker, 1998; Morris & Reilly, 1987; Thayer et al., 1994). In view of the potentially overwhelming number of forms of emotion regulation (Gross & Richards, 2000) and the limitless supply of possible control tasks (e.g., finger tapping, counting the number of times someone says "the" while talking), our strategy was to identify two theoretically defined forms of emotion regulation that we regarded as viable response options in situations that individuals face in everyday life. This comparison afforded the possibility of showing that certain forms of emotion regulation had cognitive consequences, and that not all self-regulatory tasks involving emotion down-regulation had such consequences. Although we can now be certain that it is not just any task that impairs memory, with just two regulation conditions, we are unable to comment on the cognitive effects of emotion regulation in general. Furthermore, we are unable to discern which of the many differences between reappraisal and suppression were responsible for the observed memory effects. To address these questions, future research will be necessary in which other forms of emotion regulation, such as thought suppression (Wegner, 1994), rumination (Lyubomirsky & Nolen-Hoeksema, 1995), and ingratiation (Gilbert, Krull, & Pelham, 1988) are measured and manipulated. Although we used explicit instructions to isolate the effects of two specific forms of emotion regulation, a complementary approach would be to manipulate emotion regulation indirectly by introducing or removing critical situational factors (e.g., the presence of others, norms, goals) that prompt spontaneous efforts to alter emotional responding.

Adults are more likely to regulate negative emotions than positive emotions, and the down-regulation of negative emotion through reappraisal and expressive suppression is common (Gross & Richards, 2000). For this reason, we chose to focus our two experimental studies on emotion down-regulation in the context of negative emotion. In Study 1, the target emotional state was mixed and included sadness, anger, and anxiety. In Study 2, we elicited two levels of negative emotion, which in the high-emotion condition is probably best characterized as disgust. The effects of expressive suppression were consistent across each of these negative emotional states. However, these studies do not permit us to comment on the effects of emotion regulation in other emotional contexts. Despite a long history of interest in the relation between emotion and memory (for reviews, see Christianson, 1992; Deffenbacher, 1994; Easterbrook, 1959), too little is currently known about the effects of emotion on cognitive processes to make confident predictions. It seems possible, however, that at intense levels, negative emotions such as anger might in and of themselves impair cognitive performance (Bushman, 1998). This suggests the prediction that although reappraisal had no detectable effects in the present studies (with the exception of the unpredicted enhancement of memory in Study 2), reappraisal might have salutary

consequences in the context of high levels of anger if this reappraisal were effective in producing decreases in negative emotion. One important research direction, therefore, is to systematically assess the effects that emotion per se—as well as other forms of emotion regulation—may have on memory processes.

Any study that attempts to bring complex, multiply determined phenomena under experimental control requires decisions about the kinds of contexts on which to focus. We thought it prudent to build on the methodology of previous experimental investigations of emotion regulation (Baumeister et al., 1998; Gross & Levenson, 1997) and memory (Christianson, 1992) that have used standardized emotion-eliciting stimuli such as films and slides. Now that we have demonstrated cognitive consequences of emotion regulation in passive-viewing paradigms, it will be important to determine whether emotion regulation has cognitive costs during social interactions. In this context, the regulatory demands of bidirectional interactions might be even less predictable for the regulator than they were in our studies, requiring greater flexibility and quicker reactions in order to successfully manage emotional responding. This leads to the prediction that the costs of response-focused emotion regulation such as expressive suppression might be even greater when evoked during conversations than when evoked in the more passive and solitary contexts studied experimentally here. Future studies that take complex social contexts into account will permit a more complete analysis of the consequences of emotion regulation for different forms of memory, as well, perhaps, for other forms of cognitive activity, such as decision making, social perception, and speech. Such research will provide valuable insights into the mechanisms by which self-regulation affects cognitive functioning.

Concluding Comment

Emotions arise when something important is at stake. At these critical junctures, emotions occasionally generate thoughts, feelings, behaviors, and sensations that one would rather not have. One can decrease the unwelcome signs of negative emotions in many ways, and can do so regularly. However, if it is important to someone to preserve the fidelity of cognitive functioning during emotionally trying times, some emotion regulatory strategies appear to have more to recommend them than others. Keeping a still face and stiff upper lip decreases one's memory for the details of the unfolding emotion-eliciting situation, whereas cognitively transforming the situation by changing one's thinking does not appear to exact such a cognitive cost. An old adage reminds us that an ounce of prevention is worth a pound of cure; so, too, it seems that it is more efficient to construe events in unemotional terms than to try to hold back emotional impulses that already have arisen.

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