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Affective Science and Health: The Importance of Emotion and Emotion Regulation

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Objective: The goal of this article is to provide insight into how recent findings from affective science may be translated into the health arena. ***Methods:*** We first review definitional issues related to the key concepts of emotion and stress. We then review relevant research that informs our understanding of the affect–health relationship. Subsequently, we highlight findings that are the most informative and also ripe for translation into the domains of health and health-related behaviors. ***Results:*** We identify several domains of affect-relevant processes (e.g., emotion-regulation, stress response) that would benefit from increased elaboration. Three themes may guide how best to broaden our understanding across multiple domains: the need to use a differentiated emotion-based approach, the need to consider potential synergistic and oppositional effects of emotion that can occur in parallel, and the need to examine the impact of emotions with respect to regulation and coping at both the intra- and interindividual levels. Building on insights derived from these themes, we suggest a broad integrative framework for use with future investigations. This framework categorizes potential emotion-related effects on health according to whether they influence health directly (e.g., shaping physiological responses) or indirectly (e.g., guiding decision making and behavior). Using this approach will allow researchers to examine systematically the often simultaneous and sometimes opposing influences of emotion on distinct health-relevant cognitive and physiological mechanisms, and to integrate across potentially disparate findings. ***Conclusions:*** We conclude by suggesting opportunities for future work that we see as most fruitful based on the presented framework.

Keywords: affective science, health, emotion, emotion regulation, stress

The past few decades have witnessed a remarkable growth in the field of affective science. We have seen both a rapid accumulation of findings that demonstrate the wide reach of affective states in shaping thought and behavior across many realms, and the emergence of new theories that have led to reconsideration of some long-held conceptions regarding the nature, structure, and function of emotions (for reviews, see Barrett, Mesquita, Ochsner, & Gross, 2007; Davidson, Scherer, & Goldsmith, 2009). We believe that the field of health psychology, attributable in no small part to its interrelation with and interest in aspects of physiology, cognition, and social behavior that are shaped by affect, stands to benefit greatly from these advances.

It is our view that advances in affective science can begin to address longstanding debates about the complex nature of the affect-health relationship. This includes questions about whether direct effects of emotion on health are possible via neurochemical changes that take place during the experience of affective states that are sufficient to induce pathophysiology (cf. Relman & Angell, 2002). In a related vein, emerging research may also provide insight into whether there are specific effects of distinct emotions on health, whether emotions heighten general susceptibility to multiple health problems, and whether an undifferentiated view of stress might be insufficient to capture the various ways affect might interact with health (cf. Lazarus, 1991).

Of course, any impact of affective states on health may occur through more nuanced and complex cognitive processes as well. A growing corpus of findings points to a need to expand current thinking about the range of factors that could account for indirect effects linking affect and health. Where once we had assumed unitary effects of emotion would be sufficient to predict the health-relevant sequelae of affective states, we now recognize that interactions among distinct affective responses are consequential for processes ranging from health-relevant decisions-making to the seeking and building of social support. Similarly, where once we had assumed that coping and emotion regulation occurred after an affective response had taken place (as mop-up operations), it is now clear that emotion-regulation processes operate at multiple points through the emotion-generative process, highlighting the need to take temporal context into account.

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Our goal in the present article is to review recent developments in affective science and to show how these developments are relevant to health psychology. The major structuring device we will use is the distinction between *direct effects* of emotion on health, which depend on physiological alterations that occur with affective states, and *indirect effects* of emotion on health, which operate via more indirect pathways that influence decisions and behaviors involving screening or treatment choices, diet, exercise, coping strategies, and the seeking of social support. By necessity, our review will be selective, with the guiding principle being one of demonstration as opposed to exhaustiveness. In so doing, we hope to show how new findings from basic affective science might be translated to the field of health psychology.

Conceptual and Definitional Issues

Traditionally, research on affect and health has had a significant focus on *stress*, defined as an environmental demand that can—if too intense or prolonged—disrupt healthy functioning (Lovallo, 2005). This conception trades on the analogy to a physical load that is placed on a structure, leading to deformation or even collapse if the load is too great. Two factors are key here. The first is the magnitude of the stressor (analogous to the weight of the load). The principal assumption is that stressors can be ordered from "small" to "large," and that "large" stressors create more strain than "small" stressors. The second variable is the constitution of the individual that is experiencing stress (analogous to the robustness of the structure that is being placed under load). The assumption here is that individuals respond differently to the "same" stressor, with some individuals unaffected by stressors that lead others to collapse.

From Stress to Specific Emotions and Other Forms of Affect

With the advent of the cognitive revolution in psychology, there was a shift from S-R (stimulus-response) models to S-O-R (stimulus-organism-response) models, which acknowledged the important role of construal processes. In a seminal Annual Review paper, Lazarus (1993a) argued that "psychological stress should be considered part of a larger topic, the emotions" (p. 10). He argued that within the stress field, there had already been movement from unidimensional to multidimensional conceptions of stress. Lazarus emphasized that he was not suggesting that stress conceptions were no longer useful. Instead, he proposed that "the concept of emotion includes that of stress" (p. 12). Extending this view of stress suggests that conceptualizations of stress may benefit not only by linking them to emotion, but also by considering their interrelations with variability in specific emotions.

Definitions about the nature of emotions themselves have also evolved, leading affective scientists to make distinctions between different types of phenomena (Barrett, Mesquita, Ochsner, & Gross, 2007). For our purposes here, clarification of two primary terms is beneficial. Affect refers to an embodied state corresponding to whether something is "good for me" or "bad for me." As such, it is often used as a general term to encompass many emotion-relevant phenomena. Emotions refer to more narrowly defined states that emerge in response to specific challenges and goals through the incorporation of conceptual and contextual knowledge into basic affective responses. As such, emotions engender sets of goal-oriented physiological and cognitive changes meant to lead to adaptive responding (Barrett, in press; Barrett et al., 2007).

Contemporary models of emotion and health have been divided as to whether it is necessary to examine specific emotions as opposed to simply considering the valence of affective states (e.g., Kubzansky, Cole, Kawachi, Vokonas, & Sparrow, 2006; Suls & Bunde, 2005). As we will elaborate below, although a dimensional approach to understanding emotions may sometimes be appropriate, an approach focusing on specific emotions is ultimately likely to yield more insight. As recent work in affective science has made abundantly clear, distinct negative (e.g., anger, fear, sadness) and positive (e.g., happiness, gratitude, pride) states often differentially impact cognition and behavior even when of the same valence (Loewenstein & Lerner, 2003; Keltner & Lerner, 2010).

From Coping to Emotion Regulation

As noted above, aspects of the individual, as opposed to solely the external stressor, also play a role in determining health outcomes. As is well recognized, then, attempts to regulate affective responses can take many forms that have the potential to mitigate the direct negative impacts of affective states on pathophysiology or to alter other crucial resources (e.g., social support, cognitive resources) that in turn play a key indirect role as health determinants. Traditionally, health psychologists have focused on coping processes. This focus is the intellectual legacy of theorists, including Lazarus, who defined coping as "efforts to manage demands that tax or exceed our resources" (Lazarus, 1993b, p. 34).

Unfortunately, this definition of coping fails to match an enlarged conception of stress and emotion. What is needed is a broader conception of the processes by which emotions are regulated. These emotion regulatory processes may be automatic or effortful, and may be activated in the service of either up- or down-regulating either negative or positive emotions. One approach to conceptualizing the potentially overwhelming number of processes involved in regulating emotions is to distinguish among emotion regulatory acts by considering where they have their primary impact on the emotion-generative process (Gross, 2001). This approach has led to a distinction among five families of emotion-regulatory processes: situation selection, situation modification, attentional deployment, cognitive change, and response modulation.

The first type of emotion regulation is *situation selection*, which involves taking actions that make it more likely that we will be in a situation we expect would give rise to the emotions we'd like to have (or less likely that we will be in a situation that will give rise to emotions we would prefer not to have). A second type of emotion regulation is *situation modification*, which refers to modifying the physical environment so as to alter one's emotional responses to that environment. The first two forms of emotion regulation—situation selection and situation modification—both help to shape the situation to which an individual will be exposed. However, it also is possible to regulate emotions without actually changing the environment. Situations have many aspects, and a third form of emotion regulation, *attentional deployment*, refers to influencing emotional responding by redirecting attention within a given situation. A fourth type of emotion regulation, *cognitive*

change, refers to changing one or more of the appraisals that give rise to different emotions. Finally, a fifth type of emotion regulation, *response modulation*, refers to influencing physiological, experiential, or behavioral responses relatively directly, once an emotional response has already been generated. As we will see in the sections that follow, direct effects of emotion regulation include the amplification of physiological responses associated with emotion, whereas indirect effects include processes such as impairments in symptom recognition, delay help-seeking behavior, and compromised communication about problems.

Pathways Linking Affect and Health

Emotions are biologically basic features of human functioning, and learning to regulate them constitutes a major developmental milestone (National Research Council and Institute of Medicine, 2000). Thus, patterns of emotional functioning that emerge in childhood are maintained into adulthood, and as a result child emotional functioning may provide an early indicator of adult health risk (Repetti, Taylor, & Seeman, 2002). Indeed, research is beginning to bear this out; emerging research has found that chronic high childhood distress (usually measured at age 7 or 8 years) is associated with a range of adult physical health outcomes such as obesity (Goodwin et al., 2009), number of physical illnesses (Kubzansky, Martin, & Buka, 2009), and inflammation (Appleton et al., 2011). Life course models suggest that these effects may occur by both direct and indirect processes (Kuh et al., 2003), suggesting the usefulness of a broad framework organized according to whether effects are directly or indirectly mediated. We believe this broad framework will be useful for highlighting and integrating new findings linking affective states to health.

Despite ongoing controversy about whether emotions directly contribute to disease onset and progression, almost all models of emotion and health posit direct effects via neurobiological alterations that occur with emotion experiences. Indeed, much research has shown that physical symptoms frequently accompany affective experience and that high levels of distress are generally accompanied by high levels of health care utilization (Walker, Sharpe, & Wessely, 2006). It is useful to note, however, that such direct effects may take several forms. For example, an emerging though somewhat controversial view is that the chronic experience of negative emotions can influence the development of disease via cumulative effects or, in a related vein, that such states can trigger an acute and subsequently unfolding disease episode (Rozanski, Blumenthal, Davidson, Saab, & Kubzansky, 2005). It is certainly also true that effects of affective states in an already damaged biological system may be quite different from effects in an initially healthy system (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). Thus, pathways by which emotion directly influences the development, triggering, exacerbation, or progression of disease may be overlapping, but may also be distinct. Careful consideration of both the nature of the emotional experience (i.e., valence, intensity, duration, frequency) and the disease (type, stage, onset vs. progression, severity, biological alterations) is needed when exploring whether and how emotions may influence health.

In addition to such direct effects, researchers also recognize that the influence of affective states on health can occur through indirect routes, and in fact do so in much more numerous and complex ways than often assumed. Research both in social and health psychology demonstrates the impact of specific affective states on thoughts, decisions, and behaviors, many of which hold potential to subsequently influence pathophysiology (Forgas, 2001; Schwarz & Clore, 2007; Rothman & Salovey, 2007). For example, alterations in perceptions of risk can clearly alter decisions to seek medical treatment or screenings, to adhere to exercise or dietary regimens, or to engage in safe-sex practices, all of which can shape subsequent physical health (cf. Rothman, Kelly, Hertel, & Salovey, 2003). Similarly, affect driven alterations in the quality of interpersonal communication and bonding can certainly impact one's levels of social support, which in turn may influence health (cf. Algoe & Fredrickson, 2011; Algoe & Stanton, 2011; Stanton, 2011).

In the remainder of this article, we will use this overarching dual-route framework both to provide a review of recent select findings of interest and, more importantly, to suggest areas in which current understandings of certain affect-relevant processes (e.g., emotion-regulation, physiological and social stress responses) can benefit from increased elaboration. Throughout, we will emphasize three themes that are central to increasing understanding of the roles played by affective states in health: the need to use a specific or differentiated emotion-based as opposed to valence-based approach, the need to consider potential synergistic and oppositional effects of emotion that can occur in parallel, and the need to examine the impact of emotions with respect to regulation and coping at both the intraindividual and interindividual (i.e., social) levels.

Direct Effects of Affect on Health

Can emotions directly influence health? A growing body of research suggests the answer may be an affirmative one (e.g., Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002), notwithstanding dissenting views which consider emotions largely to be a byproduct or consequence of physical illness (e.g., Relman & Angell, 2002). The instantiation of an affective state necessarily involves alterations in the body's physiology (Barrett & Bliss-Moreau, 2009; Mauss et al., 2005). Accordingly, these changes in multiple systems (e.g., cardiac functioning, blood pressure, immune response, HPA axis) hold the potential to impact physical health directly, with the specific nature of any effects depending on the intensity, frequency, and duration of affective states in question. Depending on the nature of the emotional state, and its frequency and time course, physiological responses meant to be adaptive in the short-term can lead to maladaptive outcomes in the long-term if not regulated correctly (Sapolsky, 2007).

A More Differentiated View: Beyond Stress to Negative Affect and Differentiated Emotions

Evidence that negative emotions are involved in disease etiology has most commonly considered three forms of negative affect: anger, anxiety, and depression. The best evidence to date has been provided in relation to cardiovascular disease (CVD). In the last 5 years, a consensus has grown that negative emotions do influence development of CVD (e.g., Roest, Martens, de Jonge, & Denollet, 2010). Whether emotion is involved in the etiology of other diseases is more difficult to study because they may have a long latency period or have onsets early in life, making it difficult to

establish direction of causality. However, although the literature considering other health outcomes is less robust, there is reasonable evidence that these same forms of negative emotion influence development of infectious disease (Cohen, Tyrrell, & Smith, 1993), declines in lung function (Kubzansky et al., 2006), diabetes (Mezuk, Eaton, Albrecht, & Golden, 2008), arthritis (Karakus & Patton, 2011), and cancer (Kroenke et al., 2005).

To date, most studies of negative emotions and health have considered each emotion in isolation as a risk factor. As emotions rarely occur in isolation, the consistency of findings across the three negative emotions in relation to disease risk raises the question of whether their effects are unique, or whether there is some general effect of distress thereby implying the utility of a dimensional approach (Suls & Bunde, 2005). Numerous studies have found an association between nonspecific measures of distress and CHD (e.g., Rasul, Stansfeld, Davey Smith, Shlomo, & Gallacher, 2007); however, such findings do not inform the debate as they may indicate either that underlying distress shared across multiple negative emotional states is an important contributor to disease risk, or that the general measure has captured what matters about a specific emotion state. Two empirical prospective studies of negative emotion and incident heart disease have directly addressed the issue of covariation across negative emotion. Both studies found that general distress was strongly associated with incident disease, although in one study the specific emotions maintained a stronger independent association with heart disease (Kubzansky et al., 2006) than in the other study (Boyle, Michalek, & Suarez, 2006), leading to slightly different conclusions about the relative importance of maintaining a specific emotion approach.

Support for maintaining a differentiated emotion approach is provided by the emerging research on positive emotions. One of the key theories to inform research on positive emotion and health is the Broaden-and-Build model of emotion, which identifies four positive emotion families—joy, interest, contentment, and love. While the theory was not specifically targeted to address the link between positive emotions and health, Fredrickson posited both direct effects (e.g., speeding recovery from experience of stress) and indirect effects (e.g., broadening an individual's momentary thought—action tendencies and building personal resources) that are potentially relevant for health (Fredrickson, 1998). Other theorists have proposed that positive emotions do not simply buffer the effects of stress but have more direct positive effects beyond stress (cf. Zautra, 2003).

Although the empirical literature on positive affect and health is somewhat scattered and still limited as few studies of major health outcomes to date have been designed explicitly to examine this relationship, a promising body of evidence is beginning to emerge. In 2005, Pressmen and Cohen conducted a comprehensive review of the existing literature on positive affect and health and concluded that positive affect likely has a protective effect on health (Pressman & Cohen, 2005). The strongest evidence available is in relation to cardiovascular disease. Studies generally suggest that positive affect reduces risk of developing heart disease even after adjusting for known coronary risk factors as well as accounting for negative affect (Boehm & Kubzansky, in press). In one interesting study, positivity displayed on the faces of almost 2000 participants was judged during a structured interview (Davidson, Mostofsky, & Whang, 2010). Individuals who displayed higher levels of positive affect were at 22% reduced risk of developing heart disease over a 10-year period, after controlling for both major coronary risk factors and measures of negative affect. Additional work that has considered factors related to positive affect (e.g., optimism, emotional vitality) has also found strongly protective effects in relation to onset (as well as progression) of cardiovascular disease (Boehm & Kubzansky, in press). Various reviews have considered research on subjective well-being in relation to a broad set of health outcomes, including susceptibility to infectious disease, respiratory disease, and longevity. Most have concluded that subjective well-being (and positive affect as an important subconstruct) is associated with better health, although all acknowledge wide variability in the range of outcomes and measures of positive affect, as well as the quality of the studies included in the reviews (e.g., Diener & Chan, in press).

Moving Beyond Main Effects: Examining Simultaneous Processes

Despite the limitations of the literature on positive affect in relation to health outcomes and relevant mechanisms, several consistent findings have emerged that have important implications for both theory and future work in this area. First, studies consistently demonstrate that effects of positive affect are largely independent of negative affect, particularly in relation to onset of disease. Moreover, it appears that positive affect may influence health not only by buffering effects of stress, but also by inducing positive biological function and marshaling additional health beneficial psychosocial resources (although studies that formally evaluate whether positive emotion precedes or predicts health behaviors are urgently needed; Boehm & Kubzansky, in press). Because the research on negative emotions is more established, one challenge to research on positive emotion and health has been whether there are separate and distinctive mechanisms by which positive and negative emotions influence health. Although the cleanest possible models of positive versus negative affect might show distinct relationships with health behaviors and biological function, clear and separate effects may in fact be difficult to obtain. This is attributable in part to the nature of healthy physiological systems, which are characterized by complexity and redundancy (and with regard to indirect effects, because behaviors occur on a spectrum and respond to a variety of motivational forces). The intricate interplay of these processes suggests that perfectly distinct mechanisms and effects of different aspects of psychological functioning may be difficult to achieve (Boehm & Kubzansky, in press).

Taken together, this work suggests that early models of positive or negative affect and health, which emphasize a disease-oriented model by which affect may limit or prevent disease outcomes, may be too narrowly focused. Increasingly, evidence suggests that models of emotion and health may be best served by considering the full spectrum of emotional experience. This would facilitate assessing not only the absence of poor functioning, unhealthy behaviors, or disease-related biological markers but also the presence of assets or positive functioning, restorative processes, and positive health (Seligman, 2008). Thus, building on this understanding, Boehm & Kubzansky (in press) recently proposed an expanded theoretical model on the role of positive psychological states more specifically in relation to cardiovascular health. This model proposes direct and indirect effects, such that positive states

may promote restorative processes (e.g., higher levels of antioxidants), reduce the likelihood of deteriorative processes (e.g., reduce inflammation, reduce likelihood of cigarette smoking), and reduce the impact of stress. This perspective, together with the evidence demonstrating that both positive and negative emotions matter for health, supports the view that the ability to regulate emotions or manage emotional complexity may play a critical role not only in mental health but also in physical health.

Moving Beyond Repression and Suppression: A Broader View on Emotion Regulation

Historically, health researchers have focused on a small number of emotion regulation processes ("the usual suspects"), and have considered them in isolation. These studies have found that both repression and suppression are linked to adverse health outcomes, but prospective studies of disease development are limited and findings are mixed (Consedine, Magai, & Bonnano, 2002). For example, the Framingham Heart Study found that the single item "inability to discuss angry feelings" predicted subsequent heart disease risk (Haynes, Feinleib, & Kannel, 1980). In contrast, research on alexythymia (failure/inability to express emotion) has suggested that it is a risk factor for symptoms and illness behavior but not for organic disease (Lumley, 2004). Other work has suggested that disclosure of strong emotional feelings can improve health outcomes by avoiding the cumulative stress of inhibition, although two different meta-analyses on the topic arrived at somewhat conflicting conclusions perhaps as a result of using different selection criteria for the review; one reported a moderately significant and positive effect of disclosure (Frattaroli, 2006), but another did not find clear evidence of an effect (Meads & Nouwen, 2005). A substantial line of research on the Type D personality, the joint tendency to experience high levels of negative emotions and to be unwilling to share these emotions with others, has suggested it is associated with poor health and prognosis, particularly in patient populations (Denollet, Pedersen, Vrints, & Conraads, 2006).

One way research has begun to move beyond the usual suspects is to consider the capacity to regulate emotions more broadly (rather than specific forms of regulation) as a key element of healthy psychological functioning. This work has documented that individuals with better capacity for regulating emotions have a significantly reduced risk (20% to 60% less) of developing heart disease even after controlling for known coronary risk factors and behaviors and other psychological problems (e.g., Kubzansky, Park, Peterson, Vokonas, & Sparrow, 2011) If we accept the premise that chronically high levels of anger, depression, or other negative emotions (and personality traits associated with them) in adulthood can be viewed as markers of poor emotion regulation, then the epidemiologic literature on emotion and disease development in fact provides substantial evidence that emotion regulation matters for health.

A second way research has begun to move beyond the usual suspects is by contrasting specific, theoretically defined forms of emotion regulation. There is now a substantial literature documenting the differential consequences of specific forms of emotion regulation (Gross, 2007). One particular contrast that has figured prominently in this literature is the contrast between cognitive reappraisal (which involves changing how one thinks in order to influence one's emotional response) and expressive suppression (which involves changes how one acts in order to influence what others are able to see of one's emotional response). Affectively, suppression is associated with decreased levels of positive emotion and either no change or even increases in negative emotion. By contrast, reappraisal leads to increased levels of positive emotion and decreased levels of negative emotion. Physiologically, suppression leads to increased autonomic responses, whereas reappraisal leads to diminished autonomic responses, as well as decreased brain responses in regions associated with emotion generation, such as the amygdala. These contrasting physiological effects encourage speculation that suppression—but not reappraisal—might be a risk factor for cardiovascular disease (Mauss & Gross, 2004). In one test of the contrast between reappraisal and suppression, it was found that reappraisal was associated with 21% *reduced* risk of having levels of inflammation that are associated with high risk of cardiovascular disease, in contrast to suppression which was associated with 66% *increased* risk of having high risk levels of inflammation, and findings were maintained after adjusting for known potential confounders (Appleton, Buka, Loucks, Gilman, & Kubzansky, in press).

In fact, exploration of neurobiological substrates or cellular processes that may link this more nuanced view of emotion regulation with health is currently limited but increasingly possible given recent technological advances. Biological pathways to explore in conjunction with emotion regulation and health may include cellular aging; considering oxytocin activity and effects; whether psychological experiences can modulate the expression of specific genes, the proteins they code for, and the physiological pathways they regulate; or epigenetic mechanisms, processes that alter gene expression without actually changing the genetic code (Berton et al., 2006; Cole et al., 2007; Epel et al., 2004; Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003).

Indirect Effects of Affect on Health

In the preceding section, we focused primarily on potential direct effects of affective states on pathophysiology. However, decades of research in social and personality psychology have documented the ability of affective states to influence other phenomena that hold indirect yet important consequences for health and wellbeing. For example, affective states have been shown to enhance persuasion (Petty, Fabrigar, & Wegener, 2003; Petty & Wegener, 1998), alter perceptions of risk (DeSteno, Petty, Wegener, & Rucker, 2000; Lerner & Keltner, 2001), bias memory (Forgas & Bower, 2001; Kensinger & Schacter, 2008a), shape decision-making strategies (DeSteno, 2009; Lerner & Tiedens, 2006; Loewenstein & Lerner, 2003), and guide social interactions (Fredrickson, 2001; Keltner & Lerner, 2010).

Each of these phenomena, of course, holds implications for health in specific contexts. For example, the success of public health appeals to alter attitudes and behaviors often depends on successful persuasion (Petty, Barden, & Wheeler, 2009); the adoption of specific illness detection or disease prevention strategies is influenced by people's views of their perceived risks or benefits (Rothman & Salovey, 2007); the success of coping techniques often is determined by the use of specific emotion regulation strategies (Sheppes & Gross, in press); and people's adherence to treatment regimens often depends on an individual's strength of

social support from caregivers and trust in physicians (DiMatteo, 2004).

The list of possible mechanisms by which affective states can indirectly influence health outcomes is too long to review comprehensively here. Our goal, in the spirit of this special issue, is to highlight recent findings and perspectives that hold great promise for a rapid translation or increased adoption in the health arena. In so doing, we will highlight issues related to emotion specificity, parallel processing and interaction, and a more socially embedded view of emotion functionality.

A More Differentiated View: Decision-Making in the Health Arena

One fundamental set of processes that greatly impacts health centers on how people perceive the risks they face and what types of decisions they make to address such risks. For example, whether one is likely to seek a physician's care or adhere to a healthy lifestyle is very likely dependent on how much one believes negative consequences are likely should a particular choice be made. Of course, making decisions is often a complicated task requiring both access to and effortful analysis of complex information (e.g., probabilities for certain outcomes, analysis of interrelated contingencies), and this is especially true in the health arena. Given the mind's need to solve such problems, irrespective of the time or resources allowed, it often makes use of certain implicit sources of information or processes, with affective states standing as a principal element. Indeed, research implicating the impact of affective states on risk perception and decision-making has grown at a staggering rate during the past decade (Keltner & Lerner, 2010; Phelps & Delgado, 2009).

One consistent finding from this growing corpus of work has been the need to consider the effects of affective states in a discrete, or emotion-specific manner. This view constitutes a natural outgrowth of earlier work from the late 20th century that linked affect and social cognition. This previous work primarily categorized affective states solely by valence. However, given the general view among affective scientists that discrete states function to address specific challenges, it is not surprising that this dichotomous framework has proven to be insufficient. Whereas negative states may in fact signal the presence of a threat and positive ones signal opportunities for gain, the specific natures of such threats and rewards, as well as the types of behaviors meant to address them, evidence a high degree of variability (Fredrickson, 2001; Keltner & Lerner, 2010; Phelps & Delgado, 2009).

With relevance to health-oriented decision making, nowhere is the importance of taking an emotion-specific perspective more apparent than in judgments of risk. In a seminal paper on risk perception, Johnson and Tversky (1983) demonstrated that the human mind often relies on feeling states as a heuristic to assess the probabilities associated with specific risks. According to their work, negative moods resulted in increased assessments that negative events (e.g., developing cancer, being in a car accident) were likely to occur; positive moods similarly increased the perceived odds of positive events (e.g., winning the lottery). The result of this view was a basic bifurcation of affective influences by valence. All states of the same valence were assumed to shape risk perception in the same way.

At a basic theoretical level, however, a problem brewed. Johnson and Tversky, as well as the majority who followed them, assumed that affective states influenced risk assessments as they did precisely because they were being used as a source of information. However, if one accepts that all negative emotional states engender the same bias because of the information they provide, one must also accept the view that feeling angry or disgusted or sad does not provide differential information about the threats one faces. Discrete emotional states have been shown to vary as a direct function of the nature of the environmental appraisals of threat and reward that evoke them. Anger, for example, derives from appraisals of conflict and high certainty, sadness from appraisals of loss, disgust from appraisals involving threats of contamination, and fear from appraisals involving uncertainty and lack of control (cf. Keltner & Lerner, 2010).

Given this fact, recent research has begun to demonstrate a much more fine-grained view of how emotions impact risk perception. Initial work in this area has clearly documented that valence alone cannot adequately capture the specificity of effects. To the contrary, distinct emotional states are intuitively used by the mind to assess different types of risk as a function of the threat-category posed. The experience of anger, but not sadness, increases the perceived probabilities of conflict- and frustration-relevant events (e.g., being treated unfairly, being ignored by a physician); the experience of sadness, however, increases only saddening ones (e.g., odds of losing a battle with cancer or diabetes) (DeSteno et al., 2000; Lerner & Keltner, 2000). Fear, too, works in much the same way (Lerner, Gonzalez, Small, & Fischoff, 2003; Lerner & Keltner, 2001). Correspondingly, attempts to predict how feeling states will alter risk perceptions, and the decisions and behaviors that follow them, must categorize emotional states using a more elaborated rubric. Anger may increase a patient's sense that a physician has given him the incorrect prescription as a result of prejudice or arrogance, but sadness might lead him to believe that even the correct medicine or therapeutic regimen would be ineffectual. Fear might lead one to believe that a mole is likely to be an early melanoma and to seek a screening, but sadness might lead the same person to believe that a screening would be too late and thus not to bother scheduling one.

Accordingly, interventions meant to increase the adoption of healthy behaviors need to take better account of the default or manipulated affective states of the individuals involved. Anger and happiness, for example, can both function to decrease safe sex practices precisely because both increase a sense of control even though they differ in valence. Similarly, feelings of fear of one's disease might lead an individual to feel treatment regimens will be fruitless, but focusing anger at a disease might well lead to just the opposite—a greater subjective sense of control over one's outcomes. Thus, appropriate interventions should be targeted to use affect, whether it is the emotion that is prototypical of individuals confronting a specific situation or one evoked as part of the intervention itself, to shift the underlying risk estimates in a manner that supports and motivates the desired health-relevant decisions and behaviors.

Perception of risk, however, is not the only facet of decision-making that can benefit from considering the differential impact of specific emotions. Recent findings suggest that study of decisions characterized by intertemporal choice (i.e., decisions that hold different consequences as time unfolds) necessitate adoption of a

discrete emotions perspective as well. At a general level, dilemmas of intertemporal choice pervade many health-relevant decisions. For example, should one exercise now for later benefit or enjoy some TV watching in the moment? Should one resist eating the chocolate cake now to enjoy the benefits of weight loss later? Should one accept using a condom now to ensure better health in the future or forgo it for more immediate pleasure? In each case, individuals must compare benefits in the short-terms against those in the long-term.

Much work has shown that the subjective value of potential gains often differ as a function of time (Ainslie, 1975; Loewenstein & Thaler, 1989). Indeed, temporal discounting, a phenomenon where people tend to discount the value of a reward as it approaches a more distant time horizon (i.e., the future), has been shown to be quite universal. The upshot of this bias is that individuals tend to value immediate gains more than comparable or even somewhat larger future gains. Of course, the potentially greater benefits of the future gains can only be realized, then, through inhibiting or regulating the desire for more immediate ones. Losing weight or lowering cholesterol, for instance, occurs by overcoming the immediate desire for the pleasure of eating the hot fudge sundae in one's field of vision.

Until recently, the commonly held view was that emotional responses, particularly those of positive valence, would always be detrimental for long-term wellbeing within the context of intertemporal choice (cf. Berns, Laibson, & Loewenstein, 2007). Put simply, desires to maximize already elevated positive affect in the moment would increase individuals' tendencies to choose options that feel good in the moment. Indeed, work by Wegener and Petty (1995) has clearly shown that increasing positive affect corresponds to selection of decision options that maximize hedonic benefits in the here and now. Such findings have fostered the view that willpower—or effortful self-regulation—was the only way to successfully solve intertemporal choice (cf. Berns et al., 2007; Mischel, Shoda, & Rodriguez, 1989). It is of course undoubtedly true that willpower can be a successful tactic. In fact, Magen and Gross (2007) demonstrated that even purposefully reconstruing temptations to be a test of one's willpower (i.e., a valued internal attribute) significantly enhanced people's ability to resist them. However, previous failures to consider variations among positive affective states have perpetuated the view that all affect hampers a successful focus on long-term benefits.

Work on positive social emotions has identified a class of states that increase the odds that people will accept short-term hedonic hits to engender future gains (DeSteno, 2009). The emotion pride provides one of the clearest examples. The acquisition of long-term benefits (e.g., better health) often requires sacrifices along the way that are, to put it mildly, not enjoyable (e.g., forgoing sweets or exercising). Although self-regulation provides one avenue to obtain the desired long-term ends, it is not the only one. In a series of experiments, Williams and DeSteno (2008) demonstrated that inducing individuals to feel pride through providing acclaim in response to task performances resulted in a significant increase in the efforts these individuals devoted to honing their skills on these tasks that they previously viewed as tedious. Of great import, this effect of pride was also strictly differentiated from that of self-efficacy (cf. Bandura, 1997) and generalized positive affect. Here again, the need for differentiation becomes evident. Increased pride directly predicted greater perseverance at hedonically unpleasant tasks that are thought to lead to valued outcomes in the future while general positive affect did not.

Such findings hold important consequences for many health relevant behaviors, as it is often the case that individuals need to engage in actions for their health that they doubt, at least initially, they will be able to maintain. If one believes that she cannot resist the urge to binge eat, to have unprotected sex, or to stop exercising, models of behavior regulation based on self-efficacy are of little use. However, cultivating pride as a response to each incremental step (e.g., resisting each temptation to binge, completion of each day of exercise) can increase the odds of long-term success even when an individual might not be confident that she or he could achieve these goals in the long-term.

Similar findings have emerged for other social emotions as well. Gratitude, for example, has been shown to lead individuals to forgo larger immediate short-term monetary gains for smaller ones that promise greater social benefits in the future (DeSteno, Bartlett, Baumann, Williams, & Dickens, 2009). Compassion likewise leads to costly efforts in the short-run that offer the potential for greater reciprocal benefits in the future (Valdesolo & DeSteno, 2011a). Cultivating such states, habitually or as part of health-related interventions, might well constitute a useful strategy to enhance self-regulation, especially under conditions when willpower based on executive control is ripe for failure. Indeed, recent work has shown that increased experiences of multiple types of positive affect is associated with decreased injection drug use among HIV-positive methamphetamine users (Carrico, Johnson, Colfax, & Moskowitz, 2010).

Moving Beyond Main Effects: Context and Interactions Among Indirect Mechanisms

As noted earlier, affective states incorporate many components that are capable of influencing separate mental processes simultaneously, a fact that can complicate the ultimate prediction of their impact on behavioral or physiological outcomes. What this fact suggests is that any affective state has the potential to influence several decision-relevant processes in consort, thereby leading to outcomes that can enhance, diminish, or even reverse the expected outcome resulting from any single process in isolation.

Seminal work by Petty and colleagues provides a relevant example of the perils stemming from examining affect-based influences using solely a "main effects" approach (Petty, Schumann, Richman, & Strathman, 1993). Although it had been known that positive moods could increase the favorability of attitudes in response to specific types of persuasive appeals, Petty and colleagues showed that the causal routes by which it did so could vary as a function of whether individuals were processing the information in an elaborated or heuristic fashion. For those who processed it systematically, positive mood produced attitude change by influencing the thoughts and memories that came to mind in evaluating the merits of the message; for those who processed it heuristically, positive mood produced change simply by a process of misattribution of the affective states (cf. Schwarz, Bless, & Bohner, 1991).

The finding of multiple routes by which affective states could impact attitude change has taken on greater import given the growing focus on discrete, as opposed to valence-based, categorizations of emotional states. For example, when moving to cases

involving the mixing and matching of specific emotional states and message framings, multiple outcomes can arise from distinct combinations. To demonstrate this possibility, DeSteno and colleagues (DeSteno et al., 2004) used two affective-framings for a tax-increase proposal: one emphasizing its need to combat saddening events (e.g., poor quality of orphanages) and the other to combat angering events (e.g., traffic). The messages were presented to individuals who had been induced to feel either anger or sadness. Based on our earlier discussion of risk estimation, one might assume that the sadness-framed message would be more persuasive to the sad individuals and the anger-framed one to the angry individuals, as sadness and anger should increase the odds, respectively, that people feel orphanages are of poor quality or that they'll be stuck in traffic. However, one might also predict that angry individuals, because of their use of anger as a heuristic cue for conflict and dislike, might be more rejecting of any persuasive communication. Both views are in fact correct; which emerges is a function of how much effort individuals put into processing the message. Those who thought about it carefully, as indexed by a chronic high need for cognition (cf. Cacioppo, Petty, Feinstein, & Jarvis, 1996), evidenced a matching effect driven by emotion-altered expectancies. Those who made a snap judgment showed less attitude change in response to either message if they were angry.

Sometimes, however, the situation individuals find themselves in, or even the age of the individuals themselves, can also alter whether and how affective states exert an influence on judgments. Recent work by Figner and colleagues has shown that simple alterations in context and differences in age can lead to amplification or attenuation of general affect-based influences (Figner, Mackinlay, Wilkening, & Weber, 2009; Figner & Weber, 2011). For example, multiple contingent decisions made in an incremental fashion (i.e., where one builds on the next) tend to be more susceptible to affective influence then multiple contingent decisions that are made all at once. Thus, deciding how many donuts one might eat and not cheat too badly on a diet, where the decision to eat a subsequent donut occurs after ingesting a prior one, might be more subject to affective influences than making a decision about how many to eat at the outset. Similarly, with respect to judgments of risk, the influence of affective states has been shown to vary across age differences, with adolescents being more prone to affective biases then older individuals (Figner et al., 2009).

The efficacy, then, of the emotional-framing of health-relevant communications or the impact of the magnitude of affective-biases may directly hinge on the precise interrelation of several variables. Dysphoric individuals may respond more favorably to a persuasive message that notes the reasons to get a colon cancer screening to avoid future sad events (e.g., early death, loss of loved ones) if they are thinking about it carefully. Yet, the same individuals might evaluate the message more negatively if they are processing heuristically and simply use their dysphoric state as a cue for their attitudinal response. Indeed, the picture becomes even more complex when one considers that emotional states themselves can alter individuals' default information processing styles (Petty, DeSteno, & Rucker, 2001). Anger, for instance, tends to decrease information processing effort whereas sadness does the opposite. Happiness, moreover, will decrease information processing if the information involves negative outcomes (e.g., identification of an illness) but increase it if it involves positive outcomes (e.g., gaining a target BMI; cf. Wegener, Petty, & Smith, 1995).

It is important to note, of course, that just as affective states can impact cognitive functioning through several mechanisms in parallel, it is also true that attempts to regulate such states can evidence a similar type of branching effect. As noted earlier, emotion regulation can take many forms, with the ultimate effects depending upon the utilized strategy. For example, a considerable body of research has examined the differential consequences of cognitive reappraisal and expressive suppression. In addition to their divergent effects on physiological responses, these two forms of emotion regulation also have quite different effects on cognitive functioning which can impact ongoing information processing. More specifically, expressive suppression appears to be a cognitively taxing form of self-regulation that significantly impairs an individual's ability to track and remember events in the local environment (Richards & Gross, 1999, 2000). Cognitive reappraisal, by contrast, has no such deleterious effects, and may in some circumstances actually enhance memory (Richards & Gross, 2000). These differential consequences have not to our knowledge been linked to specific health outcomes, but in view of the premium placed on indirect processes such as attitude change and decision making in health, it is easy to see how such cognitive differences might powerfully shape decision making, health behaviors, and a range of health-related outcomes (Martin & Delgado, 2011). Accordingly, the impact of any emotion-mediated effect on cognition might be differentially modulated as a function of the distinct type of regulation strategy used.

Taken together, these and related findings demonstrate that the efficacy of any health-relevant communications and decision strategies depends on a clearer understanding of the elaborated and multiprocess mechanisms by which affective states shape judgment along with the multiple factors (both situational and intrinsic to individuals) that can moderate the workings of these mechanisms.

Moving Beyond the Usual Suspects: Emotions and Social Capital

The preceding section focused on affect-based influences on decision making. However, as noted previously, indirect effects can take many forms. Decades of research in health psychology have documented the important beneficial role played by supportive social networks (cf. DiMatteo, 2004). Indeed, work by Cacioppo and colleagues has identified the negative effects of loneliness and social isolation on a wide range of physiological processes (Hawkley & Cacioppo, 2010). The past few years have witnessed a growing focus on the interplay of positive emotions, especially socially oriented ones, and social interaction (Fredrickson & Cohn, 2008; Fredrickson & Losada, 2005). To the extent that such affective states can promote social bonding and communication, they should undoubtedly also produce beneficial effects with respect to health.

Fredrickson's work was some of the first to note the specific ability of positive affective states to foster social capital (i.e., stable and supportive social networks). As such, her Broaden and Build Theory argued that a primary function of positive affective states was to *build* and enhance social relationships (Fredrickson, 2001, 2005; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008). This

perspective has indeed received a good deal of empirical support, especially with respect to the examination of the impacts of discrete positive states. For example, work by Algoe and colleagues has shown that the experience of gratitude increases the stability of and engagement in both romantic (Algoe, Gable, & Maisel, 2010) and nonromantic relationships (Algoe, Haidt, & Gable, 2008). Similarly, work by Bartlett and colleagues has revealed that gratitude toward a benefactor not only increases a desire to maintain the relationship, but also to do so even at significant economic costs to oneself (Bartlett, Condon, Cruz, Baumann, & DeSteno, 2012). In addition, the beneficial effects of gratitude also function in a reciprocal manner. Individuals who are the recipients of expressions of gratitude (e.g., spouses, caregivers) demonstrate an increased motivation to continue to act prosocially (Grant & Gino, 2010), thereby also enhancing stores of social capital.

Initial exploration of the benefits of the expression and experience of positive and socially oriented emotions into the health domain has also begun to yield fruit. For example, Algoe and Stanton (2011) examined the longitudinal effects of gratitude with respect to social support among women with metastatic breast cancer. Over a 3-month period, they found a clear relation between the frequency of experiencing gratitude and social support, but only among women who were willing to express their gratitude regularly. Those who felt it, but did not express it, showed no temporal increase in social capital, attesting to the signaling value of this state noted above. The importance of the expression of emotions in a health context is, of course, not limited to gratitude. Work by Monin and colleagues has shown a similar benefit for expressions of happiness and compassion on patient/caregiver relationship quality and willingness to engage in supportive behavior (Monin, Martire, Schulz, & Clark, 2009).

Here too, emotion regulation may be relevant to an analysis of affect-health relations. Returning to the contrast between cognitive reappraisal and expressive suppression, it is now quite clear that these two forms of emotion regulation have divergent implications for social functioning. (Gross, 2001). Laboratory studies have demonstrated that when one member of a dyad was instructed to suppress her emotional expressions, this led to decreased rapport and affiliation, and increased negative feelings about the interaction (Butler et al., 2003). No such effects were evident for individual instructed to use cognitive reappraisal. Individual differences studies bear out these laboratory findings. People who frequently suppress their emotions in everyday life have lower social support, lower peer-rated likability, and reduced levels of closeness in their relationships (Gross & John, 2003; John & Gross, 2004). Reappraisal has no such negative effects. Although the health impact of these divergent effects has not been satisfactorily documented, we hypothesize that one of the pathways linking suppression (but not reappraisal) to poorer health outcomes may be compromised social functioning.

Taken together, these findings point to the import of examining the indirect influence of affective states on health in realms beyond the purely cognitive. With the continually emerging recognition of the central role played by sufficient social capital in fostering physical health and psychological wellbeing, the power of cultivating social emotions as part of intervention, recovery, and/or coping processes becomes clear. These states can be leveraged to "grease the wheels" of social interactions that benefit the participants, whether the relationships involve friends, spouses, physicians, or caretakers.

Next Steps and Future Directions

The field of affective science continues to grow at an impressive rate, and it is a field increasingly recognized as a hub that contributes to related disciplines ranging from health psychology, to cognitive neuroscience, to behavioral economics, and beyond. In this article, we have considered links between affective science and health psychology. Although the topics we have covered are, of course, selective by necessity; we believe that they illustrate the great promise of productive cross-talk between affective and health scientists.

At the broadest level, attempts to move beyond dichotomizing affect-relevant influences by valence promise to sharpen precision in understanding how emotions can alter both physiology and the calculus of the mind in ways that impact health. Discrete affective states exist because they serve distinct purposes. No one would expect a sad individual to behave in the same way as an angry one; consequently, expectations for their physiological responses and decision-making should also be expected to differ. These states aid individuals in dealing with distinct challenges; when those challenges involve health, the case should be no different. As we have reviewed, growing evidence from both the affective science and health literatures has begun to document the distinct effects of different states on multiple phenomena that impact pathophysiology through direct and indirect means. Continued exploration of the effects of discrete states is likely to bear similar fruit. It is also useful to consider, however, that it is not only the experience or intensity of distinct states that matter, but also their chronicity. Although not examined here, the notion that extended durations of distinct states might differentially impact health is one deserving of investigation.

A second theme that we have emphasized is the need to examine the possible interactions of affect-relevant cognitive mechanisms. As we have discussed above, affective states have the potential to impact several types of cognitive phenomena simultaneously. The result is that while empirical investigation of processes in isolation can be useful for discovery, such tactics may provide an impoverished view with respect to how affect will influence health under "real world" conditions. For example, feelings of happiness cannot only decrease perceptions of the risks of smoking (a negative outcome), but may also decrease pathophysiological phenomena like inflammation (a positive outcome). Similarly, anger can increase or decrease the effectiveness of persuasive appeals depending on their framing. Likewise, different regulatory strategies can be brought "online" at different times and thereby moderate the traditional effects of affective states on the health-relevant phenomenon in question. Predicting health outcomes as a result of affective experiences, then, becomes a complex affair that will often depend upon consideration of the many situational and intraindividual factors present at the time. Here again, issues of temporal factors may become important. For example, are there critical periods for the experience of affective states in development that hold consequences for later effects on health? Can potentially toxic consequences of affective states be reversed or mitigated if regulation is successful within a certain time window? Such questions are ripe for examination.

Finally, the study of health-emotion links should, we believe, expand to examination of the interpersonal realm. Humans possess a distinct class of emotions whose functionality centers on the nurturance of social relationships. For example, gratitude and compassion lead to increased social support between individuals. Pride leads to perseverance toward socially valued goals. How such relations can be optimized by intervention techniques to enhance phenomena ranging from improved patient-caregiver relationships to greater motivation to adhere to difficult prevention and treatment behaviors stands as a relatively untapped area.

It is our hope that the long-standing exchange of information and ideas that has characterized the relationship between social-personality and health psychology will continue to benefit each subdiscipline. We are excited to offer our perspective on ideas from affective science that we believe hold promise for translation and, in turn, look forward to new views and findings coming from the health psychology arena that may inform further developments in the study of emotion. The human mind and body evolved to exist not only in the physical world, but in a social one as well. Its health, therefore, will likely depend on the interplay between the two.

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