Emotion Regulation Effectiveness:

What Works When

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Abstract

We open this chapter by defining emotion and describing how emotions are generated in a series of temporal stages. We then define emotion regulation, consider precursors to the contemporary study of emotion regulation, and review the process model of emotion regulation, which holds that different emotion regulation strategies can be differentiated according to where they intervene in the emotion generation process. According to this model, emotion regulation strategies that intervene early on are likely to be more effective than strategies that intervene later on, after emotional response tendencies are activated. A growing corpus of data supports this account. Drawing on new data and theory, we elaborate upon the process model with the aim of further specifying the effectiveness of different regulation strategies. On this expanded account, the success of any particular emotion regulation attempt is thought to be a joint function of the underlying operation of different regulation strategies, levels of emotional intensity, and regulation goals. We conclude by discussing implications and future research directions.

Consider the fear a student may experience while giving a presentation for a class assignment. Observing the frightened student, we might notice that his fear response involves a change across various external and internal domains. This change is manifested in a fearful facial expression which involves a widening of the eyes; increased autonomic arousal which includes sweating and increased heart rate; increased activation in limbic brain regions including the amygdala; a strong negative subjective experience of dread; racing negative cognitions about threat and failure, and a desire to flee.

Clearly, in this example the fear response seems to be very dominant but is it unchangeable? In the following sections we begin by briefly outlining what makes a given situation emotional. We then discuss how emotions develop in these special situations. Following that we discuss *emotion regulation*, which refers to the ways in which emotions can be altered or controlled. In doing so, we discuss past and present conceptions of emotion regulation with an emphasis on a process model of emotion regulation (Gross & Thompson, 2007). We then suggest additional relevant factors that determine the effectiveness of different emotion regulation strategies. These factors are arranged in a new framework to which we give direct empirical evidence. We conclude by offering future directions for better understanding emotion regulation.

Emotion Generation

Emotions play a vital part in our lives. We may experience fear prior to an important test and surprise followed by happiness when we receive a better grade than we expected. At the same time we can also experience sadness when our best friend tells us he she received a poor grade or switch to experiencing anger or even genuine disgust (Chapman,

Kim, Susskind, & Anderson, 2009) if we perceive the grading of that exam to be fundamentally unfair.

The Modal Model of Emotion

Though clearly central in our lives, emotions are invoked in unique circumstances and are not experienced all of the time. What are these unique circumstances in which emotions are called into being? From an evolutionary perspective, emotions are induced in order to prepare the organism and to produce a certain response that will create circumstances that are advantageous to the organism (Damasio, 1999). Specifically, emotions are generated when a certain situation is attended to, given a valenced meaning, and this evaluation gives rise to a coordinated set of experiential, behavioral and physiological responses (Gross, 1998a,b, 2001, 2002). Going back to the student who is giving a presentation, fear would be generated if the student attends to the presentation situation and appraises it as potentially harmful, leading to the experience of fear, as well as behavioral (e.g., facial expressive behavior, Ekman, 1992) and physiological (e.g., increased sympathetic activation, Kreibig, 2010) responses.

In Figure 1a, we present in schematic form the situation-attention-meaning-response sequence that constitutes an emotional response. We use a rather abstract definition here – which we refer to as the "modal model" of emotion -- because emotions form such a heterogeneous category that it is difficult to make generalizations that apply to all cases. For example, emotions can vary in their intensity, ranging from mild to overwhelming panic-like responses. Emotions can also vary in their duration or other temporal characteristics. For example, some emotions like sadness have a wave-like pattern rising and subsiding fairly slowly, whereas other emotions like disgust or fear have a burst-type

pattern with fast rise time to peak and also a fast decline (Davidson, 1998). Despite these fundamental differences between emotions, we wish to emphasize three common features for different emotional episodes.

Common Features of Emotion

First, emotions arise when a situation is construed as being relevant to one or more of an individual's personal strivings or active goals (Scherer, Schorr, & Johnstone, 2001). Some of these goals may be biologically based (e.g., securing food). Others may be culturally derived (e.g., avoiding familial shame). Some of these goals may be social (e.g., helping an elderly person in the street). Others may be self-focused (e.g., wanting to behave according to one's ideals). Because many goals are usually active at any one time, the most dominant goal will dictate which emotion – if any -- will be activated, and to what degree that emotion will be activated. Whatever the details of the emotion-generating goals that are active at a particular point in time, and whatever the details of the situation the individual faces, it is ultimately the situational-meaning-in-relation-to-a-goal that gives rise to an emotion. As either the goals or the individual's construal of the situation change, so too will the emotion.

A second common feature is that emotions are multi-faceted, embodied phenomena that involve loosely-coupled changes in the domains of subjective experience, behavior, and peripheral physiology (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). The experiential component of emotion which is also defined as feeling is a private state or an internal representation of the changes invoked by the emotional unfolding (Damasio, 1999). The behavioral component of emotion includes changes in activity in muscles of the face and body, and in what one says, as well as more general

changes in basic motivational states such as the likelihood of approaching or withdrawing from something in the environment (Frijda, 1986). The peripheral physiological component of emotion includes the autonomic and neuroendocrine responses that putatively provide metabolic support for anticipated and actual behavioral responses (Levenson, 1999).

A third common feature is that emotions play out in ways that are sensitive to the particular details of a given internal or external environment. This means that, under some circumstances, emotions can take full control (Frijda, 1986). For example, walking around the streets of Paris, your dominant goal may be sightseeing. But if a stranger pulls a knife and asks for all of your money, your dominant goal quickly becomes to survive, and fear takes over. In this case, the emotion-related goal (survival) has overridden the non-emotion-related goal (sightseeing). However, emotions do not always trump other goal-driven processes (i.e., processes related to meeting active goals like sightseeing in the example above that are unrelated to the emotion-generating goals). This means that emotions can be and often are adjusted to suit our needs in a given situation. It is this third common feature of emotion that permits us to change modify or in other words regulate our emotions (see Gross, Sheppes, & Urry in press for a relevant review on the distinction between emotion generation and emotion regulation).

Emotion Regulation: Past and Present

Emotion regulation has now emerged as an independent field of study within affective science (Gross, 2007). However, to appreciate the scope of problems addressed by this field, it is helpful to consider two major historical antecedents (Gross, 1999).

Historical Antecedents to the Contemporary Study of Emotion Regulation

The first important influence on contemporary emotion regulation research is Sigmund Freud's (1894/1961) conception of defensive mechanisms. Freud argued that individuals have a flexible defensive apparatus that employs diverse mental operations to ward off differing levels of negative experiences, unacceptable drives, and threats from conscious experience. A major premise in Freud's psychoanalytic theory is that some negative content might threaten the integrity of the self concept if it were available to awareness. Therefore, various unconscious defense mechanisms were needed to keep these unacceptable mental contents from entering awareness. Since Freud's times the study of defensive mechanisms has had its ups and downs, but in recent years there have been important experimental accounts that support these basic tenants (see Cramer, 2008 for a recent review).

In contrast to the subconscious role of defensive mechanisms in the psychoanalytic approach, a second important influence on current emotion regulation theorizing comes from the study of stress and coping (e.g., Carver & Scheier, 1994; Folkman & Lazarus, 1985). In this literature, conscious appraisals are given a central role in determining one's initial construal of events in the environment and subsequent reactions to these events. Specifically, appraisals are divided into *primary appraisals* when a certain event or encounter is construed on dimensions such as relevance to one's well being, positivity, or how negative/stressful an event is. *Secondary appraisals* refer to how an individual evaluates the coping resources and options to address a particular event. In the stress and coping literature, emotion generation is the result of specific primary appraisals. Coping is divided into *problem focused coping* which refers to doing

something to directly change or influence the environment that causes distress, and *emotion focused coping* (most directly related to modern emotion regulation), which refers to efforts to manage the distress caused by a particular event. In the 1960s, Lazarus did ground-breaking work on emotion focused coping by showing that appraising a disgusting film in an intellectual manner reduces disgust related experience and physiological arousal (Speisman, Lazarus, Mordkoff, and Davison, 1964). In more modern times influential studies by Cheng (2001) have shown that individuals who use problem focused coping strategies for controllable situations and who switch to emotion focused coping in uncontrollable situations show more adaptive long term adaptation.

The Contemporary Study of Emotion Regulation

The modern study of emotion regulation has benefited from both the psychoanalytic and stress and coping literatures. Nevertheless, by conducting rigorous experimental studies which make it possible to expose the underlying mechanisms of specific regulatory strategies, and by investigating the role of specific emotions rather than general stress, this emerging field has increased our understanding of the processes that influence which emotions we have, when we have them, and how we experience or express these emotions (Gross, 1998a). A key idea in this field is that emotion regulation is defined by the activation of a goal to modify the emotion-generative process, and involves the motivated recruitment of one or more processes to influence emotion generation (Gross, Sheppes, & Urry, in press). Whether we consult our own experiences, or the empirical literature, it is clear that emotions may be regulated in many different ways (Gross, Richards, & John, 2006).

One important point of difference across emotion regulation episodes is whether the emotion-regulatory goal is activated in the individual who is having (or is likely to have) an emotion episode, or in someone else. An example of the first type of emotion regulation episode – which we refer to as *intrinsic emotion regulation* – is when someone tries not to think about something that is upsetting. An example of the second type of emotion regulation episode – which we refer to as *extrinsic emotion regulation* – is when a friend calms us down by putting an upsetting situation in perspective. While extrinsic emotion regulation remains important in adulthood it is perhaps the most dominant form of emotion regulation in infancy where parents have a crucial role in helping infants to develop an ability to regulate their emotions (Macklem, 2008).

A second point of difference across emotion regulation episodes is whether the motivation to engage in emotion regulation is *hedonic* (to feel less negative or more positive in the near-term) or *instrumental* (to achieve one's long-term goals) (Tamir, 2009). In some cases these two types of goals are congruent for example when someone tries to decrease fear and anxiety because it makes her jittery in the moment and at the same time it can hurt her long term health. At other times these goals can compete, when for example one wants to avoid a certain situation he dreads in order to feel relief in the short run but in the long run this perpetuates the situation.

A third point of difference across emotion regulation episodes is whether the emotion-regulatory goal is *explicit* or *implicit* (Bargh,Gollwitzer, Lee-Chai, Barndollar, & Trotschel, 2001; Mauss, Cook, & Gross, 2007). Sometimes, this goal is explicit. That is, the goal is deliberate and consciously perceived, such as when an individual decides to try to direct his attention towards the exit sign when among a big crowd in an effort to calm down.

At other times, this goal is implicit. That is, the goal is activated outside of an individual's awareness, such as when an individual unconsciously stands next to the exit sign and feels calm while there. Implicit emotion regulation is perhaps the rule rather than the exception. That is in many real life situations we regulate in a fairly automatic fashion without consciously pondering how we should go about our emotions. These automated and habitual implicit processes offer a very efficient regulatory option, demonstrated in forming a strong goal that is persistent in the face of obstacles, that is reenacted after disruption (Bargh et al., 2001; Williams, Bargh, Nocera, & Gray, 2009).

Finally, emotions can be *down-regulated* where the goal is to decrease a certain emotion response, *maintained* where the goal is to prolong a given emotional response, or *up-regulated* where the goal is to increase an emotional response. While the obvious examples of down-regulation refer to decreasing negative emotions, and maintaining and up-regulation refer to positive emotions, there are many instances where one's instrumental goals are to down-regulate positive emotions or maintain or up-regulate negative emotions (Tamir, 2009). For example, when a person is on a diet they might try to reduce their joy when eating high caloric food, or when people wish to avoid certain dangers they might prefer to maintain or even up-regulate their fear levels (Tamir & Ford, 2009). Though clearly important, in the present chapter we will focus on down regulation of negative emotions which have been central in studies in emotion regulation.

The Process Model of Emotion Regulation

To create a framework for analyzing emotion regulation processes, we have found it useful to consider which parts of the emotion-generative process are primary targets of an

active goal to influence emotion. To examine this dimension of variation, we take the emotion generation model depicted in Figure 1a as a starting point. Emotion regulatory acts are, from this perspective, seen as having their primary impact on different stages of the emotion generative process (Gross, 2001). In Figure 1b, we highlight five points in the emotion-generative process at which individuals can regulate their emotions, corresponding to five families of emotion regulation processes: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. In the sections that follow, we elaborate on each of these families.

Situation Selection

Situation selection refers to efforts an individual makes to influence the situation he will encounter, with a view to increasing (or decreasing) the likelihood that certain emotions will arise. Situation selection may best be captured in the classic conceptualization of choosing between *approaching* and *avoiding* a situation. Seminal work by Kurt Lewin (1943) – one of the founders of social psychology – suggests that many situations are uncertain in the rewards and risks they offer. Therefore, individuals experience conflicts between approaching and avoiding a certain situation.

Going back to our fearful student who is required to present to others, this situation offers uncertainty about the probability of reward (receiving a positive feedback from the instructor) or risk (being too anxious at the talk to an extent that impairs its fluency). In this case our student can choose to regulate his fear by avoiding the situation altogether if he does not show up for the presentation. Avoidance functions as a very strong regulatory option that intersects the emotion generative process at the earliest point. Nevertheless, it

can be clearly maladaptive if generalized, as will be elaborated below (Campbell- Sills & Barlow, 2007).

Situation Modification

Situation modification refers to attempting to change the external features of a situation in a way that will alter one's emotional response to that situation. That is, even when one approaches or engages in a given situation, regulatory options that concentrate on changing certain characteristics of the external situation are possible.

Classic examples of situation modification include some forms of *safety signals or behaviors* (Barlow, 1988) and *problem-focused coping* (Folkman & Lazarus, 1985). Safety signals or behaviors refer to external objects individuals use in fearful situations in order to decrease anxiety. For example, our fearful student from the example above can decide to come to the presentation with papers that include a verbatim transcript of his talk. Note that these papers can offer relief simply by being there even if the student does not end up using them. Problem-focused coping, which was described above, refers to strategies individuals use in order to deal with the cause of a certain problem. For example, our fearful student may decide to come to the presentation early and adjust the placement of the podium in a way that he feels more comfortable.

Attentional Deployment

In the first two families of emotion regulation processes (situation selection, situation modification), there is a focus on external change of the actual situation. However, the third family of regulatory processes, which we refer to as attentional deployment, involves a shift

to an internal emotion regulation process that plays out in one's mind. Specifically, attentional deployment refers to directing attention in such a way that the emotion-response trajectory is altered. In this third stage, we refer to regulatory options that take place after an emotional situation has been encountered. There are several attentional regulation options.

Distraction is a broad name for different emotion regulation options that involve diverting attention away from an emotional situation. For example distraction can refers to either shifts of overt gaze from emotional features to non emotional features (Dunning & Hajcak, 2009; Hajcak, Dunning, & Foti, 2009) or to performing a secondary task like trying to remember a 7 digit number that is provided (McRae et al., 2010; Van Dillen & Koole, 2007) to creating neutral thoughts (Sheppes & Meiran, 2007, 2008). Distraction has been considered to be an emotion regulation strategy that provides fast and relatively effortless relief from emotional responses but it may become maladaptive in the long run (see McCaul, & Malott, 1984, for conceptual convergence in the realm of pain regulation).

Another classic attentional strategy is *thought suppression,* which involves efforts not to think about a certain emotional content (Wegner, 1994). Suppressing one's thoughts is an effortful process that can be successful at times, but can backfire by "ironically" making the suppressed content more accessible in one's mind especially under stress or when cognitive resources are limited.

Rumination is another emotion regulation strategy that involves directing attention inward, focusing on negative aspects of the self in an abstract, passive and repetitive way (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Watkins 2008). Rumination could be viewed as asking big why questions (e.g., Why am I sad? Why do these bad things happen

to me) about the causes of negative events without a translation into a concrete way to deal with things. Two decades of research suggest that this form of self focus is largely maladaptive and is a strong risk factor for mood and anxiety disorders. Specifically, individuals who ruminate as a way to regulate negative mood are more likely to develop a depressive episode that is stronger and longer in duration, relative to individuals who do not ruminate (Nolen-Hoeksema, 1991).

In recent years, influential accounts from eastern philosophy and Buddhism have introduced *mindfulness* as an additional form of attentional regulation. Mindfulness involves attending to emotional experiences by focusing on immediate here and now aspects with an orientation of curiosity, openness and acceptance (Bishop et al., 2004). Mindfulness has proven to be an adaptive way to regulate negative emotions and have been incorporated in cognitive treatments of anxiety and depression (Goldin et al., 2009).

To provide a clear example of each, again consider our fearful student. He could distract his attention by diverting his gaze from the fear provoking audience to his computer screen, or think about neutral calming thoughts. He could also suppress fearful thoughts by trying not to think about potential failure, or he could try to ruminate and focus inward in trying to understand why he is so preoccupied with potential criticism. Being mindful to the scary situation, the student could focus on momentary changes in his thinking by embracing such thoughts in an open and accepting way.

Cognitive Change

Cognitive change refers to altering a situation's meaning in a way that influences the emotions that situation will produce. In this fourth stage of the process model, we refer to changing the meaning of the original appraisal of an emotional event.

The most studied regulation strategy is *cognitive reappraisal*, which involves construing an emotional event in non-emotional terms (Gross, 2001, 2002; Gross & Thompson, 2007). Within the reappraisal category, there are several ways in which emotional appraisals can be modified. Self focused reappraisal involves internal focusing in decreasing the sense of personal meaning of the situation through detachment and situation-focused reappraisal includes external focusing in reinterpreting the emotional contents as neutral (Ochsner et al., 2004). Interestingly, self focused reappraisal allows asking why questions (e.g., why bad things happen) from a distance (i.e., from a third person perspective), resulting in an effective way to engage in self focus that is different from maladaptive rumination (Kross & Ayduk, 2007; Kross, Ayduk, & Mischel, 2005). As will be elaborated below, reappraisal has been found to be a very effective emotion regulation strategy. Returning to our fearful student he could reappraise the frightening situation by thinking that this presentation provides an opportunity to learn and improve his oral skills.

Response Modulation

Response modulation refers to targeting one or more of the experiential, behavioral, or physiological components of an activated emotion response for change. In this final stage of the process model, experiential, behavioral, and physiological emotional response tendencies have been launched and regulation targets a change in one of these response systems that have been sufficiently evolved.

One form of response modulation that targets the behavioral response tendency is *expressive suppression,* which involves inhibiting emotion-expressive facial behavior (Richards & Gross, 1999, 2000). A second response modulation strategy that targets the physiological emotional response tendency is *bio-feedback.* In general biofeedback refers to the broad category of consciously noticing changes in physiological activation. Some specific forms of biofeedback were found to be effective in modulating sympathetic arousal for example through controlled breathing (Philippot, Chapelle, & Blairy, 2002) or progressive muscle relaxation (Pawlow & Jones, 2002). A third response modulation regulatory option that targets a change in experiential emotional response tendency is *acceptance* which involves allowing oneself to experience an emotion by adopting an open and curious approach, without controlling, inhibiting or elaborating on its consequences (Levitt, Brown, Orsillo, & Barlow, 2004).

Going back for the last time to our fearful student, even after the fear response was created he can still keep his face calm via suppression so that he no longer appears fearful, or try to slow down his breathing via biofeedback, or accept his fearful responses with an open approach. As will be elaborated below expressive suppression has been found to be a relatively maladaptive and effortful emotion regulation strategy, whereas bio-feedback and acceptance are considered both effective emotion regulation strategies that are also applied in psychosocial interventions for various mood and anxiety disorders.

Emotion Regulation Effectiveness

Now that we have a basic understanding of the different regulatory options individuals have when dealing with their emotions, it is important to consider which emotion regulation

strategies may be more effective than others. When we refer to *effectiveness* in this context, we mean how successful a regulatory strategy is at decreasing emotional intensity per unit effort expended. In other contexts, effectiveness could of course refer to other targets, including emotion magnification, or qualitative changes in emotion. Clearly, understanding the benefits and costs of different emotion regulation strategies could help us to improve well being, and assess and treat individuals who engage in maladaptive emotion regulation strategies. Yet predicting which emotion regulation strategy would be effective is a hard task as it requires taking into account many factors. In what follows we begin with predictions that derive from the process model of emotion regulation regarding different emotion regulation strategies. We then provide a new conceptual framework that builds on the process model but elaborates on it by including other important factors.

Predicting Effectiveness Using the Process Model

As noted above, the process model of emotion regulation categorizes different emotion regulation strategies according to the point in which they influence the emotion generative process. According to the process model, the five different families of emotion-regulatory processes (situation selection, situation modification, attentional deployment, cognitive change, response modulation, depicted in Figure 1b) may be distinguished according to when in the emotion-generative process they have their primary impact. However, at a broader level, this model also distinguishes between *antecedent-focused strategies* that start operating early in the emotion-generative process, before response tendencies are fully activated, and *response-focused strategies* that start operating later on, after emotion response tendencies are more fully activated (see Figure 1c).

The emphasis placed on the developing emotional response signals the importance that this conception of emotion generation and emotion regulation places on the effectiveness of regulation strategies. In this context, a major feature of the process model is that antecedent-focused strategies are thought to be generally more effective than response-focused strategies. This is because antecedent-response focused strategies divert the emotional trajectory quite early, before emotional response tendencies are fully developed , whereas response-focused strategies must overcome a well-developed suite of inter-related emotion processes (e.g., Gross, 2001).

Empirical Tests of the Process Model's Predictions

To date, one of the main ways that this hypothesis has been tested is by pitting *cognitive reappraisal* (i.e., construing an emotional situation in non-emotional terms), which is an antecedent-focused strategy, against *expressive suppression* (i.e., inhibiting emotion-expressive behavior), which is a response-focused strategy. The basic logic of this comparison is that reappraisal which alters the emotional trajectory early on, should be a more effective regulation strategy than suppression, which intervenes later, and thus has to combat a higher intensity emotional response.

Results from a large number of studies have demonstrated the relative costs of suppression relative to reappraisal in affective, cognitive, and social domains. Affectively, suppression relative to reappraisal does not result in a reduction of negative emotional experience (see Gross 2002 for a review), increases sympathetic nervous system arousal (Gross, 1998b; Gross & Levenson, 1993, 1997) that when chronically prolonged may be associated with various health adversities such as coronary heart disease (e.g., Diamond, 1982) and cancer (e.g., Temoshok, 1987), and increases

activation in emotion-generative brain regions (Goldin, McRae, Ramel, & Gross, 2008). Cognitively, suppression but not reappraisal results in poorer memory for the emotion-eliciting situation, possibly due to the resource depletion associated with higher levels of cognitive effort (see Richards, 2004 for a review). Socially, individuals interacting with people who are engaging in suppression but not reappraisal show increased physiological responses that may reflect the diverse effects and uneasiness associated with the communication with a non-responsive partner (Butler, Egloff, Wilhelm, Smith, & Gross, 2003).

In more recent studies, these basic differences between antecedent-focused reappraisal and response- focused suppression have been extended to other important fields. For example, in behavioral economics, reappraisal but not suppression efficiently reduces the experience of fear and disgust, which results in lower levels of emotion-related biases on rational decision making (Heilman, Crisan, Houser, Miclea & Miu, 2010). In the emotional eating domain which studies how emotion and emotion regulation relates to food consumption, regulating negative mood with suppression but not reappraisal leads to increased food intake of high caloric foods which is associated with binge eating episodes (Evers, Stok, & de Ridder, 2010). In an academic setting according to some accounts, suppression contributes to cognitive deficits that cause academic performance decrements related to stereotype threat (i.e., the experience of anxiety in a situation where a person has the potential to confirm a negative stereotype about their social group. Steele & Aronson, 1995), and reappraisal can eliminate these negative consequences (Johns, Inzlicht, & Schmader, 2008).

Expanding Our Conception of Emotion Regulation Effectiveness

These findings provide compelling evidence that reappraisal and suppression have different consequences. These findings also provide initial evidence in support of the basic effectiveness hypothesis according to which antecedent regulation strategies (e.g., reappraisal) that start operating early before emotional response tendencies are fully activated are more effective than response focused strategies (e.g., suppression) that fight off a strong emotional response. However, there seem to be additional factors that influence the effectiveness of regulation strategies. In our new account (described below), we elaborate and add to the original process model three important factors.

First, regulation strategies can differ in their ability to modulate an emotional response because of their underlying operation and the cognitive effort involved in achieving this modulation. The five regulatory families in the process model of emotion regulation suggest that for example attentional strategies (like distraction) operate differently from cognitive change strategies (like reappraisal). Therefore, instead of predicting differential effectiveness based on a broad categorization (antecedent versus response focused strategies) we can put reappraisal (or any other regulation strategy) under a magnifying glass and see what are the unique characteristics and resources required in trying to change the semantic meaning or interpretation of an original emotional appraisal.

Second, the emotional intensity one is facing is likely to affect the effectiveness of some regulation strategies. Before addressing this issue it is important to clarify a confusion regarding the definition of antecedent response strategies. One may think that antecedent response strategies *must* operate before emotional response tendencies are substantially activated. However, consider the reappraisal options for our fearful student.

Though our student can definitely create reappraisals before the talk and before he feels very afraid (see above), we can easily imagine an alternative option where the student starts to talk, becomes significantly anxious, and only then tries to reappraise his fear. This latter sort of case is in fact discussed in theoretical elaborations of the process model (see Gross 1998; Gross & Thompson, 2007). That is, according to the process model, emotion generation is a dynamic process that involves repeated cycles through the emotion-generative process. If emotions arise as a result of these multiple iterating cycles, it should be possible to engage in emotion regulation at various points as an emotion episode unfolds over time. That is, reappraisal (or any other strategy) may be engaged either under low levels of emotional intensity, in one of the first few emotion-generative cycles, or under high levels in emotional intensity, in one of the later emotion-generative cycles. Nevertheless, the issue of whether reappraisal or any other regulation strategy would be differentially effective when applied under low or high emotional intensity remained open until recently.

The third factor that can be important for effectiveness is the goal one has in mind. That is, some emotion regulation strategies can provide fast relief and thus be effective in the short run, however, these strategies when generalized can actually have long term costs. One example which we will elaborate on below is distraction. Altough distraction block or modulate an emotional response very quickly it can be maladaptive in the long run especially in situations where prolonged attentional disengagement can be problematic (see also Roth, & Cohen,1986; Suls, & Fletcher, 1985). In the section below we elaborate and provide evidence for these three factors in predicting the effectiveness of regulation strategies (see also Sheppes & Gross, in press, for a complete account).

An Expanded View of Emotion Regulation Effectiveness

In our expanded framework, we take into account three major factors in order to predict the effectiveness of regulation strategies. The first and central factor is the underlying operating mechanism and the cognitive resources required for modulation. The second factor is the emotional intensity one is facing when regulating. Emotional intensity can range from a zero point where there is no indication of an emotion to a maximum degree which varies for different emotion types, situations, and contexts (Reisenzein, 1994). For present purposes, intensity is best understood as the magnitude of activation in the coordinated response systems that constitute emotion, and we can evaluate the effectiveness of different regulation strategies under different emotional intensities. The third factor is whether a regulation strategy is effective in the short or long run.

Underlying Mechanisms and Cognitive Resources

The basic logic of our framework derives from a consideration of when and how emotion-generative processes are altered via emotion-regulatory processes. Our account borrows heavily from information processing theories, which argue that people have limited cognitive capacity to execute mental operations (e.g., Pashler, 1998). The constraints posed by limited capacity and cognitive resources dictates a continuous competition between different sources of information for dominance, and consequently for determining the final output or response of the cognitive system.

This competition among different sources of information occurs at two major processing stages (e.g., Hubner, Steinhauser, & Lehle, 2010; Johnston & Heintz, 1978; Pashler, 1998). At the early stage, incoming perceptual information competes to capture selective attention, and a filtering mechanism determines which stimuli gain access to the

next stage, where more elaborated semantic analysis occurs. Resolution of conflict via the early filtering mechanism requires minimal resources. At the late stage, different types of representations compete at the semantic level to affect the final response. Resolution of conflict at this stage requires more mental effort because more information is gathered about the nature of the stimuli in question (Johnston & Heintz, 1978).

How might these considerations apply to emotion regulation? We propose that emotion-generative and emotion-regulatory processes can compete at both early and late processing stages. To provide concrete examples we chose two emotion regulation strategies.

The early selection strategy that was chosen was *distraction*, which involves diverting attention away from an emotional situation by loading working memory with independent neutral contents (see Van Dillen & Koole, 2007). In distraction, the neutral contents that are called to mind are independent from, and not in conflict with, the emotional contents (e.g., thinking about errands in the presence of a distressing situation). Therefore, distraction involves replacing existing emotional information with independent neutral information. Furthermore, incoming emotional information competes with emotion-regulatory processes at an early processing stage before stimuli are represented in working memory for further semantic evaluative processing. That is, distraction prevents the affective meaning of a stimulus from being processed by blocking it via a strong early selection filter (see Figure 2a).

The late selection strategy that was chosen was *cognitive reappraisal*, which entails attending to the emotional stimulus and reinterpreting the meaning of this stimulus in a way that alters its emotional impact (e.g., Gross, 1998a). In reappraisal, the basic

emotional representation functions as the building block of the neutral reinterpretation. Therefore, the reinterpreted neutral representation is, by definition, associatively linked to the emotional representation (e.g., the process of reinterpreting a distressing situation requires directly relating to the distressing situation). Consequently, in reappraisal, existing and incoming emotional information is modified via a dependent neutral reinterpretation and a semantic conflict exists between the emotion-generative and emotion- regulatory representations. That is, in reappraisal, emotional information passes the early attentional stage, and is provided elaborated semantic meaning before it is modified via a weak late selection filter that requires increased cognitive resources to operate (see Figure 2b. See also Kalisch, Wiech, Herrmann, & Dolan, 2006 for a related categorization of distraction and reappraisal). The result here would be that under some circumstances that are described below, late selection strategies may not be always successful at blocking emotional information.

Level of Emotional Intensity

The second factor one needs to take into account is the emotional intensity one is facing when trying to regulate an emotion. The simplest possibility is that the stronger the emotional impulse, the harder it is to regulate it. However, our model predicts that the later the emotion-regulatory process occurs, the more likely it is to be affected by the level of emotional intensity. Emotion regulation strategies that operate at an early stage (*early selection strategies*) like distraction should be relatively unaffected by the level of emotional intensity because they replace existing and incoming emotional information with minimal effort. Therefore, we would expect these strategies to operate quickly and efficiently. By contrast, emotion regulation strategies that operate at a late stage (*late*

selection strategies) like reappraisal should be affected by the level of emotional intensity because they require effort to modify existing and incoming emotional information. Therefore, under conditions of low emotional intensity reappraisal is likely to successfully modulate emotional responding via the weak late selection filter. However, under high levels of emotional intensity, the weak late selection filter is likely to only partially block emotional information, which results in emotional responding that passes that filter and affects the final response (see Figure 2b).

It is important to note that we do not argue that all emotional intensity levels could be successfully modified with early selection strategies. Clearly, there are levels of emotional intensity that are overwhelmingly high where distraction or any other regulatory strategy is likely to fail. In our account this will be represented in emotional information that is so strong that it passes the strong early selection filter and the weak late selection filter and ends up dominating the final response.

Short Term versus Long Term Effectiveness

The third factor that one needs to consider is whether a given regulation strategy is effective in the short term versus the long term. When we described emotion regulation above, we referred to whether the motivation to engage in regulation is hedonic or instrumental. Some regulatory strategies may operate quickly and provide short term relief from negative affect and thus satisfy one's hedonic goals, but they can be maladaptive and incongruent with one's long term instrumental goals. That is, in many situations one needs to engage with an emotional event and understand it so that if encountered again that emotional situation would have less impact. For example, if our student does not engage with his fear and understand it, he is likely to experience fear

every time he has to give a speech. In fact, according to a recent model of affective adaptation, emotional adjustment occurs when a person attends to an emotional event and explains it (Wilson & Gilbert, 2008).

Accordingly, our account suggests that early selection strategies like distraction are likely to offer short term relief at a long term cost, because in distraction the affective meaning is blocked from processing and it does not allow elaborated processing and consequential understanding of the emotional event (Campbell-Sills & Barlow, 2007). Thus, distraction can be considered as a ”bandage” regulation strategy that can stop the “bleeding” but not offer actual remedy. At the same time, our account predicts that adaptive late selection regulation strategies like reappraisal might have short term costs but long term benefits. Despite the increased effort associated with implementing reappraisal under high emotional intensity, reappraisal may facilitate long term adaptation, because it involves attending an emotional event and understanding it.

Not all ways of engaging with and understanding of an emotional event are beneficial in the long run. Rumination, for example, involves a repetitive and passive engagement with emotional events does not result in better understanding and thus does not result in affective adaptation (see below and also see Watkins 2008 for a review). Furthermore, there are some cases where engaging and understanding an emotional event, even via adaptive strategies like reappraisal, does not facilitate achievement of one’s instrumental goals. There are goals that are simply unrealistic, unattainable, or that may not be as important as we think. In such cases engaging and understanding may not be the best regulatory option. Put differently, in these situations it is better to disengage

from a certain goal and to move on to concentrate on something else (Watkins in press). In these cases early selection strategies may offer better long term benefit.

Empirical Tests of the Expanded Framework

Our framework makes clear predictions regarding the effectiveness of early selection distraction versus late selection reappraisal. Early selection distraction is expected to provide short term relief from high (and low) emotional intensity stimuli with minimal effort, but it is also expected to be non-effective in the long run. By contrast, late selection reappraisal is expected to be successful at modifying low levels of emotional intensity, but to only partially modify high emotional stimuli and its operation would require substantial effort. Nevertheless, reappraisal can be adaptive in the long run.

Effects of Early-Selection Distraction

Consistent with our framework, our finding indicate that distraction is equally effective in attenuating negative affect under low and high levels of emotional intensity (Sheppes & Meiran, 2007). Support for distraction's engagement of early selection processes was demonstrated by impaired memory for emotional details of the sadness-inducing film (Sheppes & Meiran, 2007, 2008). This result indicates that once distraction is operating, the regulatory process blocks incoming emotional information at an early encoding phase, thereby preventing elaborated processing.

Furthermore, in a recent study we provided direct support for distraction’s early selection operation (Thiruchselvam, Blechert, Sheppes, Rydstrom, & Gross, 2011). Utilizing the excellent temporal resolution of electroencephalography (EEG) and event related potentials (ERPs) we showed that distraction modulated an ERP component (late positive potential. See Hajcak, MacNamara, & Olvet, 2010 for a review) that is sensitive

to processing emotionally arousing information, at a very early point before emotional information is provided elaborated processing. Crucially, even under high levels of emotional intensity, distraction did not result in increased recruitment of cognitive control resources, indicative of the relative minimal resource requirement in the operation of the strong early filtering mechanism in distraction (Sheppes, Catran, & Meiran, 2009; Sheppes & Meiran, 2008).

Last, our framework predicts that distraction would prove non-effective in the long run. In the ERP study mentioned above, we were able to show that emotional stimuli that were previously distracted resulted in an increased emotional responding when subjects were re-exposed to these stimuli again. These findings are also consistent with a study performed by Kross and Ayduk (2008) that showed that although distraction attenuated sad mood in the short run, it did not lead to changes in the way negative experiences are evaluated and responded to in the long run.

Effects of Late-Selection Reappraisal

In sharp contrast to the consistent effects of distraction at low versus high levels of emotional intensity, reappraisal had different effects under low versus high levels of emotional intensity (Sheppes & Meiran, 2007). Specifically, under low levels of emotional intensity, reappraisal modulated negative emotional experience relative to a control condition in which participants responded naturally. Reappraisal also eliminated semantic activation of sadness- related memory concepts, erasing the faster reaction times usually seen for sadness versus neutral words in a lexical decision task. However, under high levels of emotional intensity, reappraisal resulted in higher negative affect and in

impaired ability to regulate sadness, manifested in slow and limited recall of happy autobiographical memories.

The notion that in reappraisal incoming emotional information passes the early filter and is provided elaborated semantic meaning prior to being modified is supported by finding intact memory for emotional information that was presented after participants began using reappraisal (Richards & Gross, 2000; Sheppes & Meiran, 2007; 2008). In addition, in the ERP study described above (Thiruchselvam et al., in press), we found that reappraisal modulated the LPP at a late point long after emotional information was provided elaborated processing. Furthermore, reappraisal's increased recruitment of the effortful late selection filter when reinterpreting high intensity levels of existing and new emotional information was demonstrated by showing that reappraisal resulted costly expenditure of self control resources (Sheppes & Meiran, 2008).

In addition, when operating under high emotional intensity, reappraisal also resulted in increased physiological sympathetic activation (increased skin conductance and reduced finger temperature), which has previously been interpreted as reflecting the increased monitoring demand that characterizes a strong semantic conflict (Sheppes et al., 2009). Last, our framework predicts that though reappraisal results in short term costs it can nevertheless pay off in the long run. The reason is that an emotional stimulus that was reinterpreted via reappraisal would change in a way that it would become less intense upon re-exposure. In the aforementioned ERP study we have showed that emotional stimuli that were previously reappraised resulted in reduced emotional processing upon re-exposure indicative of emotional adaptation.

Applications to Other Forms of Emotion Regulation

Our framework holds that the effectiveness of emotion regulation strategies is determined by taking onto account three major factors. This framework can be applied for other emotion regulation strategies other than distraction and reappraisal.

For example, other strategies like avoidance should have the same characteristics as distraction. Avoidance which is a situation selection strategy is considered an early selection strategy according to our framework because it does not allow any processing of emotional materials. Accordingly, avoidance is expected to be very effective in providing short term relief with minimal effort. Nevertheless, avoidance has clear long term costs as it does not allow emotional adaptation. In fact, avoidance is considered a key player in maintaining anxiety symptoms, and psychological interventions that reduce avoidance using repeated exposure improve anxiety symptomatology.

Strategies such as rumination are expected to be non effective because they involve allowing emotional materials to be attended to and in the late semantic meaning phase negative content is being elaborated and magnified. For that reason rumination is considered to be maladaptive in the short as well as in the long run.

Strategies such as thought suppression and expressive suppression are also considered maladaptive for a somewhat different reason. The reason is related to the way the emotional information is blocked by the early filter which is ineffective. Wegner (1994) has suggested that suppression involves trying *not* to think a certain thought without forming a substitute of what to actively think about (termed feature negative). Forming a feature negative of not thinking or expressing something is considered to be effortful and it may be that in this case the content that is tried to be suppressed ends up passing the early filter and affecting the final response. In that sense distraction is

different from thought suppression because it allows actively thinking about something else. Indeed Wegner, Schneider, Carter, and White (1987) have shown that giving subjects a focused distraction instruction resulted in eliminating the maladaptive rebound effects associated with thought suppression. In a similar way it may be that part of the reason why expressive suppression is maladaptive and biofeedback is considered an adaptive regulatory strategy is due to suppression being a feature negative strategy (i.e., do *not* show emotional facial expressions) and biofeedback involving an active feature positive substitute (e.g., focus on your breathing).

Extensions and Future Research Directions

In this chapter, we have defined how emotion develops in a series of stages and how emotion regulation strategies can target each of these unfolding stages. We also discussed the factors that influence when emotion regulation strategies will be effective. Our starting point is the process model of emotion regulation (Gross & Thompson, 2007), which holds that antecedent regulation strategies that are initiated before the emotion generative response is sufficiently developed should be more effective than response focused strategies that try to fight off a well established emotional response. There have been multiple demonstrations in support of this model showing that reappraisal (an antecedent response focused strategy) is more effective than expressive suppression (response focused strategy).

Elaborating upon this conception, in this chapter we have argued that the effectiveness of regulation strategies depends on three factors (see Sheppes & Gross, in press for elaboration). These factors are: the resources required by the underlying regulatory strategy; the emotional intensity of the impulse one is regulating; and whether

a strategy targets a short term or long term goal. We have shown that distraction blocks emotional information at an early processing stage with a minimal effort. For these reasons, distraction provides short term relief with minimal effort but it can prove to be maladaptive in the long run. By contrast, reappraisal is a late selection strategy that allows emotional information to be attended and provided meaning before it is being modulated by a late selection filter. For these reasons reappraisal is effective in the context of a low intensity emotional response, but it becomes costly and effortful in the context of a high intensity emotional response. Nevertheless, because reappraisal allows elaborated processing it can prove useful in the long run.

It is clear that emotion regulation is a young field that is developing rapidly (see Gross 2010). It is therefore safe to assume that new and more sophisticated models are likely to emerge as the field matures. We therefore wish to fully acknowledge that there are many other factors that are very likely to be important in determining the effectiveness of regulation strategies. In the following sections, we point to several of the factors we believe may be important to consider as the field develops.

Gender Differences in Emotion Regulation

On an individual difference level, certain strategies could be more effective for certain people relative to others. For example, we have not discussed gender differences: whether certain strategies are more effective for men or women (see McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008). In order to appreciate gender differences in emotion regulation, one needs to also evaluate gender differences in emotion generation. Though the popular belief is that women show more emotional reactivity than men, empirical findings have been mixed. Specifically, while women consistently display more

emotional facial expressions than men (Brody 1997), differences between genders in other emotional response systems including subjective self reports (when self report biases are controlled), peripheral psychophysiology, and neural activation in the amygdala are not consistently found (see McRae et. al., 2008 for discussion). Studies that target gender differences in emotion regulation have been relatively rare.

Related to the present focus, McRae and colleagues (2008) have conducted a neuroimaging study in order to investigate gender differences in cognitive reappraisal. This study did not find differences in effectiveness in self report measures but interesting neural differences evinced. Specifically, relative to women, men showed less prefrontal activations and greater emotional modulation in the amygdala. These findings suggest that neuraly men may show a more efficient profile of cognitive reappraisal demonstrated in less effort exerted and more emotional modulation. Nevertheless, this study also found that women relative to men showed greater activity in reward brain regions, suggesting that women may use positive emotions in the service of regulating negative emotions. Future studies are needed in order to more fully investigate gender differences in other emotion regulation strategies.

Emotion Regulation Effectiveness and Psychopathology

Another clearly important domain where individual differences in emotion regulation are crucial is in the study of psychopathology. Disrupted emotion generation and emotion regulation are a hallmark for most of the psychiatric disorders. Central features in the diagnosis of mood and anxiety disorders include disrupted emotional reactivity. Nevertheless, the nature of disrupted emotional reactivity is not always simple.

For example, in the depression literature, there are three competing accounts regarding differences in emotion generation. Specifically, some accounts argue that depressed individuals show heightened negative affect, others argue for decreased positivity and yet a third recent account suggests that severe depression involves emotional numbing with dampened negative and positive affect (see Rottenberg 2005 for a review). Within the emotion regulation domain, individuals who rely on strategies such as rumination are at high risk to develop depressive episodes that tend to be prolonged and more severe relative to individuals who use strategies like distraction (see Nolen Hoeksema et. al., 2008 for a review). In anxiety disorders, a common regulatory deficit involves an impaired ability to disengage from threatening information (see Cisler & Koster, 2010 for a recent review). In a similar vein, in posttraumatic stress disorder, regulatory impairments are manifested in an imbalance between intense and uncontrolled re-experiencing of the traumatic event with impaired regulatory efforts to overly avoid and dissociate (see Foa & Kozak, 1986; Nemeroff et. al., 2006 for reviews). Recently, new emotion regulation have been applied to develop novel clinical interventions for anxiety and depression (Campbell Sills and Barlow, 2007), but further research is clearly needed.

Culture and Emotion Regulation

Expanding the focus still further, emotion regulation has been important in the study of culture. In order to understand cultural differences in emotion regulation, differences in emotion generation should be accounted for. As with the gender literature, differences between cultures in emotion generation are not trivial. For example, in a recent important study, Chentsova-Dutton and Tsai (2010) have shown that cultural differences in emotion

reactivity depend on the target of self focus. Specifically, when individuals focused on individual aspects of their self (which is central in European independent cultures), European American individuals showed greater emotional reactivity than Asian Americans. However, when individuals focused on relational self aspects (which is central in Asian interdependent cultures) a reversed pattern emerges.

In the emotion regulation domain it was shown that expressive suppression, which is considered to be generally maladaptive in western cultures, was less disadvantageous in Eastern Asians whose culture norms involve minimizing facial expressions in public (Butler, Lee & Gross, 2007). Recently, emotion regulation frameworks have been further extended to understand and aid conflict resolution between countries (Halperin, Sharvit, & Gross in press). More work is clearly needed to understand how cultural processes shape emotion generation and emotion regulation processes.

Author Note

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References

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A., Barndollar, K., & Trotschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology, 81*(6), 1014-1027.

Barlow, D. H. (1988). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. New York: Guilford Press.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., et al. (2004). Mindfulness: A Proposed Operational Definition. *Clinical Psychology: Science and Practice, 11*(3), 230-241.

Brody, L.R., (1997). Gender and emotion: beyond stereotypes. *Journal of Social Issues, 53,* 369-393.

Butler, E. A., Egloff, B., Wilhelm, F. W., Smith, N. C., Erickson, E. A., & Gross, J. J. (2003). The social consequences of expressive suppression. *Emotion, 3*, 48-67.

Butler, E. A., Lee, T. L., & Gross, J. J. (2007). Emotion regulation and culture: Are the social consequences of emotion suppression culture-specific? *Emotion, 7*(1), 30-48.

Campbel-Sills, L., & Barlow, D.H. (2007). Incorporating emotion regulation into conceptualizations and treatments of anxiety and mood disorders. In J.J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 542-559). New York: Guilford Press.

Carver, C.S., & Scheier, M.F. (1994). Situational coping and coping dispositions in a stressful transaction. *Journal of Personality and Social Psychology, 66,* 184-195.

Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science,* 323, 1222-1226.

Cheng, C. (2001). Assessing coping flexibility in real-life and laboratory settings: A multimethod approach. *Journal of Personality and Social Psychology, 80,* 814-833.

Chentsova-Dutton, Y.E., & Tsai, J.L. (2010). Self-focused attention and emotional reactivity: the role of culture. *Journal of Personality and Social Psychology, 98,* 507-519.

Cisler, J.M., & Koster, E.H.W. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review**.** *Clinical Psychology Review, 30,* 203-216.

Cramer, P. (2008). Seven pillars of defense mechanism theory. *Social and Personality Psychology Compass, 2,* 1963-1981.

Damasio, A.R. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. New York: Harcourt Brace.

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. *Neuropsychological perspectives on affective and anxiety disorders,* 307.

Diamond, E.L. (1982). The role of anger and hostility in essential hypertension and coronary disease. *Psychological Bulletin, 92,* 410-433.

Dunning, J. P., & Hajcak, G. (2009). See no evil: Directing visual attention within unpleasant images modulates the electrocortical response. *Psychophysiology, 46*(1), 28-33.

Ekman, P. (1992). Facial Expressions of Emotion: New Findings, New Questions. *Psychological Science, 3*(1), 34-38.

Evers, C., Stok, F.M., de Ridder, D.T.D. (2010). Feeding your feelings: emotion regulation strategies and emotional eating. *Personality and Social Psychology Bulletin, 36,* 792-804.

Foa, E.B., & Kozak, M.J. (1986). Emotional processing of fear: exposure to corrective information. *Psychological Bulletin, 99,* 20-35.

Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: Study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology*, *48*(1), 150.

Frijda, N. H. (1986). The Current Status of Emotion Theory. *Bulletin of the British Psychological Society*, *39*, A75-A75.

Freud, S., (1962). The neuro-psychoses of defense. In J. Strachey (Ed. And Trans.), *The standard edition of the complete works of Sigmund Freud* (Vol. 3, pp. 45-61). London: Hogarth Press. (Original work published 1894).

Goldin, P.R., McRae, K., Ramel, W., & Gross, J.J. (2008). The neural bases of emotion regulation: reappraisal and suppression of negative emotion. *Biological Psychiatry, 63,* 577-586.

Goldin, P., Ramel, W., & Gross, J. (2009). Mindfulness meditation training and self-referential processing in social anxiety disorder: Behavioral and neural effects. *Journal of Cognitive Psychotherapy, 23*(3), 242-257.

Gross, J.J. (1998a). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2,* 271-299.

Gross, J.J. (1998b). Antecedent and response focused emotion regulation: divergent consequences for experience, expression and physiology. *Journal of Personality and Social Psychology, 74*, 224-237.

Gross, J.J. (1999). Emotion regulation: Past, present, future. *Cognition and Emotion, 13,* 551-573.

Gross, J.J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science, 10,* 214-219.

Gross, J.J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39,* 281-291.

Gross, J. J. (2010). The future's so bright, I gotta wear shades. *Emotion Review, 2*(3), 212-216.

Gross, J. J., & Levenson, R.W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology, 64,* 970–986.

Gross, J.J., & Levenson, R.W. (1997). Hiding feelings: The acute effects of inhibiting positive and negative emotions. *Journal of Abnormal Psychology, 106,* 95-103.

Gross, J.J., Sheppes, G., & Urry, H.L. (in press). Emotion generation and emotion regulation: A distinction we should make (carefully). *Cognition and Emotion*.

Gross, J. J., Richards, J. M., & John, O. P. (2006). Emotion regulation in everyday life. In D. K. Snyder, J. A. Simpson & J. N. Hughes (Eds.), *Emotion regulation in couples and families: Pathways to dysfunction and health*. Washington, DC: American Psychological Association.

Gross, J.J., & Thompson, R.A. (2007). Emotion regulation: conceptual foundations. In J.J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 3-24). New York: Guilford Press.

Hajcak, G., Dunning, J. P., & Foti, D. (2009). Motivated and controlled attention to emotion: Time-course of the late positive potential. *Clinical Neurophysiology, 120*(3), 505-510.

Hajcak, G., MacNamara, A., & Olvet, D.M. (2010). Event-related potentials, emotion, and emotion regulation: An integrative review. *Developmental Neuropsychology, 35*, 129-155.

Halperin, E., Sharvit, K., & Gross, J.J. (in press). Emotion and emotion regulation in intergroup conflict: An appraisal based framework. In D. Bar-Tal (Ed.), *Intergroup conflicts and their resolution: Social psychological perspectives*. New York: Psychology Press.

Heilman, R.M., Crişan, L.G., Houser, D., Miclea, M., & Miu, A.C. (2010). Emotion regulation and decision making under risk and uncertainty. *Emotion, 10*, 257-265.

Hubner, R., Steinhauser, M., & Lehle, C. (2010). A dual-stage two-phase model of selective attention. *Psychological Review, 117*, 759-784.

Johns, M.J., Inzlicht, M., & Schmader, T. (2008). Stereotype threat and executive resource depletion: Examining the influence of emotion regulation. *Journal of Experimental Psychology: General, 137*, 691-705.

Johnston, W. A. & Heinz, S. P (1978). Flexibility and capacity demands of attention. *Journal of Experimental Psychology: General, 107*, 420 - 435.

Kalisch, R., Wiech, K., Herrmann, K., & Dolan, R.J. (2006). Neural correlates of self-distraction from anxiety and a process model of cognitive emotion regulation. *Journal of Cognitive Neuroscience, 18*, 1266-1276.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology, 84*(3), 394-421.

Koole, S.L., Van Dillen, L.F., & Sheppes, G. (in press). The self regulation of emotion. In K.D. Vohs & R.F. Baumesiter (Eds). Handbook of self regulation: research, theory, and applications. New York: Guilford Press.

Kross, E., Ayduk, O., & Mischel, W. (2005). When asking "why" does not hurt: Distinguishing rumination from reflective processing of negative emotions. *Psychological Science*, 16, 709-715.

Kross, E., & Ayduk, O. (2008). Facilitating adaptive emotional analysis: Distinguishing distanced-analysis of depressive experiences from immersed-analysis and distraction. *Personality and Social Psychology Bulletin, 34*, 924-938.

Levenson, R. W. (1999). The intrapersonal functions of emotion. *Cognition & Emotion, 13*(5), 481-504.

Levitt, J. T., Brown, T. A., Orsillo, S. M., & Barlow, D. H. (2004). The effects of acceptance versus suppression of emotion on subjective and psychophysiological

response to carbon dioxide challenge in patients with panic disorder. *Behavior Therapy, 35*(4), 747-766.

Lewin, K. (1943). Defining the "field at a given time". *Psychological Review, 50,* 292-310.

Macklem, G.L. (2008). Parenting and emotion regulation. *Practitioner's guide to emotion regulation in school-aged children.* Springer US (pp. 42-62).

McCaul, K. D., & Malott, J. M. (1984) Distraction and coping with pain. *Psychological Bulletin, 95,* 516-533.

Mauss, I. B., Levenson, R. W., McCarter, L., Wilhelm, F. H., & Gross, J. J. (2005). The tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion, 5,* 175-190.

Mauss, I. B., Cook, C. L., & Gross, J. J. (2007). Automatic emotion regulation during anger provocation. *Journal of Experimental Social Psychology, 43*(5), 698-711.

Mcrae, K., Ochsner, K. N., Mauss, I. B., Gabrieli, J. J. D., & Gross, J. J. (2008). Gender differences in emotion regulation: An fMRI study of cognitive reappraisal. *Group Processes & Intergroup Relations, 11*(2), 143-162.

McRae, K., Hughes, B., Chopra, S., Gabrieli, J.J.D., Gross, J.J., Ochsner, K.N. (2010). The neural correlates of cognitive reappraisal and distraction: An fMRI study of emotion regulation. *Journal of Cognitive Neuroscience, 22,* 248-262.

McRae, K., Misra, S., Prasad, A., Pereira, S., & Gross, J.J. (2010). Bottom-up and top-down emotion generation: Implications for emotion regulation. *Manuscript submitted for publication.*

Nemeroff, C.B., Bremner, J.D., Foa E.B., Mayberg, H.S., North, C.S., & Stein, M.B. (2006). Posttraumatic stress disorder: A state-of-the-science review. *Journal of Psychiatric Research,* 40, 1-21.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100,* 569-582.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*(5), 400.

Ochsner, K.N., & Gross, J.J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences, 9,* 242-249.

Ochsner, K. N., & Gross, J. J. (2008). Cognitive Emotion Regulation. *Current Directions in Psychological Science, 17*(2), 153-158.

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D. E., et al. (2004). For better or for worse: neural systems supporting the cognitive down- and up-regulation of negative emotion. *NeuroImage, 23*(2), 483-499.

Pashler, H. (1998). *The psychology of attention.* Cambridge, MA: MIT Press.

Pawlow, L. A., & Jones, G. E. (2002). The impact of abbreviated progressive muscle relaxation on salivary cortisol. *Biological Psychology, 60*(1), 1-16.

Philippot, P., Chapelle, G., & Blairy, S. (2002). Respiratory feedback in the generation of emotion. *Cognition & Emotion, 16*(5), 605-627.

Reisenzein, R. (1994). Pleasure-arousal theory and the intensity of emotions. *Journal of*

Personality and Social Psychology, 67, 525-539.

Richards, J.M. (2004). The cognitive consequences of concealing feelings. *Current Directions in Psychological Science, 13*, 131-134.

Richards, J. M., & Gross, J. J. (1999). Composure at any cost? The cognitive consequences of emotion suppression. *Personality and Social Psychology Bulletin, 25*(8), 1033-1044.

Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*(3), 410-424.

Roth, S., & Cohen, L. (1986). Approach, avoidance, and coping with stress. *American Psychologist, 41*, 813-819.

Rottenberg, J. (2005). Mood and emotion in major depression. *Current Directions in Psychological Science,14,* 167-170.

Scherer, K. R., Schorr, A., & Johnstone, T. (2001). *Appraisal processes in emotion: Theory, methods, research*: Oxford University Press, USA.

Sheppes, G., & Gross, J.J. (in press). Is timing everything? Temporal considerations in emotion regulation. *Personality and Social Psychology Review*.

Sheppes, G., & Meiran, N. (2007). Better late than never? On the dynamics of on-line regulation of sadness using distraction and cognitive reappraisal. *Personality and Social Psychology Bulletin, 33*, 1518-1532.

Sheppes, G., & Meiran, N. (2008). Divergent cognitive costs for online forms of reappraisal and distraction. *Emotion, 8,* 870-874.

Sheppes, G., Catran, E., & Meiran, N. (2009). Reappraisal (but not distraction) is going to make you seat: physiological evidence for self control effort. *International Journal of Psychophysiology, 71,* 91-96.

Speisman, J. C., Lazarus, R. S., Mordkoff, A., & Davison, L. (1964). Experimental reduction of stress based on ego-defense theory. *Journal of Abnormal and Social Psychology, 68,* 367-380.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797-811.

Suls, J., & Fletcher, B. (1985). The relative efficacy of avoidant and nonavoidant coping strategies: A meta-analysis. *Health Psychology, 4,* 249-288.

Tamir, M. (2009). What do people want to feel and why? Pleasure and utility in emotion regulation. *Current Directions in Psychological Science, 18,* 101-105.

Tamir, M., & Ford, B. Q. (2009). Choosing to be afraid: Preferences for fear as a function of goal pursuit. *Emotion, 9,* 488-497.

Temoshok, L. (1987). Personality, coping style, emotion and cancer: toward an integrative model. *Cancer Surveys, 6,* 545-567.

Thiruchselvam, R., Blechert, J., Sheppes, G., Rydstrom, A., & Gross, J.J. (2011). The temporal dynamics of emotion regulation: An EEG study of distraction and reappraisal. *Biological Psychology,87,* 84-92.

Van Dillen, L.F., & Koole, S.L. (2007). Clearing the mind: a working memory model of distraction from negative mood. *Emotion, 7,* 715-723.

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*(2), 163-206.

Waktins, E. (in press). Dysregulation in level of goal and action identification across psychological disorders. *Clinical Psychology Review.*

Williams, L.E., Bargh, J.A., Nocera, C., & Gray, J.R (2009). On the unconscious regulation of emotion: Nonconscious reappraisal goals modulate emotional reactivity. *Emotion, 9*, 847-854.

Wilson, T. D., & Gilbert, D. T. (2008). Explaining away: A model of affective adaptation. *Perspectives on Psychological Science, 3*, 370-386.

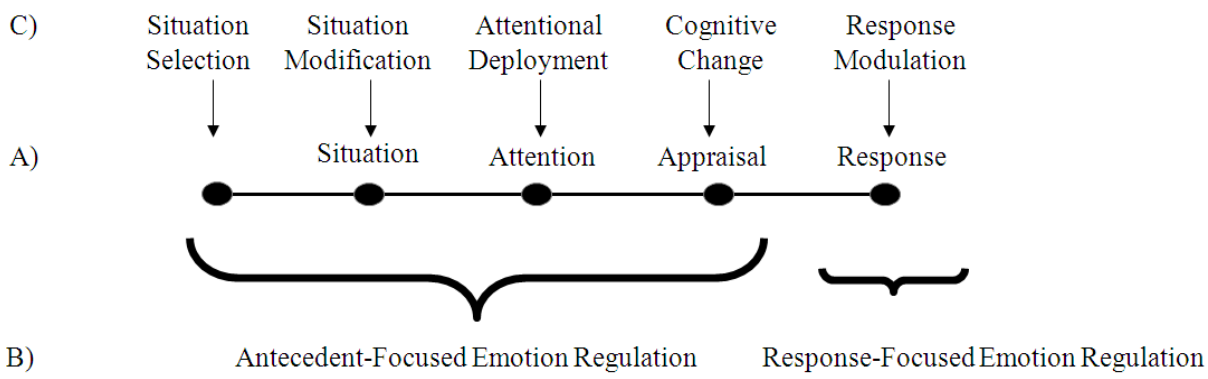
Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53* (1), 5-13.

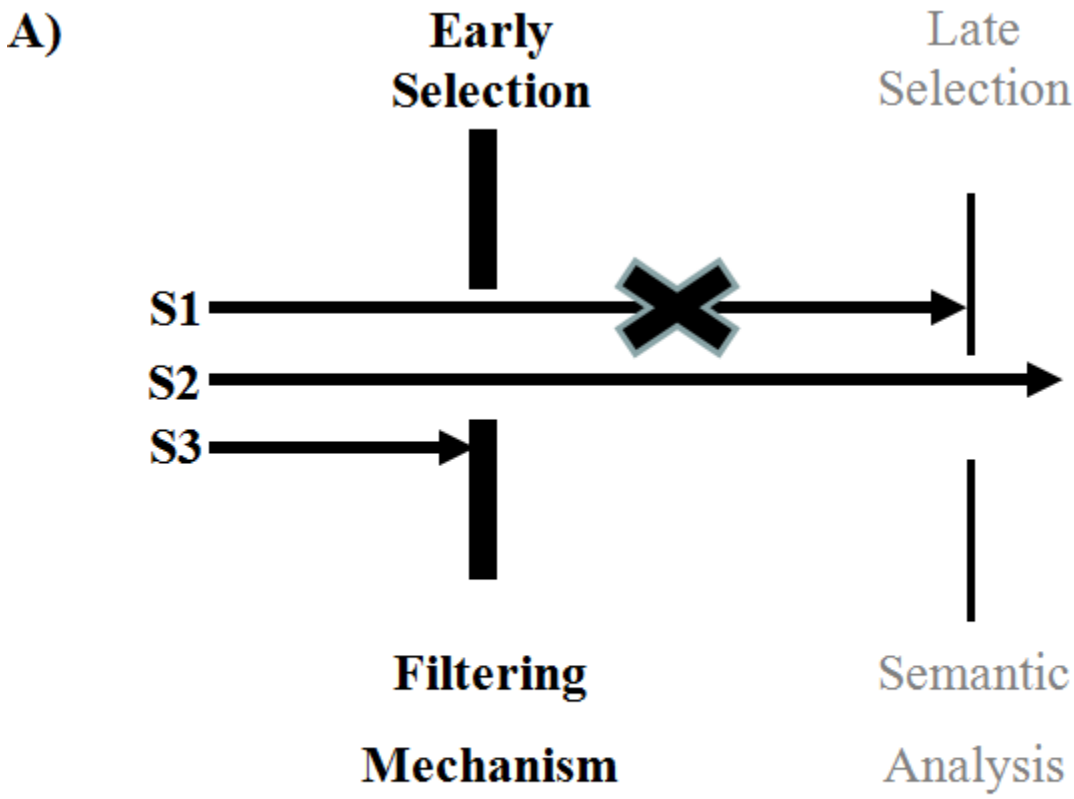
Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*(1), 34-52.

Figure Captions

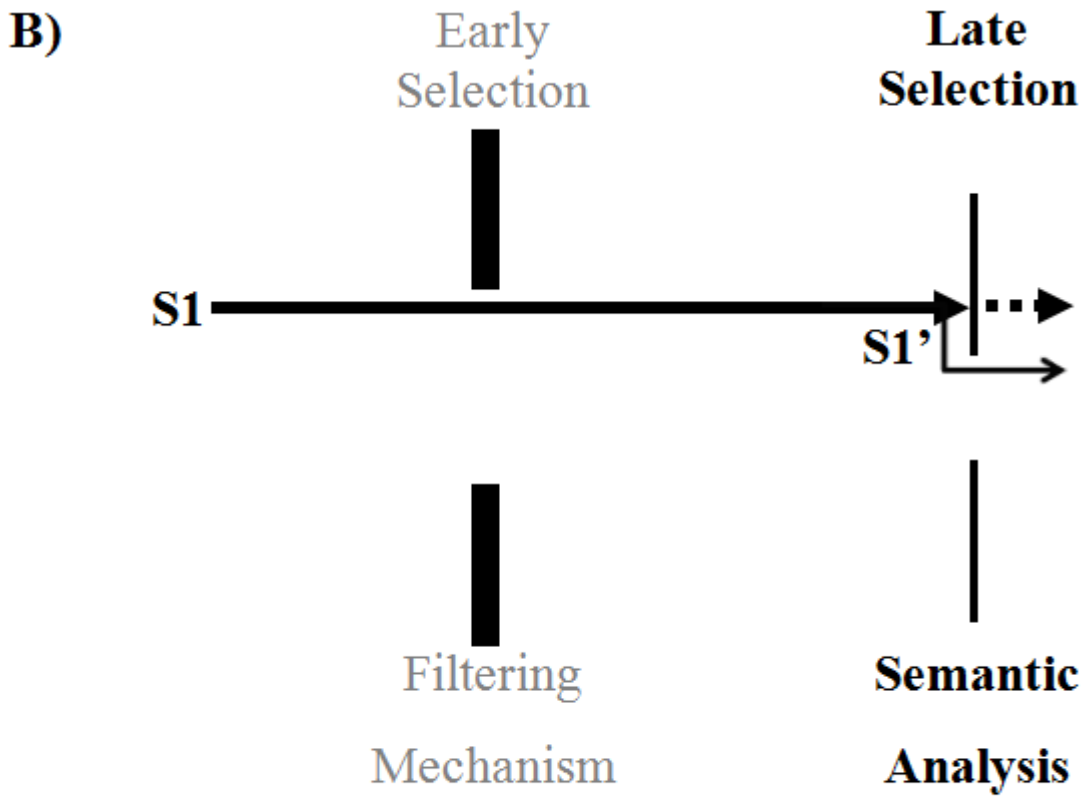
Figure 1. The process model of emotion regulation (reprinted from Sheppes & Gross, in press). A) Components of emotion generation. B) Antecedent-focused versus response-focused emotion regulation strategies. C) Five emotion regulation families.

Figure 2. Underlying operation of distraction and reappraisal (reprinted from Sheppes & Gross, in press). The thickness of each filter reflects its strength, and is inversely related to its use of cognitive resources. Thus, the early filter is stronger and uses less resources than the late filter. The thickness of each arrow represents its relative strength, with thicker arrows inducing stronger influence on the final response, which is represented in the right side of the figure. A) Operation of distraction. Existing emotional information (arrow S1) is being replaced (indicated by the X notation) by a strong independent neutral stream of information (thick arrow S2) that is dominating the final response. In addition, incoming emotional information is filtered out at an early selection phase (the arrow S3 is blocked by the strong early filter). B) Operation of reappraisal. In reappraisal, existing and incoming emotional information are treated in the same way (indicated by a single S1 notation for both types of emotional information). High intensity existing and incoming emotional information (thick arrow S1) are not fully modified by a dependent neutral interpretation (thin arrow S1') via the late selection filter. As a result, emotional information passes through the late selection filter (indicated by a dashed arrow that passes through the late selection filter and affects the response). Therefore, the dependent neutral reinterpretation of the emotional information (thin arrow S1') only partially affects the final response and is being outweighed by the strong emotional information.


C)
Situation Selection
Situation Modification
Attentional Deployment
Cognitive Change
Response Modulation
A)
Situation
Attention
Appraisal
Response
B)
Antecedent-Focused Emotion Regulation
Response-Focused Emotion Regulation



Distraction's Underlying Operation



Reappraisal's Underlying Operation