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Personality and emotional memory: How regulating emotion impairs memory for emotional events ☆

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Abstract

In everyday life, individuals actively regulate their emotions in a variety of ways. One common form of emotion regulation is *expressive suppression*, which entails inhibiting outward signs of emotion. Although expressive suppression is often undertaken with an eye to looking calm despite feeling emotional, an analysis of its self-regulatory demands suggests that this form of emotion regulation may come at a cognitive price. We tested this hypothesis in two studies. In Study 1, we measured spontaneously occurring expressive suppression during a film that depicted a surgical procedure, and then assessed memory for the film. Greater use of suppression predicted worse memory. In Study 2, we examined expressive suppression during a film that depicted a conflictual conversation, and we measured memory for what was said during the conversation. To gauge the magnitude of any cognitive costs, we compared expressive suppression with *self-distraction*, which entails intentionally trying not to think about something. Both spontaneously occurring and experimentally induced suppression were associated with worse memory. Strikingly, these effects were comparable to the effects of spontaneously occurring and experimentally induced distraction. These studies suggest that “simply” keeping a stiff upper lip during an emotional event exacts a cognitive toll that is as great as intentional

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cognitive avoidance. We argue that efforts to understand links between emotion and memory must consider emotion regulation.

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1. Introduction

James (1890) wrote that “An experience may be so exciting emotionally as almost to leave a scar on the cerebral tissues” (Vol. 1, p. 670). A large number of studies have now born out James’s suggestion that there is something particularly memorable about emotional events. For example, when participants are asked to view either emotional or neutral film clips or slide sequences, subsequent memory tests show that the emotional stimuli are often remembered better than the neutral stimuli, particularly where perceptually salient details are concerned (e.g., Christianson & Loftus, 1990; O’Carroll, Drysdale, Cahill, Shajahan, & Ebmeier, 1999).

Still, a memory is not a perfect record of a life experience (e.g., Loftus, 1993). Even when people are motivated to remember an emotionally evocative event—such as a crime, an accident, or an important social interaction—they cannot recall everything that transpired. This much is apparent in laboratory studies as well, which use objective tests to quantify the degree to which people remember the details of emotional events. Average memory performance scores are never 100% and estimates of variability show that people who are exposed to the same emotional event differ dramatically from each other when it comes to how well they remember it. Whereas some people appear to remember emotional experiences quite completely and accurately, other people are left with the Cliff Notes. What might different people be thinking or doing during an emotional event that could explain why their subsequent memories differ?

In this article, we consider the possibility that certain personality processes (a) tend to covary with emotion, and (b) influence a person’s ability to encode ongoing events into memory. Specifically, we draw on the emerging field of emotion regulation research, which highlights some candidates. In the following section, we first define what is meant by “emotion regulation.” Second, we consider how certain efforts to regulate emotion might influence memory for events that transpire during the period of regulation. Third, we present two studies which test whether memory for emotional events can be explained by willful efforts to regulate emotional responses.

1.1. *Emotion regulation*

Early emotion theories conceptualized emotion in nearly reflex-like terms (e.g., James, 1890). On this view, if an event is appraised as relevant to one’s well-being, then emotions inevitably arise, much as a tap on the patella generates an uncontrolla-

ble knee-jerk. More recently, emotion researchers have begun to emphasize that emotions are response tendencies that can be regulated. Thus, when some event happens, be it an argument or a car accident, experiencing or expressing emotions is not inevitable. Rather, people often think or do things that decrease the likelihood, magnitude, or duration of what is felt inwardly or shown outwardly (for discussions, see Erber & Erber, 2000; Larsen, 2000; Tice & Bratslavsky, 2000).

People use many different strategies for modifying their emotional reactions (e.g., Morris & Reilly, 1987; Thayer, Newman, & McClain, 1994). However, one particularly common form of emotion regulation is *expressive suppression*, which entails hiding overt signs of inner emotional states. For example, when interviewed about a recent time, when they tried to regulate their emotions, half of college-aged respondents described situations in which they focused on their face and tone of voice to suppress how they were feeling. Moreover, among undergraduates who maintained diaries of their emotion regulatory experiences over a two-week period, inhibiting emotion-expressive behavior was reported almost one quarter of the time (Gross, Richards, & John, in press). Distal factors—such as socialization processes and childhood experiences—and proximal concerns—such as immediate goals or situational constraints—likely determine if and how a person will regulate emotion in any given situation. Whatever their source, research, and theory on emotion regulation suggests that when people *do* try to regulate their emotions, consequences for memory may result.

1.2. Affective and cognitive consequence of expressive suppression

To date, studies on expressive suppression have focused primarily on their affective consequences. In these studies, instructional sets have been used to increase the use of expressive suppression in one group relative to another. Results show that participants who have been asked to view emotional films or have conversations under instructions to inhibit their expressive behavior do, in fact, show fewer behavioral signs of emotion than control participants (e.g., Bonanno, Papa, O’Neill, Westphal, & Coifman, 2004; Butler et al., 2003; Gross & Levenson, 1993, 1997). Interestingly, hiding negative emotions does not decrease the extent to which these emotions are experienced. That is, expressive suppression helps people *appear*—but not *feel*—less emotional.

Often, people suppress emotion-expressive behavior to subserve social goals. Children as young as four years old are aware of the importance of inhibiting emotional expressions in a variety of social situations (e.g., Saarni, 1984). Rather than grimacing at grandma’s yucky culinary creation or a disappointing gift, for example, children have learned that they should at least *try* to maintain a semblance of neutrality—if not pleasure—to avoid social censure. Research on interpersonal relationships (e.g., Clark, Pataki, & Carver, 1996) and interpersonal deception (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996) underscores the ubiquity of efforts to suppress emotion-expressive behavior in social contexts. For example, DePaulo et al. (1996) found that almost one-third of lies involved deceiving others about how one is feeling, which often entailed downplaying outward signs of negative emotions. Playing our

emotions close to the vest would seem to be socially expedient in many situations. However, two literatures suggest that any social benefits of concealing feelings might come at a cognitive cost.

First, the cognitive psychology literature hints at the possibility that suppressing emotion-expressive behavior might interfere with a person's ability to do something else at the same time. Specifically, the multi-tasking literature has shown that certain vigilance, motoric, and subvocal articulation tasks can divert attentional resources away from other concurrently performed tasks (e.g., Miyake, Witzki, & Emerson, 2001; Seitz & Schumann-Hengsteler, 2000). As a result, performance on these latter tasks can suffer. It stands to reason that a similar effect could accrue from expressive suppression. That is, keeping one's cool could divert attentional resources away from ongoing events in the environment, and thereby degrade memory. However, there are three reasons why the multi-tasking literature cannot sustain confident predictions about expressive suppression and memory. First, this literature has focused on tasks that differ fundamentally from hiding feelings. Multi-tasking studies typically focus on novel tasks—many involving computers—that require some training. Expressive suppression, by contrast, is common in everyday life and it should be relatively well-practiced by adulthood. Second, multi-tasking studies tend to focus on behaviors that are extrinsically motivated by an experimenter. Expressive suppression, on the other hand, tends to derive from a person's own goals for a situation (i.e., to appear calm, cool, and collected). It is not clear, therefore, whether spontaneously occurring efforts to hide feelings satisfy the conditions that are typically present in multi-tasking studies showing that one task impairs performance on another. Third, many tasks can be done concurrently without performance decrements. Thus, in the absence of research on naturally occurring expressive suppression, we cannot conclude that this form of self-regulation affects our ability to do other things.

A second literature can be brought to bear on the question of whether expressive suppression might influence memory. Specifically, cybernetic control models of self-regulation (Carver & Scheier, 1981; Larsen, 2000) suggest a mechanism by which even spontaneous expressive suppression might influence memory. According to these models, efforts to maintain or change thought or behavior evoke a negative feedback loop whereby the existing condition of a system (e.g., the expression on one's face) is compared to some salient standard (e.g., wanting to appear emotionally neutral). If a discrepancy between the two is detected (e.g., grimacing when one wishes to appear neutral), an operating process is evoked to lessen this discrepancy and achieve the desired state or behavior (e.g., appearing emotionally neutral). These self-monitoring and self-corrective processes may help people to look calm and collected. However, these processes may also draw upon the same pool of attentional resources people need to attend to what is going on around them. If this is the case, we might expect that people who suppress their emotion-expressive behavior during an emotional event will encode fewer details, and thus remember the event less well than people who do not try to suppress. This assumes, of course, that expressive suppression is not so overlearned by adulthood that it requires few attentional resources.

These predictions regarding the cognitive consequences of emotion regulation have received modest empirical support from the few studies that have now shown

links between experimental manipulations of expressive suppression and degraded memory (e.g., Bonanno et al., 2004; Richards & Gross, 2000). In these studies, participants were randomly assigned to receive suppression instructions (e.g., “focus on your facial expressions so that you do not show any emotion”) or no regulatory instructions (e.g., “behave as you naturally would”). Participants then were exposed to emotion-eliciting events, such as films or slides. When participants were asked to recall details of the emotion-eliciting material, suppression participants evidenced degraded performance as compared to controls, and this difference was not due to suppressors looking away from the material or to changes in physiological arousal.

Although promising, these initial studies have four important limitations. First, research based on explicit instructional prompts to suppress expressive behavior cannot tell us whether naturally occurring efforts to conceal emotion bear a similar relation to memory for details. It is possible, for example, that being told to suppress emotion-expressive behavior produces memory deficits, whereas spontaneous suppression does not. In the latter, intrinsically motivated case, suppression may be less likely to assume a prominent place in conscious awareness and hence impair memory. A second crucial limitation of prior experiments is that they are silent regarding individual differences in expressive suppression and memory. If dispositional suppressors are well-practiced at this emotion regulatory strategy, individual differences in spontaneous expressive suppression might not bear any relation to memory. Third, prior experiments cannot speak to whether there is a graded relationship between efforts to suppress emotion-expressive behavior and memory performance. Suppression was varied nonparametrically between-subjects to create suppression and control groups. We cannot know, therefore, whether the harder one tries to conceal feelings during an upsetting event, the worse one’s memory will be. Finally, prior experiments do not allow us to calibrate the impact of expressive suppression, for example, by comparing suppression to a task known to cause substantial memory impairments.

To address these issues, we conducted two studies to test whether the cognitive costs associated with experimentally manipulated expressive suppression would also be evident when individuals spontaneously hide their emotions. If these cognitive costs are evident, the present research also aimed to calibrate their magnitude in psychologically meaningful terms. This was done by comparing expressive suppression to another form of emotion regulation.

2. Study 1: The cognitive costs of spontaneous expressive suppression

The primary goal of Study 1 was to test whether spontaneous variation in expressive suppression would predict memory for information encountered in a moderately emotional context. To this end, participants were shown an unpleasant film clip used in prior research. A film clip was used—rather than an autobiographical memory recall task—to (a) elicit moderate levels of emotion, (b) standardize the to-be-remembered material for all participants, and (c) administer an objectively scored test of memory. This film clip was shown to groups of participants sitting in the same room

together (as opposed to participants sitting alone) because expressive suppression occurs most often in social settings.¹ Consistent with prior research on individual differences in self-regulation (e.g., emotion regulation: Gross & John, 2003; rumination and distraction: Nolen-Hoeksema, Morrow, & Fredrickson, 1993; thought suppression: Wegner & Zanakos, 1994), suppression effort was assessed by a face-valid self-report measure.

The second goal of Study 1 was to test whether spontaneous expressive suppression predicts memory above and beyond other factors that could be related to both suppression and memory. To this end, self-report measures of state emotion experience were included. Although prior experimental work has shown that expressive suppression does not exert a causal effect on the subjective experience of negative emotion, it stands to reason that the more emotional people happen to be, the more effort they must put into successfully suppressing this emotion. If increases in emotion also lead to poorer memory, then a relationship between suppression and memory could be explained by emotion. The present study therefore examined whether expressive suppression would predict memory irrespective of state emotionality. In addition, two superordinate dispositional factors were considered. The first of these was public self-consciousness, which captures the tendency to be highly self-aware and worried about how one appears to others. Second, neuroticism was assessed, which is defined in terms of negative affectivity and insecurity. Both traits seemed relevant to our analysis because people who are more self-conscious or predisposed to negative affect may be more motivated to conceal these feelings and have generally poorer memories. The present study therefore examined whether expressive suppression would predict memory irrespective of self-consciousness and neuroticism.

2.1. Method

2.1.1. Participants

Fifty-seven undergraduates (47% male, 53% female) participated in group sessions ($M=4.3$ participants per group) in exchange for course extra-credit. Participants ranged in age from 16 to 39 years ($M=20.5$ years), with 7% identifying themselves as African-American, 24% as Asian, 60% as Caucasian, 4% as Latino, 2% as Native American, and 3% as other. Data from one participant (female) were not included in analyses because she did not follow instructions on the memory test. Thus, data from fifty-six participants were analyzed.

2.1.2. Stimulus materials

Participants were shown a 64-s silent film developed by P. Ekman and W. Friesen that has been used extensively in research on basic emotion processes

¹ Increasing the social context of the study by conducting laboratory sessions in groups meant that close-up videotaping of each participant was not possible. It is important to note, however, that expressive suppression has not been associated with increases in looking away from emotion-eliciting stimuli (e.g., Gross & Levenson, 1993; Richards & Gross, 1999). Moreover, self-reports of expressive suppression have been linked with actual decreases in expressive behavior, as rated by observers (e.g., Gross & John, 2003).

(e.g., Ekman, Friesen, & O’Sullivan, 1988). This film, which reliably evokes negative emotions that exceed baseline levels, shows a close-up of the surgical amputation of an arm.

2.1.3. Measures

2.1.3.1. Spontaneous expressive suppression. To assess the extent to which participants tried to suppress their emotion-expressive behavior during the film, we asked participants to use a 7-point Likert scale (0 = *Not at all*; 6 = *A great deal*) to rate the extent to which they tried to keep themselves from showing outward signs of emotion during the film clip. This item, which has been shown to covary with actual reductions in expressive behavior in the laboratory (Richards & Gross, 1999), was adapted from an individual differences measure of emotion regulation (for psychometrics, see Gross & John, 2003).

2.1.3.2. Memory. To assess the extent to which they remembered the film, we asked participants to take a 25-item unanticipated true–false test (e.g., at one point during the film clip, a surgical instrument dropped on the floor [F]; The surgeon’s first incision was shown going clockwise [T]). Participants were instructed to provide an answer for each question, even if they had to guess. The total number of correctly answered questions was computed to derive a memory performance score (i.e., sum of correct responses).

2.1.3.3. Covariates. Participants used a 7-point Likert scale (0 = *Not at all*; 6 = *A great deal*) to rate the extent to which they felt “upset” and “distressed” both before viewing the film and immediately after viewing the film. Increases in either of these indices of emotion could predispose people to put more effort into suppression and to have poorer memory. Thus, separate composite scores for baseline and film periods were created (α s = .60 and .79, respectively), and they were used as covariates when testing for suppression-memory relations. In addition, two higher order traits were taken into account. In an initial questionnaire session conducted in the psychology department, a public self-consciousness scale was administered (Fenigstein, Scheier, & Buss, 1975). It is comprised of seven items (e.g., I’m concerned about the way I present myself. I worry about what other people think of me.) that are rated on a 5-point scale (α = .85). In addition, a measure of neuroticism was administered (John & Srivastava, 1999), which taps into a propensity to experience negative mood/insecurity. It is comprised of eight items that are rated on a five-point scale (α = .84). As with state emotionality, both self-consciousness and neuroticism could lead to greater suppression and poorer memory. Thus, these traits were used as covariates when testing for suppression-memory relations.

2.1.4. Procedure

Upon arrival to the laboratory, participants provided informed consent after a brief description of study procedures. No mention was made of any forthcoming memory tests, as we aimed to model situations in everyday life when a person does not expect to be quizzed on the details of a personal experience. Participants then completed the subjective emotion experience items described earlier. Then, partici-

pants watched the film on a 34-in monitor and completed a survey that included the subjective emotion experience and the suppression items. After a 10-min distractor task comprised of math problems, participants took the unanticipated memory test at their own pace. Filler questionnaires were appended to the memory test so that the experimenter could thank and debrief participants as a group. The distractor task and filler questionnaire data were not analyzed for this study.

2.2. Results and discussion

2.2.1. Descriptive statistics

Means, ranges, and standard deviations for memory (19.02, 8, and 2.05), suppression (2.68, 6, and 1.79), baseline emotion (.77, 4, and .93), film emotion (2.37, 6, and 1.66), self-consciousness (26.05, 24, and 5.63), and neuroticism (2.80, 3.37, and .85) did not indicate clear floor or ceiling effects. Skewness (range: $-.82$ to 1.46) and kurtosis (range: $-.70$ to 2.34) statistics indicated no substantial deviations from normality. Scatterplots focusing on relations among the suppression, covariate, and memory variables revealed no signs of nonlinear associations. Tests for linear relationships were conducted using the Pearson r correlation coefficient.²

2.2.2. Correlations among study variables

Table 1 shows that expressive suppression correlated significantly with memory: People who put more effort into suppressing facial expressions of emotion remembered film details less well than people who put in comparatively less effort. The relations between study covariates and both suppression and memory also are shown in Table 1. Focusing first on the covariates and memory, Table 1 shows that only public self-consciousness correlated with memory. Thus, people who tend to be concerned with self-presentation remembered film details less well than people who are comparatively less concerned with self-presentation. Turning to relations between covariates and suppression, we see that suppression was positively correlated with neuroticism. Thus, people who tend to be moody and insecure put more effort into hiding feelings than people who are comparatively less moody/insecure. Finally, a marginally positive correlation was found between suppression and distress levels during the film.

Overall, this pattern of results speaks against the notion that a suppression-memory relationship is driven by state emotion levels, neuroticism, or self-consciousness. None of these putative third variables were correlated with both memory and suppression. However, a partial correlation analysis was computed to confirm that expressive suppression accounted for variance in memory that could not be explained by state emotion levels, neuroticism, and self-consciousness simultaneously. As seen below the diagonal in Table 1, the suppression-memory correlation was virtually unchanged when the putative third variables were partialled.

² Although no existing theory pointed to different predictions for men and women, the Sex \times Suppression interaction was tested by the regression-based Friedrich solution (Aiken & West, 1991). The relationship between expressive suppression and memory did not depend on sex. Thus, main analyses collapse over this factor.

Table 1
Correlations among variables in Study 1

	Memory	Suppression	Film emotion	Baseline emotion	Self-consciousness	Neuroticism
Core variables						
Memory	—	-.37**	-.07	-.12	-.29*	-.02
Suppression	-.38**	—	.25	.08	.14	.30*
Covariates						
Film emotion			—	.12	.09	.16
Baseline emotion				—	.18	.30*
Self-consciousness					—	.22
Neuroticism						—

Note. Partial correlation shown below the diagonal (controlling for all other variables).

* $p \leq .05$.

** $p \leq .01$.

2.3. Summary and evaluation

Findings from Study 1 support three main conclusions. First, spontaneously occurring efforts to suppress emotion-expressive behavior predicted poorer memory: People who reported putting more effort into hiding their emotions remembered film details less well. These findings show that any cognitive costs of expressive suppression are not limited to experimental paradigms that use instructional goals to manipulate suppression. Second, Study 1 shows that memory decrements associated with expressive suppression increased in a linear fashion as suppression effort increased. Third, expressive suppression predicted memory when variance shared with state emotion experience, public self-consciousness, and neuroticism was taken into account. To extend these findings in three ways, a second study was conducted that incorporated both correlational and experimental methods.

3. Study 2: The cognitive costs of expressive suppression and self-distraction

The first goal of Study 2 was to examine the robustness of the link between expressive suppression and memory using a multi-item measure of suppression, a new and larger sample of research participants, and a different type of emotion-eliciting event.

The second goal of Study 2 was to gauge the effect of expressive suppression on memory relative to another form of emotion regulation that has a face-valid link with memory. After all, when emotional situations arise, people can regulate their emotions in different ways. Often, people end up trying to *appear* unemotional (expressive suppression). People also can adopt a different strategy whereby they try to *feel* unemotional. That is, rather than controlling their face, their chief aim is to control if or how they think about a potentially emotional event. *Self-distraction* is one way of doing this. This strategy entails thinking about things that are unrelated to a potentially emotional

event (e.g., Baumeister, 1991; Lyubomirsky, Tucker, & Caldwell, 1999). This happens, for example, when we try to “screen out” what someone is telling us during an upsetting argument by thinking about something else that is not upsetting (e.g., what to make for dinner). Expressive suppression and self-distraction have been treated as distinctly different processes in the emotion regulation literature, as reflected by the fact that they are defined differently, assessed with different individual difference scales (e.g., suppression: Gross & John, 2003; distraction: Nolen-Hoeksema & Morrow, 1991), and are manipulated experimentally with different sets of instructions (e.g., suppression: Bonanno et al., 2004; distraction: Rusting & Nolen-Hoeksema, 1998). Study 2 tested whether these strategies would have different consequences for memory. Specifically, we wondered whether suppression might be preferable to self-distraction if one wishes to preserve the fidelity of memory. We reasoned that where memory functioning is concerned, distraction may well serve as a “worst case” scenario against which to compare the cognitive consequences of expressive suppression. After all, distraction is, by its very nature, intentionally not wanting to think about something. Expressive suppression, by contrast, simply involves moving a portion of one’s attentional resources to the goal of keeping a straight face.

Our third goal was to increase our confidence that expressive suppression and self-distraction exert causal effects on memory. Although some prior research suggests suppression influences memory (e.g., Bonanno et al., 2004), these effects have not been documented widely nor compared with any effects that could follow from self-distraction. Moreover, by examining whether our measures of spontaneous suppression mediate any effects of manipulated emotion regulation on memory, we can address third variable concerns surrounding our correlational analyses. If we find, for example, that self-reported suppression and distraction effort account for the effects of these manipulations on memory, our confidence in the proposition that spontaneous emotion regulation influences memory is bolstered.

To achieve these three goals, we conducted a second study that elicited emotion using a videotape of an upsetting conversation. As in Study 1, we created a social context by showing the videotape to groups of participants. Measures of emotional experience, spontaneous use of expressive suppression and self-distraction, and subsequent memory for the film were obtained from all participants. However, random assignment was used to place participants into one of three groups. Some participants watched the film under instructions to behave as they naturally would. This group was used to conduct correlational analyses analogous to those reported for Study 1. To permit experimental analyses, we also created groups that received either an expressive suppression or a distraction manipulation. Each manipulation was aimed at increasing the probability that suppression or distraction effort would be evoked in response to the film, thereby permitting comparisons across control, suppression, and distraction groups.

3.1. Method

3.1.1. Participants

Participants were 175 undergraduates (65% female, 35% male) who participated in group-run sessions in the laboratory ($M = 3.23$) in exchange for course extra credit.

On average, participants were 19.3 years old ($SD = 1.6$ years), with 2% identifying themselves as African-American, 43% as Asian-American, 58% as Caucasian, 2% as Hispanic, and 5% as other. The sum of percentages exceeds 100% as some participants identified with more than one group.

3.1.2. Stimulus materials

Participants were shown a 140-s film clip that reliably evokes negative emotion experience above baseline levels. In this film, a husband confesses to his wife that he has had an extra-marital affair. The wife becomes agitated and upset. A shouting match and a physical scuffle ensue. Their fight is witnessed by the couple's young child, who begins to sob.

3.1.3. Measures

3.1.3.1. *Emotion.* Participants rated the extent to which they felt anger, sadness, fear, distress, and upset during the film (0 = *Not at all*; 10 = *A great deal*). Scores were averaged to form a composite index of negative emotion experience ($\alpha = .86$). The emotion experience variable is relevant to partial correlation analyses (as was the case in Study 1) and manipulation checks.

3.1.3.2. *Use of expressive suppression and distraction.* Participants rated three face valid items (0 = *Not at all*; 10 = *A great deal*) tapping into expressive suppression (e.g., To what extent did you try to keep your facial muscles from moving? To what extent did you try to keep yourself from showing outward signs of emotion?). Using the same 11-point scale, participants rated three items pertaining to self-distraction (e.g., To what extent did you try to distract yourself from the film clip by thinking about other things? To what extent did you try *not* to think about the film clip?). Items pertaining to each construct were averaged to form composite scores for expressive suppression ($\alpha = .93$) and distraction ($\alpha = .89$).

3.1.3.3. *Memory.* To assess the extent to which they remembered what was said during the film, participants took an unanticipated twelve-item five-alternative forced-choice test of what was said (e.g., name of the woman with whom the husband had an affair; where the husband first met "the other woman"). Participants were instructed to answer each of twelve questions, even if they had to guess. The total number of correctly answered questions was computed to derive a memory performance score (i.e., sum of correct responses).

3.1.4. Procedure

Upon arrival to the laboratory, participants were given a general description of study procedures. After providing informed consent, they completed a demographics questionnaire. The experimenter then informed participants that the study was designed to understand their reactions to a film. No mention was made of any forthcoming memory tests. At this point, participants were randomly assigned to one of the three instructional conditions, uninstructed ($N = 91$), suppression ($N = 40$), or dis-

traction ($N = 44$). We doubled the size of the uninstructed group to be able to compute correlations among spontaneous suppression effort, spontaneous distraction effort, emotion experience, and memory.

The instructions for the *uninstructed* condition were: “We are now ready to run a brief film clip, which shows an argument between a husband and wife.” The instructions for the suppression and distraction conditions were designed to reflect fundamental distinctions between them (i.e., aiming to control expression vs. aiming to control experience; modulating the face vs. modulating thought content). The instructions for the *expressive suppression* condition went as follows:

We are now ready to run a brief film clip, which shows an argument between a husband and wife. We are showing you this film because we wish to learn how well you can control your facial expressions while you watch it. Specifically, it is very important for the sake of this study that you try your best to adopt a neutral facial expression as you watch the film. To do this, we would like for you to keep your facial muscles from moving. In other words, keep a straight face by keeping the muscles around your neck, your chin, your lips, your cheeks, your eyes, and your forehead very still.

The instructions for the *distraction* condition went as follows:

We are now ready to run a brief film clip, which shows an argument between a husband and wife. We are showing you this film because we wish to learn how well you can control your thoughts while you watch it. Specifically, it is very important for the sake of this study that you try your best to adopt a neutral attitude as you watch the film. To do this, we would like for you to think about things other than the film—anything at all that you can call to mind. In other words, try to keep yourself from thinking about the film by distracting yourself with thoughts that have nothing to do with the film.

After watching the film, all participants were asked to complete the emotion experience and emotion regulation measures. Following a 10 min distractor task comprised of solvable anagrams, participants took the unanticipated memory test at their own pace. Filler questionnaires were appended to the memory test so that the experimenter could thank and debrief participants as a group. The distractor task and filler questionnaire data were not analyzed.

3.2. *Results and discussion*

In the following section, we first present correlational analyses that tested for linear relations among spontaneous suppression, distraction, emotion experience, and memory performance for participants who had been assigned randomly to the uninstructed (i.e., control) group. Then, we present analyses of variance (ANOVAs) that tested differences among the experimentally created conditions (i.e., uninstructed controls vs. suppressors vs. distractors). Finally, we report mediational analyses conducted on the experimental data.

3.2.1. Correlational analyses

3.2.1.1. *Descriptive statistics.* Table 3 shows means and standard deviations for all variables. There was no evidence of restricted range for expressive suppression, distraction, memory, or emotion experience in the uninstructed group. Skewness (range: $-.38$ [emotion] to 1.17 [distraction effort]) and kurtosis (range: $-.48$ [emotion] to $.90$ [distraction effort]) statistics indicated no major deviations from normality. Scatterplots revealed no hints of any curvilinear relationships. Correlational analyses then were undertaken.

3.2.1.2. *Expressive suppression, distraction, and memory.* As shown in Table 2, suppression correlated significantly with memory: People who reported putting more effort into suppressing emotion-expressive behavior remembered conversation details less well than people who put comparatively less effort into suppression. Self-distraction also correlated significantly with memory: People who reported greater effort to distract themselves remembered conversation details less well than people who reported comparatively less effort. Expressive suppression and distraction did covary to some degree, although unreliably. Still, to determine whether these two forms of emotion regulatory effort would predict memory when the variance they shared with each other was controlled, two partial correlations were computed. Expressive suppression was still a significant predictor of memory when controlling for distraction ($r = -.21, p < .05$). Distraction was a marginally significant predictor of memory when controlling for suppression ($r = -.18, p < .10$).

Table 2
Correlations among variables in Study 2

	Memory	Suppression	Distraction	Film emotion
Memory	—	$-.24^*$	$-.21^*$	$-.04$
Suppression		—	$.15$	$.35^{**}$
Distraction			—	$-.11$
Film emotion				—

* $p \leq .05$.

** $p \leq .01$.

Table 3
Descriptive statistics by instructional condition in Study 2

	Instructional condition		
	Uninstructed	Suppression	Distraction
<i>Measure</i>			
Suppression	$2.59^a(2.36)$	$6.76^b(2.19)$	$3.77^c(2.90)$
Distraction	$1.48^a(1.54)$	$1.70^a(1.90)$	$5.99^b(2.26)$
Emotion	$4.37^a(2.15)$	$3.59^{a,b}(2.57)$	$3.31^b(2.60)$
Memory	$8.48^a(1.51)$	$7.37^b(2.38)$	$7.61^b(1.90)$

Note. Numbers in a row that do not share a superscript differ from one another at $p < .05$, two-tailed with Bonferroni correction; Standard deviations are shown in parentheses.

After establishing that the expressive suppression and distraction measures did not account for the same variance in memory scores, two more partial correlations were conducted to confirm that the predictive value of suppression and distraction was not due to state emotion experience levels. This seemed unlikely given the findings of Study 1 and the fact that emotion was not correlated with memory in the present study (see Table 2). Nonetheless, we recomputed correlations between both forms of emotion regulation and memory, controlling for emotion. The coefficients were virtually unchanged for suppression ($r = -.24, p < .05$) and distraction ($r = -.22, p < .05$).

3.2.2. Experimental analyses

Experimental analyses were designed to address three major questions. First, did the expressive suppression and distraction manipulations produce the expected changes in suppression and distraction, respectively? Second, did the manipulations lead to poorer memory, and if so, were their effects similar or different? Third, what mediates any effect of expressive suppression or distraction on memory?

3.2.2.1. Use of expressive suppression and distraction. Univariate ANOVAs treating instructional condition (suppression, distraction, uninstructed) as a between-participants factor revealed significant effects for the suppression, $F(2, 172) = 39.63, p < .001$, and distraction, $F(2, 172) = 97.92, p < .001$, variables. Bonferroni tests were conducted to examine pairwise differences for each variable. Table 3 shows that the instructional manipulations generally worked as intended. As can be seen, suppression participants reported making greater efforts to hide feelings during the film, relative to uninstructed and distraction participants. Unexpectedly, distraction participants also reported hiding feelings to a greater extent than controls, although not as much as suppression participants. Table 3 also shows that distraction participants reported making greater efforts to inhibit thoughts about the film, relative to uninstructed and suppression participants. We return to this issue below. Distraction efforts of uninstructed and suppression participants did not differ from each other.

3.2.2.2. Emotion. A univariate ANOVA treating instructional condition as a between-participants factor (suppression, distraction, uninstructed) revealed a significant effect for negative emotion experience during the film, $F(2, 172) = 3.49, p = .03$. As shown in Table 3, Bonferroni tests revealed that suppression participants experienced neither more nor less negative emotion during the film than controls. This finding is consistent with prior research on the affective consequences of expressive suppression in emotionally negative contexts (e.g., Gross & Levenson, 1993). However, distraction participants experienced less negative emotion than controls. This finding is consistent with the notion that emotion levels depend, at least in part, on the extent to which people attend to potentially emotional events.

3.2.2.3. Memory. A univariate ANOVA treating instructional condition as a between-participants factor (suppression, distraction, uninstructed) revealed a significant effect for memory performance, $F(2, 172) = 6.39, p = .002$. To confirm that this effect remained when controlling for emotion, a similarly structured analysis of

covariance (ANCOVA) was computed that partialled for emotion self-reports. The instructional condition effect on memory performance remained reliable, $F(2, 171) = 4.78, p = .01$.

As shown in Table 3, Bonferroni tests revealed that both expressive suppression and distraction participants performed less well on the memory test, relative to control participants. However, the memory performance of the two regulation groups did not differ. Put another way, suppression, distraction, and uninstructed participants correctly answered 61, 63, and 71% of the memory questions, respectively. Thus, trying not to show emotion and trying not to think about an event as it unfolds produced equivalent decrements in memory.

3.2.2.4. Mediation. We reasoned that the memory performance decrements produced by the distraction manipulation should be mediated by increased efforts to think about things unrelated to the film, whereas memory performance decrements produced by the expressive suppression manipulation should be mediated by increased efforts to hide outward signs of emotion. Because our self-reported distraction and suppression measures tap directly into the intended consequences of our instructional manipulations for distraction and suppression, respectively, we focused on these measures when using Baron and Kenny's (1986) four-step regression-based mediation procedure.

Focusing first on suppression, the criteria for statistical evidence of partial mediation were met. First, condition assignment (suppression condition vs. control condition) predicted memory when the putative mediator (self-reported suppression effort) was not entered in the regression equation ($r = -.27, p = .002$). Second, condition assignment predicted suppression use, such that suppression participants reported greater use of suppression than controls ($r = .65, p < .001$). Third, suppression effort predicted memory when condition assignment was not entered in the regression equation, indicating that increases in suppression use predicted decreases in memory ($r = -.30, p < .001$). These three regression results replicate analyses we presented earlier using Pearson r correlations and ANOVAs. The critical fourth step in the mediation sequence requires us to compute a regression equation in which both condition assignment and suppression effort are entered simultaneously as predictors of memory. This regression revealed that suppression was a significant predictor of memory ($r = -.21, p = .05$) but the predictive value of condition assignment was reduced substantially ($r = -.15, ns$), Sobel test value = $-1.82, p = .06$. Overall, then, the mediation sequence suggests that suppression effort partially mediated the effect of the suppression manipulation on memory performance.³

Turning to self-distraction, condition assignment (distraction vs. control) predicted memory when the putative mediator (self-reported distraction effort) was not entered in the regression equation ($r = -.24, p = .005$). Second, condition assignment

³ According to Baron and Kenny's (1986) mediation guidelines, a variable first must be shown to vary as a function of our instructional condition to be a putative mediator. As shown in Table 3, emotion and self-reported distraction were not reliably influenced by the suppression manipulation. Thus, they were not submitted to subsequent steps in the mediation sequence.

predicted distraction, such that distraction participants reported more efforts to think about things unrelated to the film clip than controls ($r = .76, p < .001$). Third, distraction effort predicted memory when condition assignment was not entered in the regression equation, indicating that increases in efforts to think about things unrelated to the film clip predicted decreases in memory ($r = -.30, p < .001$). The critical fourth step in which both distraction effort and condition assignment were entered simultaneously as predictors of memory confirmed that distraction remained as a significant predictor of memory ($r = -.28, p = .03$) but condition assignment did not ($r = -.03, ns$), Sobel test value = $-2.09, p = .04$. Overall, then, the mediation sequence suggests that distraction effort partially mediated the effect of the distraction manipulation on memory performance.⁴

3.3. Summary and evaluation

Study 2 replicated and extended Study 1 in several ways. First, results showed that an antagonistic relationship between spontaneous expressive suppression effort and memory is not limited to graphic, visually upsetting contexts. Spontaneous suppression efforts predicted poorer memory for more ecologically valid conversational contexts as well. Second, spontaneous distraction also predicted poorer memory. Strikingly, spontaneous suppression and distraction exerted similar effects on memory, as evidenced by similar correlation coefficients. Manipulated suppression and distraction also exerted statistically indistinguishable effects on memory. Finally, mediational analyses traced the effects of these manipulations to individuals' emotion regulatory efforts during the film. Taken together, these results further increase our confidence that at least some kinds of naturally occurring efforts to regulate emotions predict decrements in memory.

4. General discussion

A human memory is never a perfect record of a life experience. One of the most intriguing questions in psychology is why people remember what they do and don't. The studies presented here suggest that the fidelity of memory for an experience may depend, at least in part, on whether people regulate their emotional responses to this experience. Given how widespread emotion regulation is among adults in Western cultures, it may seem counter-intuitive that any form of emotion regulation should

⁴ Tables 2 and 3 speak strongly against the possibility that emotion or self-reported suppression also mediated the effect of the distraction manipulation on memory. After all, emotion was unrelated to memory and self-reported suppression increased only modestly among distraction condition participants. Still, we submitted emotion and self-reported suppression to the final step in the Baron and Kenny (1986) mediational sequence. As expected, the regression predicting memory from instructional condition (distraction vs. control) and emotion showed that only instructional condition was a significant predictor ($r = .22, p = .01$). Similarly, the regression predicting memory from instructional condition (distraction vs. control) and self-reported suppression showed that only instructional condition was a significant predictor ($r = .21, p = .01$).

interfere with memory. This, however, is what seems to happen where hiding feelings (i.e., expressive suppression) is concerned.

4.1. Personality and emotional memory

In two studies, we examined whether spontaneous efforts to hide feelings during a particular event would be associated with subsequent memory for this event. Consistent with the notion that some forms of emotion regulation might consume attentional resources (Carver & Scheier, 1981), Study 1 showed that people who put more effort into suppressing emotion-expressive behavior during a disgusting film clip remembered its visual details less well than people who put in comparatively less effort. Similarly, Study 2 showed that people who put more effort into suppressing emotion-expressive behavior during a filmed argument remembered what was said less well than people who put in less effort. These studies suggest that intrinsically motivated efforts to suppress emotion-expressive behavior explain variance in memory. A causal effect of expressive suppression was confirmed in Study 2. That is, an experimental manipulation of expressive suppression produced memory impairment relative to a control condition, and this difference was largely explained by individuals' reports of spontaneous expressive suppression during the film. Overall, these findings contribute to a growing literature on emotion regulation and cognitive functioning (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Rassin, 2001; Wegner, Quillian, & Houston, 1996; Zoellner, Sacks, & Foa, 2003).

The present research also aimed to calibrate the effect of spontaneous expressive suppression on memory in psychologically meaningful terms. To this end, we compared expressive suppression to self-distraction, which we regarded as another viable response option in emotional contexts. One might speculate that intentional efforts to avoid thinking about an event (i.e., distraction) might exact a larger toll on memory than expressive suppression. However, our correlational results in Study 2 showed that (a) efforts to hide feelings during an upsetting event, and (b) efforts to avoid thinking about the event altogether, were correlated with memory to the same degree. Importantly, these correlations were not an artifact of the two forms of regulation being correlated with each other. When the minimal variance they shared with each other was partialled, findings were virtually unchanged. These findings speak to the divergent validity of expressive suppression and self-distraction. For example, if expressive suppression was “just” distraction but with the goal not to show emotion layered on top, we would have expected greater concordance between distraction and suppression effort. Convincing evidence to this effect was not found. Finally, and consistent with the correlational findings, our experimental manipulations of expressive suppression and distraction were shown to produce equivalent memory decrements. Mediation analyses traced these decrements to spontaneous suppression effort and distraction effort, respectively.

Having shown that (a) emotion and emotion regulation efforts covary, and (b) at least some forms of regulation lead to worse memory, the present research suggests that individual variation in memory for emotional events may be explained, at least in part, by considering whether people regulated their emotions during these events.

Although the correlations observed here were modest (but not atypical for individual differences research), we have identified systematic variability in memory that prior research on emotion and memory has treated as error variance. Now we might wonder whether research linking emotion with enhanced memory (e.g., Hamann, 2001) might reveal more pronounced effects if spontaneously occurring emotion regulatory efforts are taken into account. Recall that these efforts appear to be positively correlated with emotion levels but negatively correlated with memory. It stands to reason, therefore, that cognitively costly emotion regulation could work against showing a strong memory advantage for emotional events. This proposition could be examined in studies that preempt spontaneous emotion regulatory efforts among research participants, perhaps by explicitly prompting them to give free reign to their emotions. Researchers also might measure participants' emotion regulatory efforts, as we have done here, and use these measures as covariates when comparing how well people remember emotional and neutral experiences.

4.2. Implications for understanding links between emotion and memory

The present findings also encourage speculation about why some studies have linked emotionally negative events with poorer—rather than better—memory (e.g., Clifford & Holland, 1981; Clifford & Scott, 1978). Commonly, “emotion hurts memory” findings are explained by evoking Easterbrook's (1959) cue-utilization hypothesis, which argues that emotions can have an “attentional narrowing effect” that degrades memory immediately after an event has happened. However, the correlational analyses in Studies 1 and 2 give rise to an alternative explanation. Recall that people put more effort into hiding feelings as the intensity of their emotional feelings increased. Thus, we might expect that particularly emotional events also evoke particularly high levels of cognitively costly emotion regulatory effort. Interestingly, the “emotion hurts memory” studies have tended to show participants violent or gruesome stimuli (e.g., Clifford & Holland, 1981; Clifford & Scott, 1978; Christianson & Nilsson, 1984) which may be more aversive and distasteful than stimuli often used in “emotion helps memory” studies (e.g., accident and hospital scenes). To the extent that more aversive stimuli mean more emotion regulation effort, we might expect that memory for these stimuli should suffer. To address this possibility, future research on memory for emotional events might examine emotional events of different types (e.g., more vs. less intense) in the same sample and discern whether any differences in memory for the different types of events can be explained by spontaneous emotion regulatory efforts.

Another avenue for future research is to assess whether some forms of emotion regulation, such as cognitive reappraisal (Lazarus & Alfert, 1964; Tomaka, Blascovich, Kibler, & Ernst, 1997), leave memory intact on a reliable basis. One study showed that participants who were instructed to interpret slides of injured people in unemotional terms (i.e., with the objective interest of a medical doctor) were able to feel less upset during the slides, but without remembering the slides poorly later on (Richards & Gross, 2000, Study 2). However, the generalizability of this finding must be tested. Future studies might measure and manipulate several different forms of emotion regulation—including cognitive reappraisal—so that their relative effects on

memory can be compared. Moreover, it will be important to link these strategies with indices of cognitive functioning other than memory, such as vigilance, problem solving, and speech production under a wide range of emotion-eliciting conditions. Together, such studies will clarify how we may regulate our emotions if we wish to optimize cognitive functioning during emotionally trying times. As well, this work would subserve the broader goal of clarifying what “emotionally intelligent” emotion regulation truly is (Salovey & Mayer, 1990).

4.3. Limitations and future directions

As with any set of studies, however, the present studies have a number of limitations. The correlational analyses in Studies 1 and 2 revealed the predictive value of spontaneous expressive suppression when emotional intensity levels and higher order affect-relevant personality traits were taken into account. The mediational analyses in Study 2 showed that the spontaneous expressive suppression measures mediated the impact of the experimental manipulation of suppression. However, the present studies do not confirm whether *successful* expressive suppression predicts memory. Because we thought it important to study emotion regulation in a social context, close-up video recordings of each participant were not obtained during our group-run laboratory sessions. Thus, we cannot say whether people who really tried to suppress or distract (and who had poorer memory) were successful at appearing unemotional. In addition, the present studies do not clarify the phenomenology of expressive suppression and distraction. For example, we do not know specifically how the content of one’s thoughts differs when suppressing facial expressions as compared to distracting. Study 2 suggested that efforts to hide feelings do not entail thinking about other things, but rather consist of thoughts about how one is behaving. However, additional research using “think aloud” or stream-of-consciousness recording procedures might address this issue. Finally, our studies focused on tightly constrained to-be-remembered events. Future research is necessary to assess spontaneous regulation in more dynamic interpersonal contexts.

These limitations notwithstanding, the present research raises the possibility that some strategies for regulating negative emotional responses can degrade memory. Individuals differ dramatically in how well they remember emotional events, and one important contributor to this difference in emotional memory may be how individuals regulate their emotions. Thus, when considering how trustworthy a person’s memory is likely to be, it may be useful to know whether and how that person went about regulating emotions during the event in question.

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