
EARLY CAREER AWARD

Emotion regulation: Affective, cognitive, and social consequences

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Abstract

One of life's great challenges is successfully regulating emotions. Do some emotion regulation strategies have more to recommend them than others? According to Gross's (1998, *Review of General Psychology*, 2, 271–299) process model of emotion regulation, strategies that act early in the emotion-generative process should have a different profile of consequences than strategies that act later on. This review focuses on two commonly used strategies for down-regulating emotion. The first, reappraisal, comes early in the emotion-generative process. It consists of changing the way a situation is construed so as to decrease its emotional impact. The second, suppression, comes later in the emotion-generative process. It consists of inhibiting the outward signs of inner feelings. Experimental and individual-difference studies find reappraisal is often more effective than suppression. Reappraisal decreases emotion experience and behavioral expression, and has no impact on memory. By contrast, suppression decreases behavioral expression, but fails to decrease emotion experience, and actually impairs memory. Suppression also increases physiological responding for suppressors and their social partners. This review concludes with a consideration of five important directions for future research on emotion regulation processes.

Descriptors: Emotion, Regulation, Suppression, Reappraisal

Emotions represent the “wisdom of the ages” (Lazarus, 1991, p. 820), providing time-tested responses to recurrent adaptive problems. Importantly, however, emotions do not force us to respond in certain ways, they only make it more likely we will do so. This malleability permits us to regulate our emotions. When afraid, we may run, but do not always do so. When angry, we may strike, but do not always do so. And when amused, we may laugh, but do not always do so. How we regulate our emotions matters: Our well-being is inextricably linked to our emotions.

The study of emotion regulation has roots that go back over a century to early psychoanalytic theorizing about the nature of psychological defenses (Breuer & Freud, 1895/1957; Freud, 1946). A second—and related—tributary has been the stress and coping

tradition (Lazarus, 1966; Lazarus & Folkman, 1984). Together, these pioneering theoretical efforts laid the groundwork for contemporary empirical work on emotion regulation in both children (Thompson, 1991) and adults (Gross, 1998b). In the following sections, I first discuss definitional issues associated with emotion regulation, and present a process model of emotion regulation that provides an overarching conceptual framework. This framework suggests that different forms of emotion regulation should have different consequences. In the subsequent sections, I then focus on the affective, cognitive, and social consequences of two commonly used forms of emotion down-regulation. The first, reappraisal, involves changing how we think about a situation in order to decrease its emotional impact. The second, suppression, involves inhibiting ongoing emotion-expressive behavior. Finally, I suggest several directions for future research.

Emotion and Emotion Regulation

Emotions arise when something important to us is at stake. Sometimes, emotions are triggered virtually automatically, such as when we recoil fearfully from a snake (LeDoux, 1995). At other times, emotions arise only after considerable meaning analysis, such as when we grow angry after hearing a belittling comment made about a friend (Frijda, 1986). In either case, emotions call forth a coordinated set of behavioral, experiential, and physiological response tendencies that together influence how we respond to perceived challenges and opportunities.

This article is based on an Early Career Award address given at the Society for Psychophysiological Research in October, 2000. This article reviews the recipient's research on emotion regulation, and draws most heavily upon Gross (2001) and Gross and John (in press). The research described in this article was supported by Grant MH58147 from the National Institute of Mental Health and Grants BCS-93679 and SBR-9728989 from the National Science Foundation. The author gratefully acknowledges the influence of his graduate mentor, Robert Levenson, with whom this work was begun. The author also thanks Oliver John and members of the Stanford Psychophysiology Laboratory (<http://www-psych.stanford.edu/~psyphy/>) for their ongoing contributions to this program of research.

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Our emotional responses often dovetail nicely with the demands of our varying life circumstances. At such times, our emotions serve us well (Tooby & Cosmides, 1990). However, emotional responses can also mislead us, particularly when contemporary physical and social environments differ dramatically from those that shaped our emotions over the millennia (Gross, 1999a). At such times, our emotional responses may do far more harm than good. When our emotions seem to be ill-matched to a given situation, we frequently try to regulate our emotional responses so that they better serve our goals.

Emotion Regulation

Emotion regulation refers to the processes by which we influence which emotions we have, when we have them, and how we experience and express them (Gross, 1998b). Because emotions are multicomponential processes that unfold over time, emotion regulation involves changes in “emotion dynamics” (Thompson, 1990), or the latency, rise time, magnitude, duration, and offset of responses in behavioral, experiential, or physiological domains. Emotion regulation also involves changes in how response components are interrelated as the emotion unfolds, such as when increases in physiological responding occur in the absence of overt behavior.

Three aspects of this conception of emotion regulation deserve comment. First, although individuals often try to decrease negative emotion, there is more to emotion regulation than this. Individuals increase, maintain, and decrease negative and positive emotions (Parrott, 1993). Second, many examples of emotion regulation are conscious, such as deciding to change an upsetting topic, or biting one’s lip when angry. However, emotion regulation may also occur without conscious awareness, such as when one exaggerates one’s joy upon receiving an unattractive present (Cole, 1986), or when one quickly shifts attention away from something upsetting (Boden & Baumeister, 1997). Third, emotion regulation is neither inherently good nor bad. The same strategies that permit medical pro-

fessionals to operate successfully (Smith & Kleinman, 1989) may also neutralize empathic distress in torturers (Bandura, 1977).

A Process Model of Emotion Regulation

One particularly vexing problem in studying emotion regulation is finding a way of organizing the potentially limitless number of emotion regulation strategies. Our approach has been to develop a process model of emotion regulation that shows how specific strategies can be differentiated along the timeline of the unfolding emotional response (Gross, 1998b; 2001). The fundamental claim of this model is that emotion regulation strategies differ in *when* they have their primary impact on the emotion-generative process, as shown in Figure 1.

At the broadest level, we can draw a distinction between *antecedent-* and *response-focused* emotion regulation strategies. *Antecedent-focused* strategies refer to things we do before the emotion response tendencies have become fully activated and have changed our behavior and peripheral physiological responding. An example of antecedent-focused regulation is seeing a job interview as an opportunity to learn more about the company, rather than as a pass-fail test. *Response-focused* strategies refer to things we do once an emotion is already underway, after the response tendencies have been generated. An example of response-focused regulation is keeping one’s anxiety from showing as one leaves a child at kindergarten for the first time.

Five more specific families of emotion regulation strategies can be located within this broad scheme (for a more detailed discussion of these regulation strategies, see Gross, 1998b). The first of these strategies is *situation selection*, denoted in Figure 1 by the solid line toward situation one (S1) rather than situation two (S2). Situation selection refers to approaching or avoiding certain people, places, or things so as to regulate emotion. For example, you may decide to have dinner with a friend who always makes you laugh the night before a big exam (S1), rather than going to the last-minute study session with other nervous students (S2). Often,

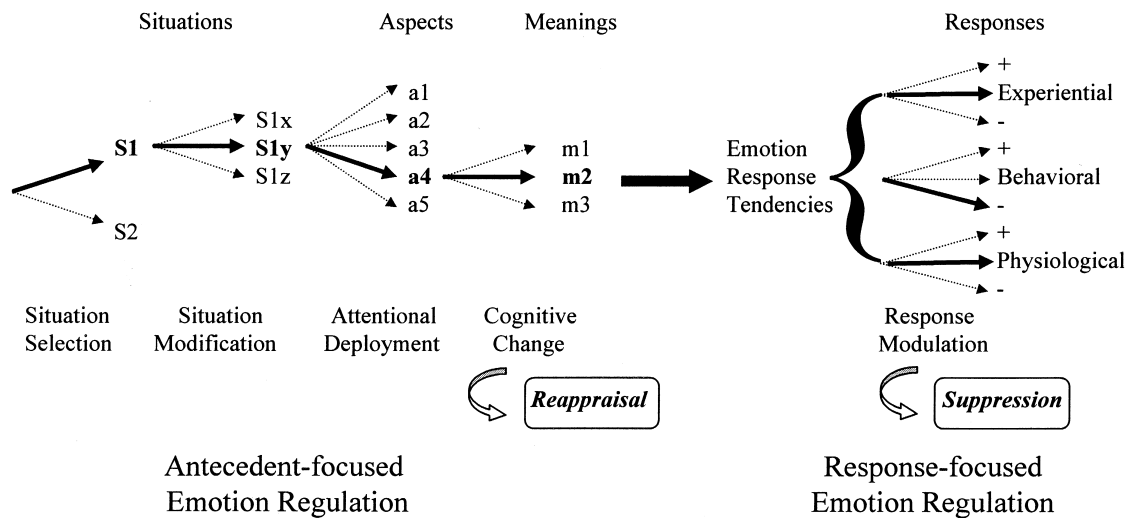


Figure 1. A process model of emotion regulation. According to this model, emotion may be regulated at five points in the emotion generative process: (1) selection of the situation; (2) modification of the situation; (3) deployment of attention; (4) change of cognitions; and (5) modulation of experiential, behavioral, or physiological responses. The first four of these are antecedent focused, the fifth is response focused. The number of response options shown at each of these five points is arbitrary, and the heavy line indicates the particular option selected in the example given in the text. Two specific emotion regulation strategies—reappraisal and suppression—are the primary focus of this review. Adapted from Gross (2001).

situation selection involves complex trade-offs between short- and long-term emotional benefits. For example, a shy person's efforts to decrease anxiety by avoiding social situations may provide short-term relief at the cost of longer term social isolation (Leary, 1986).

Once selected, a situation may be tailored so as to modify its emotional impact, creating either S1x, S1y, or S1z. This constitutes *situation modification*, which has also been referred to as problem-focused coping (Lazarus & Folkman, 1984) or as primary control (Rothbaum, Weisz, & Snyder, 1982). For example, continuing with the example of the exam, if you are talking with your friend the night before a big exam, and he asks whether you are ready for the exam, you can make it clear that you would rather talk about something else. Here too, considerable guesswork is often involved as one judges the likely impact of one's efforts to change a situation.

Third, situations have different aspects (e.g., a1, a2, a3, a4, a5), and *attentional deployment* is used to select which of the many aspects of the situation you focus on. An example is distracting yourself from a conversation that has taken an upsetting turn by counting ceiling tiles (Nix, Watson, Pyszczynski, & Greenberg, 1995). Attentional deployment also includes efforts to concentrate particularly intensely on a particular topic or task (see Csikszentmihalyi, 1975), or to get to the bottom of a problem by ruminating about it (Nolen-Hoeksema, 1993).

Once you have focused on a particular aspect of the situation, *cognitive change* refers to selecting which of the many possible meanings (e.g., m1, m2, m3) you will attach to that aspect. For example, you might remind yourself that "it's only a test" (m2), rather than seeing the exam as a measure of your value as a human being (m1). Cognitive change is often used to decrease the emotional response. However, it also may be used to magnify the emotional response, and even to change the emotion itself (e.g., transforming anger at a bully into pity). The personal meaning that is assigned to the situation is crucial because it powerfully influences which experiential, behavioral, and physiological response tendencies will be generated in that particular situation.

Finally, *response modulation* refers to attempts to influence emotion response tendencies once they already have been elicited. Response modulation is illustrated in Figure 1 by decreasing expressive behavior (−). In our example of the exam, response modulation might take the form of hiding your embarrassment after miserably failing the exam. Other targets of response modulation include the experiential and physiological components of emotion. As is widely appreciated, drugs may be used to target physiological responses such as cardiac hyperactivity (beta blockers); drugs also may be used to target affective states such as anxiety and depression.

Consequences of Emotion Regulation

It is clear that there are many, many different ways a person can go about regulating emotion. One pressing question is whether some emotion regulation strategies have more to recommend than others. Are there better and worse ways to regulate emotion?

To address this question, we have conducted a series of experimental and individual-difference studies that have focused on just two of these many forms of regulation. Both involve the down-regulation of emotion, which is a common and valued emotion-regulatory goal. The first is cognitive reappraisal, which is a type of cognitive change, and thus antecedent focused. Reappraisal is defined as construing a potentially emotion-eliciting situation in nonemotional terms. The second is expressive suppression, which is

a type of response modulation, and thus response focused. Suppression is defined as inhibiting ongoing emotion-expressive behavior.

By comparing two emotion regulation strategies, we can ask whether different emotion regulation strategies indeed produce different profiles of consequences. By including a "no regulation" condition as a control condition, we can compare each regulation strategy to whatever participants do when they are not told to regulate. It is worth noting that because participants in the "no regulation" condition are in fact free to regulate if they so choose, a comparison between one of the regulation conditions and the control condition provides a quite conservative test of the hypothesized consequences of these forms of emotion regulation.

Our aim in this research has been to coordinate experimental and individual-difference studies in order to better understand the differing consequences of two important forms of emotion regulation (Gross & John, in press). In our experimental studies, we have explicitly manipulated reappraisal and suppression. In our individual-difference studies, we have used questionnaire measures that assess the use of reappraisal and suppression. The logic of this comparative design hinges on the premise that whereas antecedent-focused forms of emotion regulation (such as reappraisal) principally concern whether or not emotion response tendencies *are triggered*, response-focused strategies (such as suppression) concern how emotion response tendencies *are modulated once they have been triggered*. In the sections that follow, I review our findings concerning the affective, cognitive, and social consequences of reappraisal and suppression.

Affective Consequences

One major aim of emotion regulation, naturally enough, is to modify emotional responding. Do reappraisal and suppression differ in their affective consequences? Based on our process model of emotion regulation, efforts to down-regulate emotion through reappraisal should alter the trajectory of the entire emotional response, leading to lesser experiential, behavioral, and physiological responses. Suppression, by contrast, should decrease expressive behavior, but should not decrease emotion experience, and might even increase physiological responses due to the effort associated with inhibiting ongoing emotion-expressive behavior. To what extent have these predictions been born out by prior research?

In an influential set of laboratory studies, Lazarus and colleagues provided the first evidence that reappraisal-like processes could influence emotional responding (Lazarus & Opton, 1966). In one representative study, Lazarus showed students a filmed circumcision ritual and manipulated the accompanying soundtrack (Lazarus & Alfert, 1964). Some participants heard a soundtrack that had been designed to minimize the negative emotional impact of the film by denying the pain involved in the surgery and emphasizing its joyful aspects. Other participants heard no sound track at all. Compared with the no soundtrack condition, participants who heard the soundtrack had lower skin conductance levels and more pleasant mood ratings. These findings suggest that leading participants to view the film less negatively decreased the stressfulness of what otherwise would have been a quite distressing experience. However, methodological features of this study such as differing delays across conditions between baselines and film viewing, as well as subsequent failures of replication (e.g., Steptoe & Vogeles, 1986), leave some doubt as to whether reappraisal can in fact "short-circuit" the emotional response.

Findings concerning emotion suppression also have been mixed. The individual-difference literature has shown that emotionally

inexpressive individuals often are more physiologically reactive than expressive individuals (e.g., Buck, 1979; Jones, 1935, 1950, 1960; Notarius & Levenson, 1979). One interpretation of this finding is that inexpressive individuals suppress their emotions, which leads to increased physiological responding. However, as Cacioppo and colleagues have argued, there are many other ways to interpret this correlational finding (Cacioppo et al., 1992). In the experimental literature—dubbed the facial feedback literature—two studies have shown that holding a fixed facial position that prevented smiling led to decreased amusement while reading cartoons (McCanne & Anderson, 1987; Strack, Martin, & Stepper, 1988). A third study showed that suppressing pride-expressive behavior decreased pride experience (Stepper & Strack, 1993). Other research reports have examined the physiological consequences of suppression. Compared to subjects who responded spontaneously, Bush, Barr, McHugo, and Lanzetta (1989) found that subjects instructed to inhibit their expressive behavior had similar heart rates but lower self-reports of amusement during a filmed comedy routine. Zuckerman, Klorman, Larrance, and Spiegel (1981) found that subjects instructed to respond with neutral facial expressions to pleasant and unpleasant films had lesser increases in a composite measure of physiological arousal than subjects instructed to respond naturally. Taken together, these findings concerning suppression suggest decreases in positive emotion experience, but the physiological effects of suppression are not clear.

Affective Consequences of Reappraisal and Suppression: Experimental Data

To test whether reappraisal and suppression have different consequences for behavioral, experiential, and physiological responses,

we used a short film that showed an arm amputation to elicit disgust (Gross, 1998a). We administered specific instructions to participants who had been randomly assigned to one of three experimental conditions. In the first, subjects were asked to *think* about what they were seeing in such a way that they did not feel anything at all (reappraise). In the second, subjects were asked to *hide* their emotional reactions (suppress). In the third, subjects simply watched the films (control).

Results indicated that suppression and reappraisal could indeed be distinguished. Suppression decreased disgust-expressive behavior, and increased sympathetic activation of the cardiovascular and electrodermal systems (Figure 2). Like suppression, reappraisal decreased expressive behavior. Unlike suppression, however, reappraisal had no observable consequences in terms of sympathetic activation of the cardiovascular or electrodermal systems. Whereas suppress participants showed greater increases in sympathetic activation than watch or reappraise subjects, these latter two groups did not differ from one another. Also unlike suppression, reappraisal decreased disgust experience, whereas suppression had no effect on disgust experience.

One concern regarding the finding that reappraisal decreased negative emotion experience is that it might be due to demand characteristics. After all, in the reappraisal condition participants were asked to feel less emotion. However, the finding that reappraisal decreases emotional responding has been replicated using a behavioral measure (the magnitude of a startle response to a loud noise burst) as an index of emotional state (Jackson, Malmstadt, Larson, & Davidson, 2000).

Related studies have examined the boundary conditions of the effects of suppression. For example, Gross and Levenson (1997) examined a second negative emotion—sadness—as well as a pos-

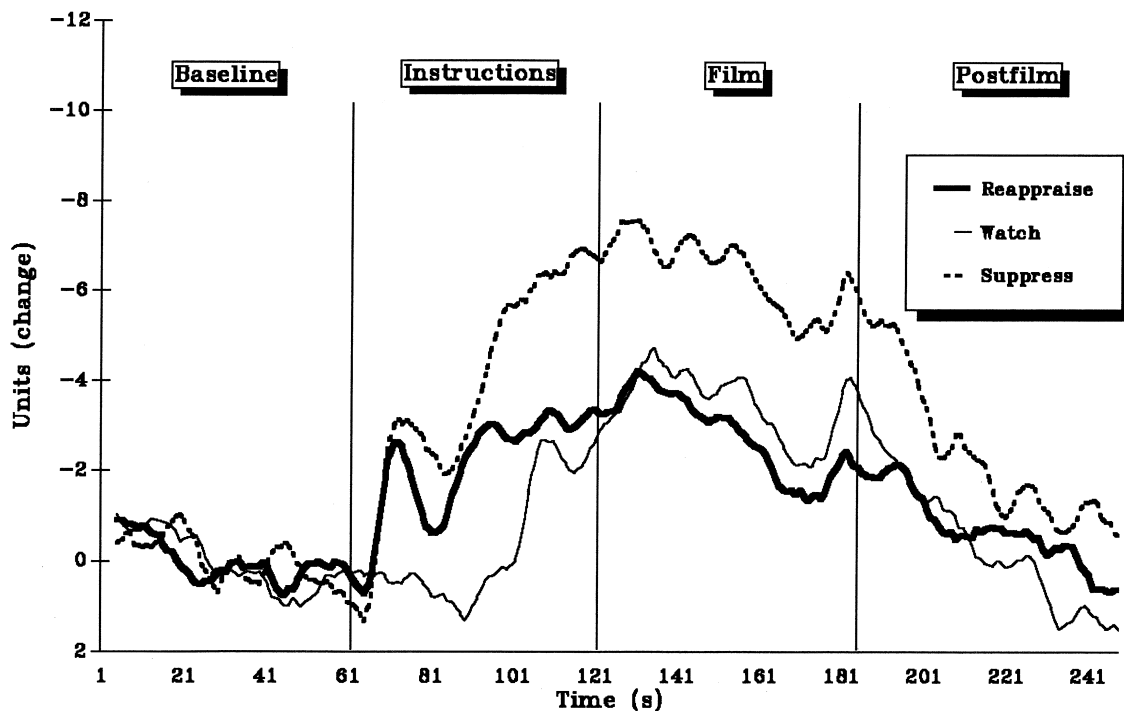


Figure 2. Affective consequences of reappraisal and suppression. Mean change in finger pulse amplitude for the three instructional groups. Note that the ordinate's scale is orientated so that increased sympathetic activation is upward. Used with permission from Gross (1998a).

itive emotion, namely amusement. Consistent with expectations, suppressing sadness and amusement led to increased sympathetic activation of the cardiovascular system, as indexed by changes in finger pulse amplitude, finger temperature, and pulse transit times to the finger and ear. Similarly, Harris (2001) has found that suppressing visible signs of embarrassment leads to enhanced blood pressure responses, but does not affect emotion experience reports.

It is noteworthy that whereas suppressing negative emotion-expressive behavior has no discernible impact on negative emotion experience (e.g., disgust, sadness, embarrassment), suppressing positive emotion-expressive behavior *does* have an impact on positive emotion experience (e.g., amusement). Gross and Levenson (1997) found a suppression effect for amusement experience both in a context that predominantly elicited amusement (an amusement film) and in a context in which there were lower levels of amusement (a sadness film that evoked a bit of secondary amusement). This finding jibes with prior scattered reports from the facial feedback tradition that inhibiting amusement (e.g., McCanne & Anderson, 1987; Strack, Martin, & Stepper, 1988) and pride (e.g., Stepper & Strack, 1993) expressive behavior leads to decreases in the self-reports of these positive emotions. It is not yet clear why the effects of suppression on emotion experience vary for positive and negative emotions. It seems likely, however, that a complete analysis of the experiential effects of suppressing negative versus positive emotions will require consideration of individual differences in sensitivity to facial feedback (Duclos & Laird, 2001).

If the experiential and physiological effects we have described really are the result of suppressing ongoing emotion-expressive behavior, suppressing nonemotional behavior should have no such consequences. To test this critical boundary condition, we examined participants' responses during a neutral film (Gross & Levenson, 1997). This film produced low levels of self-reported emotion and nonemotional expressive behavior such as lip biting and yawning. As expected, suppression decreased nonemotional behavior, and no differences were found between suppress and watch subjects for any of the physiological or experiential variables. This finding shows that the physiological impact of emotion suppression grows out of the counterpoising of attempts to inhibit expression against strong impulses to express. Absent a stimulus that produces impulses to express, behavioral inhibition has relatively little impact on physiological responding.

One puzzle is what to make of prior studies that have examined the physiological effects of emotion suppression and failed to find increased sympathetic activation. Methodological differences may be responsible for some of these differences. With respect to the single study of suppression in the context of both positive and negative emotions, (a) analyses were conducted using a composite measure of physiological arousal that included skin conductance and heart rate, (b) suppression subjects knew they were being videotaped and spontaneous subjects did not, and (c) results were presented collapsed across positive and negative film conditions (Zuckerman et al., 1981). Given known differences in responding across response systems and emotional contexts, any one or more of these methodological differences might account for differences. It is less clear how to reconcile present findings with studies showing that inhibiting one's expressive behavior while waiting for a painful shock decreases physiological responding (Lanzetta, Cartwright-Smith, & Kleck, 1976). One possibility is that although pain is often richly imbued with emotion, the suppression of pain behaviors per se (at least in Lanzetta's experimental context) does

not produce the same consequences as emotion suppression. If so, this study provides further evidence that concealing *nonemotional* behaviors (such as gross motor activity associated with pain) fails to produce the physiological tug of war that leads to the increased sympathetic activation that has been observed repeatedly in studies of emotion suppression.

Affective Consequences of Reappraisal and Suppression: Individual-Difference Data

Laboratory findings concerning the differential impact of reappraisal and suppression suggest the possibility that individual differences in these two emotion regulation strategies should have discernible affective consequences. Based on our model of emotion regulation and on the experimental literature, we hypothesized that individuals who habitually suppress should have lesser negative and positive emotion-expressive behavior. Given the apparently asymmetric relations between emotion experience and emotion expression for negative versus positive emotions, we further hypothesized that individuals who habitually suppress should have comparable levels of negative emotion experience, but lesser positive emotion experience. By contrast, we expected that individuals who habitually reappraise should have lesser negative emotion experience and expression, and greater positive emotion experience and expression.

To test these predictions, Gross and John (in press) used the Emotion Regulation Questionnaire to assess individual differences in suppression and reappraisal, and obtained self-ratings of emotion experience and expression, as well as peer ratings of emotion expression. As predicted, suppression was associated with lower levels of positive emotion experience and expression. Relations between suppression and negative emotion expression also followed expectations, with suppression being associated with lesser negative emotion expressive behavior. Findings regarding suppression and negative emotion experience were mixed, showing either no effects or positive effects, that is, the more individuals said they suppressed, the more negative emotion they said they felt. Reappraisal, by contrast, was associated with greater positive emotion experience and expression, and lesser negative emotion experience and expression. As with suppression, self- and peer reports converged with the results of previous experimental studies.

One important question is whether these affective consequences are ephemeral—resulting in slight and transient changes in temporary emotion experience—or whether their effects accumulate and impact long-term well-being. To assess the impact of habitual suppression and reappraisal on adaptation, Gross and John (in press) related their individual-difference measures of these two emotion regulation strategies to indicators of personal functioning: life satisfaction, well-being, and depression. In each case, suppression was associated with negative outcomes, whereas reappraisal was associated with positive outcomes. Together with the experimental findings described above, these findings provide strong evidence that suppression and reappraisal have strikingly divergent consequences for affective responding.

Cognitive Consequences

Emotions arise when something happens that is important to an individual. Sometimes, the goals that give rise to emotions are transient (e.g., seeing one's team win a ball game: see Clore, 1994). At other times, the goals that give rise to emotions derive from enduring values associated with health, close relationships, and important work-related projects. In many of these emotion-

eliciting situations, a high level of cognitive performance is desirable (Richards & Gross, 2000). Given that emotions often need to be regulated in such circumstances, how might we expect suppression and reappraisal to affect an individual's ability to perform well cognitively?

Suppression is a form of emotion regulation that requires self-monitoring and self-corrective action throughout an emotional event. Such monitoring requires a continual outlay of cognitive resources, reducing the resources available for processing events so that they can later be remembered. Reappraisal, by contrast, is evoked early on in the emotion generative process. Therefore, this strategy typically does not require continual self-regulatory effort during an emotional event. This would make costly self-regulation unnecessary, leaving memory intact.

Cognitive Consequences of Reappraisal and Suppression: Experimental Data

We tested these predictions regarding the cognitive consequences of emotion regulation on memory in a series of interlocking studies (Richards & Gross, 2000). In the first study, we focused on suppression. Participants were shown a short film clip known to elicit negative emotion. This film depicts a husband who confesses to his wife that he has had an extramarital affair. A fight ensues, which is witnessed by their young child, who begins to cry. Half of the participants were randomly assigned to inhibit emotion-expressive behavior during the film clip (suppress), whereas the other participants simply watched the film (control). To assess the cognitive impact of suppression, after participants had viewed the film, we administered a surprise cued-recognition test for auditory and visual details contained in the film. We also asked participants how confident they were about each of their responses to the memory test. As predicted, results indicated that suppression led to reliable decrements (compared to the control condition) in both objective memory and memory confidence ratings.

In a second study, we examined the cognitive consequences of both suppression and reappraisal (Richards & Gross, 2000, Study 2). Our goals in this study were to assess the impact of regulating differing levels of emotion, and to begin to test the mechanisms by which emotion regulation might be affecting cognitive performance on our memory tests. Participants watched a series of slides that either elicited high or low levels of negative emotion. As in Study 1, some of the participants were randomly assigned to view the slides while inhibiting their ongoing emotion-expressive behavior (suppress). Others were simply asked to watch the slides (control). Still others were randomly assigned to view the slides with the detached interest of a medical professional (reappraise). As slides were presented, participants were provided with information about each slide. Then, after slide viewing, participants were given two types of memory tests. The first—a nonverbal memory test—involved a series of photo spreads, and a participant's task was to identify which of four photos corresponded to a slide seen in the viewing phase. The second—a verbal memory test—required that participants write down the information associated with each slide as it was presented for a second time. As predicted, suppression participants performed less well on the verbal memory test than control participants. By contrast, reappraisal had no impact on verbal memory. Importantly, suppression's effect on verbal memory was just as pronounced for the low-emotion as for the high-emotion slides, suggesting that it is the process of engaging in suppression that is cognitively costly, rather than the amount of emotion that is actually suppressed. Interestingly, suppression had no reliable impact on nonverbal memory,

Table 1. *Cognitive Consequences of Reappraisal and Suppression (Controlling for Neuroticism and Social Desirability)*

Memory	Suppression		Reappraisal
	AEQ	ERQ-S	ERQ-R
Self-reported	-.31*	-.23*	.09
Objective	-.33*	-.27*	.05

Note: $N = 76$. Self-reported memory was measured by the Inventory of Memory Experiences–Conversations subscale (Herrmann & Neisser, 1978); objective memory was assessed by the proportion of emotion episodes recalled from a daily diary record; AEQ: Ambivalence Over Emotional Expressiveness Questionnaire (King & Emmons, 1990); ERQ-S: Emotion Regulation Questionnaire–Suppression subscale (Gross & John, in press); ERQ-R: Emotion Regulation Questionnaire–Reappraisal subscale (Gross & John, in press). Poorer memory is denoted by lower memory scores. Predicted correlations are set in bold. Adapted from Richards and Gross (2000).

* $p < .05$.

suggesting that the cognitive costs of suppression are due to the verbal demands of self-instructions issued during the course of suppression (e.g., “I need to keep my face still”).

Cognitive Consequences of Reappraisal and Suppression: Individual-Difference Data

To examine whether individual differences in emotion regulation have the same consequences on memory as our laboratory manipulations, we examined the impact of individual differences in reappraisal and suppression on memory (Richards & Gross, 2000, Study 3). We measured individual differences in habitual reappraisal and suppression using the Emotion Regulation Questionnaire (Gross & John, in press). We assessed memory using two measures that were selected to assess memory for contexts in which we thought it likely that individual differences in emotion regulation might be evident. The first was a self-report measure of memory for conversations (Herrmann & Neisser, 1978). The second was an objectively scored free-recall test for spontaneous emotion regulation episodes that occurred over a 2-week period and had been reported daily.

As shown in Table 1, we found that individuals who scored higher on either of the two suppression scales reported having worse memory than those who scored lower on these suppression scales. They also performed worse on an objective memory test in which they were asked to recall events they had listed in a daily diary 1 week earlier. By contrast, individual differences in reappraisal had no effects on either self-reported or objective memory. Importantly, these memory findings remained intact when controlling for neuroticism and social desirability, either of which might have led to spurious associations between emotion regulation and memory. These individual-difference findings converge with the results of our experimental studies, and suggest that whereas suppression is cognitively costly, reappraisal is not.

Social Consequences

Theorists since Darwin (1872/1998) have maintained that emotion-expressive behavior plays an important role in facilitating social interactions. This view has been reinforced by recent social func-

tional analyses of emotion (e.g., Campos, Mumme, Kermoian, & Campos, 1994). Given the importance of emotion-expressive behavior in social interaction, what consequences might reappraisal and suppression have for social functioning?

Based on the studies we have reviewed concerning affective consequences, suppression seems to be a blunt instrument—one that decreases both negative and positive emotion-expressive behavior, thereby masking important social signals that would otherwise be available to social interaction partners. In addition, the ongoing requirement of monitoring one's own facial expressions and vocal signals could distract the suppressing individual and make them less responsive to the emotional cues of their partner. This led us to predict that suppression should have negative social consequences in casual conversation. By contrast, reappraisal seems to decrease negative emotion experience and expression while either having no impact or actually increasing positive emotion experience and expression. Reappraisal also does not appear to be as cognitively taxing as suppression, at least as indexed by memory performance. These findings led us to predict that reappraisal should have positive social consequences relative to suppression.

Social Consequences of Reappraisal and Suppression: Experimental Data

To test these predictions, we focused on one important social context, namely an interaction in which two people discuss an upsetting topic. We asked unacquainted pairs of women to watch an upsetting film, and then discuss their reactions (Butler, Egloff, Wilhelm, Smith, & Gross, 2002). Unbeknownst to the other, one member of each dyad had been asked to either suppress, reappraise, or interact naturally with her conversation partner. We expected suppression to decrease both negative and positive emotion-expressive behavior in the regulator, as well as decreasing her responsiveness to the emotional cues of her partner. Because positive emotion expressions and emotional responsiveness are key elements of social support, and social support decreases physiological responses to stressors (Uchino, Cacioppo, & Kiecolt-Glaser, 1996), the diminished positive emotion-expressive behavior and responsiveness shown by suppression participants should produce large physiological responses in their interaction partners. By contrast, we expected reappraisal participants to show lesser decreases in positive emotion-expressive behavior, and little or no reductions in responsiveness. We therefore expected that the interaction partners of reappraisal participants would have physiological responses comparable to those of control participants.

As predicted, partners of suppression participants showed greater increases in blood pressure than partners of participants who were either reappraising or acting naturally (Figure 3). There were no blood pressure differences between partners of participants who were reappraising and partners of participants who were acting naturally. These findings indicate that interacting with a partner who shows little positive emotion, and who is unresponsive to emotional cues, is more physiologically activating than interacting with a partner who shows greater positive emotion and responsiveness. It is not yet clear, however, which aspects of the suppression participants' behavior mediate these intriguing social consequences of suppression.

Social Consequences of Reappraisal and Suppression: Individual-Difference Data

One important question is whether these findings, which were based on a laboratory interaction between two unacquainted women, would generalize beyond this context. Would these social conse-

quences of emotion regulation be discernible using an individual-difference approach? To find out, Gross and John (in press) used a correlational approach to relate individual differences in suppression and reappraisal to measures of social functioning, including social support, coping, and being liked by one's peers. Results indicated that individuals who habitually suppress were less likely to share either their negative or their positive emotions with others than were individuals who reappraised. Suppression also was associated with poorer social support and lesser use of instrumental and emotional social support coping. Finally, suppression and reappraisal were differentially related to both self- and other reports of how well-liked a person was, so that individuals who tended to use reappraisal were more likely to be liked than individuals who tended to use suppression.

Directions for Future Research

Recent theoretical and methodological advances have generated increased interest in emotion regulation (Gross, 1999b). Clearly, a large number of exciting questions remain to be addressed. Five directions for future research that seem particularly promising include: (1) Broadening the measurement of psychophysiological consequences of emotion regulation; (2) expanding the focus to other theoretically defined forms of emotion regulation; (3) making explicit links to the study of psychopathology; (4) assessing the longer term health consequences of differing emotion regulation strategies; and (5) relating emotion regulation to other important forms of self-regulation. In the following sections, I describe each of these in turn.

The Psychophysiology of Emotion Regulation

Suppression decreases whatever behavioral response tendencies arise with a particular emotion in a given context, and heart rate generally follows body movement (Gross, 1998a; Gross & Levenson, 1993, 1997). Suppression also increases electrodermal responding and blood pressure, and decreases finger pulse amplitude, finger temperature, and pulse transit times. These latter changes cohere theoretically, and can be described in terms of "increased sympathetic activation of the cardiovascular system." To date, this has been a useful level of abstraction. In future research, it will be important to more precisely specify these changes by using additional measures of sympathetic activation of the cardiovascular system (e.g., pre-ejection time; Cacioppo, 1994) as well as other peripheral responses (e.g., hypothalamo-pituitary-adrenocortical axis; Kirschbaum & Hellhammer, 1994).

It also will be important to examine theoretically defined patterns of central nervous system activation associated with reappraisal, suppression, and other forms of regulation (e.g., prefrontal cortex; Davidson, 2000). In one recent study, for example, we used fMRI to examine the neural bases of reappraisal (Ochsner, Bunge, Gross, & Gabrieli, 2002). Participants either were asked to reappraise negative scenes (drawn from the International Affective Picture System, or IAPS; Lang, Ohman, & Vaitl, 1988) or to let themselves respond emotionally to them. Comparison of these two conditions showed that reappraisal led to increased activation of lateral prefrontal regions important for cognitive control, and to decreases in activation of the amygdala and medial orbitofrontal cortex, two regions important for different kinds of emotion processing. Studies such as these promise a clearer understanding of the bidirectional links between limbic centers that generate emotion and cortical centers that regulate emotion, helping us move beyond simple models of top down control (Head, 1921; Jackson,

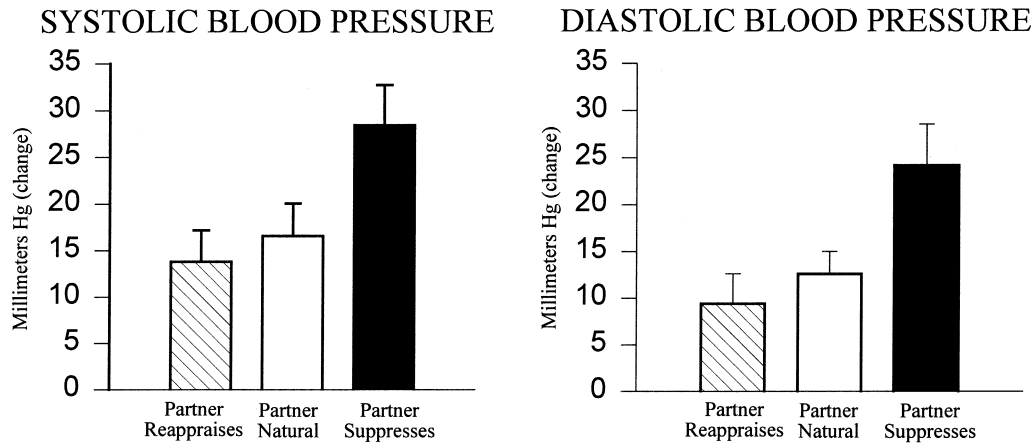


Figure 3. Social consequences of reappraisal and suppression. Mean change in systolic and diastolic blood pressure for individuals whose conversation partners were asked to reappraise the situation, act naturally, or suppress their emotions. Adapted from Butler et al. (2002).

1884) to models that emphasize emotional tuning of higher brain centers (Derryberry & Tucker, 1992) as well as top down control.

Expanding the Focus to Other Forms of Emotion Regulation

The process model of emotion regulation shown in Figure 1 makes the prediction that strategies that act at different points in the emotion generative process should have importantly different affective, cognitive, and social consequences. To test this prediction, we have focused on two commonly used forms of emotion down-regulation. One is a type of cognitive change (reappraisal), and the other is a type of response modulation (suppression).

One clear direction for future research is testing whether other forms of cognitive change and response modulation have similar consequences. It also will be important to examine differences among the antecedent-focused strategies of situation selection, situation modification, cognitive change, and attentional deployment, as well as differences among the response-focused strategies. A systematic analysis of the commonalities and differences among these diverse forms of emotion regulation as they are employed in different contexts holds out promise for increased understanding both of specific regulatory strategies and of the emotion generative process itself.

Emotion, Emotion Regulation, and Psychopathology

Emotion dysregulation is a prominent feature of many forms of psychopathology (American Psychiatric Association, 1994). Indeed, by one count, over half of the nonsubstance related Axis I clinical disorders and all of the Axis II personality disorders involve some form of emotion dysregulation (Gross & Levenson, 1997). Unfortunately, however, links between affective science and clinical science are still in their early stages. This means that there is considerable uncertainty about how emotions are disrupted in different forms of psychopathology, and what clues such disruptions might provide to the nature of the emotion regulatory deficits.

One important direction for future research is thus to extend laboratory research on emotion and emotion regulation to clinical populations. Promising candidates can be drawn from throughout the *Diagnostic and Statistical Manual* of the American Psychiatric

Association (1994). For example, individuals with Major Depressive Disorder have decreased emotional reactivity while viewing negative and positive emotional films (Rottenberg, Kasch, Gross, & Gotlib, in press). Can such deficits be conceptualized in terms of emotion regulatory processes? Another promising example of clinical extensions of basic research on emotion regulation may be found in schizophrenia. Individuals with schizophrenia have decreased emotion-expressive behavior compared with controls, but comparable levels of emotion experience (Kring & Neale, 1996). Patients with schizophrenia also have well-characterized deficits in social functioning, and lead those interacting with them to feel uncomfortable (Krause, Steimer, Sanger-Alt, & Wagner, 1989). Might an analysis of the social consequences of emotion suppression help to shed light on the social difficulties associated with schizophrenia? These questions provide a glimpse of just how rich the marriage of affective science and the study of psychopathology promises to be.

Emotion Regulation and Physical Health

It has long been suspected that the emotion regulation required by civilization may come at a steep price (Mauss & Gross, in press). In the popular literature, this price has often been represented in terms of the adverse consequences emotion inhibition may have for physical health (e.g., Martin, 1998). In the scientific literature, too, there have been reports linking emotion inhibition to a variety of diseases ranging from asthma (Florin, Freudenberg, & Hollaender, 1985) to cancer (Greer & Watson, 1985). Recently, particular attention has been given to the role of emotion and emotion regulation in cardiovascular diseases, which represent the single most important source of disability and mortality worldwide (Guyton & Hall, 1997; Murray & Lopez, 1997) and typify the slow-developing, multifactorial disease processes that are most influenced by psychosocial factors (Depue & Monroe, 1986; Sapolsky, 1998).

Our laboratory studies to date have focused on the acute physiological consequences of reappraisal and suppression. However, because there appear to be consistent individual differences in emotion regulation styles, we might expect that such differences should have cumulative effects. For example, each time emotion is suppressed, physiological responses are magnified. Any one physiological response of increased intensity is unlikely to have dele-

terious consequences. But if such responses recur day after day after day, there might be adverse health consequences. A recent study illustrates how such a hypothesis might be tested. Heart attack survivors were divided into four groups, depending on their scores on measures of distress and the tendency to inhibit emotion (Denollet et al., 1996). The subgroup scoring high on both distress and inhibition had a significantly higher death rate (27%) than other patients (7%).

Emotion Regulation and Other Forms of Self-Regulation

Emotions are by no means the only impulses we regulate. We also regulate other affective processes such as moods (Carver & Scheier, 1990), motivational impulses such as sex and hunger (Baumeister & Heatherton, 1996), and cognitive processes such as thoughts (Wegner, 1994). Are impulses to respond—and the processes by which they are modulated—crucially similar, as suggested by Block and Block's (1980) conception of ego control and by recent discussions of impulsivity (Newman et al., 1993)? Or are each of these forms of self-regulation importantly distinct, with different triggers, mechanisms, and outcomes?

At present, it seems wise to maintain distinctions among various forms of affect regulation. For example, how we go about improving a bad mood (e.g., exercise, improved diet) may or may not be how we go about altering our emotional experiences and expressive behavior (e.g., keeping a still face). It also seems reasonable to maintain distinctions between processes that regulate emotion, on the one hand, and those that regulate thoughts (e.g., Wegner & Bargh, 1998) or well-learned operant responses (e.g., Logan, Schachar, & Tannock, 1997) on the other. Presumably, the coordinated set of response tendencies postulated in emotion is absent in some other forms of self-regulation, but the implications of such differences need to be investigated. It is less clear whether processes that regulate emotion should be distinguished from those that regulate hunger, thirst, aggression, and sexual arousal (Buck, 1985). Diverse forms of self-regulation result in similar kinds of "ego depletion," which suggests that a common resource may be consumed in diverse forms of regulation (Baumeister, Bratslavsky, Muraven, & Tice, 1998). However, the evidence we have reviewed concerning the affective, cognitive, and social consequences of reappraisal and suppression suggests caution in too quickly lumping together diverse forms of self-regulation. One clear priority for future research is to examine other forms of self-regulation that—like emotion regulation—shape the trajectory from impulse to action.

Concluding Comment

It is often necessary to down-regulate negative emotions. Road rage, office rage, and even air rage are now regularly in the news,

providing compelling anecdotal evidence of the damage that is done by failures to regulate negative emotions such as anger. The grim statistics on spousal, child, and elder abuse stand as a further testament to the serious harm that can come from dysregulated emotions. However, there are many ways to go about regulating emotions, and it is far from clear which strategies work best when it is necessary to regulate emotions.

Using a process model of emotion regulation as an overarching framework, I have shown that suppression decreases not only negative but also positive emotion-expressive behavior. Worse, suppression appears to have little impact on negative emotion experience, while decreasing positive emotion experience. Suppression also is associated with increased sympathetic activation of the cardiovascular system that appears to be out of keeping with metabolic demand. By contrast, reappraisal decreases negative emotion experience and expression, while increasing positive emotion experience and expression. Unlike suppression, reappraisal is not associated with increased sympathetic activation. Suppression also consumes cognitive resources, impairing memory for information presented during the emotion regulation period. Reappraisal, by contrast, appears to have no such cognitive consequences. Even in the social domain, suppression appears to have less desirable consequences than reappraisal. Compared to reappraisal, suppression leads individuals to share less of their positive and negative emotions, resulting in weakened social support, and even being less liked. Also unlike reappraisal, suppression leads to increased blood pressure in social partners.

An analysis of these two forms of regulation consistently seems to favor reappraisal over suppression. However, it is important to note that reappraisal may not always be preferable to suppression. There may be times when it would be very difficult to reappraise, and suppression is the only way to regulate negative emotions that have arisen. Furthermore, it may be maladaptive to change one's accurate construal of a situation that compromises important goals, and far better to work to change the situation than to reappraise. After all, emotions comprise integrated packages of response tendencies that help to coordinate adaptive behavior in the face of challenge (Levenson, 1994). If these response tendencies are habitually and inflexibly overridden, an individual's ability to manage these challenges successfully may be significantly compromised. Thus, if one has a bad feeling about one's surroundings, but one inhibits the tendency to withdraw that is associated with fear, one may take unwise risks. Similarly, if one is upset at how one is being treated, but inhibits one's anger, one's treatment is unlikely to improve. What seems likely to prove essential is having a rich palette of emotion regulatory response options that can be flexibly employed, with a clear appreciation of the relative costs and benefits of using any given regulatory strategy in a particular situation.

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(RECEIVED September 19, 2001; ACCEPTED December 7, 2001)