Journal of Personality and Social Psychology
1998, Vol. 74, No. 1, 224–237

0022-3514/98/$3.00

Antecedent- and Response-Focused Emotion Regulation: Divergent Consequences for Experience, Expression, and Physiology

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Using a process model of emotion, a distinction between antecedent-focused and response-focused emotion regulation is proposed. To test this distinction, 120 participants were shown a disgusting film while their experiential, behavioral, and physiological responses were recorded. Participants were told to either (a) think about the film in such a way that they would feel nothing (*reappraisal*, a form of antecedent-focused emotion regulation), (b) behave in such a way that someone watching them would not know they were feeling anything (*suppression*, a form of response-focused emotion regulation), or (c) watch the film (a control condition). Compared with the control condition, both reappraisal and suppression were effective in reducing emotion-expressive behavior. However, reappraisal decreased disgust experience, whereas suppression increased sympathetic activation. These results suggest that these 2 emotion regulatory processes may have different adaptive consequences.

What happens when we get so angry with an erratic driver that we feel like yelling at him, yet we do not? Or when we feel down but want to be in good spirits for a party? Or when we find something outrageously funny but need to stifle our laughter during a formal ceremony? At times such as these, we regulate our emotions. That is, we attempt to influence which emotions we have, when we have them, and how these emotions are experienced or expressed.

As these examples suggest, emotion regulation is a regular feature of everyday life (Morris & Reilly, 1987; Rippere, 1977). Nine out of 10 undergraduates report that they alter their emotions, about once a day, and most can readily recall a recent example (Gross, Feldman Barrett, & Richards, 1998). Indeed, attempts at regulating emotions are so common that we typically take emotion regulation for granted, noticing only its absence, such as when a child throws a temper tantrum (Thompson, 1991), a friend shows too little happiness at our good news, a depressed colleague is unable to stem overwhelming feelings of sadness (Gross & Muñoz, 1995), or we lose our composure in the heat of the moment and say things we later regret.

Considering the ubiquity of emotion regulation, one might expect theoretical and empirical analyses to abound. Surprisingly, this is not the case.[1] Moreover, the two broad literatures in which emotion regulation has been considered, one concerned with psychological health and the other with physical health, offer remarkably divergent conclusions about the consequences of emotion regulation. In the following sections, I first review these two literatures. I then use a process model of emotion to draw a distinction between two forms of emotion regulation and suggest that this distinction may help to reconcile these two literatures.

Emotion Regulation: Less Stress and Better Psychological Health

Clinical tradition dating back to Freud has emphasized that psychological health hinges on how affective impulses are regulated (Freud, 1923/1961). This has led psychodynamic researchers to focus on the health consequences of characteristic emotion regulatory styles (e.g., Haan, 1993; Vaillant & Drake, 1985). Recently, proponents of other theoretical persuasions also have elaborated the view that psychological health requires that emotional impulses be regulated properly. For example, Beck, Rush, Shaw, and Emery (1979) and Seligman (1991) have argued that cognitive strategies may be used to prevent or alleviate depression and Barlow (1991) has advanced a model of emotion dysregulation and affective psychopathology.

But what support is there for the proposition that emotion regulation has measurable beneficial consequences? Lazarus and colleagues provided some of the first evidence in an influential series of studies (Lazarus & Opton, 1966). In one representative study, Lazarus and Alfert (1964) showed students a filmed circumcision ritual and manipulated the accompanying soundtrack. 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 the joyful

This research was supported by Behavioral Science Track Award for Rapid Transition (B/START) Grant MH53859 from the National Institute of Mental Health. I would like to thank Paul Ekman, Oliver P. John, Richard S. Lazarus, Jane M. Richards, Jeanne Tsai, and Robert Zajonc for their thoughtful comments on a draft of this article and Robert W. Levenson for making his laboratory facilities available. This article benefited from the comments of both members of the Emotion Research Group at its February 1996 meeting at Vanderbilt University, Nashville, Tennessee, and members of the International Society for Research on Emotion at its August 1996 meeting at the University of Toronto, Toronto, Ontario, Canada.

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[1] In the developmental literature, however, there has been a recent surge of interest in emotion regulation (e.g., Campos, Campos, & Barrett, 1989; Eisenberg et al., 1995; Fox, 1994; Garber & Dodge, 1991).

aspects of the procedure. Other participants heard no soundtrack at all. Compared with the no-soundtrack condition, participants who heard the soundtrack had slower heart rates, lower skin conductance levels, and more pleasant mood ratings. These findings suggested that leading participants to view the film less negatively decreased the stressfulness of what otherwise would have been a quite distressing experience.

Studies such as this one demonstrated that cognitive strategies could reduce stress responses and suggested that such regulation might have benefits for psychological health. This view has been incorporated into theories of emotion (e.g., Frijda, 1988; Lazarus, 1991; Plutchik, 1980), coping and stress reduction (e.g., Katz & Epstein, 1991; Lazarus & Folkman, 1984; Meichenbaum, 1985), delay of gratification (Mischel, 1974; Shoda, Mischel, & Peake, 1990), and psychopathology (e.g., Barlow, 1988; Beck et al., 1979; Sayette, 1993). Despite its wide currency, however, the view that cognitive strategies may be used to decrease negative emotion has a surprisingly weak empirical foundation. Since Lazarus's pioneering studies, there has been at least one failure to replicate (Steptoe & Vogele, 1986) and only one successful replication (Dandoy & Goldstein, 1990). As Wegner (1994) demonstrated so elegantly in the realm of thought suppression, attempts to influence ongoing mental processes may have paradoxical or unintended effects. This suggests caution in assuming that the cognitive control of emotion has uniquely, or even primarily, salutary consequences.

Emotion Regulation: More Physiological Activation and Worse Physical Health

With the advent of psychosomatic medicine, the impact of emotion regulation on physical health took center stage (Alexander, 1939). Here, however, emotion regulation was cast not as hero, but as villain. Indeed, the notion that the regulation of negative emotions could have deleterious consequences became a cornerstone of the entire psychosomatic enterprise (Alexander & French, 1946; Dunbar, 1954). The chronic inhibition of sadness and crying was thought to lead to respiratory disorders, such as asthma (Alexander, 1950; Halliday, 1937); the chronic inhibition of affiliative tendencies was linked to gastrointestinal disorders, such as ulcers (Alexander, 1950); and the chronic inhibition of anger was associated with cardiovascular disorders, such as hypertension (Alexander, 1939).

Although some of these hypotheses have fallen into disfavor, others have remained popular, such as the view that chronic hostility and anger inhibition may be linked to hypertension and coronary heart disease (e.g., Friedman & Booth-Kewley, 1987; Manuck & Krantz, 1986; T. W. Smith, 1992; Steptoe, 1993). In addition, new hypotheses involving emotion regulation have emerged, suggesting that emotion inhibition may exacerbate minor ailments (Pennebaker, 1990) and that inexpressiveness may accelerate cancer progression (Fawzy et al., 1993; Gross, 1989; Spiegel, Bloom, Kraemer, & Gottheil, 1989).

The theme that unites these hypotheses is that tight control of negative emotions may adversely affect physical health. Just how this might happen is not known, but the underlying premise usually is that inhibiting emotion leads to acute increases in physiological response parameters that may, over the long term, do damage (Krantz & Manuck, 1984). Results of studies that have examined the acute physiological effects of emotion regulation empirically have been mixed (for a review, see Gross & Levenson, 1993), but more recent work has shown that emotional suppression leads to acute increases in sympathetic activation of the sort postulated by these models (Gross & Levenson, 1993, 1997).

Integrating the Two Literatures

When placed side by side, the literatures on psychological and physical health give the uncomfortable impression that emotion regulation may benefit psychological health but harm physical health. Are psychological well-being and physical well-being really at odds with one another?

To address this issue, I have adopted the process model of emotion shown in Figure 1. This model is a distillation of major points of convergence among researchers concerned with emotion (e.g., Arnold, 1960; Ekman, 1972; Frijda, 1986; Izard, 1977; Lang, 1995; Lazarus, 1991; Levenson, 1994; Plutchik, 1980; Scherer, 1984; Tomkins, 1984). According to this consensual model, emotion begins with an evaluation of external or internal emotion cues. Certain evaluations trigger a coordinated set of behavioral, experiential, and physiological emotional response tendencies that together facilitate adaptive responding to perceived challenges and opportunities. However, these response tendencies may be modulated, and it is this modulation that gives final shape to manifest emotional responses.

Clearly, this input–output model does not do—and is not meant to do—full justice to the complexities of emotion. For example, this model does not adequately represent the multifaceted evaluation and modulation processes. Neither does this model capture the dynamic and recursive nature of emotion. Nor does it provide sufficient means of representing differences among emotions or differences among individuals. These limitations notwithstanding, this model does suggest two major ways in which emotions might be regulated.

As shown in Figure 1, this model suggests that emotions may be regulated either by manipulating the input to the system (*antecedent-focused* emotion regulation) or by manipulating its output (*response-focused* emotion regulation). Within these two broad classes of emotion regulation, more fine-grained distinctions may be made (see Frijda, 1986; Gross, 1998). For example, antecedent-focused emotion regulation includes *situation selection,* in which one approaches or avoids certain people or situations on the basis of their likely emotional impact; *situation modification,* in which one modifies an environment so as to alter its emotional impact; *attention deployment,* in which one turns attention toward or away from something in order to influence one's emotions; and *cognitive change,* in which one reevaluates either the situation one is in or one's capacity to manage the situation so as to alter one's emotions. Response-focused emotion regulation also includes a multiplicity of types, such as strategies that *intensify, diminish, prolong,* or *curtail* ongoing emotional *experience, expression,* or *physiological responding.*[2]

[2] The distinction between antecedent- and response-focused emotion regulation should not be confused with Lazarus and colleagues' distinction between *problem-* and *emotion-*focused coping, a distinction recently retired in favor of more specific coping strategies (Folkman & Lazarus, 1988). *Emotion-focused* coping refers to efforts to regulate stressful emotion and thus is coextensive with the superordinate category

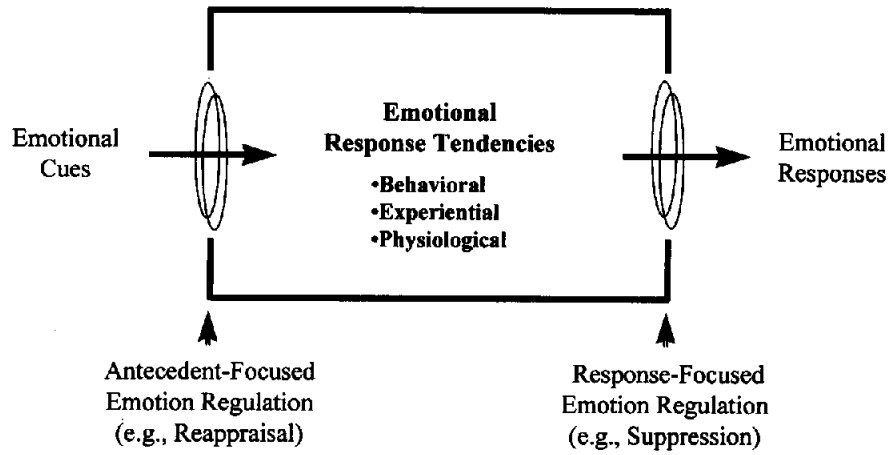

Figure 1. A consensual process model of emotion that highlights two major classes of emotion regulation.

Yet even this initial distinction between two broad classes of emotion regulation may help to reconcile the two literatures reviewed above. The psychological health literature might be seen as concerned primarily with cognitive forms of antecedent-focused emotion regulation, that is, regulation before the emotion is triggered. The physical health literature, by contrast, might be seen as concerned primarily with response-focused emotion regulation that involves the inhibition of emotional response tendencies once the emotion already has been generated.

Might this model also be used to make more specific predictions regarding these two forms of emotion regulation? In the context of a potentially stressful situation, antecedent-focused emotion regulation might take the form of reevaluating the situation so as to decrease its emotional relevance (see Lazarus, 1991; Scherer, 1984; C. A. Smith & Ellsworth, 1985). This should decrease the extent to which emotion response tendencies are activated, leading to lesser subjective, physiological, and expressive signs of negative emotion than otherwise would have been evident. Response-focused emotion regulation, by contrast, should target response tendencies that have been produced once the emotion is under way. For example, consider *suppression,* defined as the conscious inhibition of ongoing emotion-expressive behavior. Because regulatory efforts selectively focus on behavior, we would expect lesser emotion-expressive behavior. The subjective consequences of hiding expressive behavior are a matter of some dispute, but recent reviews (Gross & Levenson, 1993, 1997) suggest that suppression should have little or no impact on subjective experience, at least in the context of a negative emotion.[3] Because inhibitory pathways would be activated concurrently with the physiological response tendencies associated with emotion, we might expect a mixed physiological state. This state would include increased sympathetic activation due to the additional task of suppressing behavioral response tendencies as they are generated (Gross & Levenson, 1993, 1997); decreased somatic signs of emotion, because these are the target of suppression; and decreased heart rate, which is influenced by somatic activity (Obrist, 1981).

The Present Study

The goal of the present study was to test the general proposition that "shutting down" an emotion at the front end would have different consequences from shutting down an emotion that already had generated powerful response tendencies. Thus, the present study directly compared one form of antecedent-focused emotion regulation, reappraisal, and one form of response-focused emotion regulation, suppression, with a control condition. *Reappraisal* was defined as interpreting potentially emotion-relevant stimuli in unemotional terms (see Speisman, Lazarus, Mordkoff, & Davison, 1964). *Suppression* was defined as inhibiting emotion-expressive behavior while emotionally aroused (Gross & Levenson, 1993).

A potent film stimulus known to elicit disgust was used. This film's potency ensured that most participants would have the desired emotional response tendencies (Gross & Levenson, 1995). However, it also increased the likelihood that some participants would be overwhelmed. To decrease this possibility, all participants first viewed a neutral and a disgusting film under no special instructions, to acquaint them with the film materials and procedures. Only then did they view a second disgusting film, during which participants in the two experimental conditions were to regulate their responding while control participants simply watched the film.

Although emotion theorists agree that emotions involve changes in the response domains of experience, expression, and physiology, previous studies of emotion regulation typically

of emotion regulation (at least for "stressful" emotions). By contrast, *problem-focused* coping refers to attempts to modify a troublesome environment and thus is one form of antecedent-focused emotion regulation.

[3] The opposite prediction would be made by the *facial feedback* hypothesis (FFH). However, recent reviews and empirical findings suggest that the FFH-inspired notion that suppression and exaggeration are opposite ends of a single continuum may be mistaken (see Gross & Levenson, 1993, 1997).

have sampled only one or two of these domains. One unique contribution of this study was the examination of all three domains. By directly comparing two forms of emotion regulation with a control condition, this study tested three hypotheses.

The first hypothesis concerned expressive behavior. I predicted that both reappraisal and suppression participants would show fewer behavioral signs of disgust than would control participants. I expected this effect to be evident whether expressive behavior was assessed in discrete terms (i.e., specific signs of disgust), dimensional terms (i.e., the intensity of overall emotional responding), or global terms (i.e., overall activity levels). Because of the way I operationalized reappraisal and suppression, I did not expect emotion regulation participants to look away from the film or avert their gaze to a greater extent than control participants (which would represent yet another form of emotion regulation).

The second hypothesis concerned subjective experience. I expected that reappraisal participants would report less subjective experience of emotion than control participants; in the context of a film that specifically targeted disgust subjective experience, I expected that these reductions would be specific to disgust. By contrast, on the basis of prior findings, I predicted that suppression and control participants would report equivalent experience of disgust.

The third hypothesis concerned physiological responding. Here, my expectation was that reappraisal participants would show less sympathetic activation (as measured by finger pulse amplitude, finger temperature, and skin conductance), less somatic activity, and lower heart rates than control participants. By contrast, because I conceptualize suppression as involving the activation of inhibitory processes over and above the ongoing emotion, I expected suppression participants to evidence a mixed physiological pattern, characterized by greater sympathetic activation than control participants but less somatic and heart rate reactivity.

Method

Overview

Participants watched a disgust-eliciting film under one of three conditions. In the reappraisal condition, participants were asked to adopt a detached and unemotional attitude as they watched the film. In the suppression condition, participants were asked to behave in such a way that a person watching them would not know that they were feeling anything at all. The watch condition served as a control; in this condition, participants were simply asked to watch the film. Participants were videotaped, and their physiological responses were monitored. Participants also used emotion-rating forms to describe their subjective experience of emotion.

Participants

One hundred twenty undergraduates (60 men and 60 women) participated in individual experimental sessions, to fulfill a research requirement in their psychology course.[4] On average, participants were 21 years old (SD = 4.1). The ethnic composition of this sample was mixed: 1% African American, 55% Asian American, 33% Caucasian, 3% Latino, and 8% other.

Stimulus Films

Three well-validated silent films were used (Gross & Levenson, 1995). The first film (1 min) was a dynamic abstract display that elicits very little emotion of any kind. The second and third films showed medical procedures. These were first used by Paul Ekman of the University of California, San Francisco (see Ekman, Friesen, & O'Sullivan, 1988). The first showed the treatment of burn victims (burn film) and was 55 s long. The second showed a close-up of the amputation of an arm (amputation film) and was 64 s long. In pretesting, these two films elicited self-reported disgust, with little report of other emotions.

Procedure

On arrival, participants were seated in a well-lit 4 × 6–m room. They were informed that the experiment was concerned with emotion and that they would be videotaped. Physiological sensors were attached, and participants used a self-report form to answer questions concerning demographics and current mood. Participants then were shown three short films on a 19-in. color television monitor at a distance of 1.75 m. All instructions were prerecorded and presented via the television monitor.

Before the first and second film trials, participants were told that the television screen would be blank for about a minute and that this time should be used to "clear your mind of all thoughts, feelings, and memories." After this 1-min baseline period, participants received the following instructions: "We will now be showing you a short film clip. It is important to us that you watch the film clip carefully, but if you find the film too distressing, just say 'stop.' " These instructions were followed by either the neutral film (first trial) or the burn film (second trial). After each film, there was a 1-min postfilm period, at the end of which participants completed an emotion-rating form (described below), to assess their emotional reactions during the film.

The third trial began with the same 1-min baseline procedure. Participants then received one of three instructions, determined by random assignment to one of three conditions (watch, reappraisal, or suppression). Assignment was constrained so that equal numbers of men and women were assigned to each condition. For watch participants (n = 40), the foregoing instructions were repeated. Reappraisal participants (n = 40) received the following instructions:

> We will now be showing you a short film clip. It is important to us that you watch the film clip carefully, but if you find the film too distressing, just say "stop." This time, please try to adopt a detached and unemotional attitude as you watch the film. In other words, as you watch the film clip, try to think about what you are seeing objectively, in terms of the technical aspects of the events you observe. Watch the film clip carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all.

Participants in the suppression condition (n = 40) received the following instructions:

> We will now be showing you a short film clip. It is important to us that you watch the film clip carefully, but if you find the film too distressing, just say "stop." This time, if you have any feelings as you watch the film clip, please try your best not to let those feelings show. In other words, as you watch the film clip, try to behave in such a way that a person watching you would not know

[4] A total of 127 students initially participated. Of these, 7 were excluded from analyses because they requested to stop the amputation film (3 in the watch condition and 4 in the suppression condition).

you were feeling anything. Watch the film clip carefully, but please try to behave so that someone watching you would not know that you are feeling anything at all.

Participants then watched the amputation film, which was followed by a 1-min postfilm period. After the postfilm period, participants completed an emotion-rating form and answered several additional questions concerning their responses to the amputation film.

Measures

Data were collected in three response domains: expressive behavior, subjective experience, and physiology. Because the first film (abstract display) was included solely to accustom participants to the laboratory, data from this film were not analyzed. For the burn and amputation films, data reduction for behavioral and physiological data was based on the prefilm (1 min), instructional (1 min), film (approximately 1 min), and postfilm (1 min) periods. Self-report data were available for baseline and film periods. As manipulation checks, after the amputation film, participants rated three statements using a 9-point Likert-type scale, ranging from 0 (*strongly disagree*) to 8 (*strongly agree*): (a) During the film, I tried not to feel anything at all; (b) during the film, I felt emotions but tried to hide them; and (c) during the film, I reacted completely spontaneously.

Behavior. A remote control video camera placed behind darkened glass unobtrusively recorded participants' facial behavior and upper body movement. Participants' behavioral responses were rated by four coders (two men and two women), who were unaware of stimuli and experimental conditions. Coders used a modified version of the Emotional Behavior Coding System (Gross & Levenson, 1993), including (a) overall disgust, (b) emotional intensity, (c) overall activity (an a priori composite defined by four codes: mouth movement, facial movement, face touching, and body movement), and (d) obscures vision. The first three measures were designed to assess emotion-expressive behavior in discrete (disgust), dimensional (intensity), and global (activity) terms. Obscures vision was a control variable, designed to assess whether emotion regulation participants prevented themselves from seeing the films by shielding their gaze or looking away from the screen. Reliabilities were good (mean r = .92), ranging from .83 for disgust to .98 for obscures vision. As expected, the four components of the activity composite were correlated, and the composite had alphas ranging from .68 to .75. Final values for each of the measures were determined by averaging the coders' ratings. Participants received scores for baseline, instructional, film, and postfilm periods; change scores were computed by subtracting baseline scores from each of the other scores.

Subjective experience. Participants rated how they felt before each film (baseline rating) and, after viewing each film, how they had felt during the film (film rating). On each occasion, participants rated their disgust, which was embedded in a set of 15 distractor items (amusement, anger, arousal, confusion, contempt, contentment, embarrassment, fear, happiness, interest, pain, relief, sadness, surprise, and tension). Each emotion was rated using a 9-point Likert-type scale, ranging from 0 (*none*) to 8 (*most in my life*), adapted from Ekman, Friesen, and Ancoli (1980). The primary focus was on disgust experience, but change scores were computed for all 16 measures by subtracting the baseline score from the film score.

Physiology. Five measures were selected for use in this study to provide a broad index of the activity of physiological systems especially relevant to emotional responding. The first three measures assessed activation of the sympathetic branch of the autonomic nervous system:

1. *Finger pulse amplitude.* A UFI photoplethysmograph recorded the amplitude of blood volume in the finger using a photocell taped to the distal phalange of the second finger of the nondominant hand.

2. *Finger temperature.* A thermistor attached to the palmar surface of the distal phalange of the fourth finger recorded temperature in degrees Fahrenheit.

3. *Skin conductance level.* A constant-voltage device was used to pass a small voltage between Beckman regular electrodes (using an electrolyte of sodium chloride in Unibase) attached to the palmar surface of the middle phalanges of the first and third fingers of the nondominant hand.

The fourth and fifth measures assessed somatic activity and heart rate, respectively:

4. *General somatic activity.* An electromechanical transducer attached to the platform under the participant's chair generated an electrical signal proportional to the amount of movement in any direction.

5. *Cardiac interbeat interval.* Beckman miniature electrodes with Redux paste were placed in a bipolar configuration on opposite sides of the participant's chest. The interbeat interval was calculated as the interval (in milliseconds) between successive R-waves.

During the experimental sessions, laboratory software computed second-by-second averages for each of the five physiological measures throughout each baseline, instructional, film, and postfilm period. These second-by-second physiological values later were used to compute scores for each participant representing the averages of the physiological variables for the baseline, instructional, film, and postfilm periods. Change scores for the five measures were computed by subtracting baseline scores from instructional, film, and postfilm periods.

Results

Random Assignment and Manipulation Checks

All participants viewed the initial disgust-eliciting film (the burn film) under the same instructions to simply watch the film. This film therefore provided an opportunity to evaluate the effectiveness of our random assignment of participants to experimental conditions. Overall multivariate analyses of variance (MANOVAs) for the behavioral, subjective, and physiological domains failed to reveal any differences among participants assigned to the three instructional groups during this film, suggesting that our random assignment had been successful.[5]

As emotion regulation participants received their instructions, was there evidence of preparatory activity that might distinguish them from watch participants? In the behavioral domain, reappraisal participants showed greater increases in emotional intensity than watch participants (e.g., interest, concentration), and suppression participants showed greater increases in activity than watch participants (see Table 1).[6] As compared with watch participants, both reappraisal and suppression participants showed greater decreases in finger pulse amplitude and finger temperature and greater increases in skin conductance and somatic activity (see Table 1). In general, physiological responding was somewhat greater in the suppression condition

[5] In each analysis, participant sex was initially included as a factor. Because sex did not interact with instructional condition, sex was dropped from the final analyses.

[6] As might be expected, during the prefilm period, there were no group differences in ratings of disgust-expressive behavior or obscuring vision.

Table 1
Mean Change in Expressive Behavior and Physiological Responding During the Instructional Period

Measure	Instructions					
	Reappraise		Watch		Suppress	
	M	*SD*	*M*	*SD*	*M*	*SD*
Behavioral						
Emotional intensity	0.90_a	1.01	0.35_b	0.86	$0.58_{a,b}$	0.87
Overall activity	-0.06_a	0.81	-0.24_a	0.76	0.30_b	0.60
Physiological						
Finger pulse amplitude	-2.26_a	3.19	-0.13_b	2.07	-4.13_c	2.78
Finger temperature	-0.07_a	0.52	0.18_b	0.62	-0.13_a	0.45
Skin conductance	0.06_a	0.62	-0.20_b	0.51	0.36_c	0.55
Somatic activity	0.06_a	0.14	-0.01_b	0.13	0.12_a	0.23
Interbeat interval	-25.90_a	39.62	-10.99_a	36.54	-47.73_b	52.09

Note. Means in a given row with different subscripts differ significantly at $p < .05$, two-tailed.

than in the reappraisal condition, and only suppression participants showed greater increases in heart rate than watch participants. Although the behavioral signs of preparation differed somewhat for the two groups, the overall similarity in responses suggests that these preparatory effects may be quite general. When participants in the two emotion regulation groups heard that they soon would be called on to manage their emotions, they appeared to steel themselves, and their heightened autonomic activation (relative to the watch participants) suggests both their concern about the assigned task and the efforts they made to prepare themselves.

After the amputation film, three questions were administered to assess compliance with instructions. Compared with the watch participants, both suppression participants, $t(78) = 4.7$, $p < .001$, and reappraisal participants, $t(78) = 3.2$, $p < .01$, reported reacting less spontaneously during the amputation film, consistent with their having been asked to regulate their emotions. As expected, reappraisal participants reported trying not to feel the emotion to a greater degree than watch participants, $t(78) = 8.8$, $p < .001$, and suppression participants, $t(78) = 2.2$, $p < .05$. Also as expected, suppression participants reported feeling but hiding emotions to a greater degree than watch participants, $t(78) = 7.3$, $p < .001$, and reappraisal participants $t(77.7) = 2.0$, $p < .05$.

Emotion Regulation and Expressive Behavior

Hypothesis 1 predicted that emotion regulation participants would show less expressive behavior during film and postfilm periods than watch participants. Indeed, as presented in Table 2, this is precisely what was found. During the film period, reappraisal and suppression participants showed lesser increases in disgust, emotional intensity, and activity than watch participants. For disgust and intensity, this reduction was somewhat more pronounced for suppression participants than for reappraisal participants. During the postfilm period, reappraisal and suppression participants showed lesser increases in disgust than watch participants, and suppression participants showed lesser increases in intensity than reappraisal or watch participants. There were no differences among groups in the degree to which participants obscured their vision, indicating that emotion regulation participants did not simply cover their eyes to lessen the emotional impact of the film.

Emotion Regulation and Subjective Experience

Extensive pretesting had shown that the amputation film generally elicits high levels of disgust experience. Hypothesis 2 suggested that reappraisal would lessen the subjective impact of this film but that suppression would not. As presented in Figure 2, this was indeed the case. Reappraisal participants had lesser increases in disgust experience while watching the film than watch participants, $t(77) = 2.2$, $p < .05$, whereas suppression participants did not, $t(78) = 0.8$, *ns*.

Was this alteration in subjective experience specific to the target emotion of disgust? Or was there a general dulling of subjective experience? The other emotion terms were included as distractors to make the key comparison less obvious to participants, but they permitted an examination of whether this reduction in disgust was part of a larger pattern of altered subjective experience. To test this possibility, I conducted an overall three-level condition (watch, suppress, or reappraise) MANOVA for the 15 other emotion experience ratings. The condition effect was not significant, $F(30, 202) = 1.1$, suggesting that emotion regulation did not have an overall effect on experience.

Emotion Regulation and Physiology

Hypothesis 3 predicted that reappraisal participants would show less sympathetic, somatic, and heart rate responding than the watch participants during the film and postfilm periods. By contrast, suppression participants were hypothesized to show greater sympathetic responding during the film and postfilm periods than watch participants but less somatic and heart rate responding. As presented in Table 3, analyses were conducted using period averages; continuous physiological plots also are presented for the three measures of sympathetic activation, to

Table 2
Mean Change in Expressive Behavior During the Film and Postfilm Periods

	Instructions					
	Reappraise		Watch		Suppress	
Behavioral measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Target variables						
Overall disgust						
Film	0.82_a	1.11	2.30_b	2.10	0.35_c	1.00
Postfilm	0.35_a	0.92	0.85_b	1.27	0.13_a	0.40
Emotional intensity						
Film	1.03_a	1.05	2.27_b	1.69	0.45_c	0.90
Postfilm	0.80_a	1.07	1.00_a	1.01	0.30_b	0.52
Overall activity						
Film	-0.12_a	0.66	0.24_b	0.96	-0.12_a	0.56
Postfilm	-0.01_a	0.68	0.11_a	0.77	-0.10_a	0.69
Control variable						
Obscures vision						
Film	0.43_a	1.58	0.53_a	1.52	0.53_a	3.16
Postfilm	0.00_a	0.00	0.00_a	0.00	0.00_a	0.00

Note. Means in a given row with different subscripts differ at $p < .05$, two-tailed.

elucidate the dynamic effects of emotion regulation (see Figures 3–5).

Did the two emotion regulation conditions diverge from the control condition? As predicted, during the film period, suppression participants showed greater sympathetic activation than watch participants, and this effect was evident for all three measures of sympathetic responding. Compared with both watch and reappraisal participants, suppression participants showed greater decreases in finger pulse amplitude and greater decreases in finger temperature (both indicative of greater vasoconstriction and hence greater sympathetic activation), as well as greater increases in skin conductance (another sign of increased sympathetic activation). This effect continued into the postfilm period in a somewhat attenuated form. Here, suppression participants had greater decreases in finger pulse amplitude and finger temperature than the other two groups. Unexpectedly, however, suppression participants did not show less somatic or heart rate responding than watch participants during either film or postfilm periods. The hypothesis that reappraisal participants would show fewer physiological signs of emotion than watch participants also was not confirmed. Reappraisal participants showed physiological responses that were indistinguishable from watch participants during film and postfilm periods.

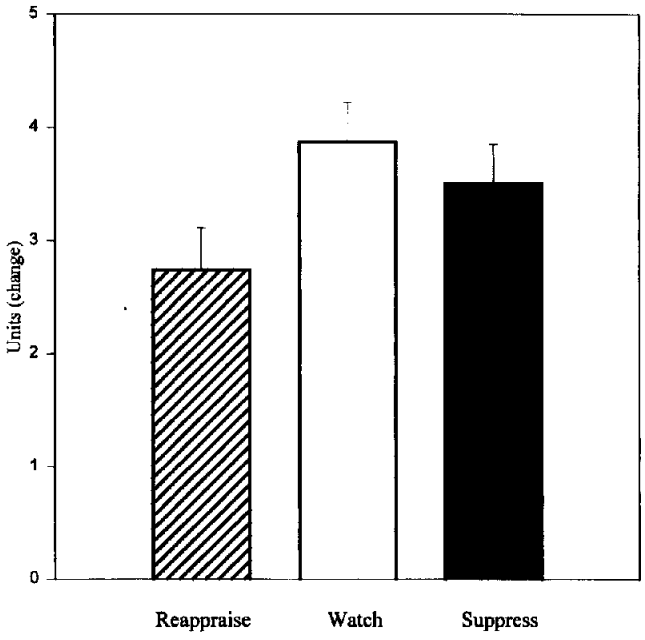

Figure 2. Mean change in self-reported disgust experience during the amputation film for the three instructional groups. Error bars indicate standard error of the mean.

Discussion

These findings suggest a number of differences between the antecedent-focused and response-focused forms of emotion regulation studied here. In the following sections, I review the present results and discuss their implications for psychological and physical health.

What Happens When We Regulate Our Emotions?

Despite striking commonalties in the effects of preparing to regulate emotions, participants in the two emotion regulation conditions showed quite different responses during the actual period of emotion regulation. Reappraisal led to decreases in both behavioral and subjective signs of emotion, with no hint of elevations in physiological responding. Thus, it was a relatively effective means of inhibiting emotion. Suppression, by contrast, although effective at diminishing expressive behavior, had no impact on subjective experience and led to increases in multiple indices of sympathetic nervous system activation.

Table 3
Mean Change in Physiological Responding During the Film and Postfilm Periods

	Instructions					
	Reappraise		Watch		Suppress	
Physiological measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Sympathetic activation						
Finger pulse amplitude						
Film	-2.70_a	4.40	-3.25_a	4.77	-6.08_b	4.71
Postfilm	-0.60_a	3.28	-0.01_a	3.82	-2.17_b	3.82
Finger temperature						
Film	-0.49_a	0.83	-0.19_a	1.00	-1.13_b	0.79
Postfilm	-0.54_a	1.10	-0.45_a	1.35	-1.47_b	1.31
Skin conductance						
Film	0.13_a	0.87	0.34_a	1.28	0.79_b	0.89
Postfilm	-0.10_a	0.75	0.10_a	0.90	0.21_a	0.82
Activity and heart rate						
Somatic activity						
Film	-0.06_a	0.11	-0.05_a	0.18	-0.08_a	0.25
Postfilm	0.03_a	0.11	0.05_a	0.25	-0.02_a	0.22
Interbeat interval						
Film	38.27_a	44.87	33.81_a	51.83	32.61_a	70.38
Postfilm	9.32_a	26.40	12.07_{ab}	29.43	30.68_b	56.73

Note. Means in a given row with different subscripts differ from one another at $p < .05$. All tests are two-tailed except skin conductance, which was predicted on the basis of results of three prior studies (Gross & Levenson 1993, 1997).

Effects of reappraisal. On the basis of the process model of emotion depicted in Figure 1, I hypothesized that reevaluating the significance of a potentially emotion-eliciting film would lead to fewer experiential, behavioral, and physiological signs of emotion than simply watching the film. Indeed, compared with watch participants, reappraisal participants reported less disgust experience and showed fewer behavioral signs of disgust, suggesting the efficacy of this emotion regulatory strategy, even in the context of a potent negative emotion. This point is reinforced by the observation that although 7 watch and suppression condition participants asked for the film to be stopped (and thus were replaced; see footnote 4), none of the reappraisal participants did so, $\chi^2(1, N = 120) = 3.41$, $p = .07$ (one-tailed).

Surprisingly, however, reappraisal and watch participants had comparable physiological responses to the film. An inspection of the continuous plots of physiological responding (see Figures 3–5) reveals that reappraisal participants may have shown slightly less physiological activation, but these differences were not significant. Why didn't reappraisal decrease physiological responding? Null findings are susceptible to divergent explanations, but one possibility is that reappraisal simply does not affect the physiological component of an emotional response (Steptoe & Vogele, 1986). Given the small correlations among the components of an emotional response (e.g., Lang, Rice, & Sternbach, 1972), an intervention such as reappraisal might selectively target just two of the components of the response (behavior and experience) and not a third (peripheral physiology). Alternatively, it may be that the potency of the amputation film gave reappraisal participants little chance to shut down its powerful (possibly subcortically mediated) autonomic effects (see LeDoux, 1989). Perhaps with a milder film, a more cognitively elaborated emotion, a longer emotion episode, or more detailed reappraisal instructions, reappraisal participants would have shown lesser physiological responding.

Effects of suppression. Compared with watch participants, those in the suppression condition showed the expected decrease in expressive behavior. Moreover, they experienced just as much disgust and showed more sympathetic activation on all three measures (finger pulse amplitude, finger temperature, and skin conductance level). This pattern of findings is consistent with previous studies using this paradigm (Gross & Levenson, 1993, 1997) and suggests that response-focused emotion regulation comes at the cost of heightened physiological responding, possibly due to the parallel activation of subcortical emotion centers alongside higher order inhibitory structures.

In previous studies (Gross & Levenson, 1993), participants who suppressed disgust showed decreased somatic activity and had concomitant decreases in heart rate. In the present study, however, even though suppression participants were rated as showing less expressive behavior than watch participants, they showed neither less somatic activity nor lower heart rates. Why might this feature of the suppression response found in two previous studies of disgust be absent in the present study? An examination of activity level means across studies provides one possible explanation. Whereas participants in the watch condition in the two prior studies (Gross & Levenson, 1993) showed an average increase of 0.11 units of somatic activity, participants in the watch condition in the present study showed a decrease from baseline of −0.05 units (as compared with −0.08 in the suppression condition). This makes it likely that a floor effect was operative: Suppression could not decrease somatic activity further because the somatic activity levels of the participants in the watch condition already were well below their baseline lev-

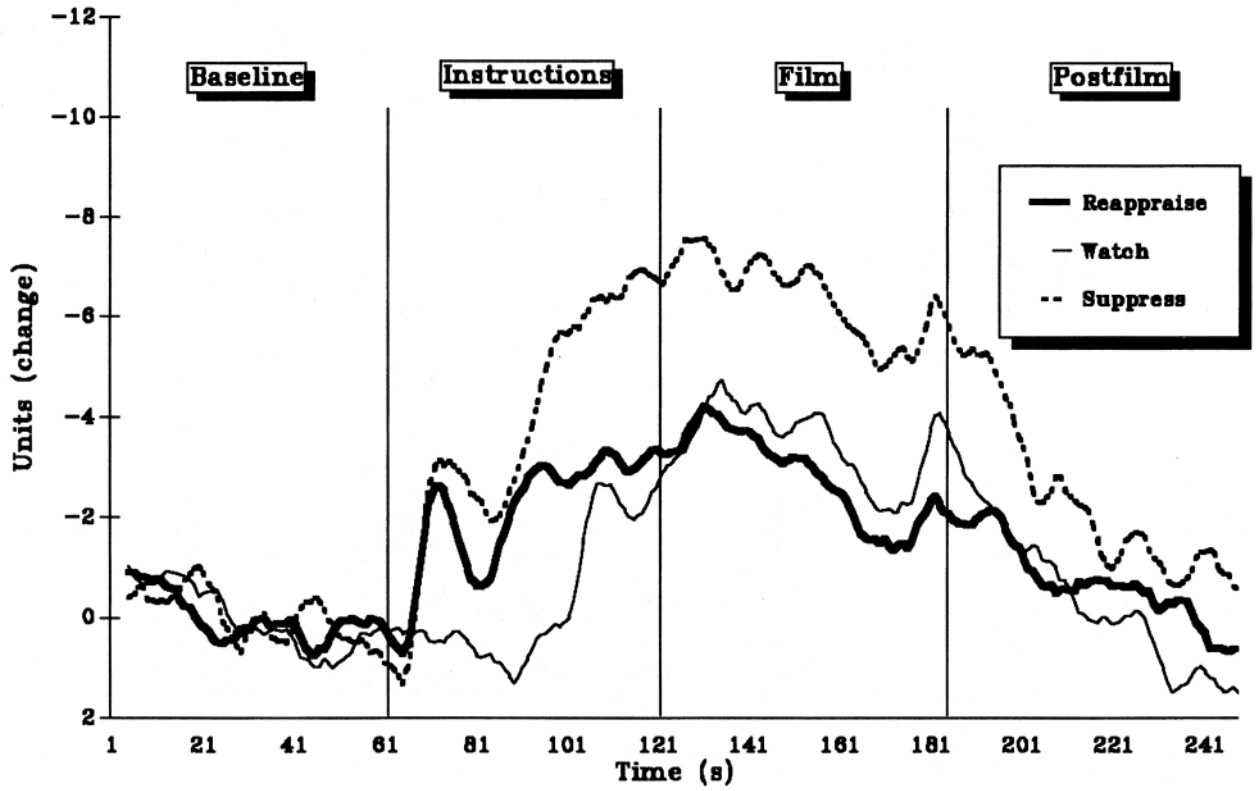

Figure 3. Mean change in finger pulse amplitude during the amputation trial for the three instructional groups. Note that the ordinate's scale is such that increased sympathetic activation is upward.

els. This suggests that the specific effects of suppression on somatic activity, and hence heart rate, will depend on the precise pattern of somatic activity generated by the target emotion in a given setting (see Gross & Levenson, 1997).

Implications for Psychological Health

The present research suggests that for negative emotions such as disgust, antecedent-focused and response-focused emotion regulation may have quite different consequences. Reappraisal led to decreased feelings of disgust, even when this strategy was foisted on participants in the context of a potent emotion-eliciting film, where it might be thought there would be little room for such cognitive strategies. This suggests that reappraisal might have much to recommend it as an effective route to experiencing less negative emotion, and it may well be reappraisal and other antecedent-focused emotion regulatory strategies that theorists have in mind when espousing the positive consequences of emotion regulation for psychological health (Thayer, Newman, & McClain, 1994). By contrast, inhibiting the outward expression of negative emotion fails to provide any relief from the subjective experience of negative emotion.

These findings indicate that reappraisal may be preferable to suppression as a route to psychological well-being. But antecedent-focused emotion regulation is not itself without costs. For example, inflexible or unrealistic reappraisals might lead one to deny important features of one's environment, such as hazards at work or abusive tendencies in a partner. In such cases, the short-term benefits of relief from negative emotion would almost certainly be outweighed by the long-term costs of stifling the adaptive behavioral tendencies, such as flight, associated with negative emotions. In addition, there may be more general costs of any form of emotion regulation that diminishes emotion-expressive behavior. Theorists since Darwin (1872/1965) have argued that we rely on the emotional expressions of our social partners to give us information about their needs and preferences. For example, if we inadvertently anger someone, their angry expression signals what has happened, and we are able to apologize. But if the person we have angered regulates emotion in a way that diminishes expressive behavior, we may be oblivious to the problem and do nothing to change our actions. In this case, the person who is regulating is likely to continue to have emotional responses, perhaps at even greater intensity levels.

If, as I have argued, different forms of emotion regulation have different consequences, no one strategy is likely to prove uniformly superior to all others across all contexts. Thus, what is crucial is knowing how and when to use various emotion regulatory strategies (Tavris, 1984). Such knowledge may be communicated in a variety of ways (Gross & Muñoz, 1995), and a more complete understanding of the costs and benefits of diverse regulatory processes promises to inform clinical interventions designed to promote healthy forms of emotion regula-

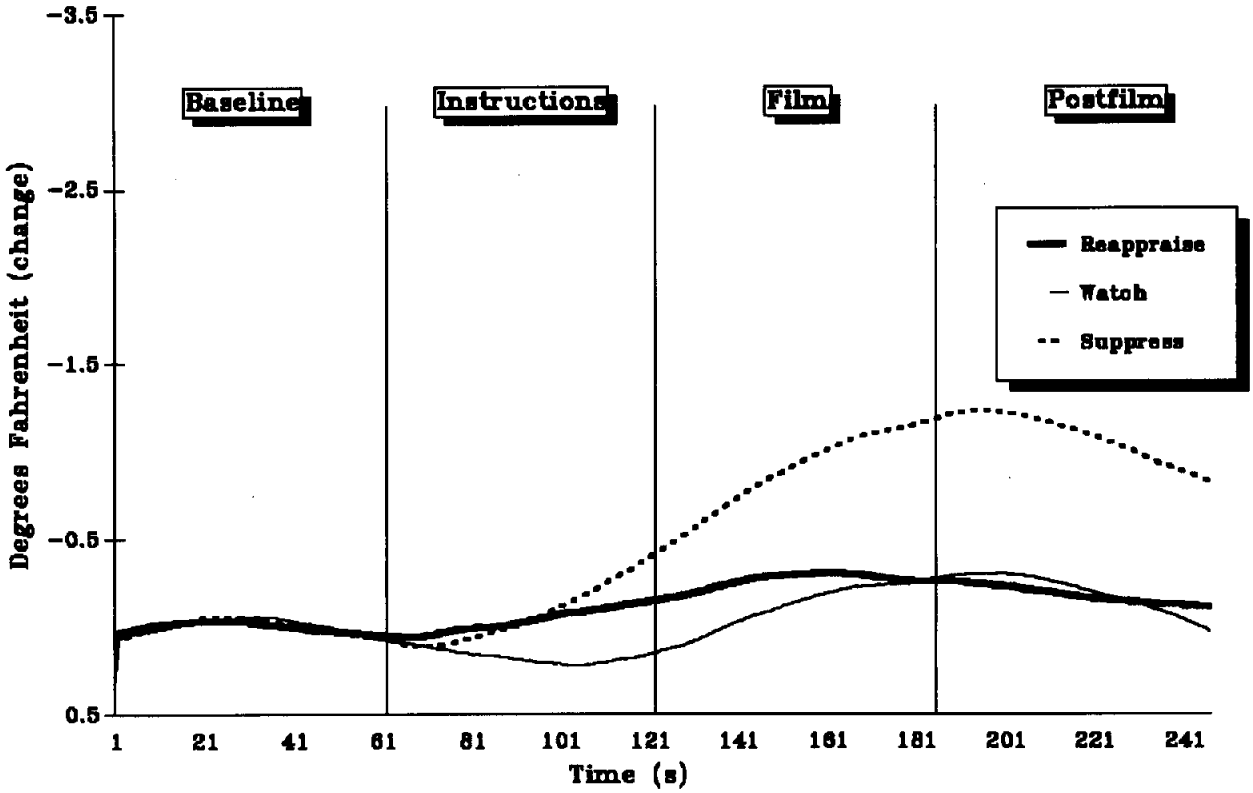

Figure 4. Mean change in finger temperature during the amputation trial for the three instructional groups. Note that the ordinate's scale is such that increased sympathetic activation is upward.

tion that are well matched to situational demands. These interventions may target individuals known to be at elevated risk for depression or anxiety, or those whose professions (e.g., airline personnel and paramedics) require them to regularly manage intense emotions such as anger and disgust (Hochschild, 1983; A. C. Smith & Kleinman, 1989; Sutton, 1991).

Implications for Physical Health

The present results are consistent with the view that emotion regulation, particularly emotional suppression, may play a role in physical health. Although the long-term health consequences of acute emotional suppression were not assessed in this study, the present results do show that each time emotion is suppressed rather than expressed, sympathetic tone will be elevated. Any one response of increased intensity would be unlikely to have deleterious consequences, but it is conceivable that if such responses were repeated many times there might be adverse health consequences (Krantz & Manuck, 1984). Extrapolating further, suppression might increase not only the intensity of physiological responses but also their frequency. As noted above, one important function of emotions is to signal to others one's wishes and needs. If these signals are systematically concealed, others may not know one's wishes. This would make it less likely that one's interactants would be accommodating and more likely that one would have intense and frequent negative-emotion-laden interactions.

But how might these intense, frequent emotional responses affect physical health? One link between emotional suppression and physical health is suggested by the literature on cardiovascular disease. Here, emotional suppression has been shown to be associated with essential hypertension and coronary artery disease (Friedman & Booth-Kewley, 1987; Manuck & Krantz, 1986; Roter & Ewart, 1992; Steptoe, 1993). One possible mechanism underlying this association may be sustained physiological reactivity that is in excess of current metabolic demands (Steptoe, 1981; Williams, 1986). The evidence from the present study is consistent with this possibility, showing that the acute effects of emotional suppression include increased sympathetic activation of the cardiovascular system despite low levels of somatic activity. It remains to be determined, of course, whether repeated episodes of this sort do in fact affect the integrity of the cardiovascular system in vulnerable individuals.

A second potential link between emotional suppression and health is suggested by the stress tradition (Ursin & Olff, 1993) and, more particularly, by research on stress and immune functioning (Kiecolt-Glaser & Glaser, 1991). Here, the suggestion is that the stress response (which involves both autonomic and neuroendocrine components) may lead to the selective inhibition of certain aspects of the immune response (Maier, Watkins, & Fleshner, 1994; Sapolsky, 1994). Clearly, the links between various components of the stress response and immune functioning are extremely complex (Dienstbier, 1989; O'Leary, 1990).

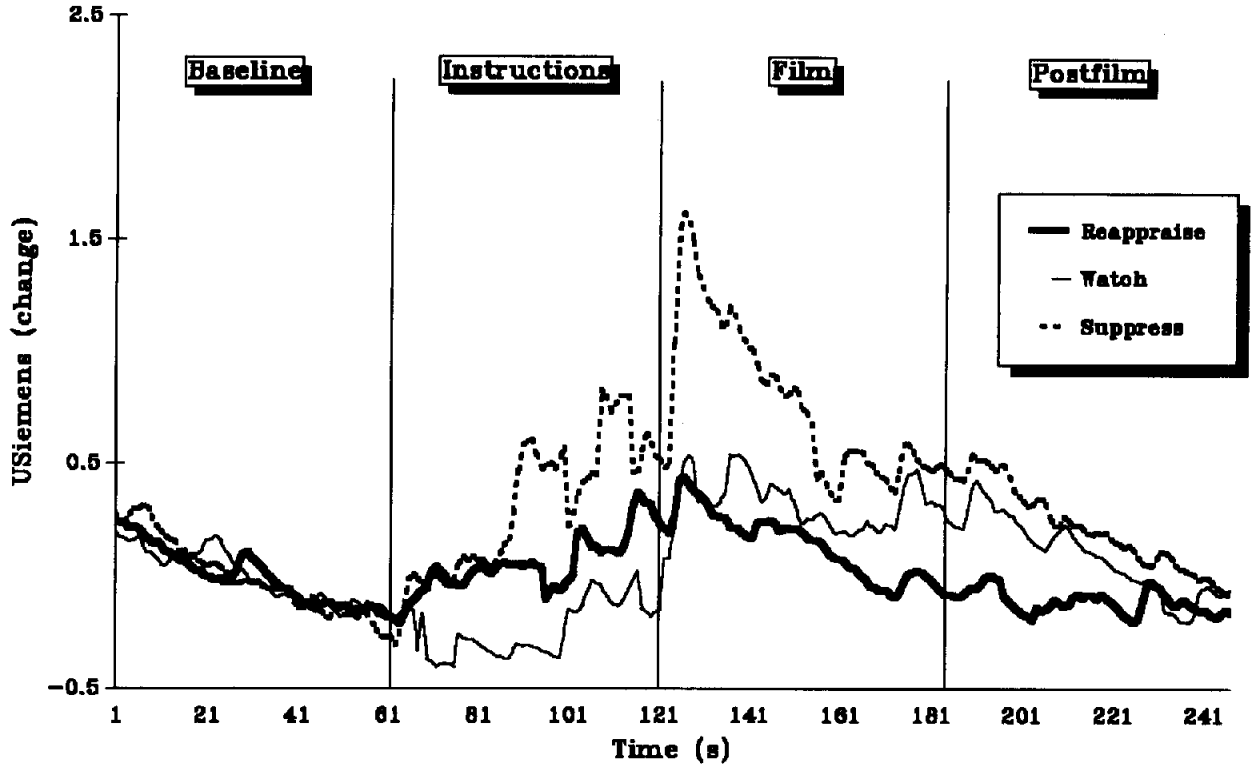

Figure 5. Mean change in skin conductance during the amputation trial for the three instructional groups. Note that the ordinate's scale is such that increased sympathetic activation is upward.

Nonetheless, the finding that inhibiting moderate levels of emotional expressive behavior leads to increased sympathetic activation of the cardiovascular system raises the possibility that suppression may activate some elements of the classic stress response, which in turn may influence the nature and course of immune responding (Esterling, Antoni, Kumar, & Schneiderman, 1990; Felten & Felten, 1994; Pennebaker, Kiecolt-Glaser, & Glaser, 1988).

Directions for Future Research

One direction for future research concerns the generalizability of the present findings. For example, might the consequences of emotion regulation vary according to whether the emotion being regulated is anger, disgust, sadness, or some other emotion? The lack of consensus as to whether each emotion calls forth emotion-specific physiological (e.g., Cacioppo, Klein, Berntson, & Hatfield, 1993; Levenson, 1992; Zajonc & McIntosh, 1992) and behavioral (e.g., Ekman, 1994; Izard, 1994; Russell, 1994) response tendencies makes this question difficult to answer, but different emotions conceivably might present different emotion regulatory challenges. Note, however, that in the context of emotional suppression, results to date suggest that commonalities in the effects of suppression outweigh differences (Gross & Levenson, 1997). A second form of generalizability concerns participant characteristics. Over half of the participants in the present study were Asian American, and all were college-age. Given known differences in emotional experience, expression, and control across ethnic groups (e.g., Gross & John, 1998) and age groups (e.g., Gross et al., 1997), it will be important to assess whether these findings generalize to other research participants. A third aspect of generalizability concerns relations with other forms of emotion regulation, such as distraction or exaggeration (see Ekman & Friesen, 1969). It also will be important to test limits of generalizability by examining other regulatory processes, such as negative mood regulation (Catanzaro & Mearns, 1990; Nolen-Hoeksema, Parker, & Larson, 1994; Thayer et al., 1994), thought suppression (Roemer & Borkovec, 1994; Wegner, 1994), and even self-esteem regulation (Steele, Spencer, & Lynch, 1993). By tracing points of divergence and convergence across different emotions, participant groups, and regulatory processes, a more differentiated view of emotion regulation will emerge—one that avoids premature synthesis but reveals interconnections among apparently diverse processes (e.g., Westen, 1994).

Future work also must consider emotion regulation in all its complexity outside the confines of the laboratory. Interview data (Gross et al., 1998; Tice & Baumeister, 1993) suggest that individuals use a rich variety of emotion regulation strategies and that these may vary rapidly over the course of an interaction. Some of these would have been difficult to observe in a laboratory paradigm such as the one used here. Examples include situation selection and situation modification (primary control strategies in which a person modifies a bothersome environment; see Rothbaum, Weisz, & Snyder, 1982), as well as strategies

that occur outside conscious awareness, such as repression (Brown et al., 1996; Weinberger, 1990). Laboratory-based studies must be complemented with fieldwork, and the range of dependent measures should be broadened to include a wider range of cognitive, experiential, physiological, and behavioral measures.

In addition, it will be important to consider how individuals' emotion regulatory goals (e.g., King & Emmons, 1990; Swinkels & Giuliano, 1995) and spontaneously chosen strategies (e.g., Bandura & Rosenthal, 1966) affect proximal intraindividual and interpersonal functioning, as well as more distal psychological and physical health outcomes. For example, does the effect of reappraisal depend on whether someone habitually uses this strategy? Or how, specifically, a person goes about trying to reappraise a potentially emotion-eliciting situation? Complementing this idiographic approach, nomothetic analyses will be needed to integrate broader but related constructs, such as the internalizer–externalizer dimension (Buck, 1979; Cacioppo et al., 1992), diverse facets of emotional expressivity (Gross & John, 1997), emotional ambivalence (King & Emmons, 1990), and emotional intelligence (Goleman, 1995; Salovey, Hsee, & Mayer, 1993). By examining these personal and contextual factors, we will learn whether some people are better suited cognitively and temperamentally to use some emotion regulatory strategies rather than others in particular situations (e.g., Engebretson, Matthews, & Scheier, 1989; Rothbart & Ahadi, 1994).

Summary

In the complex social world in which we live, strong emotions occasionally may be unwelcome (e.g., when they compromise task performance or betray secret preferences). At such times, we attempt to regulate our emotions, and I have suggested that we may do so in two quite different ways. The first is to reappraise our circumstances so as to alter their emotional impact. This study has shown that such reappraisals decrease expressive behavior and subjective experience. The second is to inhibit emotion-expressive behavior once the emotion is already under way. This study has shown that such emotional suppression decreases expressive behavior, but does not affect subjective experience, and actually increases certain aspects of physiological responding. With these divergent consequences in mind, I have speculated that certain forms of antecedent-focused emotion regulation (e.g., reappraisal) often may be better for one's health than certain forms of response-focused emotion regulation (e.g., suppression).

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Received September 6, 1996
Revision received January 31, 1997
Accepted February 3, 1997 ■