

UC Berkeley

UC Berkeley Electronic Theses and Dissertations

Title

Awe Reduces the Magnitude of Responses to Daily Hassles

Permalink

<https://escholarship.org/uc/item/6wz5w8b1>

Author

Bai, Yang

Publication Date

2017

Peer reviewed|Thesis/dissertation

Awe Reduces the Magnitude of Negative Responses to Daily Hassles

By

Yang Bai

University of California, Berkeley

A dissertation submitted in partial satisfaction of the

Requirements for the degree of

Doctor of Philosophy

in

Psychology

in the

Graduate Division

Of the

University of California, Berkeley

Committee in charge:

Professor Dacher Keltner, Chair

Professor Serena Chen

Professor David Whitney

Professor Iris Mauss

Professor Clayton Critcher

Fall 2017

Abstract

Awe Reduces the Magnitude of Responses to Daily Hassles

By

Yang Bai

Doctor of Philosophy in Psychology

University of California, Berkeley

Professor Dacher Keltner, Chair

Stress in the quotidian events of daily life, or daily hassles, is a powerful predictor of individuals' health and well-being. In the current investigation, across four studies, I tested whether and how awe reduces hassle-related stress, and thus leads to boosts in people's well-being. On a trait level, individuals with higher awe proneness (Study 1) reported lower levels of hassle-related stress. In follow-up laboratory experiments (Studies 2 & 3), induction of awe, compared to control conditions (amusement, joy, pride, & neutral), significantly decreased the intensity of individuals' major hassle-related stress. Finally, a naturalistic induction of awe in which participants viewed august sceneries from the top floor of a 200 feet campus tower reduced levels of both general hassle-related stress and personal major concerns (Study 4). Mediation data demonstrated that the effect of awe on reduced daily hassle-related stress is explained by a sense of perceived vastness. Furthermore, the relationship between awe and decreased daily hassle-related stress, in turn, explained awe's positive influence upon individuals' well-being. Together, these data establish awe's unique role in reducing daily concerns as well as increasing well-being.

Acknowledgements

First, I want to thank my dissertation chair and graduate advisor, Dacher Keltner, for his generous encouragement, support and guidance throughout my graduate life. He introduced me to the fascinating world of social psychology and mentored me in every step of social science research, from research question conceptualization to academic paper writing. Moreover, he provides me with a secure and encouraging environment for conducting research of my own interest, and helps me transcend all the barriers on the way into my unique strengths. Without his support, I would not have been able to finish this thesis and complete this degree. I also want to express my gratitude toward David Whitney who started my research journey at Berkeley, taught me academic rigor in experimental design and technique, and armed me with advanced statistic knowledge, all of which serve as crucial foundations for my current and future research. Furthermore, I want to thank Serena Chen and Iris Mauss, not only for their warm support and constructive feedback regarding my dissertation writing, but also for their persistent encouragement, enthusiasm and understanding throughout my graduate career. Finally, I want to thank Clayton Critcher for his helpful ideas and advice regarding my three lines of research including the dissertation topic.

My journey at Berkeley has never been lonely. I am truly grateful for the opportunity to work with a group of young, intelligent, and passionate scholars. I thank Allison Yamanashi Leib. As my first collaborator at Berkeley, she helped me conquer my fears as a beginner in the field and continued to provide me with all the support—both intellectually and emotionally—throughout my entire graduate life. I owe my thanks to Laura Maruskin, for her accompany and help as a friend and collaborator. I want to thank Galen MacNeil, Maria Monroy, Jennifer Stellar, Amie Gordon, Paul Conor for their wisdom and advice not only in research but also in life. I also want to thank all my research assistants who have been working with me in the past six years. Thank you Gening Jin for all the hard work you have put into this project. Thank you, Kylie Li, as those nights of working with you and writing my papers will be treasured memories kept forever. Thank you, Qinzhi Cao, for all your selfless contributions to all the projects we have worked together. I cannot list all the names in this short section, but I will remember all the contributions made by each and every research assistant and will forever cherish these days working with them all.

Finally, I would like to express my gratitude to my parents who forever stand behind me and provide tremendous love, care, and strength. I also want to thank my husband and best friend Tianbo Sun, who has shared all my sorrows and happiness during this long and rewarding journey and offered constant trust and courage as I harvest intellectual and personal growth.

Awe Reduces the Magnitude of Responses to Daily Hassles

“Imagine someone calling you an idiot. Or that you’re stuck in traffic. Or that the boss is hassling you. When this happens, you can become angry and caught up in the pettiness of life. The remedy? Take a moment to go outside and walk under the stars. When you witness the vastness of the universe, it puts things into perspective. When you come back inside, you won’t be starry-eyed. You’ll be energized. You’ll say, I’m sorry. Let’s forget it and move on.” (Rabbi Noah Weinberg “The Power of Awe”)

“In the woods, we return to reason and faith. There I feel that nothing can befall me in life, — no disgrace, no calamity (leaving me my eyes), which nature cannot repair. Standing on the bare ground, — my head bathed by the blithe air and uplifted into infinite space, — all mean egotism vanishes.” (Emerson, 1901, p. 39)

One of the most commonly reported dimensions in experiences of awe is that everyday life stresses seem more inconsequential. Empirical studies have found that immersing oneself in nature, being near nature, and even trips to a botanical garden, reduce the likelihood of dysphoric affect, stress, and even depression (e.g., Hartig, Evans, Jamner, Davis, & Gärling, 2003; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Mitchell & Popham, 2008; Nisbet & Zelenski, 2011; Kohlleppel, Bradley, & Jacob, 2002).

Why and how does nature reduce stress? One answer to this question, as we speculated above, focuses on awe—a self-transcendent positive emotion (Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013) that is elicited by a wide range of elicitors including nature (e.g., Keltner & Haidt, 2003) and is often associated with a sense of vanished self and uplifted well-being (Bai et al., 2017; Keltner & Haidt, 2003; Shiota, Keltner, & Mossman, 2007; Shiota, Keltner, Campos, & Herterstein, 2004).

In the current investigation, we offer the first rigorous support of the hypothesis that awe influences stress. We do so by examining how different elicitors of awe at both trait and state levels lead to decreased level of stress intensity. We argue that experiences of awe specifically reduce the intensity of individuals' daily concerns--small everyday irritations that give rise to stress on a daily basis (Lazarus & Folkman, 1984).

Stress: A Definition and Influences upon Health

Stress arises when individuals face challenges that they do not have the resources to face, and is experienced in terms of subjective feelings of being out of control and hopeless (Folkman & Lazarus, 1988; Hobfoll, 1989; Lazarus, 1966; Lazarus & Folkman 1984; McEwen, 2007; McGrath, 1970). In both lay descriptions and empirical studies, stress has been found to be universally and frequently experienced, and closely associated with various mental (Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann, 2010; Endler, & Parker, 1990; Fite, Greening, & Stoppelbein, 2008; van Praag, 2004; Hammen, 2005; Mazure, 1998) and physical (Cohen et al., 2012; Brydon, Magid, & Steptoe, 2006; Dimsdale, 2008; Jacobs, & Bovasso, 2000, Pieper & Brosschot, 2005; Pereira et al., 2003) health disorders.

In more specific terms, stress can be a pre-condition for depressive episodes (e.g., McEwen, 2000; Monroe, & Hadjiyannakis, 2002; Kendler, Karkowski, & Prescott, 1998; Johnson, & Sarason, 1978; see reviews by Hammen, 2005): individuals' probability of depression onset increases as a function of the number of recorded stressful life events occurred

in that month (Hovey & King, 1996). Furthermore, stress can be expressed in the form of verbal and physical aggressions. Frye and Karney's (2006) longitudinal study of 82 first-married newlyweds found that partners were more likely to engage in psychological aggression towards each other at times when they experience higher levels of acute stress external to the relationship (Frye & Karney, 2006).

Finally, cumulative findings suggest that exposure to stress--both acute and chronic--markedly increases individuals' vulnerability to adverse medical outcomes (Cohen et al., 2012; Miller, Chen, & Zhou, 2007). Through hyperactivation of the hypothalamic-pituitary-adrenocortical axis (HPA; Cohen et al., 2012), stress has been associated with various physical risks, such as cancer (e.g., Duijts, Zeegers, & Borne, 2003; Jacobs, & Bovasso, 2000; Sephton, & Spiegel, 2003), cardiovascular disease (e.g., Brydon et al., 2006; Cooper, Faragher, Bray, & Ramsdale, 1985), arthritis (e.g., Heijnen, & Kavelaars, 2005), autoimmune diseases (e.g., Cohen, Janicki-Deverts, & Miller, 2007), upper respiratory infections (e.g., Cohen, Doyle, & Skoner, 1999), and poorer wound healing (Kiecolt-Glaser, Marucha, Mercado, Malarkey, & Glaser, 1995); as well as life style problems, such as obesity (e.g., Epel et al., 2000) and fatigue (e.g., Bower, Ganz, & Aziz, 2005).

Levels of Stress: Major Life Event and Daily Hassles

Given the documented relationship between stress and mental and physical health, much effort has been devoted to understanding its various elicitors. Major life events, which include dramatic life events and severely taxing situations, consistently predict increased stress and are implicated in the onset of depressive conditions, neurotic disorders, and social maladjustments (Brown & Harris, 1978; Caspi, Bolger, & Eckenrode, 1987). Examples of such events include economic difficulties (e.g., eviction, unemployment), death, and abuse, all of which have well-documented influences upon levels of stress (Adler et al., 1994; Conger, Ge, Elder, Lorenz, & Simons, 1994; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; Segerstrom, & Miller, 2004;). Similar findings are found in studies of problems in physical health, such as severe illness, care giving of ill individuals, and hospitalization (Mishel, 1984; Pearlin, Mullan, Semple, & Skaff, 1990; Pochard et al., 2001; Skipper Jr, & Leonard, 1968). Finally, social relational problems and trauma, for example the death of a family member, divorce, witnessing violence, and stigma and social rejections, require some significant adjustment on the part of the individual and have also been found to be associated with stress (e.g., Booth & Amato, 1991; Caspi et al., 1987; Dohrenwend & Dohrenwend, 1974; Holmes & Rahe, 1967; Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002; Tomiyama et al., 2014),

While these dramatic events and taxing situations have been the major focus in the literature on stress, particularly in terms of documenting health-related difficulties, individuals also find stress in the quotidian events of daily life. These more ordinary elicitors of stress are known in the empirical literature as daily hassles--daily minor events that are appraised as irritating, challenging, and even harmful (Lazarus, 1984). In contrast to major life events, daily hassles center upon more transient, less disruptive events. Daily hassles encompass a wide range of events and contexts, including ordinary troubles of family life (e.g., the demands of children and parents; incongruity between spouses), conflicts in the workplace (e.g., work overload and underload; role ambiguity; rude and uncivil bosses), as well as aspects of the psychological environment (e.g., rush hour traffic, pollution) (Caspi, Bolger, & Eckenrode, 1987; Caplan & Jones, 1975; Frankenhaeuser & Gardell, 1976; Kanner & Coyne, 1979; Lazarus, 1980; Lazarus and Cohen, 1977; Levine & Scotch, 1970; Novaco et al., 1979; Pearlin, 1975).

Daily hassles, acting cumulatively, can have surprisingly larger influences upon health and well-being, compared to those acute life events. In an early study by Kanner et al. (1981), a community sample of 100 middle-aged participants completed measures of daily hassle-related stress (Hassle-Scale; Kanner, Coyne, Schaefer, & Lazarus, 1981) and major life events (Recent Life Events Questionnaire; Berkman, 1974) each month for nine consecutive months, along with other measures assessing individuals' health status (Hopkins Symptom Checklist; Derogatis et al., 1970, 1971, 1974; Bradburn Morale Scale; Bradburn & Caplowitz, 1965). Results revealed that compared to life events, hassles were better predictors for both concurrent and subsequent health symptoms (Kanner et al., 1981). In a similar analysis with the same sample, DeLongis et al. (1982) reported that aggregated measures of daily hassles were positively correlated with somatic illness, and this correlation was stronger than that obtained for life events. Finally, in another longitudinal study, Monroe (1983) found that while traditional life events only moderately correlated with individuals' psychological symptoms, daily hassles significantly predicted prospectively assessed psychological symptoms, even after controlling for initial symptom levels.

In fact, daily hassles are not only better predictors but also function as mediators of adverse consequences associated with major life events and psychological symptoms (Caspi et al., 1987; DeLongis et al., 1982; Kanner et al., 1981; Pearlin, Menaghan, Lieberman, & Mullan, 1981). A great proportion of hassles, instead of emerging from unique origins, are triggered or partially caused by the onset of major life events. These daily strains, although ordinary and mundane, persist far beyond the time needed for the precipitating event adjustment, and significantly alter one's day-to-day living patterns. Consistent with this, in a longitudinal study Pearlman et al. (1981) found that involuntary disruption of jobs, through increased daily economic strains (e.g., difficulty in purchasing life necessities such as food, clothing, housing, and health), led to an increase in depression among a random sample of Chicago residents. Likewise, in another study, a sample of community females reported their daily stressors and mood every day for 28 consecutive days. Daily diary data combined with interview data (including measures of major life events, chronic stress as well as psychological well-being) revealed that the negative effects of major life events on well-being were partially mediated by subsequent increases in daily stressors (Eckenrode, 1984). In a more recent longitudinal study in which both daily hassles and major life stress were measured for three months, researchers found that the relationship between major negative life events assessed at Time 1 and psychiatric symptomatology assessed at all three time points (baseline, 1-month follow up, and 3-month follow up) was mediated by baseline daily hassles measured at Time 1 (Johnson & Sherman, 1997).

Given the influences of daily hassles upon psychological and physical health outcomes, there is a compelling need to determine factors--dispositional or contextual--that will help individuals cope with these daily stressors. It is also important to make progress in understanding the processes by which hassle-induced stress dissipates. Guided by recent findings on awe (Shiota, 2017), we postulate that experiencing awe, by perceiving the vastness of the outside and shifting one's attention away from the self, will reduce daily hassles.

Factors that Moderate or Buffer the Effect of Stress on Health

While in general, stressful experiences can lead to emotional difficulties and compromised health (e.g., Cohen, Horowitz, Lazarus, Moos, Robins, Rose, & Rutter, 1982; Cohen, Kamarck, & Mermelstein, 1983; Gentry & Kobasa, 1984; Hobfoll, 1989, 2001; Kendall, 1983; Lazarus, 1966; Lazarus & Folkman, 1984; McGrath, 1970; Johnson & Sarason, 1979; Wilcox & Vernberg, 1985), it is critical to recognize the role of individual differences in these

relationships; not everyone who encounters stressful life experiences succumbs to their problematic outcomes. Mounting evidence suggests that stressful times are not necessarily bad times, and the casual link between stressful events and health problems may be moderated by a host of personal and contextual factors (e.g., Cohen & Wills, 1985; Elder, Caspi, & Van Nguyen, 1986; Wheaton, 1985). Understanding these factors--both external and internal—is a critical conceptual endeavor.

To begin, social support is a protective factor that prevents psychological and somatic disorders in the face of stressors (Cohen & McKay, 1984; Cohen, Mermelstein, Kamarck, & Hoberman, 1985; Cohen & Wills, 1985;). The experience of stress, coupled with low levels of social support, has been found to be associated with psychological distress and various health problems (e.g., Broadhead et al., 1983; Berkman & Syme, 1979; Nabi et al., 2013). In relevant empirical studies, when transiting from high school to college, adolescents who received higher levels of parental support were better adjusted and less distressed compared to those with lower levels of parental support (Cutrona, Cole, Colangelo, Assouline, & Russell, 1994; Holahan, Valentiner, & Moos, 1995; Friedlander, Reid, Shupak, & Cribbie, 2007). Similarly, research has shown that elderly people with higher levels of social integration were more likely to experience supportive milieu and, consequently, were better to cope with life crises (Krause, 1987; Cutrona, Russell, & Rose, 1986; Blazer, 1982). In working environments, social support has been identified as a significant moderator that enables individual to cope with work-related stress (House 1981; Zabel & Zabel, 1982). For example, in one cross-sectional study, public school teachers who reported that they had supportive supervisors and received constructive feedback from peers were less vulnerable to burnout (Russell, Altmaier, & Van Velzen, 1987). Finally, one recent line of research found that online social network size significantly predicts individuals' stress levels and, in turn, degree of physical illness and psychological well-being (Nabi, Prestin, & So, 2013).

Individuals' personal resources--such as socioeconomic status, time availability, cognitive resources, etc.—have also been found to impact the effects of stress on physical and psychological distress (Adler et al., 1994). For individuals with limited resources such as those from lower socioeconomic status (SES) backgrounds, daily hassles will tax and exceed their resources and, consequently, more stress will be experienced (Baum, Garofalo, & Yali, 1999; Bilings & Moos, 1982, 1984; Kasl, 1978; Williams, Yu, Jackson, & Anderson, 1997). On the other hand, individuals' cognitive resources, with their direct impact on both cognitive appraisal and coping processes, significantly moderate the person-environment relations (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus & Folkman, 1984; Lazarus, Kanner & Folkman, 1980). For example, in one cross-sectional study, veterans diagnosed with posttraumatic stress disorder (PTSD) were found to exhibit more cognitive deficits and perform worse on various attention and memory tasks compared to those without PTSD symptoms (Archibald & Tuddenham, 1964; Vasterling, Brailey, Constans, & Sutker, 1998).

Another factor moderating the influence of life stress on depression is the individual's neurophysiological propensities, captured in such variables as genetic makeup, endocrine response, and default brain activation (e.g., Caspi et al., 2003; Costello et al., 2002; Monroe, & Simons, 1991; Gur et al., 1992; Grimm et al., 2008). A number of studies have documented that individuals carrying specific genes might be more vulnerable for depressive symptoms when experiencing stress. In one longitudinal study of a representative birth cohort, in the face of stressors, participants who carried one or two copies of the short allele of the 5-HTT promotor polymorphism exhibited more depressive symptoms, diagnosis of major depression, and suicide

ideation or attempt than the l/l homozygotes—individuals who carry two copies of long allele (Caspi et al., 2003). One's brain activity has also been associated with depression: hyper/hypoactivity in specific brain areas have been found to alter individuals' processing of emotional stimuli and lead to stressful symptoms. For example, Sherline and her colleagues found that patients with major depression exhibited greater left amygdala activation to fearful faces, even when these faces were masked and presented outside of conscious awareness (Gur et al., 1992; Sheline, Barch, Donnelly, Ollinger, Snyder, & Mintun, 2001). In another functional magnetic resonance imaging (*fMRI*) study, in contrast to healthy subjects, participants with major depressive disorder showed hyperactivity in the right dorsolateral prefrontal cortex (DLPFC), the brain region where its activity is associated with depression severity (Grimm et al., 2008). Finally, through interrupting individuals' adaption to stressors, hypersecretions of stress related hormones--such as adrenocorticotropin (ACTH) from the anterior pituitary, glucocorticoids from the adrenal cortex, epinephrine from the adrenal medulla, and norepinephrine from sympathetic nerves—will also introduce clinical depressive symptoms (e.g., Axelrod, & Reisine, 1984; Holsboer, 2000; Mannie, Harmer, & Cowen, 2007; Yehuda, Teicher, Trestman, Levengood, & Siever, 1996; Young, 2004). In one empirical study, Mannie et al. (2007) measured individuals' salivary cortisol level after awakening, and found that compared to healthy subjects, participants with major depression secreted more cortisol on both workdays and non-workdays, even after controlling for relevant individual differences such as parental attachment, life events, and personality.

In sum, stress is a complex system in which social support, personal resources, and physical health significantly moderate or buffer the impact of stressors on mental and physical health. These findings set the stage for understanding how positive emotions can alleviate corresponding stressful experiences.

Positive Emotions as Pathways to Reduced Stress

A central focus in this literature has been to document interventions that reduce stress. This is evident in various literatures, such as that on mindfulness, exercise, sleep, and therapeutic approaches of different kinds (e.g., Grossman, Niemann, Schmidt, & Walach, 2004; Chiesa & Serretti, 2009). Within this broader emphasis, there has been a concerted focus on how positive emotions reduce stress (e.g., Folkman & Moskowitz, 2000; Fredrickson, 2004; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Galanakis, Galanopoulou & Stalikas, 2011).

Positive emotions, such as gratitude and love, enhance the sense of social support, and thus mitigate the negative experiences introduced by various stressors (e.g., Algoe & Haidt, 2009; Bar-Tal, Barzohar, Greenberg, & Hermon, 1977; Emmons & McCullough, 2003; Froh, Yurkewicz, & Kashdan, 2009; Kong, Ding, & Zhao, 2015; see review by Wood, Froh, & Geraghty, 2010). For example, in a 36-week daily diary study, participants' daily positive emotional experiences were found to significantly predict more intimate physical contact with their partners (e.g., sexual activity), which in turn reduced individuals' daily stress levels (Burlinson, Trevathan, & Todd, 2007). Similar findings were obtained among first-year college students. Across two longitudinal studies, Wood and his colleagues found that over time, students' reported gratitude was shown to lead to higher levels of social support, and lower stress and depression (controlling for past values of all of the variables), with analyses yielding no evidence for reverse or reciprocal relationships (Wood, Maltby, Gillett, Linley, & Joseph, 2008).

Empirical evidence also suggests that positive emotions, through building an individual's personal resources (e.g., broadening people's momentary thought-action repertoires), facilitate effective coping with stress (Aspinwall, 1998; Fredrickson, 2001). For example, people reporting

that they took advantage of positive emotions reported higher scores on the Ego-Resiliency Scale, a measurement of psychological resilience (Fredrickson, 2004). In relevant empirical studies, students with high levels of hope were found to have greater coping efficacy and used more problem-focused coping than students with low hope (Danoff-Burg, Prelow, & Swenson, 2004). In a similar vein, Folkman and Moskowitz (2000) demonstrated through their study of caregivers of people diagnosed with AIDS that the occurrence of positive emotions, under stressful conditions, was associated with positive appraisal, problem-focused coping, and positive meaning making, which helped sustain positive emotion through chronic stress.

Positive emotions also positively influence physical health, which in turn alleviates stress symptoms. In this vein, there is mounting evidence that positive affect styles, such as the tendency to consistently experience happiness, joy, excitement, enthusiasm, and contentment, are associated with lower morbidity (e.g., rate of stroke, injuries, pregnant problems etc.; Cohen, Doyle, Turner, Alper, & Skoner, 2003; Cohen & Pressman, 2006; Middleton & Byrd, 1996; Klonoff-Cohen, Chu, Natarajan, & Sieber, 2001; Koivumaa-Honkanen et al., 2000; Ostir, Markides, Peek, & Goodwin, 2001), decreased symptoms and pain (Cohen, et al., 2003) and increased longevity (Danner, Snowdon, & Friesen, 2001). Similar findings have been documented in laboratory studies with experimentally-induced positive emotions. Compared to subjects who watched sadness- or neutral-eliciting movies, those who watched videos eliciting positive emotions (contentment or joy) exhibited more rapid cardiovascular activity recovery (Fredrickson & Levenson, 1998).

Based on the aforementioned analysis of positive emotions, it is evident that through enhancing the sense of social support, building personal resources, and improving physical status, positive emotion interventions can greatly relieve the pain of various stressors. The current investigation provides evidence, first of its kind, to suggest that awe, a unique kind of positive emotion, decreases levels of stress by introducing a sense of perceived vastness and diminished self-focus—one other possible mechanism also suggested by past studies that explains the link between stressors and health (e.g., Ayduk & Kross, 2010; Pyszczynski et al., 1987).

Awe, Reduced Daily Hassle-Related Stress, and Increased Well-being

The experience of awe usually arises when people feel that they are in the presence of something grand or vast that transcends their current frames of reference, thus triggering an accommodation of existing knowledge structures (Keltner & Haidt, 2003; Shiota et al., 2007). Although a wide range of stimuli can elicit awe—ranging from human art and artifact to spiritual experiences to the virtues and magnanimity of other people—nature, in both its *in vivo* experience and its artistic renditions, has been identified as one of the most prototypical awe-eliciting situations across different cultures (Bai et al., 2017).

In previous awe literature, awe has been conceptualized as a collective emotion and has been found to predict a number of important outcomes at both state and trait level. More specifically, awe has been found to shift the sense of self: people feeling awe consistently report a diminished self-size perception (Bai et al., 2017) and an increased sense of common humanity with others (Shiota et al., 2007). Awe has been found to increase prosocial tendencies, including greater sharing, assistance, and cooperation as well as increased religious intentions (Piff et al., 2015; Van Cappellen & Saroglou, 2012). Brief experiences of awe shift cognitive patterns, producing an expanded time perception (Rudd, Vohs & Aaker, 2012) and greater agency detection (Valdesolo & Graham, 2014).

The present investigation focuses on whether and how awe reduces stress. Several lines of research lend credence to this hypothesis. Firstly, the experience of awe has been found to be

associated with reduced daily concerns. For example, in one study, trait level awe proneness was associated with reduced levels of IL6, a biomarker that assesses levels of inflammation response, which covaries with levels of stress (Stellar et al., 2012). In another study, when primed with experimentally-elicited awe in the laboratory, participants reported feeling small or insignificant and unaware of day-to-day concerns (Shiota et al., 2007). Furthermore, many of the central sources of awe have been found to covary with reduced stress. Namely, stress is lower for people who engage in outdoor activities (Morita et al., 2007; Hansmann, Hug, & Seeland, 2007; Hartig et al., 2003; Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010), who have a regular religious or spiritual practice (Ferriss, 2002; Tuck, Alleyne, & Thinganjana, 2006; Varambally & Gangadhar, 2012), who enjoy music and art (Labbé, Schmidt, Babin, & Pharr, 2007; Moradipanah, Mohammadi, & Mohammadil, 2009), and who are engaged with inspiring others. All of these activities and experiences are likely to involve awe.

Another line of research that supports our speculation has to do with appraisal processes and stress, suggesting that orienting the attention away from the self to a broader frame can significantly mitigate the negative impact of stressors on various health outcomes (e.g., Ayduk & Kross, 2010; Kross & Ayduk, 2011; Libby, Eibach, & Gilovich, 2005; Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991; Pyszczynski et al., 1987). For example, mindfulness—a state that fosters disengagement with the self and full awareness of the present—is associated with decreased levels of stress and enhanced levels of well-being (Brown & Ryan, 2003). Furthermore, studies have found that by distracting attention away from the self, both clinical dysphoric and non-dysphoric individuals reported more positive construals of the current self and more optimistic attitudes toward the future (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991). Similarly, self-distancing, another perspective which reduces individuals' self-focused attention, is also associated with less negative emotional reactivity (Ayduk & Kross, 2010; Kross & Ayduk, 2011). In one study, after recalling a negative experience, participants who were instructed to adopt a self-distancing perspective reported significantly less distress compared to those who were immersed in the experience (Kross & Ayduk, 2008). Taken together, these findings indicate that placing less focus on the self vis-à-vis something with a larger frame can reduce stress. To the extent that awe is associated with a sense of perceived vastness—cognitive processes which involve diminishment and disengagement of the self, and increased attention on the present moment (Bai et al., 2017; Shiota et al., 2007; Piff et al., 2015)—it should also reduce one's stressful feelings.

A final line of research which sets the stage for our hypothesis involves studies on awe's positive impact on individuals' well-being. Awe is a positive emotion. Early research suggests that experiences involving awe, such as admiration (McDougall, 1911) and peak experience (Maslow, 1964), often introduce a sense of boosted well-being. Consistent with this, empirical studies have found that trait and state experiences of awe lead to increased well-being, as assessed with measures of trait and momentary life satisfaction (Gordon et al., 2016; Rudd et al., 2012). Guided by the foregoing analysis of the close association between daily hassles and decreased levels of well-being, we posit that the effect of awe on enhanced well-being can be explained by awe's direct influence on mitigating negative consequences of individuals' daily hassles.

Although the findings of awe and stress point to a relationship between awe and levels of daily hassles, the evidence remains equivocal. The available evidence does not unambiguously document whether awe is a possible factor in reducing daily hassles. No study has examined whether awe, with its impact on perceived vastness, decreases individuals' sense of daily

concerns. Nor has any research shown that the effect of awe upon decreased levels of daily hassles is unique to awe, rather than simply as part of the more general tendency of positive states to decrease general stress levels. In light of these concerns, in our current investigation we examine both correlational and causal relationships between awe and stress.

Present Investigation

In the current research, we tested the relation between awe and daily stress across four studies. We examined how awe experienced at the trait level, in the lab, and in natural settings decreases individuals' daily stresses, thereby increasing general well-being. Our first hypothesis was that awe, relative to other positive emotions—joy, amusement, or pride—would significantly decrease individuals' hassle-induced stress level at both trait and state levels (Hypothesis 1). In keeping with theoretical claims on how emotional experiences guide cognitive processes (e.g., Keltner & Horberg, 2015; Lerner, Valdesolo, & Kassam, 2015; Schwarz, 1990), we predicted that the intensity of the subjective experience of awe would predict the reduction in hassle-related stress (Hypothesis 2). Guided by an appraisal tendency approach to emotion-cognition interactions (Han, Lerner, & Keltner, 2007; Lerner & Keltner, 2000, 2001; Lerner & Tiedens, 2006; Tiedens & Linton, 2001), as well as the conceptual analyses of the negative association between perceived vastness and stress, we predicted that the effect of awe on decreased levels of hassle-related stress would be mediated by a sense of perceived vastness (Hypothesis 3). Finally, given awe's close association with individuals' well-being (Rudd et al., 2012; Stella et al., 2015), and daily hassles' well-documented impact on psychological health (e.g., Caspi et al., 1987; DeLongis et al., 1982; Kanner et al., 1981; Pearlin et al., 1981), we hypothesized that the relation between awe and well-being can be at least partially explained by awe's effect on diminishing individuals' daily concerns (Hypothesis 4).

Study 1: Dispositional Awe and Daily Hassles

Study 1 was designed to document the association between trait-level awe experiences and lower levels of daily hassle-related stress. We hypothesized that individuals who were more prone to experience awe would report lower level of daily stress. Emotional traits reflect the frequency and intensity with which individuals experience a specific emotion (Rosenberg, 1998), and in the moment, often demonstrate similar effects on social cognition as emotional states (for a review, see Keltner & Lerner, 2010). Trait-based awe, as measured by the Dispositional Positive Emotion Scale (DPES; Shiota, Keltner & John, 2006), predicts lower levels of proinflammatory cytokines—molecules that have a strong link with stressful experience and negative mood (Kiecolt-Glaser et al., 2002; Stellar et al., 2015). Furthermore, to test our hypothesis, we controlled for gender and ethnicity, which have been associated with levels of stress and well-being in previous stress research (e.g., Contrada et al., 2000; Nelson & Burke, 2002). We also controlled for dispositional amusement, an epistemological emotion which has often been used as a control emotion in awe research, to account for positivity since awe is typically categorized as a positive emotion.

Finally, in addition to measures of daily stress levels (Lazarus, 1984), we assessed participants' stress resulting from major life events (Monroe & Harkness, 2005). Guided by theoretical analyses of daily hassles as small daily events *appraised* as large and irritating, as well as empirical findings of the close association between daily well-being and self-focused attention (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Wood, Saltzberg, Neale, Stone, & Rachmiel, 1990), we expected that awe, defined as experiences arising from appraisals of

perceived vastness, would have a closer association with reduced daily concerns compared to stress-related to major life events.

Method

Participants.

A total of 329 students at a major public West Coast University participated in exchange for course credit. Nineteen participants failed more than two attention checks or skipped at least one question, and were excluded from our analyses. The final sample consisted of 310 participants (79 male, $M=20.49$ yrs, $SD= 2.57$ yrs). This sample was 2% African-American, 36% European-American, 37% Asian-American, 12% Latin-American, 3% other ethnicities, and 10% mixed race.

Measures and Procedure.

After giving consent, participants were directed to a webpage to complete a series of questionnaires.

Dispositional positive emotion. Dispositional awe and dispositional amusement were measured by two subscales of the Dispositional Positive Emotion Scales (DPES; Shiota et al., 2006), a self-report instrument that assesses the extent to which participants experience different discrete positive emotions at a trait-like level. The awe subscale contains six items consisting of: *I often feel awe, I see beauty all around me, I feel wonder almost every day, I have many opportunities to see the beauty of nature, I often look for patterns in objects around me, I seek out experiences that challenge my understanding* ($M =4.68$, $SD=0.96$, $\alpha= 0.81$). The amusement subscale is made up of five items such as: *I find humor in everything and the people around me make a lot of jokes* ($M =5.00$, $SD= 0.98$, $\alpha= 0.79$). Participants reported their level of agreement with each statement on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Hassle-related stress level. General hassle-related stress level was assessed using the Hassles Scale (Kanner et al., 1981), which contains a list of 117 hassles - those irritating, frustrating, distressing demands that characterize everyday interactions with the environment. Hassles include areas of work, health, family, friends, practical considerations, and chance occurrences (e.g., concerns about weight, physical appearance, misplacing or losing things etc.) Participants were instructed to report the occurrence of any items from the list which have "hassled" them in the past one month and the severity of each occurred hassle using a 4-point Likert scale: none or did not occur, somewhat severe, moderately severe, or extremely severe. Participants' severity ratings for those items were summed up to form a single index of hassle-related stress level.

Major life event-related stress level. Major life stresses were assessed using the Social Readjustment Rating Scale (Holmes & Rahe, 1967). This scale contains 43 different stressors that describe various major stressful life events (e.g. Death of a close friend, sexual difficulties, major personal injuries or illness). Similar to the Hassle Scale, participants were instructed to report the occurrence and severity of each major life events on a four point Likert scale: none or did not occur, somewhat severe, moderately severe, or extremely severe. Again, participants' severity ratings were summed up to form an index of major life event-related stress level.

Results and Discussion

To test our first hypothesis, we regressed each participant's daily hassle-related stress on DPES awe. As expected, trait awe significantly predicted the intensity of daily hassles, such that people who tend to feel more awe on a regular basis reported lower levels of intensity of stress associated with the 117 daily hassles, $b = -.13$, $t(318) = -2.39$, $p = 0.02$. We next tested whether this relation between awe and daily hassles might be confounded by general positivity and/or

demographic variables (e.g., gender, ethnicity) that might co-vary with both awe and daily hassles. Consistent with our first hypothesis, results indicated that after controlling for general positivity, age, gender (1 = male, 2 = female), and ethnicity (0 = non-white, 1 = white), awe still significantly predicted intensity of daily hassles (see in Table 1). A similar regression of awe on stress related to major life events was not significant, $b = -.08$, $t(318) = -1.42$, suggesting that awe, at least on trait level, only influences stresses elicited by small daily irritations.

In sum, building on previous studies linking trait-level awe to lower levels of inflammatory cytokines associated with stressful experiences (Kiecolt-Glaser et al., 2002; Stella et al., 2015), Study 1 found that trait-level awe was negatively correlated with self-reported general hassle-related stress, but not with stress related to major life events. Importantly, the relationship between awe and hassle-related stress was not merely a function of positive affect (e.g., Shiota et al., 2006). Building upon these trait-level findings, in our remaining studies we focused on experiment inductions of awe so as to test awe's causal effects on reduced hassle-related stress levels.

Study 2: Awe in the Lab and Daily Hassle-Related Stress

Study 2 extended the findings of Study 1 in several significant ways. First, we sought to replicate the relation between awe and the reduced level of daily stress (Hypothesis 1) that was observed at the trait level in Study 1; in Study 2 we experimentally induced awe in the laboratory, and compared its impact on daily hassles with the impact of amusement, a high arousal, positive emotion also related to changes in well-being (e.g., Ruch, 2009). Second, to better ascertain awe's specific effects, beyond simply exposure to nature, on hassle-induced stress, we matched the content of the two conditions: both videos depicted images of the natural world. Third, to ascertain the causal relationship between awe and decreased daily stress, we measured participants' levels of daily stress before and after the awe induction in the lab.

Finally, it is noteworthy that the hassle scale used in Study 1 used a checklist format that can be potentially biased by the emotional state of the person, and might introduce subjective, idiosyncratic meanings and judgments (e.g., problems with aging parents have enormously different meanings depending on the circumstances of a person's life). In addition, given the complexity of daily stress elicitors, as well as the highly personal meaning for each item, one checklist can hardly include all possible events (Monroe, 1983). Moreover, previous studies have found that the relationship among hassles is not linear: some hassles, more central to important personal goals, are more closely related to emotional distress, psychological symptoms, and health outcomes (Gruen, Folkman & Lazarus, 1988; McIntyre, Korn, & Matsuo, 2008; Vazquez, Jimenez, Saura, & Avia, 2001). Guided by these considerations, we adopted a central-hassle measurement paradigm from Gruen, Folkman and Lazarus (1988) in which participants report upon their own hassle and rate its intensity. We hypothesized that individuals, after watching awe-eliciting videos, would report lower levels of daily hassles compared to the ones who watched amusement or neutral videos.

Method

Participants

A total of 135 college students at a major public West Coast university participated in exchange for course credit. Seven participants failed to follow the instructions (e.g., fail to report their personal hassle before coming to the lab) and were thus excluded from all analyses. The final sample consisted of 128 college students (25 male; $M = 21.13$ yrs, $SD = 3.59$ yrs). The

ethnicity distribution in this sample was:47% European-American, 1% African-American, 11% US Latino, 27% Asian-American, 2% Native American and 12% other.

Measures and Procedure

Participants were invited to participate in a study of emotional experience. Before arrival, each participant's baseline level of daily hassles was measured. Upon arrival, participants were seated in individual testing cubicles where they watched a video designed to elicit one of the three target emotions (awe, amusement, or neutral), and then filled out the measures of hassle-related stress level again. All stimuli were viewed on a 22-inch monitor with a resolution of 1680 X 1050 and 75 Hz refresh rate.

Hassle-related stress level. Hassle-related stress level was measured by instructing participants to report on their most recent central hassle and then rate its intensity. The specific instructions that participants received for reporting their central hassle consisted of the following: (adapted from Gruen et al., 1988)

Hassles can differ in how much they say about you as a distinctive individual. Some hassles may be very central and revealing, and others may not be. A central hassle is one that you have a lot of concern about. This kind of hassle could reflect a troubling problem for you, perhaps a problem that is an ongoing theme in your life, such as an unresolved conflict, an unfulfilled need, or a personal inadequacy. Please think about the most stressful central hassle you have experienced in the past 1 month up to the present.

Participants were then instructed to write about their central daily hassle in 5 to 10 sentences and use a scale from 1 (*not stressful and bothersome at all*) to 100 (*extremely stressful and bothersome*) to evaluate how stressful and bothersome their central daily hassle was.

Emotion manipulation. After completing the pre-survey online, participants were invited to come to the lab and finish the lab session within the following five days. During this session, participants were randomly assigned to watch an awe-inducing video, an amusement-inducing video, or a neutral video. The awe-inducing video was a five-minute montage from the BBC's *Planet Earth* nature documentary depicting aerial images of avalanches, waterfalls, mountains, oceans, and forests. The amusement-eliciting video was a five-minute montage from the BBC's *Walk on the Wild Side* depicting wild animals from various ecosystems whose voices were overdubbed by actors engaging in funny conversations in their respective natural environments. The neutral clip was a five-minute news interview conducted by Mike Wallace. All videos have been pre-tested and used in previous research (Valdesolo & Graham, 2014).

Manipulation check. Participants reported the degree to which they felt each of 6 emotions while watching the video (i.e., "amusement", "awe", "anger", "sadness", "pride", "fear") on a seven-point scale from 1 (*not at all*) to 7 (*extremely*).

Results and Discussion

Manipulation Check

Participants' self-reported emotions confirmed that those who watched the awe-inducing video ($M = 6.33$, $SD = .95$) experienced stronger feelings of awe compared to participants who watched the amusement-inducing video ($M = 3.02$, $SD = 1.47$) and those who watched the neutral video ($M = 2.98$, $SD = 1.71$), $F(2, 125) = 77.99$, $p < .01$, $\eta_p^2 = .55$. Participants in the amusement condition ($M = 6.12$, $SD = .83$) experienced more amusement compared to those in the awe ($M = 4.21$, $SD = 2.03$) and neutral ($M = 3.32$, $SD = 1.63$) conditions, $F(2, 125) = 35.14$, $p < .01$, $\eta_p^2 = .36$.

Hassle-Related Stress

Participants described various daily events that hassled them during that month. While the majority of the stories were about midterms and homework (e.g., *Studying for midterms has been the most stressful event this month. The midterms went on for a couple of weeks. Even though they are over, I now have three essays I need to work on and more tests coming up. It seems as though it never ends.*), students also reported other sources of daily stress, such as troubles with family life (e.g., *One of my brothers has a lot of medical problems and had to move home because of it. Initially, he went to the doctor due to severe, crippling back pain.*), as well as aspects of the psychological environment (e.g., *A daily hassle that bothers me most is public transportation. I grew up in an area where it was easy to drive and park a car and have had to adjust to taking the bus since moving to Berkeley. Often the bus will be early or late, both of which can cause delay for my travel.*).

A one-way analysis of covariance (ANCOVA), controlling for baseline levels of hassle-related stress ($M = 73.45$, $SD = 19.05$) measured in the pre-survey, revealed that participants' post-manipulation reports of their hassle-related stress were significantly influenced by emotion condition, $F(2, 124) = 9.01$, $p < .001$, $\eta_p^2 = .13$ (Figure 1). We next conducted two orthogonal contrasts. In the first contrast (“control contrast”), we tested whether participants primed with positive feelings—awe (adjusted $M = 46.31$, $SE = 2.67$) and amusement (adjusted $M = 53.24$, $SE = 2.66$)—reported lower levels of hassle-related stress than those in the neutral ((adjusted $M = 61.15$, $SE = 2.60$) condition by comparing the awe condition to the amusement and neutral conditions (coded as awe = 1, amusement = 1, neutral = -2). In the second contrast (“awe and amusement contrast”) we compared the awe condition to the amusement condition (coded as awe = 1, amusement = -1, neutral = 0). As expected, the control contrast was significant, $F(1, 124) = 14.87$, $p < .001$, $\eta_p^2 = .11$. Furthermore, the awe and amusement contrast was marginally significant, $F(1, 124) = 3.34$, $p = .07$, $\eta_p^2 = .03$. These results suggest that experiences of awe and amusement decrease stress associated with a central hassle. Moreover, compared to those primed with a general positive emotion (amusement), participants primed with awe perceived their central hassle as less troublesome.

Experiences of Awe and Stress Related to a Central Hassle

Supporting Hypothesis 2, across conditions participants' self-reports of awe were significantly correlated with their hassle-related stress change (a difference score calculated by subtracting their hassle-related stress rating after watching the video from their baseline hassle-related stress rating), $r = .35$, $p < .00$. To examine awe's unique impact on reducing daily hassle-related stress, we ran a regression model in which we entered awe together with all the other emotions—amusement, pride, sadness, fear, and anger—simultaneously as the predictor of hassle-related stress change. Results revealed that even after controlling for all the other emotions (see Table 2), awe significantly predicted the reduction of perceived intensity of the central hassle, $b = .30$, $SE = 0.11$, $p = .008$. The correlation between hassle-related stress decrease and other positive emotions (amusement and pride) was not significantly.

By measuring participants' intensity rating of their daily hassle before and after their emotional experience, Study 2 provided experimental evidence that awe is especially related to decreased daily hassle-related stress. After watching an awe-eliciting video, participants reported that they were less bothered by their personal central daily hassle – issues at school, or with their family, or the challenges of everyday life—compared to their counterparts in the other two conditions. Moreover, the feelings of awe but not other emotions, predicted reductions in hassle-related stress.

Study 3: Awe, Perceived Vastness and Decreased Hassle-related stress

Thus far, we have seen that trait and state levels of awe predict decreased levels of hassle-related stress. In Study 3, we induced awe and appropriate comparison positive emotions (joy and pride) by asking participants to write about a prototypical experience of the target emotion, a method that has been well-validated in past studies (e.g., Griskevicius, Shiota, & Neufeld, 2010). This method allowed us to test whether awe leads to a lower sense of hassle-related stress across a wider range of awe-eliciting situations than in Study 2 (Bai et al., 2017). To further ascertain awe's unique impact upon daily hassles, we contrasted the effect of awe with two other positive emotions, joy and pride. Joy, like awe, is a high arousal, positive emotion, and often contrasted with awe in past studies (Shiota et al., 2007; Bai et al., 2017; Van Cappellen & Saroglou, 2012; Piff et al., 2015). Pride is also a high arousal, positive emotion, but in contrast to awe, promotes a sense of self-focused attention (Bai et al., 2017; Tracy & Robins, 2004).

Finally, guided by an appraisal tendency-based approach (e.g., Keltner & Haidt, 1999; Keltner & Lerner, 2010; Han et al., 2007; Lerner & Keltner, 2000, 2001; Lerner & Tiedens, 2006; Tiedens & Linton, 2001), we sought to illuminate one mechanism by which awe leads to lower levels of hassle-related stress (Hypothesis 3). Within this framework, each emotion is defined by a set of central appraisal tendencies that in turn direct cognition to address specific problems or challenges (Lerner & Keltner, 2000, 2001). For example, experiences of anger that arise from appraisals of other people as being in control of negative events, increases the tendency to perceive other individuals as responsible for subsequent events (Lerner & Keltner, 2000; Keltner, Ellsworth, & Edwards, 1993). Guided by this framework, we posited that awe, arising from appraisals of perceived vastness and an accompanying sense of diminished self-focus (Keltner & Haidt, 2003; Bai et al., 2017), will mediate the relationship between awe and diminished stress-related hassles (Lazarus, 1984).

Method

Participants

A total of 221 college students at a major public West Coast university participated in exchange for course credit. Sixteen participants who failed more than one attention check (out of five) were excluded. The final sample consisted of 205 students (64 male, $M = 21.17$, $SD = 3.16$). The ethnic distribution of this sample was as follows: 34% were European American, 41% were Asian or Asian American, 2% were African American, 10% were Latino/Latina, 3% were Native American, and 10% were mixed race.

Measures and Procedure

After giving consent, participants completed measures of baseline hassle-related stress level, and then recalled and wrote about a personal experience of awe, joy, or pride. They were then asked to report their hassle-related stress level and the sense of perceived vastness.

Hassle-related stress level. Participants' hassle-related stress level was measured as in Study 2. Specifically, participants recalled a central hassle that occurred in the past month and rated their level of stress on a scale from 1 (*not stressful and bothersome at all*) to 10 (*extremely stressful and bothersome*).

Emotion elicitation. Participants were randomly assigned to describe a particular experience that elicited a target emotion: awe, joy, or pride. Participants were provided with the definition of each target emotion (see below) and an emoticon (see in Appendix A) showing the prototypical facial expression of the target emotion (Bai et al., 2017). Following Strack, Schwarz, and Gschneidinger (1985), the instructions emphasized focusing on concrete, vivid, experiential aspects.

Awe. When experiencing awe, people usually feel like they are in the presence of something or someone that is so great in terms of size or intensity that their current understanding of the world, their surroundings, or themselves is challenged in some way. Please take a few minutes to think about a particular time, fairly recently, during which you felt awe.

Joy. When experiencing joy, people usually feel a burst of great happiness or delight. Please take a few minutes to think about a particular time, fairly recently, during which you felt joy.

Pride. When experiencing pride, people usually feel proud and accomplished. Please take a few minutes to think about a particular time, fairly recently, during which you felt pride.

Perceived vastness. Participants responded from 1 (*strongly disagree*) to 7 (*strongly agree*) to three items reliably used in previous research (Piff et al., 2015; Shiota et al., 2007). Items included: “I feel the presence of something greater than myself,” “I feel the greatness of something,” “I feel like I am in the presence of something grand.” ($\alpha = .93$, $M = 4.44$, $SD = 1.74$).

Emotions. Participants reported the degree to which they felt each of nine emotions during the experience they wrote about (“happiness”, “awe”, “joy”, “amusement”, “sadness”, “fear”, “anger”, “gratitude”, “pride”) on a 7-point scale (1 = *not at all*; 7 = *extremely*).

Data Coding

Coding of awe elicitors. Two native English-speaking research assistants from the U.S. were trained to code each entry as elicited by something in nature or not (inter-rater reliability: $\alpha = .97$). A third native coder who was naive to the research question read all the codes and settled discrepancies between the two coders. In total, 36 out of 62 awe narratives were coded as elicited by something in nature.

Results and Discussion

Awe Experience and Decreased Hassle-related Stress Level

To examine Hypothesis 1, we first conducted a 3-way (emotional condition: awe vs. joy vs. pride) ANOVA treating the hassle-related stress level change (a difference score calculated by subtracting their hassle-related stress rating after writing their emotional experience from hassle-related stress rating before emotion priming) as the dependent variable. Results yielded a significant effect of emotion condition on hassle-related stress level change, $F(2, 202) = 3.39$, $p = .04$, $\eta_p^2 = .03$, as seen in Figure 2. Furthermore, we conducted two orthogonal contrasts. In the first contrast (“awe contrast”), we examined whether the participants primed with awe ($M = -2.56$, $SE = 0.29$) reported greater decreases in hassle-related stress level than those in the joy ($M = -1.94$, $SE = 0.20$) and pride ($M = -1.62$, $SD = 0.28$) conditions (coded as awe = 2, joy = -1, pride = -1). In the second contrast (“positive contrast”) we tested the residual difference between the joy and pride conditions (coded as awe = 0, joy = 1, pride = -1). As expected, the awe contrast was significant, $F(1, 202) = 6.00$, $p = .01$, $\eta_p^2 = .03$, while the positive contrast was not, $F(1, 202) = 0.76$, $p = .39$.

To rule out the possibility that awe’s effect on hassle-related stress was produced solely by the nature elicitors, we compared awe participants’ reports of hassle-related stress change after writing about something in nature versus after writing about other awe eliciting situations. This comparison was not significant, $F(1, 65) = 0.05$, $p = .82$, suggesting that decreased levels of hassle-related stress due to awe is not simply a result of nature-eliciting awe situations.

Furthermore, supporting Hypothesis 2, across conditions, participants’ self-reports of awe were significantly correlated with their hassle-related stress level change, $r = -.18$, $p = .01$. Importantly, the same regression analysis as in Study 2 revealed that after controlling for other

positive and negative emotions (“happiness”, “awe”, “joy”, “amusement”, “sadness”, “fear”, “anger”, “gratitude”, “pride”), awe was the only emotion that predicted a change in hassle-related stress level (see Table 3), $b = -.33$, $SE = 0.11$, $p = .002$.

Awe, Perceived Vastness, and Reduced Hassle-related stress

A similar ANOVA on perceived vastness revealed the predicted emotion condition effect, $F(2, 202) = 5.43$, $p = .005$, $\eta_p^2 = .05$. Furthermore, we conducted the same two orthogonal contrasts to test whether awe ($M = 5.37$, $SD = 1.35$), compared to joy ($M = 4.71$, $SD = 1.55$) and pride ($M = 4.66$, $SD = 1.31$), introduced a stronger sense of perceived vastness. As expected, the awe contrast was significant, $F(1, 202) = 10.81$, $p = .001$, $\eta_p^2 = .05$, while the positive contrast was not significant, $F(1, 202) = .04$, $p = .84$, revealing that awe, but not joy or pride, produced a stronger sense of perceived vastness.

Next, to test our final hypothesis, we performed a mediation analysis to test whether awe, through perceived vastness, decreases individuals' hassle-related stress level. Figure 3 illustrates the mediational model and provides path coefficients. As shown, the negative association between awe-eliciting conditions (in contrast to joy- and pride-eliciting conditions) and decreases in hassle-related stress level became nonsignificant when perceived vastness was included in the model. We tested the proposed mediating effect using a bootstrapping procedure for mediator models recommended by Preacher and Hayes (2004, 2008). Analyses were conducted with the PROCESS macro for SPSS (Hayes, 2012) using 5,000 bootstrap samples. This technique yielded a 95% bias-corrected confidence interval that did not include zero [-.13 to -.002], suggesting that perceived vastness mediated the effect of awe in reducing the intensity of hassle-related stress.

The results of Study 3 extended our understanding of the relation between awe and hassle-related stress in several meaningful directions. First, by demonstrating that non-nature-based awe similarly decreased individuals' hassle-related stress, our results suggest that awe's effect on hassle-related stress decrease is not limited to exposure to nature. Moreover, consistent with Hypothesis 3, the mediation analysis in Study 3 suggests that these effects are driven by appraisals of vastness—a key component of the awe experience which closely links with diminished self-focused attention. Finally, Study 3 found that two other positive emotions, joy and pride, do not produce reductions in hassle-related stress.

Study 4: Awe, Hassle-related Stress, and Enhanced Well-being

In our final study, we moved beyond traditional emotion inductions in the lab and induced awe by situating participants into a real awe-inspiring setting. In keeping with Hypothesis 1, we predicted that when immersed to awe in the natural setting, individuals will be less bothered by their daily hassles. Furthermore, we expected that the intensity of the subjective experience of awe reported by participants will significantly correlate with their daily hassle-related stress reduction (Hypothesis 2). Third, consistent with the mediation finding from Study 3, we predicted that awe's effect on reduced daily hassle-related stress can be explained by the subjective sense of perceived vastness (Hypothesis 3). Finally, guided by existing findings on both awe and hassle's association with well-being (e.g., Rudd et al., 2012; Stella et al., 2015; Lazarus, 1984), we predicted that awe, through decreased daily hassle-related stress level, will enhance people's well-being (Hypothesis 4).

Method

Participants

Eighty-six college students (25male; $M = 20.64$ yrs, $SD = 2.42$ yrs) at a major public West Coast university participated in the experiment in exchange for course credit. The ethnic distribution of the sample was as follows: 14% were European-American, 54% were Asian-American, 20% were Latin-American, and 12% were other ethnicities.

Measures and Procedure

Participants were invited to participate in a study of emotional experience. Upon arriving at the lab, participants were instructed to fill out measures of baseline hassle-related stress level and life satisfaction. Afterward, participants walked with the experimenter to the Campanile, a clock tower at the center of the UC Berkeley campus with a height of 200 feet, where they were told to finish another set of questionnaires. Mindful of the potential confounding biases introduced by the elevated height, we brought all participants to the top level of the tower and then randomly assigned them to one of two conditions. In the awe condition, participants were instructed to look out and enjoy the expansive view of the Bay, San Francisco, and the Golden Gate Bridge. In the control condition, participants were asked to face the inside wall of the tower and were not allowed to look out of the tower until they finished answering all the questions (see Figure 4). Participants in both conditions were asked to report their emotional experiences, sense of perceived vastness, hassle-related stress level, as well as life satisfaction while standing at the top level of the tower. Upon finishing, all participants were allowed to tour around the tower and were then brought back to the lab room, debriefed, thanked, and released.

Emotional Experience. Participants used a seven-point scale from 1 (*not at all*) to 7 (*extremely*) to indicate the extent to which they experienced each of five emotions (“amusement,” “happiness,” “awe,” “fear,” and “anger,”) while viewing either the interior of the tower or the bay from the top of the tower.

Perceived vastness. The same three-item perceived vastness scale was used to measure individuals' appraisal of vastness while they were standing at the top level of the tower ($\alpha = .82$, $M = 4.44$, $SD = 1.70$).

Central hassle-related stress. Participants' central hassle level was measured by the similar central hassle recall task used in Study 2.

General hassle frequency and intensity. Participants general hassle-related stress and frequency was assessed using the same Hassles Scale (Kanner et al., 1981) as used in Study 1.

Well-being. Participants' well-being was measured using the Satisfaction with Life Scale (Diener, Emmons, Larsen & Griffin, 1985). This scale contains five items that measure global cognitive life satisfaction judgments. Participants responded using a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), indicating how much they agreed or disagreed with each item at the current moment. This scale showed strong reliability ($M = 4.79$, $SD = 1.21$, $\alpha = .89$).

Results and Discussion

Awe Experienced at the Top Level of the Tower

Independent samples *t*-test showed that compared to the participants who were instructed to face the wall in the interior of the Campanile (control condition; $M = 2.73$, $SD = 1.62$), participants who were looking out of the tower (awe condition; $M = 5.26$, $SD = 1.48$) reported stronger feelings of awe $t(84) = -7.56$, $p < .001$, $d = 1.84$.

Decrease in General Hassle-Related Stress

To examine our prediction regarding awe's impact on hassle-related stress, we first conducted a 2 (emotion condition: awe vs. control) \times 2 (time: pre or post assessment of general hassle-related stress) MANOVA. Results yielded a significant interaction between emotion

condition and time, $F(1, 84) = 13.21, p < .001, \eta_p^2 = .14$. Simple effect analyses revealed that people in both conditions reported lower intensity of general hassle after walking to the top level of the tower, which fits with what is known about the benefits of being outdoors (e.g., Hartig et al., 2003; Kohlleppel et al., 2002; Mayer et al., 2009; Mitchell & Popham, 2008; Nisbet & Zelenski, 2011). This effect, however, was much larger among participants who were assigned to the awe condition ($M = -33.90, SE = 4.59$), $F(1, 84) = 73.40, p < .001, \eta_p^2 = .47$, compared to the ones who were facing the inner side of the tower ($M = -13.80, SE = 3.16$), $F(1, 84) = 12.73, p = .001, \eta_p^2 = .13$.

Hassle-related Stress

We conducted a similar 2 (emotion condition: awe vs. control) \times 2 (time: pre or post assessment of central hassle-related stress) MANOVA and discovered a similar significant interaction between emotion condition and time, $F(1, 84) = 18.99, p < .001, \eta_p^2 = .18$. Simple effects analyses revealed that although people in both conditions were less bothered by their central daily hassle after walking to the top level of the tower, this effect was much larger among participants who were assigned to awe condition ($M = -3.40, SE = 2.18$), $F(1, 84) = 130.77, p < .001, \eta_p^2 = .61$, compared to the ones who were facing the inner side of the tower ($M = -1.59, SE = 1.66$), $F(1, 84) = 29.91, p < .001, \eta_p^2 = .26$.

Increase in Well-being

To examine our predictions concerning awe and life satisfaction, we then conducted 2 (emotion condition: awe vs. control) \times 2 (time: pre or post assessment) MANOVA test with self-reported life satisfaction as dependent variables. Consistent with our prediction, the interaction between emotion condition and time was significant, $F(1, 84) = 9.56, p = .003, \eta_p^2 = .10$. Simple effect analyses of this interaction revealed that, after viewing the awe-inducing scenery at the top level of the tower, participants' self reported life satisfaction ($M = 5.07, SE = 0.21$) was significantly higher than before ($M = 4.67, SE = 0.19$), $F(1, 84) = 11.56, p = .001, \eta_p^2 = .12$. On the other hand, when viewing the inner side of the tower, participants' life satisfaction did not change from baseline, $F(1, 84) = 0.90, p = .35$.

Hassle-related stress Change and Awe

To test Hypothesis 3, that feelings of awe would correlate with decreased hassle-related stress level, we created a composite of general hassle-related stress change (a difference score calculated by subtracting their general hassle-related stress rating after getting to the top level of the tower from their general hassle-related stress rating before emotion priming) and central hassle-related stress change (a difference score calculated by subtracting their central hassle-related stress rating after getting to the top level of the tower from their central hassle-related stress rating before emotion priming), by standardizing and finding the average of these two measures. Supporting Hypothesis 3, across conditions participants' self-reports of awe were significantly correlated with their hassle-related stress change, $r = -.29, p = .006$.

Awe, Perceived Vastness, Decreased Hassle-related Stress Level, and Increased Well-Being

In our final analyses, we carried out two two mediation analyses to address how awe's effect on daily hassle intensity might lead to increased well-being. Figure 5 illustrates the mediational model and provides path coefficients. In the first mediation analysis, we replicated our findings in Study 3, showing that awe, through appraisals of vastness, decreased hassle-related stress. Following the similar bootstrapping procedure using the SPSS PROCESS macro provided by Hayes (2013), we found significant indirect effect of awe (in contrast to control condition) on hassle-related stress change as mediated by perceived vastness (95% CI [-

0.19,0.03). The direct effect of awe on hassle-related stress level decrease became less significant (95% CI [-0.47, -0.15]) when perceived vastness was included as a mediator.

In a second mediation analysis, we investigated whether awe, through decreased hassle-related stress level, leads to increased well-being. Following the same bootstrapping procedure, we discovered a significant indirect effect of awe (in contrast to control condition) on well-being change as mediated by decreased hassle-related stress level (95% CI [0.03, 0.21]). The direct effect of awe on well-being change became no longer significant (95% CI [-0.03, 0.33]) when hassle-related stress level change was included as a mediator.

In sum, Study 4's results provided evidence for all of the hypotheses guiding this investigation. By immersing participants into an awe-inspiring moment, we documented that state-level awe experience significantly decreases individuals' daily hassle-intensity level (Hypothesis 1). Furthermore, our data again revealed that individuals' awe experience intensity significantly predicted decreases in their hassle-related stress intensity (Hypothesis 2). Finally, this study is the first to provide evidence for a causal link between awe, hassle-related stress, and life satisfaction, suggesting that awe, through decreased daily hassle-related stress, can elevate life satisfaction (Hypotheses 3 & 4).

General Discussion

Stress is ubiquitous and consequential. Over the past two decades, questions concerning what can be stressful and how stress-related problems can be attenuated have become a central focus in social psychology (e.g., Antonovsk, 1987; Folkman, 2013; Kanner et al., 1981). In this body of research, growing attention has been paid to daily hassles—every day ongoing stresses and strains—which, compared to acute life events, more closely associate with individuals' adaptational outcomes and psychological symptoms (e.g., DeLongis et al., 1982; Folkman & Lazarus, 1985; Kanner et al., 1981). While a wide range of daily events have been identified as daily hassles, studies have rarely shed light on the ways in which their severity can be attenuated. In the present investigation, we focused on how awe reduces hassle-related stress.

The results of the current four studies lend direct support for this central hypothesis: awe predicted lower hassle-related stress. We found this at the trait level (Study 1), after viewing tightly controlled awe-inducing video clips (Study 2), when immersed in a recollection of a past experience of awe (Study 3), and when in an awe-inspiring setting (Study 4). Lending support to our second hypothesis, in the first three studies (Studies 1-3), participants' reports of their experience of awe, even after controlling for other positive and negative emotional experiences, predicted reduced hassle-related stress, a finding in line with studies showing that the experience of an emotion tracks emotion-specific influences upon cognition (Keltner & Horberg, 2015; Lerner et al., 2015; Schwarz & Clore, 1983).

Our results also yielded one answer to the question of *why* awe reduces the stress associated with daily hassles. Across our studies, we found that the link between awe and decreased levels of hassle-related stress was fully mediated by perceived vastness—a key component of awe experience which is closely associated with diminished self-focused attention (Bai et al., 2017). Further analyses revealed that the mitigation of daily concerns explains why awe promotes well-being. In Study 4, compared to participants in the control condition, participants primed with awe reported greater improvement in well-being, and such change was mediated by their reduced daily concern levels.

Finally, our results undermine the plausibility of an alternative explanation: that awe's impact on daily stress is simply due to the general benefits of immersion in nature (e.g., Hartig, et al., 2003; Mayer et al., 2009; Kohlleppel et al., 2002). In Study 2, after watching two videos

composed of images from the natural world, participants who watched the awe eliciting video were less bothered by their central daily hassle. In Study 3, compared to those who were immersed in recalling a nature-based, awe-eliciting situation, those who recalled non-nature awe-eliciting experiences reported similar reductions in hassle-related stress. Our findings suggest that awe exerts a specific and likely unique effect on daily hassles that is distinct from the influences of other positive emotions, not confounded by more general positive affect, and not limited to experiences in nature.

Theoretical Implications

This research makes a number of contributions to the growing literature on positive emotion and stress reduction. First, by focusing on one pervasive kind of stress—daily hassles—the current research complements previous work emphasizing the importance of differentiating various types of stressors and identifying their specific interventions (e.g., Caspi et al., 1987; Caplan & Jones, 1975; Frankenhaeuser & Gardell, 1976; Kanner & Coyne, 1979; Lazarus, 1980; Lazarus and Cohen, 1977; Levine & Scotch, 1970; Novaco et al., 1979; Pearlin, 1975). Because hassle-related stress usually correlates with major life events-related stress (Caspi et al., 1987; Kanner et al., 1981), in early stress intervention research, many scholars have conceptualized them as isomorphic and confounded them in measurement. Our research suggests that doing so is an oversimplification. In Study 1, when both hassle-related and major life events-related stress were measured, awe only predicted individuals' levels of daily concerns, suggesting that the observed effects of awe in the current investigation are specific to daily hassles. These findings are some of the first to suggest that daily hassles, with their own causes and consequences, merit systematic investigation for specific interventions.

Our investigation also adds to and strengthens the approach of defining distinct positive emotions within the overall family of positive emotions (Shiota et al., 2017). While researchers have long been interested in differentiating negative emotions (e.g., anger, fear, and disgust), research on discrete positive emotions is more recent (e.g., Ekman 1994; Shiota et al., 2004). Our findings support earlier research on positive states as a whole in predicting decreased levels of stress (e.g., Fredrickson, 2001; Folkman, & Moskowitz, 2000). At the same time, though, by comparing awe to other positive emotions such as amusement (Studies 1 & 2), joy (Study 3), and pride (Study 3) which have been well documented as factors that buffer stress and improve well-being (e.g., Thorson, Powell, Sarmany-Schuller, & Hampes, 1997; Fredrickson, 2001), our findings suggest that awe exerts unique benefits upon daily hassles through introducing a sense of perceived vastness. It will be important for future research, to test other discrete positive emotions (e.g., contentment; Cordaro, Brackett, Glass, & Anderson, 2016) and their impact on various types of stress.

Finally, our data advance the emerging science of awe. As a growing area in emotion research, awe has only recently captured researchers' attention. Previous research, based on the unique appraisal frameworks of awe, has focused more on its consequent changes in cognitive processes and social interactions, including decreased sense of self (Bai et al., 2017), increased religious intentions (Van Cappellen & Saroglou, 2012), expanded time perception (Rudd et al., 2012), agency detection (Valdesolo & Graham, 2014) and increased prosocial behaviors (Piff et al., 2015). Our investigation is the first of its kind, in its exploration of awe's impact on mental health and well-being, providing systematic evidence suggesting that beyond altering social cognitions, awe serves an important role in buffering individuals' daily stress and improving overall well-being.

Limitations and Future Directions

Although we used a variety of methodological approaches to explore the link between awe and daily hassles, a few limitations merit attention. First, while the research presented in this paper, together with a large body of previous awe research, focuses on awe as a positive emotion, further work must be done to extend these findings to negatively-valenced awe experiences, namely, the subset of awe experiences (12% - 24%) that empirical studies find are elicited by more fearful and threat elicitors such as thunderstorms, earthquakes, and floods, and that do not predict elevated well-being (Gordon et al., 2017). We would expect that more threat-based forms of awe, accompanied by enhanced fear and anxiety, will exacerbate individuals' stressful symptoms. However, guided by the social functional analysis of awe (Lerner & Keltner, 2000, 2001; Lerner & Tiedens, 2006; Bai et al., 2017), it is also plausible that negatively-valenced awe, again through perceived vastness, still diminishes individuals' daily concerns. Future studies need to pit these predictions against one another.

In addition, while we measured awe's impact on daily stress at the trait and state levels, the question of how these influences unfold over time and across contexts remains unaddressed. Past research (e.g., Fredrickson & Levenson, 1998; Fredrickson et al., 2003) has demonstrated that positive emotions, in addition to interrupting ongoing stress, may also protect against slow or prolonged recovery from stress. This raises questions about how awe's effect in stress manifests in chronic situations. Based on the social functioning approach of awe and its argument regarding the appraisal tendency change under stressful situations, it is reasonable to predict that awe experiences will also yield unique benefits to prolonged recoveries from stress-related damages.

In the current investigation, we only focused on hassles--small daily irritations. One notable direction for future endeavors should concern its counterpart, namely daily uplifts that captures the positive experiences derived from tiny everyday events such as relating well with friends, eating outside, spending time with family, etc. It is important to note that uplifts are not merely mirrored experiences of hassles. Indeed, they only moderately correlate with hassles and have clearly distinguishable functions in maintaining daily well-being (Kanner et al., 1981; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000). It stands to reason that awe, through introducing a sense of perceived vastness and diminished sense of self-focus, will lead individuals to pay more attention to those relatively minor moments in their life, and thus bring positive impact toward daily well-being.

Furthermore, it is noteworthy that across four studies, we relied on self-report measures to measure participants' levels of hassle-related stress. While self-report measures have been widely used in the stress literature, these self-reported scores can be biased by multiple individual and contextual factors. It is possible, however, that the "most stressful" daily concerns were actually not that bothersome. Future investigations should thus take a multimethod approach (for a discussion, see J. E. Singer & Davidson, 1991) to stress assessment by including not only self-reports from respondents but also physiological outcomes, biochemical assessments, and behavioral measures of stress.

Finally, it would be both theoretically intriguing and practically useful to test awe's impact on daily hassles among other populations, such as elders, veterans, who are more sensitive and vulnerable for stresses and related diseases (for reviews, see Hawkey & Cacioppo, 2004; Smith, 2003). For example, some studies have documented that veterans with post-traumatic stress disorder (PTSD) experience difficulties in daily striving and more easily experience stress on daily basis (e.g., Kashdan, Breen, & Julian, 2010). Findings in the current

study point to a potential future remedy for vulnerable groups, such as veterans, who experience high stress from daily hassles, through developing treatments incorporating awe experiences.

Conclusion

In the presence of something vast and transcends your understanding of the current world, we are often in the state of awe. As this profound feeling may shift our attention away from the self or brings us a new look on life, the bothersome daily concerns seem to be less salient and daily stress becomes less intense. Our findings verify that awe does indeed help to reduce the intensity of hassle-related stress and, moreover, improves overall well-being. Further research should extend the current investigation by examining other possible underlying mechanisms and the relationship of different positive emotions and various kinds of stressors in a broader sense.

References

- Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S. L. (1994). Socioeconomic status and health: The challenge of the gradient. *American psychologist, 49*(1), 15-24.
- Algoe, S. B., & Haidt, J. (2009). Witnessing excellence in action: The 'other-praising' emotions of elevation, gratitude, and admiration. *The journal of positive psychology, 4*(2), 105-127.
- Aspinwall, L. (1998). Rethinking the Role of Positive Affect in Self-Regulation. *Motivation and Emotion, 22*(1), 1-32.
- Axelrod, J., & Reisine, T. D. (1984). Stress hormones- Their interaction and regulation. *Science, 224*(4648), 452-459.
- Ayduk, O., & Kross, E. (2008). Enhancing the pace of recovery: Self-distanced analysis of negative experiences reduces blood pressure reactivity. *Psychological science, 19*(3), 229-231.
- Ayduk, O., & Kross, E. (2010). From a distance: Implications of spontaneous self-distancing for adaptive self-reflection. *Journal of Personality and Social Psychology, 98*, 809 – 829.
- Bai, Y., Maruskin, L. A., Chen, S., Gordon, A. M., Stellar, J. E., McNeil, G. D., Peng, K., & Keltner, D. (2017). Awe, the diminished self, and collective engagement: Universals and cultural variations in the small self. *Journal of Personality and Social Psychology*. Advanced online publication. <http://dx.doi.org/10.1037/pspa0000087>
- Berkman, L. F., & Syme, S. L. (1979). Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *American journal of Epidemiology, 109*(2), 186-204.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of personality and social psychology, 84*(4), 822-848.
- Bar-Tal, D., Bar-Zohar, Y., Greenberg, M. S., & Hermon, M. (1977). Reciprocity behavior in the relationship between donor and recipient and between harm-doer and victim. *Sociometry, 40*, 293–298.
- Baum, A., Garofalo, J. P., & Yali, A. N. N. (1999). Socioeconomic status and chronic stress: does stress account for SES effects on health?. *Annals of the New York Academy of Sciences, 896*(1), 131-144.
- Billings, A. G., & Moos, R. H. (1984). Coping, stress, and social resources among adults with unipolar depression. *Journal of personality and social psychology, 46*(4), 877-891.
- Blazer, D. G. (1982). Social support and mortality in an elderly community population. *American journal of epidemiology, 115*(5), 684-694.
- Bodenmann, G., Meuwly, N., Bradbury, T. N., Gmelch, S., & Ledermann, T. (2010). Stress, anger, and verbal aggression in intimate relationships: Moderating effects of individual and dyadic coping. *Journal of Social and Personal Relationships, 27*(3), 408-424.
- Booth, A., & Amato, P. (1991). Divorce and psychological stress. *Journal of health and social behavior, 32*(4), 396-407.
- Bower, J. E., Ganz, P. A., & Aziz, N. (2005). Altered cortisol response to psychologic stress in breast cancer patients with persistent fatigue. *Psychosomatic Medicine, 67*, 277–280.
- Brydon, L., Magid, K., & Steptoe, A. (2006). Platelets, coronary heart disease, and stress. *Brain, Behavior, and Immunity, 20*(2), 113-119.

- Burleson, M. H., Trevathan, W. R., & Todd, M. (2007). In the mood for love or vice versa? Exploring the relations among sexual activity, physical affection, affect, and stress in the daily lives of mid-aged women. *Archives of sexual behavior*, 36(3), 357-368.
- Campos, B., Shiota, M. N., Keltner, D., Gonzaga, G. C., & Goetz, J. L. (2013). What is shared, what is different? Core relational themes and expressive displays of eight positive emotions. *Cognition & emotion*, 27(1), 37-52.
- Caspi, A., Bolger, N., & Eckenrode, J. (1987). Linking person and context in the daily stress process. *Journal of Personality and Social Psychology*, 52(1), 184-195.
- Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., ... & Poulton, R. (2003). Influence of life stress on depression: moderation by a polymorphism in the 5-HTT gene. *Science*, 301(5631), 386-389.
- Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: a review and meta-analysis. *The journal of alternative and complementary medicine*, 15(5), 593-600.
- Cohen, S., Doyle, W. J., & Skoner, D. P. (1999). Psychological stress, cytokine production, and severity of upper respiratory illness. *Psychosomatic Medicine*, 61(2), 175-180.
- Cohen, S., Doyle, W. J., Turner, R. B., Alper, C. M., & Skoner, D. P. (2003). Emotional style and susceptibility to the common cold. *Psychosomatic medicine*, 65(4), 652-657.
- Cohen, S., Mermelstein, R., Kamarck, T., & Hoberman, H. M. (1985). Measuring the functional components of social support. In *Social support: Theory, research and applications* (73-94). Springer Netherlands.
- Cohen, S., & McKay, G. (1984). Social support, stress and the buffering hypothesis: A theoretical analysis. In A. Baum, J. E. Singer, & S. E. Taylor (Eds.), *Handbook of psychology and health*, vol. 4. Hillsdale, NJ: Erlbaum.
- Cohen, S., Janicki-Deverts, D., Doyle, W. J., Miller, G. E., Frank, E., Rabin, B. S., & Turner, R. B. (2012). Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. *Proceedings of the National Academy of Sciences*, 109(16), 5995-5999.
- Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *Jama*, 298(14), 1685-1687.
- Cohen, S., & Pressman, S. D. (2006). Positive affect and health. *Current Directions in Psychological Science*, 15(3), 122-125.
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 2, 310-357.
- Contrada, R. J., Ashmore, R. D., Gary, M. L., Coups, E., Egeth, J. D., Sewell, A., ... & Chasse, V. (2000). Ethnicity-related sources of stress and their effects on well-being. *Current Directions in Psychological Science*, 9(4), 136-139.
- Conger, R. D., Ge, X., Elder, G. H., Lorenz, F. O., & Simons, R. L. (1994). Economic stress, coercive family process, and developmental problems of adolescents. *Child development*, 65(2), 541-561.
- Cooper, C. L., Faragher, E. B., Bray, C. L., & Ramsdale, D. R. (1985). The significance of psychosocial factors in predicting coronary disease in patients with valvular heart disease. *Social Science & Medicine*, 20(4), 315-318.
- Cordaro, D. T., Brackett, M., Glass, L., & Anderson, C. L. (2016). Contentment: Perceived completeness across cultures and traditions. *Review of General Psychology*, 20(3), 221.

- Costello, E. J., Pine, D. S., Hammen, C., March, J. S., Plotsky, P. M., Weissman, M. M., ... & Hellander, M. (2002). Development and natural history of mood disorders. *Biological psychiatry*, 52(6), 529-542.
- Cutrona, C. E., Cole, V., Colangelo, N., Assouline, S. G., & Russell, D. W. (1994). Perceived parental social support and academic achievement: an attachment theory perspective. *Journal of personality and social psychology*, 66(2), 369-378.
- Cutrona, C., Russell, D., & Rose, J. (1986). Social support and adaptation to stress by the elderly. *Psychology and aging*, 1(1), 47-54.
- Danner, D. D., Snowdon, D. A., & Friesen, W. V. (2001). Positive emotions in early life and longevity: findings from the nun study. *Journal of personality and social psychology*, 80(5), 804-813.
- Danoff-Burg, S., Prelow, H. M., & Swenson, R. R. (2004). Hope and life satisfaction in Black college students coping with race-related stress. *Journal of Black Psychology*, 30(2), 208-228.
- DeLongis, A., Coyne, J. C., Dakof, G., Folkman, S., & Lazarus, R. S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology*, 1(2), 119-136.
- Derogatis, L. R., Lipman, R. S., Covi, L., Rickels, K., and Uhlenhuth, E. H. (1970). Dimensions of outpatient neurotic pathology: Comparison of a clinical versus an empirical assessment. *Journal of Counselling Psychology*, 34, 164-171.
- Derogatis, L. R., Lipman, R. S., Covi, L., & Rickels, K. (1971). Neurotic symptom dimensions: As perceived by psychiatrists and patients of various social classes. *Archives of General Psychiatry*, 24(5), 454-464.
- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., and Covi, L. (1974). The Hopkins Symptoms Checklist (HSCL): A measure of primary symptom dimensions. In Pichot, P. (ed.), *Psychological Measurements in Psychopharmacology. Modern Problems in Pharmacopsychiatry*, Vol. 7, Karger, Basel, pp. 79-110.
- Dimsdale, J. E. (2008). Psychological stress and cardiovascular disease. *Journal of the American College of Cardiology*, 51(13), 1237-1246.
- Duijts, S. F., Zeegers, M., & Borne, B. V. (2003). The association between stressful life events and breast cancer risk: a meta-analysis. *International journal of cancer*, 107(6), 1023-1029.
- Eckenrode, J. (1984). Impact of chronic and acute stressors on daily reports of mood. *Journal of personality and social psychology*, 46(4), 907-918.
- Elder, G. H., Jr., Capsi, A., & Van Nguyen, T. (1986). Resourceful and vulnerable children: Family influences in hard times. In R. Silbereisen, H. Eyferth, & A. Rudinger (Eds.), *Development as action in context: Problem behavior and normal youth development* (167-186). New York: Springer.
- Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: an experimental investigation of gratitude and subjective well-being in daily life. *Journal of personality and social psychology*, 84(2), 377-389.
- Endler, N. S., & Parker, J. D. A. (1990). "Multidimensional Assessment of Coping: A Critical Evaluation." *Journal of Personality and Social Psychology*, 58(5), 844-854.
- Fenigstein, A., Seheier, M. E., & Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology*, 43, 522-527.

- Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., & Gruen, R. J. (1986). Dynamics of a stressful encounter: Cognitive appraisal, coping, and encounter outcomes. *Journal of personality and social psychology*, *50*(5), 992-1003.
- 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), 150-170.
- Folkman, S., & Lazarus, R. S. (1988). The relationship between coping and emotion: Implications for theory and research. *Social Science Medicine*, *26*(3), 309-317.
- Folkman, S., & Moskowitz, J. T. (2000). Positive affect and the other side of coping. *American Psychologist*, *55*(6), 647-654.
- Froh, J. J., Yurkewicz, C., & Kashdan, T. B. (2009). Gratitude and subjective well-being in early adolescence: Examining gender differences. *Journal of adolescence*, *32*(3), 633-650.
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*(3), 218-226.
- Fredrickson, B. (2004). The broaden and build theory of positive emotions. *Philosophical Transaction of the Royal Society B*.*359*, 1367–1377.
- Fredrickson, B. L., & Levenson, R. W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition and Emotion*, *12*(2), 191-220.
- Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and emotion*, *24*(4), 237-258.
- Friedlander, L. J., Reid, G. J., Shupak, N., & Cribbie, R. (2007). Social support, self-esteem, and stress as predictors of adjustment to university among first-year undergraduates. *Journal of college student development*, *48*(3), 259-274.
- Frye, N. E., & Karney, B. R. (2006). The context of aggressive behavior in marriage: A longitudinal study of newlyweds. *Journal of Family Psychology*, *20*(1), 12-20.
- Gibbons, F. X. (1987). Mild depression and self-disclosure intimacy: Self and others' perceptions. *Cognitive Therapy and Research*, *11*(3), 361-380.
- Gibbons, F. X., Smith, T. W., Ingram, R. E., Pearce, K., Brehm, S. S., & Schroeder, D. J. (1985). Self-awareness and self-confrontation: Effects of self-focused attention on members of a clinical population. *Journal of Personality and Social Psychology*, *48*(3), 662.
- Grimm, S., Johannes B., Daniel S., Daniel H., Peter B., Felix B., Ludwig N., Heinz B., & Georg N. (2008). Imbalance between left and right dorsolateral prefrontal cortex in major depression is linked to negative emotional judgment: an fMRI study in severe major depressive disorder. *Biological psychiatry*, *63*(4), 369-376.
- Griskevicius, V., Shiota, M. N., & Neufeld, S. L. (2010). Influence of different positive emotions on persuasion processing: a functional evolutionary approach. *Emotion*, *10*(2), 190.
- Gruen, R. J., Folkman, S., & Lazarus, R. S. (1988). Centrality and Individual Differences In the Meaning of Dally Hassles. *Journal of Personality*, *56*(4), 743-762.
- Gur RC, Erwin RJ, Gur RE, Zwiil AS, Heimberg C, Kraemer HC (1992): Facial emotion discrimination: II. Behavioral findings in depression. *Psychiatry Res* *42*, 241–251.
- Gordon, A. M., Stellar, J. E., Anderson, C. L., McNeil, G. D., Loew, D., & Keltner, D. (2017). The dark side of the sublime: Distinguishing a threat-based variant of awe. *Journal of personality and social psychology*, *113*(2), 310-328.
- Hammen, C. (2005). Stress and Depression. *Annual Review of Clinical Psychology*, *1*, 293-319.
- Han, S., Lerner, J.S., & Keltner, D. (2007). Feelings and consumer decision making: The appraisal-tendency framework. *Journal of Consumer Psychology*. *17*(3), 158-168.

- Hansmann, R., Hug, S. M., & Seeland, K. (2007). Restoration and stress relief through physical activities in forests and parks. *Urban Forestry & Urban Greening*, 6(4), 213-225.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23(2), 109-123.
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.
- Heijnen, C. J., & Kavelaars, A. (2005). Psychoneuroimmunology and chronic autoimmune diseases: Rheumatoid arthritis. In K. Vedhara & M. Irwin (Eds.), *Human psychoneuroimmunology* (195–218). New York: Oxford University Press.
- Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, 44, 513-524.
- Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Applied psychology*, 50(3), 337-421.
- Holsboer, F. (2000). The corticosteroid receptor hypothesis of depression. *Neuropsychopharmacology*, 23(5), 477-501.
- Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of psychosomatic research*, 11(2), 213-218.
- Hovey, J. D., & King, C. A. (1996). Acculturative stress, depression, and suicidal ideation among immigrant and second-generation Latino adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, 35(9), 1183-1192.
- Ingram, R. E. (1990). Self-focused attention in clinical disorders: Review and a conceptual model. *Psychological bulletin*, 107(2), 156.
- Ingram, R. E., Lumry, A. E., Cruet, D., & Sieber, W. (1987). Attentional process in depressive disorders. *Cognitive Therapy and Research*, 11, 351-360
- Ingrain, R. E., & Smith, T. S. (1984). Depression and internal versus external focus of attention. *Cognitive Therapy and Research*, 8, 139-152.
- Jacobs, J. R., & Bovasso, G. B. (2000). Early and chronic stress and their relation to breast cancer. *Psychological medicine*, 30(3), 669-678.
- Johnson, J. H., & Sarason, I. G. (1978). Life stress, depression and anxiety: Internal-external control as a moderator variable. *Journal of psychosomatic research*, 22(3), 205-208.
- Johnson, J. H. , & Sarason, I. G. (1979). Recent development in research on life stress. In V. Hamilton & D. Warburton (Eds.), *Human stress and cognition: An information processing approach*. London: Wiley.
- Johnson, J. G., & Sherman, M. F. (1997). Daily hassles mediate the relationship between major life events and psychiatric symptomatology: Longitudinal findings from an adolescent sample. *Journal of Social and Clinical Psychology*, 16(4), 389-404.
- Kanner, A., Coyne, J., Schaefer, C., & Lazarus, R. (1981). Comparison of Two Modes of Stress Measurement: Daily Hassles and Uplifts Versus Major Life Events. *Journal of Behavioral Medicine*, 4(1), 1-39.
- Kanner, A., and Coyne, J. (1979). Uplifts, hassles, and a little androgyny. Paper presented at the Meeting of the Western Psychological Association, San Diego, California, April 6, 1979
- Keltner, D., Ellsworth, P. C., & Edwards, K. (1993). Beyond simple pessimism: effects of sadness and anger on social perception. *Journal of personality and social psychology*, 64(5), 740-752.
- Kawachi, I., Kennedy, B. P., Lochner, K., & Prothrow-Stith, D. (1997). Social capital, income inequality, and mortality. *American journal of public health*, 87(9), 1491-1498.

- Keltner, D., & Haidt, J. (2003). Approaching awe, a moral, spiritual, and aesthetic emotion. *Cognition and Emotion, 17*(2), 297-314.
- Keltner, D., & Horberg, E. J. (2015). Emotion cognition interactions. *APA Handbook of Personality and Social Psychology, 623-664*.
- Keltner, D., & Lerner, J. S. (2010). Emotion. In D. T. Gilbert, S. T. Fiske & G. Lindsay (Eds.), *The handbook of social psychology* (5th ed., pp. 312–347). New York, NY: McGraw Hill.
- Kendler, K. S., Karkowski, L. M., & Prescott, C. A. (1998). Stressful life events and major depression: risk period, long-term contextual threat, and diagnostic specificity. *The Journal of nervous and mental disease, 186*(11), 661-669.
- Kiecolt-Glaser, Janice K., et al. "Emotions, morbidity, and mortality: new perspectives from psychoneuroimmunology." *Annual review of psychology 53.1* (2002): 83-107.
- Kiecolt-Glaser, J. K., Marucha, P. T., Mercado, A. M., Malarkey, W. B., & Glaser, R. (1995). Slowing of wound healing by psychological stress. *The Lancet, 346*(8984), 1194-1196.
- Kohlleppel, T., Bradley, J. C., & Jacob, S. (2002). A walk through the garden: can a visit to a botanic garden reduce stress? *HortTechnology., 12*(3), 489-492.
- Krause, N. (1987). Life stress, social support, and self-esteem in an elderly population. *Psychology and Aging, 2*(4), 349-356.
- Kross, E., & Ayduk, O. (2011). Making meaning out of negative experiences by self-distancing. *Current Directions in Psychological Science, 20*(3), 187-191
- Kuehner, C., & Weber, I. (1999). Responses to depression in unipolar depressed patients: An investigation of Nolen-Hoeksema's response styles theory. *Psychological Medicine, 29*, 1323–1333.
- Lazarus, R. S. (1966). *Psychological stress and the coping process*. New York, NY: McGrath-Hill.
- Lazarus, R. S. (1980). The stress and coping paradigm. In Eisdorfer, C., Cohen, D., and Kleinman, A. (eds.), *Conceptual Models for Psychopathology*, Spectrum, New York, pp. 173-209.
- Lazarus, R. S. (1984). Puzzles in the study of daily hassles. *Journal of Behavioral Medicine, 7*(4), 375-389.
- Lazarus, R. S., and Cohen, J. B. (1977). Environmental stress. In Altman, I., and WohlwiU, J. F. (eds.), *Human Behavior and the Environment: Current Theory and Research*, Plenum New York, pp. 89-127.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.
- Lazarus, R. S., Kanner, A. D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. *Theories of emotion, 1*, 189-217.
- Lerner, J. S., & Tiedens, L. Z. (2006). Portrait of the angry decision maker: How appraisal tendencies shape anger's influence on cognition. *Journal of Behavioral Decision Making, 19*, 115-137.
- Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology, 81*(1), 146-159. doi:10.1037/0022-3514.81.1.146
- Lerner, J.S. & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition and Emotion, 14*(4), 473-493.
- Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual Review of Psychology, 66*, 799-823. doi:10.1146/annurevpsych-010213-115043

- Libby, L. K., Eibach, R. P., & Gilovich, T. (2005). Here's looking at me: the effect of memory perspective on assessments of personal change. *Journal of personality and social psychology*, 88(1), 50.
- Lyubomirsky, S., Caldwell, N. D., & Nolen-Hoeksema, S. (1998). Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories. *Journal of personality and social psychology*, 75(1), 166.
- Mannie, Z. N., Harmer, C. J., & Cowen, P. J. (2007). Increased waking salivary cortisol levels in young people at familial risk of depression. *American Journal of Psychiatry*, 164(4), 617-621.
- Maslow, A. H. (1964). *Religions, values, and peak-experiences*. Columbus, OH: Ohio State University Press.
- McDougall, W. (1911). *An introduction to social psychology*. Boston, MA: J.W. Luce & Co.
- McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Psychological Reviews*, 87(3), 873-904.
- McIntyre, K. P., Korn, J. H., & Matsuo, H. (2008). Sweating the small stuff: How different types of hassles result in the experience of stress. *Stress and Health*, 24(5), 383-392.
- McGrath, J. E. (1970). A conceptual framework for research on stress. In J. E. McGrath (Ed.), *Social and psychological factors in stress* (10-21). New York, NY: Holt, Reinhart, and Winston.
- Mendoza-Denton, R., Downey, G., Purdie, V. J., Davis, A., & Pietrzak, J. (2002). Sensitivity to status-based rejection: implications for African American students' college experience. *Journal of personality and social psychology*, 83(4), 896-918.
- Middleton, R. A., & Byrd, E. K. (1996). Psychosocial factors and hospital readmission status of older persons with cardiovascular disease. *Journal of Applied Rehabilitation Counseling*, 27(4), 3-10.
- Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological Bulletin*, 133(1), 25-45.
- Mishel, M. H. (1984). Perceived uncertainty and stress in illness. *Research in Nursing & Health*, 7(3), 163-171.
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. *The Lancet*, 372(9650), 1655-1660.
- Monroe, S.M. (1983). Major and minor life events as predictors of psychological distress: Further issues and findings. *Journal of Behavioral Medicine*, 6, 189-205.
- Monroe, S. M., & Hadjiyannakis, K. (2002). The social environment and depression: Focusing on severe life stress. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression* (314-340). New York: Guilford Press.
- Monroe, S. M., & Harkness, K. L. (2005). Life stress, the "kindling" hypothesis, and the recurrence of depression: considerations from a life stress perspective. *Psychological review*, 112(2), 417-445.
- Monroe, S. M., & Simons, A. D. (1991). Diathesis-stress theories in the context of life stress research: implications for the depressive disorders. *Psychological bulletin*, 110(3), 406-425.
- Morita, E., Fukuda, S., Nagano, J., Hamajima, N., Yamamoto, H., Iwai, Y., ... & Shirakawa, T. (2007). Psychological effects of forest environments on healthy adults: Shinrin-yoku

- (forest-air bathing, walking) as a possible method of stress reduction. *Public health*, 121(1), 54-63.
- Nabi, R. L., Prestin, A., & So, J. (2013). Facebook friends with (health) benefits? Exploring social network site use and perceptions of social support, stress, and well-being. *Cyberpsychology, Behavior, and Social Networking*, 16(10), 721-727.
- Nelson, D. L., & Burke, R. J. (2002). *Gender, work stress, and health*. *American Psychological Association*, 10(2), 80-85.
- Nisbet, E. K., & Zenlenski, J. M. (2011). Underestimating nearby nature: Affective forecasting errors obscure the happy path to sustainability. *Psychological Science*, 22(9), 1101-1106.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of abnormal psychology*, 100(4), 569.
- Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive Symptoms. *Journal of Abnormal Psychology*, 109(3), 504–511.
- Nolen-Hoeksema, S., Parker, L. E., & Larson, J. (1994). Ruminative coping with depressed mood following loss. *Journal of Personality and Social Psychology*, 67(1), 92–104.
- Park, B. J., Kagawa, T., Kasetani, T., Miyazaki, Y., & Tsunetsugu, Y. (2010). The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): evidence from field experiments in 24 forests across Japan. *Environmental health and preventive medicine*, 15(1), 18-26.
- Pearlin, L. I. (1975b). Status inequality and stress in marriage. *Am. Sociol. Rev.* 40: 344-357.
- Pearlin, L. I., Menaghan, E. G., Lieberman, M. A., & Mullan, J. T. (1981). The stress process. *Journal of Health and Social behavior*, 22(4), 337-356.
- Pearlin, L. I., Mullan, J. T., Semple, S. J., & Skaff, M. M. (1990). Caregiving and the stress process: An overview of concepts and their measures. *The gerontologist*, 30(5), 583-594.
- Piff, P. K., Dietze, P., Feinberg, M., Stancato, D. M., & Keltner, D. (2015). Awe, the small self, and prosocial behavior. *Journal of personality and social psychology*, 108(6), 883-899.
- Pochard, F., Azoulay, E., Chevret, S., Lemaire, F., Hubert, P., Canoui, P., ... & Schlemmer, B. (2001). Symptoms of anxiety and depression in family members of intensive care unit patients: ethical hypothesis regarding decision-making capacity. *Critical care medicine*, 29(10), 1893-1897.
- Preacher, K., & Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, 36(4), 717-731.
- Preacher, K., & Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891.
- Pyszczynski, T., Hamilton, J. C., Herring, F. H., & Greenberg, J. (1989). Depression, self-focused attention, and the negative memory bias. *Journal of Personality and Social Psychology: Personality Processes and Individual Differences*, 57(2), 351-357.
- Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and social psychology bulletin*, 26(4), 419-435.
- Rosenberg, E. L. (1998). *Levels of analysis and the organization of affect* (Vol. 2, No. 3, p. 247). Educational Publishing Foundation.

- Ruch, W. (2009). Amusement. In D. Sander & K. Scherer (Eds.), *The Oxford companion to the affective sciences* (pp. 27–28). New York, NY: Oxford University Press.
- Rudd, M., Vohs, K. D., & Aaker, J. (2012). Awe expands people's perception of time, alters decision making, and enhances well-being. *Psychological science*, *23*(10), 1130-1136.
- Russell, D. W., Altmaier, E., & Van Velzen, D. (1987). Job-related stress, social support, and burnout among classroom teachers. *Journal of applied psychology*, *72*(2), 269-274.
- Schwarz, N. (1990). *Feelings as information: informational and motivational functions of affective states*. Guilford Press.
- Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513-515.
- Segerstrom, S. C., & Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychological bulletin*, *130*(4), 601-630.
- Sephton, S. E., & Spiegel, D. (2003). Circadian disruption in cancer: A neuroendocrine-immune pathway from stress to disease. *Brain, Behavior, and Immunity*, *17*, 321–328.
- Sheline, Y. I., Barch, D. M., Donnelly, J. M., Ollinger, J. M., Snyder, A. Z., & Mintun, M. A. (2001). Increased amygdala response to masked emotional faces in depressed subjects resolves with antidepressant treatment: an fMRI study. *Biological psychiatry*, *50*(9), 651-658.
- Shiota, M. N., Campos, B., Keltner, D., & Herterstein, M. J. (2004). Positive emotion and the regulation of interpersonal relationship. In R. S. Feldman & P. Philippot (Eds.), *The regulation of emotion* (129-157). New Jersey, NJ: Lawrence Erlbaum Associates.
- Shiota, M. N., Keltner, D., & John, O. P. (2006). Positive emotion dispositions differentially associated with Big Five personality and attachment style. *The Journal of Positive Psychology*, *1*, 61–71.
- Shiota, M. N., Keltner, D., & Mossman, A. (2007). The nature of awe: Elicitors, appraisals, and effects on self-concept. *Cognition and Emotion*, *21*(5), 944-963.
- Skipper Jr, J. K., & Leonard, R. C. (1968). Children, stress, and hospitalization: A field experiment. *Journal of Health and Social Behavior*, *275-287*.
- Smith, T. W., & Greenberg J. (1981). Depression and self-focused attention. *Motivation and Emotion*, *5*, 323-331.
- Smith, T. W., Ingram, R. E., & Roth, L. D. (1985). Self-focused attention and depression: Self-evaluation, affect, and life stress. *Motivation and Emotion*, *9*, 381-389.
- Stellar, J. E., Manzo, V. M., Kraus, M. W., & Keltner, D. (2012). Class and compassion: socioeconomic factors predict responses to suffering. *Emotion*, *12*(3), 449.
- Strack, R., Schwarz, N., & Gschneidinger, E. (1985). Happiness and reminiscing: The role of time perspective, affect, and mode of thinking. *Journal of Personality and Social Psychology*, *49*, 1460-146.
- Tiedens, L. Z., & Linton, S. (2001). Judgment under emotional certainty and uncertainty: the effects of specific emotions on information processing. *Journal of Personality & Social Psychology*, *81*, 973–988.
- Tomiya, A. J., Epel, E. S., McClatchey, T. M., Poelke, G., Kemeny, M. E., McCoy, S. K., & Daubenmier, J. (2014). Associations of weight stigma with cortisol and oxidative stress independent of adiposity. *Health Psychology*, *33*(8), 862.
- Tracy, J. L., & Robins, R. W. (2004a). Putting the self into self-conscious emotions: A theoretical model. *Psychological Inquiry*, *15*, 103–125.

- Valdesolo, P., & Graham, J. (2014). Awe, uncertainty, and agency detection. *Psychological science*, 25(1), 170-178.
- Van Cappellen, P., & Saroglou, V. (2012). Awe activates religious and spiritual feelings and behavioral intentions. *Psychology of Religion and Spirituality*, 4(3), 223-236.
- Van Praag H. M. (2004). Can stress cause depression? *Prog Neuropsychopharmacol Biol Psychiatry*, 28(5), 891-907.
- Vasterling, J. J., Brailey, K., Constans, J. I., & Sutker, P. B. (1998). Attention and memory dysfunction in posttraumatic stress disorder. *Neuropsychology*, 12(1), 125-133.
- Vázquez, C., Jiménez, F., Saura, F. Y Avia, M.D. (2001). The importance of “importance”: A longitudinal-stress model of depression measuring the importance of the attributions and the impact of stressor. *Personality and Individual Differences*, 31, 205- 214.
- Watkins, E., & Teasdale, J. D. (2004). Adaptive and maladaptive self-focus in depression. *Journal of affective disorders*, 82(1), 1-8.
- Wheaton, B. (1985). Models for the stress-buffering functions of coping resources. *Journal of Health and Social Behavior*, 26, 352-364.
- Williams, D. R., Yu, Y., Jackson, J. S., & Anderson, N. B. (1997). Racial differences in physical and mental health: Socio-economic status, stress and discrimination. *Journal of health psychology*, 2(3), 335-351.
- Wood, A. M., Froh, J. J., & Geraghty, A. W. (2010). Gratitude and well-being: A review and theoretical integration. *Clinical psychology review*, 30(7), 890-905.
- Wood, A. M., Maltby, J., Gillett, R., Linley, P. A., & Joseph, S. (2008). The role of gratitude in the development of social support, stress, and depression: Two longitudinal studies. *Journal of Research in Personality*, 42(4), 854-871.
- Wood, J. V., Saltzberg, J. A., Neale, J. M., Stone, A. A., & Rachmiel, T. B. (1990). Self-focused attention, coping responses, and distressed mood in everyday life. *Journal of personality and social psychology*, 58(6), 1027.
- Yehuda, R., Teicher, M. H., Trestman, R. L., Levengood, R. A., & Siever, L. J. (1996). Cortisol regulation in posttraumatic stress disorder and major depression: a chronobiological analysis. *Biological psychiatry*, 40(2), 79-88.
- Young, A. H. (2004). Cortisol in mood disorders. *Stress*, 7(4), 205-208.

Table 1: Predictions of Daily Hassle-related stress from Age, Gender (1 = male, 2 = female), Ethnicity (0 = non-white, 1 = white) and DEPS – Awe, and DEPS – Amusement: Standardized Regression Coefficients (Study 1)

Predictor	<i>b</i>	SE (<i>b</i>)	95% confidence interval (<i>b</i>)	<i>t</i>
Awe	-.14	.06	[-.26, -.03]	-2.41*
Amusement	.06	.06	[-.05, .17]	1.05
Age	.12	.06	[.01, .24]	.03*
Gender	.09	.06	[-.02, .20]	1.62
Ethnicity	-.12	.06	[-.23, -.004]	-2.04*

Note: * $p < .05$, ** $p < .01$

Table 2: Predictions of Hassle-related stress Change from Emotional Experience Intensity
 Rating of Awe, Amusement, Pride, Sadness, Anger, Fear: Standardized Regression Coefficients
 (Study 2)

Predictor	<i>b</i>	SE (<i>b</i>)	95% confidence interval (<i>b</i>)	<i>T</i>
Awe	.30	.11	[.08, .52]	2.69**
Amusement	-.03	.09	[-.21, .15]	-0.31
Sadness	-.09	.11	[-.30, .12]	0.75
Anger	-.13	.10	[-.33, .07]	-1.32
Pride	.06	.11	[-.15, .28]	.62
Fear	.08	.10	[-.13, .28]	.75

Note: * $p < .05$, ** $p < .01$

Table 3: Predictions of hassle-related stress change from self-reported intensities of awe, amusement, happiness, gratitude, pride, fear, sadness, and anger: Standardized Regression Coefficients (Study 3)

Predictor	<i>b</i>	SE (<i>b</i>)	95% confidence interval (<i>b</i>)	<i>t</i>
Awe	-.33	.11	[-.54, -.12]	-2.11**
Happiness	-.01	.08	[-.17, .14]	-0.16
Amusement	.25	.09	[.07, .42]	2.70**
Fear	-.02	.07	[-.17, .12]	-0.28
Sadness	-.01	.08	[-.17, .15]	-0.12
Anger	-.12	.08	[-.29, .05]	-1.43
Gratitude	.01	.09	[-.16, .18]	0.07
Pride	-.01	.08	[-.17, .14]	-0.18

Note: * $p < .05$, ** $p < .01$

Hassle-Related Stress

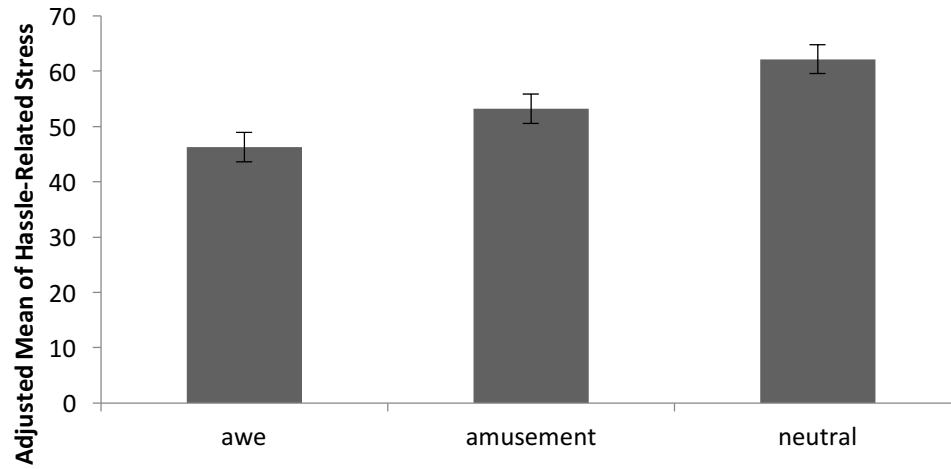


Figure 1. Adjusted mean of hassle-related stress reported after priming (controlling for baseline central hassle-related stress measured in the pre-online survey). Error bars represent ± 1 standard error (Study 2).

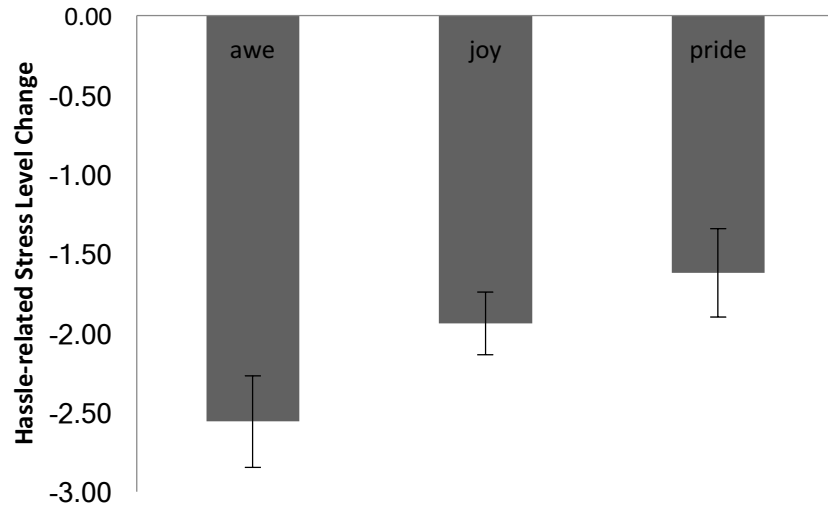


Figure 2. Average hassle-related stress change after primed with different emotions (awe, joy, and pride). Error bars represent ± 1 standard error (Study 3).

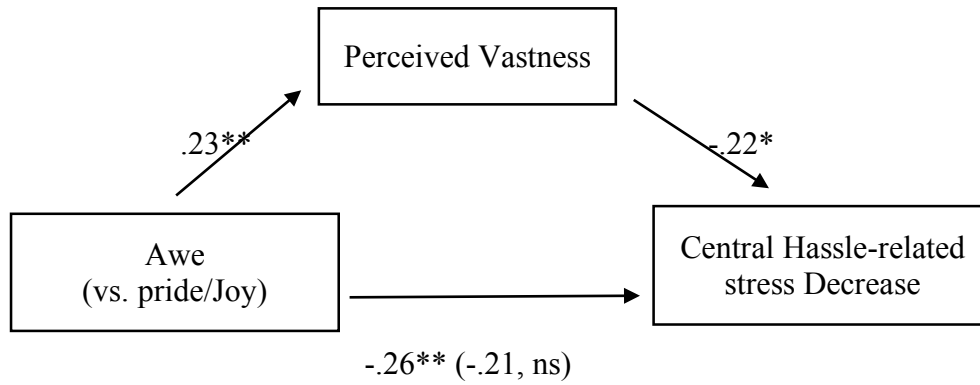


Figure 3. Mediation model for Study 3. The predictor variable compares the awe condition with the joy and pride conditions (coded as awe = 2, joy = -1, pride = -1). Analyses control for the orthogonal control contrast (coded as awe = 0, joy = 1, pride = -1). Unstandardized coefficients are displayed. * $p < .05$, ** $p < .01$.



Figure 4. View of the UC Berkeley campus from Sather Tower used to induce awe (left panel) and the inside of Sather Tower used for the control condition (right panel) in Study 4. See the online article for the color version of this figure.

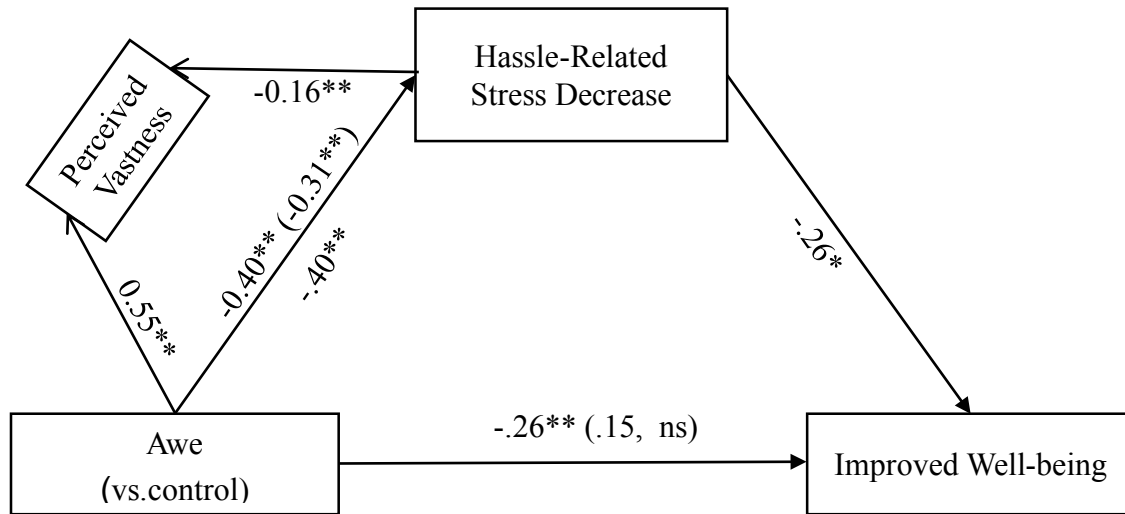




Figure 5. Mediation model for study 4. The predictor variable compares the awe condition with control condition (coded as awe = 1, control = -1). Unstandardized coefficients are displayed.

$*p < .05$. $**p < .01$.

Appendix A

Emoticons used in Study 3

Emotion	Emoticon
Awe	
Joy	
Pride	