TRANSFORMATIVE TECHNOLOGY: EXAMINING THE CAPACITY OF
VIRTUAL REALITY INDUCED AWE TO CHANGE SELF-TRANSCENDENT
VALUES AND IMPROVE HEDONIC AND EUDAIMONIC WELL-BEING

A Dissertation

presented to

the Faculty of the Graduate School
at the University of Missouri-Columbia

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

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May 2020

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VIRTUAL REALITY INDUCED AWE TO CHANGE SELF-TRANSCENDENT
VALUES AND IMPROVE HEDONIC AND EUDAIMONIC WELL-BEING

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ACKNOWLEDGEMENTS

I would like to thank Dr. Ann Bettencourt, my advisor, for guiding me throughout graduate school and supporting my autonomy and passions these past 5 years. I would also like to thank the social-personality area faculty, including Dr. Ken Sheldon, Dr. Jamie Arndt, Dr. Laura King, and Dr. Bartholow, for creating such a lively and exceptional program conducive for learning, productivity, and growth. In addition, I would like to thank the rest of my committee, Dr. Ed Merkle and Dr. Dan Cohen, for their great insights and generous feedback on this project. Finally, I would like to express my sincere appreciation for all the research assistants who helped collect data for this project and other previous projects.

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Abstract

Awe is an emotion that tends to shift focus away from individual concerns of the self towards collective interests that transcend the self. The primary purpose of the current study was to examine whether an experimentally induced experience of awe, compared to amusement, had the potential to change participant's self-transcendent values of universalism (e.g., preserving nature and a world at peace) and benevolence (e.g., honesty and concern for the welfare of others). The secondary purpose was to examine whether awe influenced same and next day hedonic and eudaimonic well-being. Feelings of a small self and connectedness (to self, others, and nature) were hypothesized to mediate any effects of awe on changes in values and well-being. Participants were 240 University students who, after completing a baseline survey to assess values, were randomly assigned to either a 5-minute virtual reality (VR) experience of awe or amusement. Then, participants completed a post-test survey assessing values, emotions, connectedness and small self. Between conditions and within-individuals analyses showed that neither manipulation significantly increased participants prioritization of self-transcendent values. Participants from both conditions reported high levels of awe, however, which was correlated with higher hedonic (i.e., positive and negative affect, life satisfaction) and eudaimonic (i.e., meaning, purpose, vitality, basic psychological needs satisfaction) well-being. Feelings of connectedness mediated this relationship between awe and both types of well-being. Although there was little support for the primary hypotheses regarding the effects of awe, compared to amusement, on self-transcendent values, this study uncovered interesting findings about associations between awe, connectedness, and well-being.

Keywords: Awe, Values, Self-transcendence, Connectedness, Small self, Well-being, Eudaimonic, Hedonic, Virtual reality

Transformative Technology: Examining the Capacity of Virtual Reality-Induced Awe to
Change Self-Transcendent Values and Improve Hedonic and Eudaimonic Well-Being

“In outer space you develop an instant global consciousness, a people orientation, an intense dissatisfaction with the state of the world, and a compulsion to do something about it. From out there on the Moon, international politics look so petty. ” – Edgar Mitchell, astronaut

“For small creatures such as we, the vastness is bearable only through love.” – Carl Sagan, astronomer

“Men go abroad to wonder at the height of mountains, at the huge waves of the sea, at the long courses of the rivers, at the vast compass of the ocean, at the circular motion of the stars; and they pass by themselves without wondering.” – Saint Augustine, theologian and philosopher

“In any case, I have found in the most creative scientists I have talked with that the more they know, the more apt they are to go into an ecstasy in which humility, a sense of ignorance, a feeling of smallness, awe before the tremendousness of the universe, or the stunningness of a hummingbird, or the mystery of a baby are all a part, and are all felt subjectively in a positive way, as a reward.” – Abraham Maslow, psychologist

Chapter 1: Introduction

The world is currently in a fragile state with pervading suffering, inequality, isolation, violence, unsustainable consumption, poverty, and environmental destruction. As a collective, humanity has the resources and technology to address many of these issues, but people are often too caught up in their own self-interests and day-to-day personal concerns to do anything. Because values guide what people find important in life and motivate behavior (e.g., Schwartz, 2012; Skimina, Ciecuch, Schwartz, Davidov & Algesheimer, 2019), changes in individual values can change the world. Specifically, a shift to greater self-transcendent values of benevolence (e.g., helping others and concern for others' well-being) and universalism (e.g., equality for all and preserving nature) may motivate individuals to contribute towards solutions of these global challenges—and ultimately help improve society and the world.

Awe is often considered a collective emotion (e.g., Haidt & Keltner, 2003) as well as a self-transcendent experience (e.g., Yaden, Haidt, Hood, Vago, & Newberg, 2017a) because it leads to a diminished sense of an individual self (i.e., “small self”; Bai et al., 2017; Piff, Dietze, Feinberg, Stancato, & Keltner, 2015; Shiota, Keltner, & Mossman, 2007) and greater feelings of connectedness (e.g., Nelson-Coffey, Ruberton, Chancellor, Cornick, Blascovich, & Lyubomirsky, 2019; Yang, Hu, Jing, & Nguyen, 2018). Experimental evidence shows that awe is related to less aggression (Yang, Yang, Bao, Liu, & Passmore, 2016) and materialism (Rudd, Vohs, Aaker, 2012; Zhao, Zhang, Xu, He, & Lu, 2019) and greater prosocial attitudes and behavior (Guan, Chen, Chen, Liu, & Zha, 2019; Piff et al., 2015; Yang et al., 2016), generosity and helping (Piff et al., 2015; Prade & Saroglou, 2016), ecological behavior (Yang et al., 2018), humility (Preston &

Shin, 2017; Stellar, Gordon, Anderson, Piff, McNeil, & Keltner, 2018), well-being (Gordon et al., 2017; Rudd et al., 2012; Zhao et al., 2019), meaning in life (Rivera, Vess, Hicks, & Routledge, 2019; Zhao et al., 2019) and other self-transcendent emotions such as gratitude, compassion, love, and optimism (Nelson-Coffey et al., 2019). No research, however, has examined whether experiences of awe increase self-transcendent *values*. Moreover, whereas a few studies have examined awe and well-being (e.g., Bai et al., 2017; Gordon, Stellar, Anderson, McNeil, Loew, & Keltner, 2017), no study has thoroughly examined whether awe has differing effects on hedonic or eudaimonic well-being. Thus, the current study will examine whether awe induced through virtual reality, compared to an active control condition of amusement, influences self-transcendent values and hedonic and eudaimonic well-being. This study will advance our understanding of the potentially transformative experience of awe by examining its capacity to change values and have a lasting positive impact on well-being.

Awe

Throughout history awe has stirred ponderings on the mysteries of life, nature, and the universe and has captured the minds of great thinkers—from Plato who said “Philosophy begins in wonder” to Lao Tzu who heeded that disaster strikes when people lack a sense of awe to William James who sought awe for inspiration and spiritual insights. Much early writing about awe often described it as a religious or spiritual emotion that led to personal transformation, reverence, and sacredness (e.g., Burke, 1757; Emerson, 1836; James, 1902). Others described awe in terms of its ability to arouse fear and trembling, dread and terror, or humility and respect for the threatening power of something bigger than themselves, such as a punitive God or natural disasters (e.g.,

Burke, 1757; Gordon et al., 2016; Kant, 1764; Kierkegaard, 1843). Current psychological research (Keltner & Haidt, 2003) defines awe as “an emotional response to perceptually vast stimuli that defy one’s accustomed frame of reference in some domain” (Piff et al., 2015, p. 883). This definition encompasses the positive and negative variants of awe and includes two components: vastness and the need for accommodation. Vastness refers to experiencing something as being much larger than the self, whether that be physically (e.g., the size of something), conceptually (e.g., complex mathematic equations or scientific theories), or temporally (e.g., thinking in terms of light years). The need for accommodation refers to experiencing something that does not fit into one’s current understanding of the world and requires a change in beliefs or schema to accommodate the information (e.g., Piaget, 1976). The most common elicitors of awe are from vast, natural sources (e.g., mountains, the ocean, and looking at the stars), but awe can also arise from social/interpersonal (e.g., meeting a powerful leader or personal hero), religious (e.g., spiritual experiences), and artistic (e.g., large churches, architecture, paintings, music, or dance performance) phenomena (e.g., Keltner & Haidt, 2003).

Awe is generally considered a complex emotion because it can contain both positive (e.g., wonder and joy) and negative valence (e.g., fear and powerlessness) and has been categorized into multiple emotion families (e.g., positive emotions, aesthetic emotions, epistemological emotions, prosocial emotions, and self-transcendent emotions; Chirico & Yaden, 2018; Gordon et al., 2017). As with other emotions, the embodiment of awe has a physiological signature too: goosebumps (e.g., Schurtz et al., 2012), increased parasympathetic activity (respiratory sinus arrhythmia; Gordon et al., 2017), reduced inflammatory cytokines (IL-6; Stellar et al., 2015), and decreased activity in the default

mode network of the brain (e.g., van Elk et al., 2019). This change in brain activity makes sense because activation of the default mode network is associated with increased self-referential thinking and awe is related to less self-focused thought and more outwards attention. In line with this, the leading perspective for the function of awe is that it is a collective emotion that promotes social engagement (e.g., Bai et al., 2017; Keltner & Haidt, 2003; Piff et al., 2015; Stellar et al., 2018). Purportedly, awe evokes “cognitive and behavioral tendencies that enable individuals to fold into collaborative social groups and engage in collective action. Action within collectives, including collaboration, cooperation, and coaction, requires a diminished emphasis on the self and its interests and a shift to attending to the larger entities one is a part of (e.g., small groups, social collectives, and humanity)” (Piff et al., 2015, p. 883). Consistent with this proposed function of awe, participants are more willing to volunteer their time (Rudd et al., 2012) and money (Guan et al., 2019) and report greater generosity—even to strangers—following an awe induction (e.g., Piff et al., 2015; Prade & Saroglou, 2016). Another possible explanation for the function of awe based on these findings, however, is that it may also promote self-transcendent values that lead to these behavioral and psychological tendencies.

Several different methods have been used to experimentally induce feelings of awe in the laboratory. One method simply involves asking participants to recall a time in which they experienced a feeling of awe, beauty, or vastness, often from nature, and write about it (e.g., Preston & Shin, 2017; Rudd et al., 2012; Shiota et al., 2007; Van Cappelen & Saroglou, 2012). Another commonly used method involves having participants watch a 2-5-minute awe-inspiring video. These videos generally show natural landscapes and

consist of sweeping scenes of vast mountains, forests, canyons, plains, and vistas (e.g., Piff et al., 2015; Vandesolo & Graham, 2014) or of outer space (e.g., Gordon et al., 2017; Nelson-Coffey et al., 2019). Awe is considered to consist on a continuum of intensity, and some methods may elicit stronger feelings of awe than others (Hendricks, 2018; Silvia, Fayn, Nusbaum, & Beaty, 2015). Virtual reality may be a particularly potent method for eliciting awe within the laboratory (e.g., Chirico & Gaggioli, 2018; Gaggioli, Villani, Serino, Banos, & Botella, 2019).

Recent studies have capitalized on this potential of virtual reality (VR) technology to induce awe (Chirico, Cipresso, Yaden, Biassoni, Riva, & Gaggioli, 2018; Nelson-Coffey et al., 2019). Chirico et al. (2018) compared whether the same stimulus of natural scenes presented in either an immersive VR environment or a 2-dimensional video elicited stronger feelings of awe. They found that, while both methods led to increases in awe, VR led to greater increases in awe and positive affect. VR may be especially powerful for eliciting awe for at least two reasons. First, VR offers the opportunity to virtually go to places that one may not otherwise be able to. For example, Stepanova et al. (2019) used VR to provide participants the experience of viewing earth from space; this “Overview Effect” has been found to lead to profound feelings of interconnectedness and awe among astronauts (e.g., Yaden, Iwry, Slack, Eichstaedt, Zhao, Vaillant, & Newberg, 2016). Second, VR captures attention and provides a sense of *immersion* into the experience and *presence* that one is realistically “there” in that setting (Chirico et al., 2017; Riva, Waterworth, & Waterworth, 2004; Riva, Waterworth, Waterworth, & Mantovani, 2011). The combination of both of these qualities afforded by VR can lead to

experiences that do not fit into one's current schema and need to be accommodated—creating a real, visceral feeling of awe (Gaggioli, 2015).

Self-Transcendence and Awe

Like the self, self-transcendence is a nebulous construct that is hard to define (e.g., Yaden et al., 2017a). Abraham Maslow offered many definitions of transcendence but condensed it into one statement: “Transcendence refers to the very highest and most inclusive or holistic levels of human consciousness, behaving and relating, as ends rather than means, to oneself, to significant others, to human beings in general, to other species, to nature, and to the cosmos” (Maslow, 1971, p. 269). Self-transcendence has also been considered a personality trait related to spiritual ideas, such as the feeling as though one is an integral part of something greater than one's individual self (e.g., the universe; Cloninger, 1993). People high on the self-transcendence trait “have an outlook of unity and connectedness that motivates them to work in the service of others, instead of being preoccupied with individual accomplishments and self-aggrandizement” (Monasterio & Cloninger, 2019, p. 2). But increasingly, self-transcendence is studied as a transient *experience* (Yaden et al., 2017a). At the core of the self-transcendent experience are two components: (a) the diminishment of a bodily sense of self or reduced self-salience and (b) a sense of connectedness with something beyond the self, including connectedness to other people, the surrounding context, nature, the world, God, and/or the universe (e.g., Yaden et al., 2017a). All these variations in the construct and definition point to a shift of focus away from the personal self (i.e., transcending the self) and toward feeling connected to something greater than the self, whether that be spiritual or religious in nature or not.

A hallmark of awe is that it leads to a diminished emphasis on the self, or what researchers commonly call the experience of a small self (e.g., Bai et al. 2017; Shiota et al., 2007), and greater feelings of connectedness (e.g., Van Cappellen & Saroglou, 2012). These two qualities that arise from awe—small self and connectedness—are why awe is often classified as a self-transcendent emotion and experience (e.g., Nelson-Coffey et al., 2019; Shiota, Thrash, Danvers, & Dombrowski, 2017; Stellar et al., 2017; Van Cappellen & Saroglou, 2012; Yaden et al., 2017a). Across many studies, small self or connectedness or both have been proposed and supported as mediators of the relationship between awe and various outcomes. For example, mediated through feelings of a small self, awe reduces aggression (Yang et al., 2016) and the desire for money (Jiang et al., 2018), and increases humility (Stellar et al., 2018), sharing, generosity, and helping (Piff et al., 2015). Mediated through feelings of connectedness, awe increases ecological behavior (Yang et al., 2018), environmentalism (Zhao et al., 2018), and other self-transcendent emotions (Nelson-Coffey et al., 2019). These studies demonstrate that there is much evidence that feelings of connectedness and a small self are mechanisms of the effects of awe.

As with awe, the intensity of self-transcendent experiences range on a continuum and vary in their capacity to be transformative (Chirico & Yaden, 2018; Yaden et al., 2017b). Transformative experiences result in deep changes that lead people to profoundly alter the way they perceive themselves, their life, and the world and have a significant lasting effect (e.g., Gaggioli, 2015; Gaggioli et al., 2019; Gaggioli, Chirico, Triberti & Riva, 2016). For example, at one extreme of self-transcendence, a person under the influence of a psychedelic drug may experience complete ego-dissolution, with no sense

of boundary between self and other/world, leading to a feeling of interconnectedness, unity, and oneness with everything. This type of intense mystical or self-transcendent experience predicts environmental behavior and has been rated as among the top five most personally meaningful and spiritually significant moments of a person's life that also leads to increased well-being for years after the experience occurred (e.g., Griffiths et al., 2008; Kettner, Gandy, Haijen, & Carhart-Harris, 2019; Snell & Simmonds, 2015). A less extreme example of self-transcendence is the state of flow where a person loses self-consciousness and is completely immersed and absorbed in the present moment and current task at hand (Nakamura & Csikszentmihalyi, 2014; Yaden et al., 2017a). People not only report enjoyment during flow activities but they reap positive psychological benefits, such as enhanced well-being, after the experience is over (e.g., Maslow, 1971). There are many other activities or contexts that lead people to lose their sense of self, including during meditation, dancing, and even through war, but importantly, simply being present in vast natural beauty has the potential to improve well-being (Hartig et al., 2014; Meredith et al., 2020) and initiate transformative change (Gaggioli, 2015; Maslow, 1964).

Self-transcendent experiences can influence values and well-being. The pursuit of psychological well-being can be differentiated in terms of hedonia and eudaimonia. Briefly, a hedonic approach achieves well-being through feelings of pleasure, satisfaction, and positive emotions; a eudaimonic approach achieves well-being through living a good or virtuous life focused on meaning, purpose, personal expression, and growth (e.g., Deci & Ryan, 2008a). The positive effects on well-being of increased hedonic activity (e.g., from eating dessert) are often short-lived, whereas the positive

effects on well-being of increased eudaimonic activity (e.g., from authentically expressing oneself) are often longer lasting (e.g., Huta & Ryan, 2010; Sheldon, Corcoran, & Prentice, 2019). Results from a qualitative study on participant's self-transcendent experiences revealed that the short-term effects of this type of experience included decreased anxiety and increased energy, insight, and sociability, and the long-term effects included value re-orientation, increased concern for others, positive affect, and disidentification from old patterns of thinking or behaving (Garcia-Romeu, Himelstein, Kaminker, 2015). Particularly important for the current study, participants reported that the long-term impact of the experience resulted in "shifts away from conventional and materialistic values, towards more personally meaningful, existential, and spiritually oriented concerns" (Garcia-Romeu et al., 2015, p. 644). Therefore, it is reasonable to hypothesize that a self-transcendent experience, such as strong feelings of awe, can re-orient one's values and result in sustained increases in hedonic well-being (e.g., positive emotions and life satisfaction) and eudaimonic well-being (e.g., meaning and purpose in life, vitality, and basic psychological needs satisfaction).

Values

Values serve as principles to guide what people find important in life and motivate behavior (e.g., Bardi & Schwartz, 2003). People often behave congruently with their values even when they are not consciously thinking about them. According to Schwartz's value theory (1992, 2012), values have six defining qualities: (1) Values are beliefs; (2) Values pertain to desirable goals that motivate action; (3) Values are trans-situational or transcend specific actions or situations; (4) Values function as standards and guide the selection or evaluation of behavior, people, or events; (5) Values are

prioritized by importance relative to one another; (6) The relative importance of values guide behavior (e.g., Schwartz, 1994; Schwartz, 2012). All values are characterized by these features, which explain how values differ from traits, needs, motives, and attitudes (Bardi, Buchanan, Goodwin, Slabu, & Robinson, 2014; Hitlin & Piliavan, 2004; Schwartz, 2012).

There are multiple theories that describe how values are organized. For example, drawing from self-determination theory, values or aspirations can be separated into extrinsic and intrinsic value orientations (e.g., Deci & Ryan, 2008b; Kasser & Ryan, 1996). Intrinsic values include helping, community, and personal growth; extrinsic values include money, image, and popularity (e.g., Sheldon & Krieger, 2014). Relative to extrinsic values, higher intrinsic values represent greater eudaimonic activity orientation (e.g., Sheldon et al., 2019). While it is reasonable to hypothesize that awe and self-transcendence may increase intrinsic values relative to extrinsic values, the current study will primarily focus on Schwartz's theory of values because it includes a well-established set of universal values and directly measures self-transcendent values (e.g., Schwartz, 1992; Schwartz et al., 2012).

Schwartz (1992) theorized that "basic values are organized into a coherent system that underlies and can help to explain individual decision making, attitudes, and behavior" (Schwartz et al., 2012, p. 2). The theory includes 10 basic values that can be categorized into four higher-order values (See Table 1 for a description of the values, Schwartz et al., 2012, p. 664.) The theory was later refined to reflect further distinctions of the 10 values and that the values express motivations on a circular continuum (See Figure 1; Schwartz, 2012, p. 9). This circumplex structure depicts the relation between

each of the values as continuous rather than discrete. In other words, values that are adjacent on the circular structure are likely to be compatible, whereas values on opposite sides of the circle are likely to be in conflict (See Figure 1). For example, people who prioritize benevolence are more likely to also value universalism and less likely to value power. Hence, a relative increase in self-transcendent values (i.e., universalism and benevolence) likely leads to a relative decrease in self-enhancement values (i.e., power and achievement).

Although individuals differ in the importance they place on the 10 values, there is remarkable agreement on the hierarchical order of values across cultures (e.g., Schwartz, 1994, 2012). Specifically, drawing from studies in over 50 countries, benevolence, universalism, and self-directedness are consistently rated as the most important values, and power, tradition, and stimulation are rated as the least important values (Schwartz, 1992, 1994, 2012; Schwartz & Sagiv, 1995). Notwithstanding social desirability biases, the self-transcendent values may be most highly endorsed because they function to reinforce positive social relations that are necessary for cooperation and survival (e.g., Schwartz, 2012). As seen in Table 1, the primary motivational goals of benevolence and universalism are to enhance the well-being of others. Therefore, it is unsurprising that research has shown that benevolence values, in particular, are positively related to prosocial behaviors (Arieli et al., 2014; Bardi & Schwartz, 2003) such as helping others, cooperating, donating money, and volunteering (Grant & Mayer, 2009; Maio & Olson, 1995; Sagiv et al., 2011; Rioux & Penner, 2001; Verplanken & Holland, 2002). As previously reviewed, awe and self-transcendence have been shown to be positively related to these same behaviors. Thus, a clear extension is to test whether awe and self-

transcendent experiences may function to re-organize one's value hierarchy so that self-transcendent values become a higher priority.

While values are considered relatively stable, especially in adulthood, there is evidence that they can change (Rokeach & Ball-Rokeach, 1989; Schuster, Pinkowski, & Fisher, 2019). Because values are central to the self and self-concept (e.g., Arieli et al., 2014), value change necessarily involves a change in schema (Bardi & Goodwin, 2011). It follows then that an experience that challenges one's schema and needs to be accommodated, such as awe or self-transcendence, has the potential to influence one's value hierarchy. A recent systematic review on changes in values from studies using Schwartz's (2012) model found that cross-sectional, experimental studies led to moderate shifts in values (Schuster et al., 2019). These studies focused on changing values through self-persuasion and cognitive support manipulations by asking participants to think about reasons they prioritize specific values (Arieli et al., 2014; Maio & Olson, 1998; Maio & Olson, 2003; Maio et al., 2009). The majority of these experimental studies examined mean-level changes, or the change of average value importance between conditions (Bardi & Goodwin, 2011). Fewer studies have examined intra-individual change, or the change in importance of values within individuals. Also, it is unclear how long any shift in values are maintained after experimental manipulations or interventions (Schuster et al., 2019). Therefore, to test for lasting intraindividual changes, the current study included a baseline survey, post-manipulation survey, and 1-week follow-up survey that allowed for both between and within person analyses.

Current Study

The primary purpose of the current study was to examine whether the experience of awe influenced self-transcendent values. Following other studies on value change (e.g., Arieli et al., 2014), Schwartz's Portrait Values Questionnaire (Schwartz et al., 2001) was measured before the experimental manipulation, and Schwartz's Value Survey (Schwartz & Sagiv, 1995) was measured after the manipulation. These scales are both well-validated measures of the same 10 values represented in Schwartz's (2012) model that can be compared equivalently. Because both VR and awe have the potential to generate lasting transformative experiences (e.g., Chirico et al., 2016), values were measured again 1-week after the manipulation. The secondary purpose of this study was to examine whether VR-induced awe influenced same day (Day 0) and next day (Day 1) hedonic and eudaimonic well-being. Specifically, differences between the experimental conditions on the evening and next day assessments of hedonic (i.e., positive and negative affect, life satisfaction) and eudaimonic well-being (i.e., meaning, purpose, vitality self-transcendent emotions and basic psychological needs satisfaction) were examined. The VR awe condition was compared to a closely matched VR amusement control condition. The amusement control condition was chosen because it elicits a need for accommodation, similar to the experience of awe, from witnessing animals behaving in surprising and novel ways that challenges one's schema of the world but does not elicit a sense of conceptual or physical vastness—a crucial component for experiencing awe (e.g., Chirico et al., 2016; Keltner & Haidt, 2003). The following hypotheses were examined.

Hypothesis I: I expected participants in the awe condition to experience a greater change towards self-transcendent values than those in the control condition, both

immediately after the manipulation and at the 1-week follow-up. **Hypothesis II:** I expected those in the awe condition to report greater self-transcendent values after the manipulation, compared to those in the control condition. **Hypothesis III:** I expected feelings of connectedness and small self to mediate the effect of the awe condition (compared to the control condition) on changes in self-transcendent values. **Hypothesis IV:** I expected those in the awe condition would report higher eudaimonic and hedonic well-being the same and next day after the manipulation. **Hypothesis V:** Within individuals (regardless of condition), greater levels of connectedness and small self would predict changes in self-transcendent values and increases in hedonic and eudaimonic well-being.

Chapter 2: Methods

Participants

Participants were Psychology 1000 students recruited from the University of Missouri research participant pool for a study on “Virtual Reality and Emotions.” Of the 402 participants who completed the baseline survey, only 240 participants completed an in-lab session with the post-test survey after the VR awe or amusement manipulation. Of those 240 participants, 218 completed the same-day survey (Day 0), 217 completed the next-day survey (Day 1), and 203 completed the 1-week follow-up survey that was sent 7 days after the in-lab session. Simple randomization techniques were used to randomly assign participants to the awe or the amusement condition upon finishing the baseline survey, and due to the attrition following the baseline survey, there were uneven numbers of participants between the groups (Awe condition: $n = 128$, Amusement condition: $n = 112$). Demographic data and background information from participants who completed the post-test survey are in Table 2. The current sample consisted of primarily white (75.4%) female (59.6%) college freshmen with little to no previous experience with virtual reality (71.3%).

Procedure

At least 48 hours prior to coming into the lab, participants consented to be in the study and completed an online baseline survey that included questions about their values, well-being, spirituality, and demographic information. Participants were randomly assigned to the experimental condition or the control condition after finishing the baseline survey, and then they scheduled a time to participate in the lab session with VR. Upon

arrival to the lab, participants were informed that the purpose of the study was to understand the relationship between VR and emotions.

Participants in both conditions sat at a desk wearing the Oculus Go VR headset. Those in the experimental condition (i.e., awe condition) watched a 5-minute video of a drone flying over the Alps mountains in 4k high definition. The video included vast and scenic landscapes and panoramic views of mountains, valleys, forests, trees, lakes, and more. Those in the active control condition (i.e., amusement condition) watched a 5-minute video of animals acting like humans. The video included a walrus playing a saxophone, a bear riding in a motorcycle sidecar waving to people, a dog riding a tricycle, and more. People in both conditions watched these videos in a virtual reality movie theatre environment where they had an immersive 360-degree experience with the videos playing on a large movie theatre screen.

Immediately following the VR experience, participants completed a post-test survey on a study tablet. This survey measured a variety of emotions, feelings of connectedness, small self, and values. Upon completion of the survey, the experimenter explained the follow-up procedure to the participant. Specifically, participants were asked to complete a brief survey that same night and the next night at 7:30 p.m. as well as complete another survey 1-week after this in-lab session to assess well-being and values again.

Measures

Values. To assess value changes from the experimental manipulation, values were measured at baseline, immediately after the manipulation, and 1-week after the

manipulation, using two different scales to prevent response bias (Arieli et al., 2014). Specifically, participants completed the Schwartz Value Survey (SVS; Schwartz & Sagiv, 1995) after the manipulation and the Portrait Values Questionnaire (PVQ; Schwartz et al., 2001) at baseline and the 1-week follow-up. Both scales measured the same 10 values but in different ways (Schwartz, 2012). The PVQ included 40 short portraits of a gender-matched individual to the participant. An example of a universalism value portrait was (e.g., For men: “He strongly believes that people should care for nature. Looking after the environment is important to him.” For women: “She strongly believes that people should care for nature. Looking after the environment is important to her.”). For each portrait, participants rated “How much like you is this person?” on a 7-point scale of (1 = *not at all like me* to 7 = *very much like me*). The SVS included 57 values that participants rated on the importance “as a guiding principle in MY life” on a 9-point scale (–1 = *opposed to my values*, 7 = *of supreme importance*). An example of a universalism value was (“A WORLD AT PEACE (free of war and conflict)”) and a benevolence value was (“HELPFUL (working for the welfare of others)”). The higher-order self-transcendent value was also examined by combining the mean scores of benevolence and universalism values (e.g., Schwartz et al., 2012). Reliabilities for values at each time point are presented in Table 4.

As suggested by Schwartz (2012), “to measure value *priorities* accurately, we must eliminate individual differences in use of the response scales” p. 12. Therefore, value scores of both scales were adjusted to reflect relative importance compared to other values among oneself. To do so, each participants’ average value rating across all the items (i.e., their grand mean) was computed. Then, the grand mean was subtracted from

each value item score; values with a positive sign reflected prioritizing the value more than the average value importance *to that person*. These centered or adjusted value scores were used for all analyses (e.g., Bardi et al., 2014; Schwartz, 2012).

Spirituality. The Spiritual Self-Transcendence Scale (Piedmont et al., 1999) measured spirituality in the baseline survey. The 24-item scale was separated into three subscales: universality (e.g., “Although individual people may be difficult, I feel an emotional bond with all of humanity” $\alpha = .89$), connectedness (e.g., “I am a link in the chain of my family’s heritage, a bridge between past and future” $\alpha = .60$), and prayer fulfillment (e.g., “I find inner strength and/or peace from my prayers or meditations” $\alpha = .87$). Participants endorsed each item using a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*), where higher scores represent greater levels of spirituality.

Emotions. After the VR manipulation, participants reported the extent to which they felt various emotions. Following other research on awe (e.g., Piff et al., 2015; Rivera et al., 2019; Yang et al., 2016), single items assessed awe, anger, disgust, fear, sadness, and happiness on a 7-point Likert scale (1 = *Not at all* to 7 = *Extremely*). Additionally, I included items of fun, enjoyment, humility, energy/aliveness, and self-transcendent emotions of love, gratitude, appreciation, peace, and optimism (Nelson-Coffey et al., 2019). Consistent with previous research (e.g., Stellar et al., 2017), a composite measure of awe was created by combining the emotional items of awe, wonder, and amazement ($\alpha = .83$). This aggregated measure of awe was used in all analyses.

Small Self. The Small Self Scale used by Preston and Shin (2017; adapted from Shiota et al., 2007; Piff et al., 2015) measured the extent to which participants felt: “like I am part of a greater whole”, “like I am small or insignificant”, “the existence of things

more powerful than myself”, “like I am in the presence of something grand”, “like my day to day concerns are relatively trivial”, immediately following the VR experience. These 5-items were rated on a 7-point Likert scale (1 = *Strongly disagree* to 7 = *Strongly agree*) and combined into an overall score of small self, where higher scores represented greater feelings of a small self ($\alpha = .70$).

Connectedness. I used the newly developed, but validated, Watts’ Connectedness Scale at post-test, Day 0, and Day 1 follow-ups. This 18-item measure was created based on qualitative data from patient experiences during psilocybin-assisted therapy for treatment resistant depression (Watts, Day, Krzanowski, Nutt, & Carhart-Harris, 2017). The scale includes three subscales to measure connectedness to self (e.g., “I felt connected to my senses (touch/taste/sight/smell/hearing)” post-test $\alpha = .69$), to others (e.g., “I felt connected to friends and/or family” post-test $\alpha = .59$), and to the world, nature, or the universe (e.g., “I felt connected to nature” post-test $\alpha = .85$). Participants responded to how they felt for each item on a 0 to 100 visual analogue scale slider from “Not at all” to “Entirely”. The three subscales were calculated separately and also combined for a composite measure of connectedness (post-test $\alpha = .85$).

Hedonic and Eudaimonic Well-Being. Hedonic well-being was operationalized in two ways: (1) subjective well-being (positive affect minus negative affect plus satisfaction with life) assessed at baseline and 1-week follow-up, and (2) composite measures of positive emotions (happiness, excited, proud, relaxed, calm; Day 0 $\alpha = .80$, Day 1 $\alpha = .82$), negative emotions (sad, anxious, angry, stressed, upset Day 0 $\alpha = .85$, Day 1 $\alpha = .86$) and satisfaction with life (“How satisfied were you with your life today?”)

assessed on the same night and next night after the experimental manipulation on a 5-point scale (1 = *Not at all*, 5 = *Extremely*).

Eudaimonic well-being was also operationalized in two ways: (1) psychological well-being (Ryff & Keyes, 1995) and self-actualization (Kaufman, 2018) measured at baseline and 1-week follow-up, and (2) a composite measure of basic psychological needs satisfaction (i.e., feelings of autonomy, competence, and relatedness), meaning in life (“How meaningful did your life feel today?”), purpose in life (“How much did you feel your life had purpose today?”), vitality (e.g., “Today I felt... Alive and vital; alert and awake; energized”), and self-transcendent emotions (awe, peace, compassion, appreciation/gratitude, love) as measured on the same night (Day 0, $\alpha = .91$) and next night (Day 1, $\alpha = .93$) after the experimental manipulation.

Data Analysis

As a manipulation check, differences between the conditions on emotions following the VR experiences were tested with independent samples *t*-tests. To test the main hypothesis that awe would lead to increased self-transcendent values, I conducted repeated measures ANOVAs for Time (baseline, post-test/1-week) X Condition (awe, control) interactions, and paired samples *t*-tests within the conditions on differences between self-transcendent values measured at post-test compared to baseline. These *t*-tests examined intraindividual change regarding whether individuals in each condition change in relative importance of self-transcendent values of benevolence and universalism (e.g., Arieli et al., 2014). I also conducted independent samples *t*-tests on algebraic difference scores (post-test mean minus baseline mean value scores of each condition) to examine differences between the groups for mean-level changes in self-

transcendent values after the manipulation (Maio et al., 2009). As previously stated, adjusted value scores were used for all analyses (e.g., Schwartz, 2012).

Chapter 3: Results

Preliminary Analyses

Independent samples *t*-tests between the conditions were conducted to compare the differences in emotional responses following the VR experiences. Table 3 shows that those in the awe condition reported significantly higher levels of awe compared to those in the amusement control condition. Similarly, those in the amusement condition reported significantly higher levels of amusement compared to those in the awe condition.

Although there were significant differences between the conditions on awe, it was unexpected that the amusement control condition reported relatively high levels of awe as well. Other notable differences in emotions were that those in the awe condition reported significantly higher levels of peace, wonder, amazement, gratitude, appreciation, and optimism and those in the amusement condition reported significantly higher levels of fun, love, and disgust. There were no differences, however, in happiness, sadness, fear, anger, or enjoyment between the conditions.

Primary Analyses

Changes in Self-Transcendent Values

To test Hypothesis I, which stated that participants in the awe condition, compared to those in the amusement control condition, would experience an increase in self-transcendent values from baseline to post-test and 1-week follow-up, I conducted a series of repeated measures ANOVAs and paired-samples *t*-tests. Table 4 shows centered means and standard deviations of benevolence, universalism, and self-transcendent values (higher-order combination of the two) at baseline, post-test, and 1-week follow-up

by condition. Results showed there were no significant hypothesized effects of Time or Time x Condition on benevolence (Time: $F(1, 238) = 3.84, p = .051$; Time x Condition: $F(1, 238) = .63, p = .43$), universalism (Time: $F(1, 238) = 2.24, p = .14$; Time x Condition: $F(1, 238) = .086, p = .77$), and self-transcendent values (Time: $F(1, 238) = 1.79, p = .18$; Time x Condition: $F(1, 238) = .028, p = .87$)¹.

Counter to predictions, paired samples *t*-tests within the awe condition, from baseline to post-test, revealed no significant increase in benevolence ($t(127) = .80, p = .43$), universalism ($t(127) = -.83, p = .41$), nor self-transcendent values ($t(127) = -1.06, p = .29$). Paired samples *t*-tests within the amusement condition, from baseline to post-test, revealed that participants reported a slight but significant increase in benevolence values ($t(111) = 2.06, p = .041$) but not universalism ($t(111) = -1.32, p = .19$) or self-transcendent values ($t(111) = -.84, p = .40$). A similar set of analyses, but from baseline to the 1-week follow-up, showed a significant effect of Time for benevolence ($F(1, 201) = 5.96, p = .016$) and self-transcendent values ($F(1, 201) = 8.12, p = .005$) but no Time x Condition interactions. Unexpectedly, participants in both the awe and amusement condition reported somewhat lower levels of benevolence (awe: $t(104) = 2.05, p = .04$); amusement: $t(97) = 3.16, p = .002$) and self-transcendent values (awe: $t(104) = 1.98, p = .05$); amusement: $t(97) = 2.04, p = .04$) at 1-week follow-up, compared to baseline.

To test Hypothesis II that those in the awe condition would report higher self-transcendent values compared to those in the control condition following the

¹ These results were the same when using the reduced sample of 194 participants who were removed according to recommendations while calculating value scores from Schwartz Values Scale.

manipulation, I conducted independent samples *t*-tests on *post-test value scores only*. There were no significant differences on any values at post-test between the two conditions. Also, using algebraic difference scores in values (post-test minus baseline), there were no differences between the conditions on changes in benevolence ($t(238) = -.79, p = .43$), universalism ($t(238) = .29, p = .77$), or self-transcendent values ($t(238) = -.17, p = .87$). These same patterns of findings were replicated using multivariate analysis of variance tests and multilinear regressions predicting post-test value scores controlling for baseline values. Therefore, Hypotheses I and II were not supported: self-transcendent values of benevolence and universalism did not increase (in reference to baseline scores) immediately following VR-induced awe, and there was no difference in these self-transcendent values following the awe manipulation compared to the amusement manipulation.

Small Self and Connectedness

Hypothesis III stated that feelings of a small self and connectedness would mediate the effects of the awe condition on changes in self-transcendent values. Although results failed to show that the awe condition, compared to the amusement control condition, increased self-transcendent values, I examined the effect of the VR manipulations on feelings of a small self and connectedness to self, others, and nature/world. Again, I did not, however, test for full mediation because a dummy variable for condition (0 = amusement, 1 = awe) did not predict the difference scores of benevolence ($b = -.063, \beta = -.051, p = .43$), universalism ($b = .021, \beta = .02, p = .77$), nor self-transcendent ($b = -.009, \beta = -.01, p = .87$) values (e.g., Baron & Kenny, 1986). Table 3 shows that, as predicted, those in the awe condition had significantly higher scores of

small self² (i.e., smaller self), connectedness (overall), and connectedness to the world³, compared to the control condition. There were no significant differences between the conditions on the subscale scores of connectedness to self or connectedness to others. Because people from both conditions experienced relatively high levels of awe ($M = 5.65$, $SD = 1.28$), I examined whether the self-reported composite emotion of awe following virtual reality, *regardless of condition*, predicted feelings of connectedness and a small self. Results showed that higher levels of awe were associated with overall feelings of connectedness ($b = 4.78$, $\beta = .38$, $t(238) = 6.32$, $p < .01$) and small self ($b = .53$, $\beta = .58$, $t(238) = 10.88$, $p < .01$) as well as feelings of connectedness to self ($b = 5.23$, $\beta = .37$, $t(238) = 6.11$, $p < .01$) and connectedness to the world ($b = 8.54$, $\beta = .45$, $t(238) = 7.81$, $p < .01$) but not feelings of connectedness to others ($b = 1.76$, $\beta = .12$, $t(238) = 1.78$, $p = .08$). These findings provide some support for the first half of the proposed mediational model, such that those in the awe condition, and those who experienced higher levels of awe during the VR experience, reported higher levels of connectedness and small self.

To examine Hypothesis V that greater levels of awe, connectedness, and small self would predict intraindividual changes in self-transcendent values, I conducted correlational analyses between these predictors and outcomes. Specifically, Table 5 reports the relationships between the emotions of awe, amusement, small self, and

² Upon closer inspection, the largest and only significant mean difference of the 5-items between the conditions on the small self scale was “I felt like I am small or insignificant”, $t(238) = 25.31$, $p < .01$.

³ The difference between the conditions on feelings of connectedness to the world or nature seem to be driven by greater endorsement of the following items in the awe condition: “I felt connected to nature”, $t(221) = 8.41$, $p < .01$, and “I felt connected to a spiritual essence (in the secular or religious sense)”, $t(181) = 5.91$, $p < .01$.

connectedness felt following the VR experience, regardless of condition, on self-transcendent values at post-test as well as changes in self-transcendent values from baseline to post-test (algebraic differences). Results showed that small self and the connectedness to the world subscale were significantly associated with post-test universalism and self-transcendent values. None of the variables examined, however, were associated with changes in values from baseline to post-test. Although these correlations were small, they provide some evidence in support of Hypothesis III and V that awe increased feelings of small self and connectedness and, in turn, small self and connectedness were associated with higher universalism and self-transcendent values immediately following the manipulation.

Hedonic and Eudaimonic Well-being

Hypothesis IV stated that those in the awe condition would report higher levels of both hedonic and eudaimonic well-being on the same and next day after the manipulation. Table 6 shows means and standard deviations of hedonic and eudaimonic well-being variables separated by condition and day. There were no differences between conditions on any of the well-being measures from the survey at the end of the same-day of the experience. For the next-day, contrary to expectations, those in the amusement condition felt significantly higher levels of awe, positive affect, meaning and purpose in life, and vitality. Therefore, there was not support for Hypothesis IV that awe, compared to amusement, would enhance eudaimonic and hedonic well-being.

To examine the impact of the awe condition compared to the amusement control condition on changes in hedonic and eudaimonic well-being from baseline to 1-week follow-up, I conducted repeated measures ANOVAs and paired-samples *t*-tests within

conditions. Table 7 shows means, standard deviations, and significant within-condition differences of the well-being variables, including subscales, at these timepoints. Although there were a few significant effects on well-being within the conditions from baseline to 1-week follow-up, there was little evidence to suggest that a 5-minute VR experience of awe or amusement had a sustainable increase on hedonic or eudaimonic well-being one week later.

It was also hypothesized (V) that, regardless of condition, greater feelings of awe, small self, and connectedness would be associated with higher levels of hedonic and eudaimonic well-being on the same and next day. Table 8 shows the correlations between these variables of interest. Important findings to note were that greater levels of awe were related to higher same-day reports of positive affect, self-transcendent emotions, life satisfaction, purpose in life, vitality and basic psychological need satisfaction (See Panel A of Table 8). As shown in Panel B of Table 8, awe felt during the VR experience was significantly related to positive affect, self-transcendent emotions, life satisfaction, and overall higher hedonic and eudaimonic well-being on the following day.

Correlations between the proposed mediators of small self and connectedness to self, others, and the world showed stronger associations than the feeling of awe on hedonic and eudaimonic well-being measured at Day 0 and Day 1. Specifically, regardless of condition, higher levels of small self during the virtual reality experience were associated with higher same-day evening reports of positive affect, self-transcendent emotions, and basic psychological need satisfaction. Higher levels of connectedness overall was related to higher same-day reports of both hedonic well-being (positive affect, life satisfaction) and eudaimonic well-being (self-transcendent emotions,

meaning, purpose, vitality, and basic psychological need satisfaction). Participants' overall feelings of connectedness was associated with next-day reports of eudaimonic well-being. These results together partially support Hypothesis V: awe and feelings of connectedness and a small self appear to enhance aspects of both hedonic and eudaimonic well-being for at least the same day and, to a lesser degree, the next day.

Exploratory Analyses

Although examining the effects of awe on changes in self-transcendent values and well-being was the main focus of the current study, the following exploratory analyses contextualize the findings and inform possible future research. The first finding to note is that the other 8 basic values and 3 higher-order values in Schwartz's theory follow the same pattern of results as those reported on self-transcendent values. Specifically, as shown in Table 9, there were few between condition differences on values at any single time point nor were there many within-individual changes from baseline to post-test. Thus, there was little evidence that the awe or amusement manipulation had any effect on participant's value prioritization.

I explored whether feelings of connectedness and small self were possible mediators between self-reported awe and hedonic and eudaimonic well-being reported on the same evening as the manipulation (Day 0). A series of PROCESS (Hayes, 2012) mediational models with 5,000 bootstrapped samples were used to test for direct and indirect effects of awe on each well-being outcome through feelings of small self and connectedness (overall). Both proposed mediators were entered simultaneously into each separate model predicting a well-being outcome. The results of these mediational analyses are reported in Table 10 (Panel A). Worth highlighting, overall feelings of

connectedness fully mediated the association between awe and hedonic and eudaimonic well-being as well as basic psychological needs satisfaction and purpose in life, as reported on the same day⁴. Also, feelings of connectedness partially mediated the relationship between self-reported awe and vitality and positive and self-transcendent emotions. Because much research has established autonomy, competence, and relatedness as predictors of well-being (e.g., Martela & Ryan, 2016; Martela & Sheldon, 2019), I also tested whether satisfaction of these innate needs mediated the effect between awe and hedonic and eudaimonic well-being. Analyses revealed that basic psychological needs satisfaction partially mediated the effects between awe and hedonic and eudaimonic well-being (see Table 10 Panel B). These results together suggest that feelings of connectedness to self, others, and the world/nature as well as basic psychological needs satisfaction may partially explain how the emotion of awe is related to hedonic and eudaimonic well-being⁵.

⁴ A reverse-causal model showed similar findings with awe partially mediating the relationship between feelings of connectedness and hedonic and eudaimonic well-being.

⁵ There was also evidence for the reverse, baseline levels of subjective well-being and self-actualization (overall and more specifically the peak experiences and humanitarian subscales) significantly predicted self-reported awe at post-test, controlling for condition.

Chapter 4: Discussion

Awe is an emotion that tends to shift our focus away from individual concerns of the self towards collective interests that transcend the self. The primary purpose of the current study was to examine whether an experimentally induced experience of awe, compared to an active control condition, had the potential to change participant's self-transcendent values of universalism (e.g., protecting nature and a world at peace) and benevolence (e.g., honesty and concern for the welfare of others). There was no evidence for significant intraindividual changes in self-transcendent values from baseline to post-test in participants in the awe condition, compared to participants in the amusement control condition, nor was there any significant difference between the two conditions on self-transcendent values measured at post-test only. The current study also examined whether awe, compared to the control condition, increased feelings of connectedness (to self, others, and the world), a sense of a small self, and hedonic and eudaimonic well-being. As hypothesized, immediately following the VR manipulations, those in the awe condition reported higher levels of a small self and connectedness to the world (e.g., nature, all humanity, a spiritual essence), but not connectedness to self (e.g., body, emotions, mind) and others (e.g., friends, family, community). There were no differences between the awe condition and the amusement control condition on hedonic (i.e., positive and negative affect, life satisfaction) and eudaimonic (i.e., meaning, purpose, vitality, basic psychological needs satisfaction) well-being measured the same and next evening after the manipulation. Nevertheless, self-reported awe (composite of awe, amazement, and wonder), overall feelings of connectedness, and small self, immediately after both VR experiences, were positively related to hedonic and eudaimonic well-being. Although

there was little support for the primary hypotheses regarding the effects of awe, compared to amusement, on self-transcendent values, the results of this study uncovered interesting findings about associations between awe, connectedness, and well-being.

First, it is important to acknowledge that both the awe and the amusement VR conditions led to relatively high levels of self-reported awe following the experience. Whereas most previous research testing the effects of experimental manipulations of awe have used neutral control conditions (e.g., an interview with Ayn Rand, video of a person finishing a wooden cabinet, or building a fence; Gordon et al., 2017; Piff et al., 2015; Rivera et al., 2019), the current study used a more closely matched active control condition of amusement that included a series of clips of animals acting like humans. This amusement control condition was meant to evoke the need for accommodation by violating one's expectations of what animals are capable of after seeing them behave in ways most likely never seen before. Hence, both the awe and amusement conditions were intended to elicit the need for accommodation—one of the two defining components of awe—but only the awe condition, with sweeping landscapes of mountains, valleys, roads, and forests, was intended to elicit vastness—the other defining component of awe (e.g., Keltner & Haidt, 2003). Therefore, the experimental design of the current study provided a stringent test of the hypotheses that it is the complete emotional experience of awe—not just a similar positive emotion that challenges one's schema of the world—that caused differences in effects between the two conditions. It was unexpected, however, that the amusement control condition led to such high levels of awe because previous research has shown that schema-incongruence leads to distinct emotional responses (e.g., awe, horror, surprise) depending on the content or nature of the experience (Taylor & Uchida,

2019). Because of the high levels of awe in both the awe and the control condition, any between condition effects were difficult to detect.

About 70% of participants had never or only once experienced VR prior to the study, so it is possible that the immersive 360-degree movie theatre environment (that all participants experienced) contributed to relatively high scores of awe, regardless of the video content of either manipulation. This combination of novice VR users and a high need for accommodation stimulus in the amusement condition could partially explain why the mean level of awe in the current study's amusement control condition ($M = 5.20$, $SD = 1.38$) was much higher compared to amusement conditions in previous studies (e.g., Piff et al., 2015: $M = 2.93$ $SD = 1.53$, Stellar et al., 2017: $M = 2.95$, $SD = 1.20$) and even considerably higher compared to neutral control conditions in other studies (e.g., Piff et al., 2015: Study 3 $M = 2.56$ $SD = 2.00$; Study 4 $M = 1.93$ $SD = 1.82$, ; Rivera et al., 2019: Study 1, $M = 2.55$, $SD = 1.69$; Study 2, $M = 2.15$, $SD = 1.60$). Nevertheless, after the awe manipulation, compared to the amusement manipulation, participants reported significantly higher levels of the feeling of awe as well as related emotions of peace, wonder, amazement, gratitude, and appreciation. Moreover, similar to previous studies, the awe condition led to greater feelings of connectedness and a sense of a small self (e.g., Piff et al., 2015; Nelson-Coffey et al., 2019; Yang et al., 2016, 2018). Thus, although self-reported awe was significantly higher in the awe condition than the amusement control condition, the relatively high levels of awe in both conditions should be kept in mind when interpreting the current findings. These high levels of awe in both conditions also provided reasonable grounds for examining associations of self-reported awe following both VR experiences (regardless of condition).

Because values are central to the self and become reinforced over years of experiences, perhaps it is unsurprising that 5-minutes of VR failed to influence people's values. If something as quick and simple as passively watching an awe-inspiring video facilitated value change, it would likely already be widely implemented to help solve global issues! Nevertheless, previous research has shown that although values are relatively stable, they can change following brief experimental manipulations (e.g., Arieli et al., 2014; Bardi et al., 2009; Maio et al., 2009; Prentice, Kasser, Sheldon, 2018; Schuster et al., 2019). A major difference between previous experimental manipulations showing value change and the current experimental manipulations is that most of the other experimental manipulations specifically focused on influencing values, whereas the current manipulation specifically focused on eliciting emotions of awe. Therefore, one possible explanation for the lack of effects in the current study is that without the explicit instruction, priming, intention, or desire to change values (e.g., Bardi & Goodwin, 2011, Schuster et al., 2019), the emotion of awe alone might be insufficient to cause a person to reprioritize their values. Previous research, however, has shown that an awe-induction, compared to an amusement-induction, can change contentious ideological convictions, beliefs, and attitudes (Stancato & Keltner, 2020). Although attitudes are similar to values, values are thought to be less mutable and are considered to “hold a higher place in one’s internal evaluative hierarchy than attitudes” (Hitlin & Piliavan, 2004, p. 361). It may be that a longer or more intense experience of awe or self-transcendence has the capacity to change values (Garcia-Romeu et al., 2015; Hayes et al., 2020), but the current results provided little support that a brief experience of awe has any significant or lasting impact on self-transcendent values of benevolence and universalism.

The one-time VR awe experience appeared to have an acute effect on well-being but not a lasting one. Specifically, self-reported awe, wonder, and amazement (combined) after VR was related to enhanced hedonic and eudaimonic well-being on the same and next day as the VR experience. Moreover, feelings of connectedness, and to a lesser extent small self, were associated with higher hedonic and eudaimonic well-being the same and next day. Exploratory analyses revealed that feelings of connectedness mediated the association between awe and hedonic and eudaimonic well-being—further supporting results from meta-analyses showing that people who feel more connected to nature tend to have higher hedonic and eudaimonic well-being (e.g., Pritchard et al., 2019). These findings together can be extrapolated to suggest that repeated experiences of awe and connectedness may serve as viable ways to boost day-to-day hedonic and eudaimonic well-being. Indeed, Gordon et al. (2017) found in a 14-day daily diary study that the positive-based awe participants felt on a given day was associated with higher levels of happiness and life satisfaction on that day. Certainly, there are awe-inspiring experiences that people can seek out (e.g., hiking, looking at the stars, meeting a celebrity, VR), but it is also possible that the lens through which one experiences everyday life can influence the frequency that one feels awe. For example, just as a person can pause and feel gratitude for any number of things, so too can a person pause and stand rapt in awe from any number of things, such as the mysteries of nature, the beauty of a sunset, or the complexity of the human body.

The current findings advance previous research examining the effects of awe on well-being by providing a more nuanced understanding of the relationship between awe and hedonic and eudaimonic well-being. Past studies show that experimental

manipulations of awe increased meaning in life (Rivera et al., 2019), happiness (Gordon et al., 2017; Rivera et al., 2019), life satisfaction (Rudd et al., 2012) and self-transcendent emotions of optimism, gratitude, love, appreciation, and other positive emotions (Nelson-Coffey et al., 2019). In the current study, the awe condition, compared to the amusement control condition, did not result in higher levels of these well-being indicators, but the results from correlational analyses revealed that the emotion of awe was associated with these same well-being outcomes. The novel contribution of this study is that self-reported awe following VR was also associated with higher levels of vitality, purpose in life, and, most importantly, basic psychological needs satisfaction (i.e., autonomy, competence, and relatedness). Copious amounts of research on self-determination theory has shown that satisfying these basic psychological needs is at the core of well-being and leads to greater physical and psychological health as well as more intrinsic motivation, and prosocial, benevolent behavior (e.g., volunteering, spending on others, acts of kindness; Martela & Ryan, 2016; Martela & Sheldon, 2019; Ryan & Deci, 2000, 2017). The current findings that the relationship between awe and well-being is mediated by basic psychological needs satisfaction and the relationship between awe and basic psychological needs satisfaction is mediated by feelings of connectedness are important because they further integrate research on awe with feelings of connectedness and the large body of research on self-determination theory. Although this study suggested the direction of the relationship was from awe to psychological needs satisfaction and well-being, it may be that those who already have higher levels of autonomy, competence, and relatedness and eudaimonic well-being are more likely to experience awe or self-transcendence (Huta & Ryan, 2010; Maslow, 1971; Ryan & Martela, 2016). Consistent

with this speculation, results supported that self-actualization measured at baseline significantly predicted higher levels of awe, over and above VR condition. Regardless of the direction of causality, the often elevating emotion of awe, associated with feelings of aliveness, energy, peace, gratitude, purpose, autonomy, competence, and connection as well as happiness and life satisfaction, may be an integral aspect to both feeling good and living well.

The finding that connectedness was elicited from the VR awe experience should not be understated. Participants reported feeling more connected overall to the self, others, and world in the awe condition, compared to the amusement control condition, but the strongest effect was that those in the awe condition felt more connected to the world, nature, and universe, in particular. This finding is noteworthy because feeling connected or related to nature, rather than separate or disconnected from it, provides many individual and societal benefits. Specifically, research shows that feeling connected to nature is associated with improved physical health, psychological well-being, prosociality, and ecological behavior (e.g., Capaldi et al., 2014; Kettner et al., 2020; Twohig-Bennet & Jones, 2018; Yang et al., 2018; Zhao et al., 2018). Although VR is not the same as actually spending time in nature (which is also associated with many salutary and positive ecological outcomes [e.g., Hartig et al., 2014; Meredith et al., 2020]), it allows people to visit and immerse themselves in natural environments that they otherwise would not have been able to experience. The possibilities to explore and elicit awe, connectedness, and well-being from natural scenes are seemingly endless in a VR world, yet it is important to remember that we are a part of nature and actually being in

and seeing nature with our own (high-definition) eyes is likely a better source for feelings of awe and connectedness.

There are practical implications from the findings of the current study. VR of an awe-inspiring panorama of beautiful nature scenery (i.e., the alps) may be a possible emotion regulation strategy that, at least temporarily, improves well-being. In addition to VR being used as a treatment for mental health disorders (Clus et al., 2018; Mishkind et al., 2017; Rus-Calafell et al., 2018), a recent systematic review found that many different types of VR interventions are effective for enhancing emotion regulation and well-being (Montana et al., 2020). There are multiple settings in which this application of VR might be useful, such as when a person is bed-ridden or homebound (or quarantined) and it is impossible or very difficult to actually be in nature. An immersive awe environment might be especially appealing for clinical populations too because it leads to less focus on the self and personal worries and concerns (i.e., ruminations) and more focus on feeling connected to something larger than the self (e.g., Nelson-Coffey et al., 2019; Shiota et al., 2007). This type of VR intervention is simple and relatively inexpensive and can be widely implemented to momentarily improve a person's mood and well-being and possibly decrease symptoms such as pain (Spiegel et al., 2019; Tong et al., 2015) anxiety (Opris et al., 2012), or phobias (Opdyke et al., 1995). Of course, this application of VR may not be without downsides, including people using it to withdraw or escape from reality and avoid personal issues, but the potential tradeoffs are worth further exploration. Specifically, future research can examine whether an awe-inspiring VR environment of nature has similar effects on psychological, physiological, and emotional well-being as actually being in nature (see Mayer et al., 2009). Also, as VR technology progresses and

becomes more capable of eliciting transformative awe experiences (Chirico & Yaden, 2018; Yaden et al., 2017b, Gaggioli et al., 2016, 2019), it may have the potential to lead to more lasting improvements in hedonic and eudaimonic well-being.

Limitations

A major strength of this study was using VR to elicit high levels of awe and self-transcendence (small self and connectedness), however, there were several limitations. First, the reported results were limited to analyses solely on changes in Schwartz's values. Although intrinsic and extrinsic values were also measured in this study, there was a mistake on the baseline survey such that only males answered questions related to intrinsic and extrinsic value orientation (See appendix A for results related to intrinsic/extrinsic values). Consequently, intraindividual changes of intrinsic and extrinsic value orientation could not be thoroughly examined. As previously noted, however, Schwartz's values were of primary interest because they directly measure self-transcendent values and were theoretically compatible with previous findings about the experience of awe. Nevertheless, changes in other types of values would be interesting to explore in future research following an awe manipulation, such as materialistic values (Kasser, 2016; Zhao et al., 2018), spiritual values (e.g., Kansas, 2020), engaged living values (e.g., Trompetter et al., 2013), and many other types of values related to acceptance and commitment therapy (Reilly et al., 2019).

Another limitation was the constraint on generality (Simons, Shoda, Lindsay, 2017); the current sample was comprised of primarily white college females without any psychiatric or neurological disorders. It remains unclear whether the effects of VR-induced awe would influence feelings of connectedness and well-being in a clinical

sample or older adult population. Also, the current study used self-report measures, only. Future research should include behavioral measures to understand whether this type of awe experience influences behavior in a way that leads people to consistently act more congruently with self-transcendent values (e.g., Skimina et al., 2019). If awe does lead to more frequent self-transcendent behaviors, what might the world look like then?

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Table 1

Conceptual Definitions of 10 Basic Values According to Their Motivational Goals and Components of the Definitions That Suggest Subtypes of Values

Value	Conceptual definition
Self-direction	Independent thought and action—choosing, creating, exploring
Stimulation	Excitement, novelty, and challenge in life
Hedonism	Pleasure and sensuous gratification for oneself
Achievement	Personal success through demonstrating competence according to social standards
Power	Social status and prestige, control or dominance over people and resources
Security	Safety, harmony, and stability of society, of relationships, and of self
Conformity	Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms
Tradition	Respect, commitment, and acceptance of customs and ideas that traditional culture or religion provides
Benevolence	Preservation and enhancement of the welfare of people with whom one is in frequent personal contact
Universalism	Understanding, appreciation, tolerance and protection for the welfare of <i>all</i> people and for nature

Note: Reprinted from “Refining the theory of basic individual values”, by Schwartz et al., 2012, *Journal of personality and social psychology*, 103(4), 663-688.).

<https://www.scribbr.com/apa-style/using-tables-figures-sources/>

Table 2
Baseline and demographic information separated by condition.

	Awe condition	Amusement condition
Sample size, <i>n</i>	128	112
Age <i>M</i> years (SD)	18.88 (3.00)	18.89 (1.85)
Gender (M/F)	52/75	44/68
Race (%)		
White	75.8	75.0
African American	11.7	6.3
Asian	3.9	6.3
Other	8.6	12.4
Neurological disorder (N/Y)	110/11	96/8
Psychiatric disorder (N/Y)	106/14	91/12
Previous Virtual Reality Experience (% never or once)	68.8	74.1

Table 3

Differences between conditions on post-manipulation emotions and measures.

Variable	Awe condition (<i>n</i> = 128)	Amusement condition (<i>n</i> = 112)	<i>t</i> (238)	[95% CI]
	M (SD)	M (SD)		
Awe	6.09 (1.27)	5.12 (1.73)	5.00***	[.59, 1.35]
Amusement	4.90 (1.81)	5.94 (1.31)	-4.98***	[-1.44, -.62]
Amazement	6.13 (1.26)	5.38 (1.47)	4.26***	[.40, 1.10]
Wonder	5.95 (1.18)	5.09 (1.61)	4.74***	[.50, 1.21]
Awe Composite	6.05 (1.04)	5.20 (1.38)	5.49***	[.55, 1.17]
Gratitude	4.94 (1.62)	4.23 (1.74)	3.28***	[.28, 1.14]
Love	4.02 (1.83)	4.62 (1.93)	-2.45*	[-1.07, -.11]
Appreciation	5.91 (1.22)	4.96 (1.68)	5.09***	[.59, 1.33]
Optimism	5.16 (1.53)	4.73 (1.72)	2.03*	[.01, .84]
Peace	6.09 (1.16)	4.92 (1.59)	6.54***	[.82, 1.53]
Happiness	5.61 (1.37)	5.70 (1.39)	-.49	[-.44, .26]
Humility	3.23 (2.04)	2.97 (1.86)	1.00	[-.25, .75]
Energy/Aliveness	5.23 (1.56)	5.02 (1.63)	1.02	[-.20, .62]
Enjoyment	5.96 (1.18)	5.84 (1.42)	.69	[-.22, .45]
Fun	5.11 (1.54)	5.69 (1.41)	-3.00**	[-.97, -.20]
Sadness	1.79 (1.28)	1.60 (1.24)	1.17	[-.13, .51]
Anger	1.34 (1.06)	1.41 (.96)	-.60	[-.34, .18]
Disgust	1.20 (.80)	1.49 (1.10)	-2.34*	[-.53, -.046]
Fear	1.41 (.97)	1.45 (1.11)	-.30	[-.30, .22]
Small self	4.58 (1.07)	3.65 (1.10)	6.63***	[.65, 1.21]
Connectedness	57.65 (15.08)	52.66 (16.98)	2.41*	[.91, 9.07]
Overall				
Connectedness to Self	62.86 (20.95)	59.11 (20.34)	1.40	[-1.52, 9.02]
Connectedness to Others	55.52 (20.17)	58.88 (20.84)	-1.26	[-8.60, 1.89]
Connectedness to World	53.63 (20.68)	40.92 (23.20)	4.47***	[7.11, 18.31]
Existential Isolation	3.62 (1.03)	3.45 (1.01)	1.27	[-.092, .43]

Note. Awe composite = aggregate of awe, amazement, and wonder.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4

Means and standard deviations between conditions at baseline, post-test, and 1-week follow-up for self-transcendent values.

Value	Awe Condition <i>M</i> (SD)	Amusement Condition <i>M</i> (SD)	Reliabilities (α)
Benevolence			
Baseline	.46 (.58)	.51 (.45)	.73
Post-test	.50 (.67)	.61 (.66)	.78
1-week	.37 (.53)	.40 (.57)	.81
Universalism			
Baseline	.19 (.60)	.22 (.50)	.78
Post-test	.15 (.77)	.15 (.68)	.81
1-week	.17 (.55)	.19 (.48)	.84
Self-transcendence			
Baseline	.32 (.46)	.36 (.38)	.84
Post-test	.29 (.52)	.33 (.51)	.85
1-week	.27 (.44)	.30 (.42)	.90

Table 5

Correlations of self-reports during the virtual reality experience, combined from participants in both conditions, with self-transcendent values at post-test only and changes in self-transcendent values from baseline to post-test.

	Post-test only			Difference Scores		
	Benevolence	Universalism	Self-Transcendence	Benevolence	Universalism	Self-Transcendence
Awe	.05	.08	.09	.02	.01	.03
Amusement	.08	.03	.06	.08	-.10	-.02
Small Self	.04	.15*	.15*	-.07	.11	.04
Connectedness (overall)	.03	.12	.12	-.02	.03	.02
Connectedness to Self	.01	.10	.10	.01	.01	.04
Connectedness to Others	.12	.05	.10	.04	-.04	-.01
Connectedness to World	-.05	.15*	.11	-.10	.09	.03

* $p < .05$

Table 6
Day 0 and Day 1 hedonic and eudaimonic well-being means and standard deviations.

	Awe condition M (SD)		Amusement condition M (SD)	
	Day 0	Day 1	Day 0	Day 1
Hedonic Well-Being				
Life satisfaction	5.18 (1.09)	4.84 (1.39)	5.26 (1.30)	5.17 (1.49)
Positive Affect	3.49 (.72)	3.17 (.79)	3.40 (.82)	3.52 (.89)
Negative Affect	2.02 (.84)	2.29 (.97)	2.17 (.96)	2.22 (.95)
Eudaimonic Well-Being				
BPNS	3.81 (.55)	3.72 (.68)	3.67 (.70)	3.77 (.74)
Autonomy	3.55 (.71)	3.55 (.84)	3.50 (.77)	3.63 (.82)
Competence	3.95 (.68)	3.70 (.87)	3.75 (.85)	3.78 (.85)
Relatedness	3.94 (.65)	3.90 (.75)	3.77 (.85)	3.91 (.90)
Meaning	4.93 (1.26)	4.54 (1.54)	4.96 (1.51)	5.14 (1.54)
Purpose	4.90 (1.40)	4.57 (1.59)	4.91 (1.52)	5.19 (1.60)
Vitality	4.63 (1.26)	4.26 (1.45)	4.60 (1.31)	4.73 (1.38)
Self-Transcendent Emotions	3.40 (.82)	3.00 (.82)	3.31 (.79)	3.37 (.81)
<i>Note.</i> BPNS = basic psychological needs satisfaction.				

Table 7

Baseline and 1-week follow-up means, standard deviations, and within-conditions *t*-tests on subjective well-being, psychological well-being, and self-actualization.

	Awe condition M (SD)	Amusement condition M (SD)
Subjective Well-Being		
Baseline	36.91 (16.09)	36.30 (16.19)
1-week	37.37 (16.19)	36.73 (16.73)
Autonomy		
Baseline	5.30 (1.14)	5.28 (1.17)
1-week	5.21 (1.16)	5.27 (1.14)
Environmental Mastery		
Baseline	5.23 (1.21)	5.04 (1.21)
1-week	5.12 (1.17)	5.05 (1.26)
Personal Growth		
Baseline	6.25 _a (.92)	6.21 _a (.88)
1-week	5.96 _b (1.07)	5.99 _b (1.18)
Positive Relations		
Baseline	5.23 (1.44)	5.24 (1.31)
1-week	5.31 (1.32)	5.25 (1.43)
Purpose in Life		
Baseline	5.14 (1.27)	5.24 _a (1.18)
1-week	5.08 (1.27)	5.39 _b (1.15)
Self-Acceptance		
Baseline	5.69 (1.45)	5.52 (1.42)
1-week	5.66 (1.38)	5.63 (1.30)
Self-Actualization		
Baseline	3.74 (.52)	3.62 _a (.50)
1-week	3.77 (.58)	3.75 _b (.60)

Note. For each measure, different subscripts within a column indicate paired-samples *t*-test value of $p < .05$.

Table 8

Correlations between awe, amusement, small self, and connectedness with hedonic and eudaimonic well-being measures separated by Day 0 and Day 1.

Panel A for Day 0 Well-Being										
	PA	NA	Life satisfaction	Hedonic Well-being	Self-transcendent emotions	Meaning	Purpose	Vitality	BPNS	Eudaimonic Well-being
Awe	.37**	-.08	.15*	.26**	.36**	.13	.18*	.25**	.17*	.25**
Amusement	.24**	-.01	.11	.17*	.24**	.14*	.17*	.18*	.05	.19*
Small Self	.33**	-.06	.12	.22**	.35**	.09	.12	.12	.20*	.19*
Connected overall	.38**	-.13*	.16*	.27**	.39**	.17*	.19*	.21*	.26**	.28**
Connected Self	.30**	-.06	.14*	.22**	.31**	.16*	.16*	.17*	.22**	.23**
Connected Others	.24**	-.08	.12	.18*	.29**	.11	.15*	.13	.15*	.19*
Connected World	.38**	.17*	.13	.25**	.37**	.15*	.19*	.20*	.23**	.25**
Panel B for Day 1 Well-Being										
	PA	NA	Life satisfaction	Hedonic Well-being	Self-transcendent emotions	Meaning	Purpose	Vitality	BPNS	Eudaimonic Well-being
Awe	.17*	.03	.14*	.16*	.21*	.13	.13	.08	.10	.14*
Amusement	.20*	.04	.19*	.20**	.21*	.20*	.23**	.11	.04	.20*
Small Self	.05	-.03	.05	.04	.13	.06	.05	.07	.13	.08
Connected overall	.11	-.02	.11	.12	.16*	.22**	.22**	.14*	.16*	.21*
Connected Self	.13*	-.03	.16*	.16*	.16*	.21*	.21*	.12	.18*	.20*
Connected Others	.06	-.02	.09	.08	.16*	.18*	.19*	.10	.10	.17*
Connected World	.05	-.01	.04	.04	.08	.15*	.14*	.11	.09	.13

Note. PA = positive affect; NA = negative affect; Meaning = meaning in life, Purpose = purpose in life, BPNS = basic psychological needs satisfaction, Awe = aggregate of awe, wonder, and amazement, Connected self = connectedness to self, Connected others = connectedness to others, connected world = connectedness to world, Connected overall = composite score of connectedness.

Table 9

Baseline, post-test, and 1-week follow-up means, standard deviations, and within conditions t-tests on centered values scores.

	Awe condition M (SD)	Amusement condition M (SD)	Reliabilities (α)
Self-Direction			
Baseline	.41 (.54)	.38 (.57)	.69
Post-test	.50 (.68)	.45 (.64)	.61
1-week	.39 (.49)	.41 (.54)	.79
Stimulation			
Baseline	-.06 (.80) _a	-.08 (.77)	.62
Post-test	-.30 (.88) _b	-.22 (.96)	.68
1-week	-.15 (.78)	-.09 (.83)	.73
Hedonism			
Baseline	.24 (.74)	.28 (.64) _a	.67
Post-test	.15 (.98)	.10 (.93) _b	.74
1-week	.14 (.60)*	.31 (.63)*	.78
Achievement			
Baseline	.27 (.63) _a	.15 (.63) _a	.77
Post-test	.45 (.67) _b	.36 (.57) _b	.65
1-week	.11 (.59) _c	.07 (.67)	.80
Power			
Baseline	-.78 (.96) _a	-.86 (.92) _a	.68
Post-test	-1.83 (1.27) _b	-1.81 (1.14) _b	.71
1-week	-.76 (.87)	-.74 (.97)	.71
Security			
Baseline	-.13 (.53) _a	-.07 (.53)	.61
Post-test	-.20 (.69)	-.12 (.64)	.51
1-week	-.008 (.50) _b	-.03 (.59)	.76
Conformity			
Baseline	-.12 (.72) _a	-.09 (.75) _a	.71
Post-test	.11 (.81) _b	.10 (.78) _b	.67
1-week	.02 (.63)* _c	-.19 (.76)* _c	.81
Tradition			
Baseline	-.70 (.68) _a	-.65 (.74) _a	.50
Post-test	-.95 (.88) _b	-.98 (.90) _b	.54
1-week	-.57 (.79) _c	-.57 (.80)	.70
Self-Enhancement			
Baseline	-.09 (.50) _a	-.14 (.50) _a	.81
Post-test	-.69 (.75) _b	-.73 (.68) _b	.74
1-week	-.17 (.44) _c	-.12 (.51)	.86
Openness to Change			
Baseline	.18 (.53)	.15 (.56)	.76
Post-test	.19 (.52)	.17 (.51)	.81
1-week	.12 (.47)	.16 (.57)	.84
Conservation			

Baseline	-.32 (.45) _a	-.28 (.49) _a	.82
Post-test	-.38 (.50)	-.37 (.53) _b	.78
1-week	-.18 (.43) _b	-.26 (.53)	.88

NOTE. Different subscripts within columns indicate a paired samples *t*-test value of $p < .05$ between baseline and post-test and baseline and 1-week follow-up.

* $p < .05$ indicates between group differences at time-point.

Table 10

Mediational effects of self-reported awe on same day hedonic and eudaimonic well-being through feelings of connectedness and small self.

Panel A				
	Unmediated direct effects of awe	Mediated direct effects of awe	Indirect effects of connectedness	Indirect effects of small self
Hedonic Well-being	.18** [.09, .27]	.11* [.001, .22]	.05* [.01, .09]	.02 [-.04, .09]
Eudaimonic Well-being	.18** [.09, .28]	.12* [.001, .24]	.05* [.02, .10]	.004 [-.06, .07]
BPNS	.09* [.02, .15]	.02 [-.05, .10]	.04* [.009, .07]	.02 [-.02, .07]
Autonomy	.09* [.01, .17]	.04 [-.06, .13]	.05* [.02, .09]	.006 [-.05, .06]
Competence	.09* [.008, .17]	.03 [-.07, .13]	.03 [-.002, .07]	.03 [-.02, .08]
Relatedness	.07 [-.007, .15]	.006 [-.09, .10]	.03 [-.007, .06]	.04 [-.01, .10]
Purpose	.21** [.06, .36]	.16 [-.03, .34]	.06* [.005, .14]	-.01 [-.12, .09]
Life Satisfaction	.14* [.02, .26]	.09 [-.06, .24]	.04 [-.006, .10]	.009 [-.08, .09]
Vitality	.25** [.12, .38]	.23* [.07, .39]	.06* [.005, .12]	-.04 [-.13, .06]
PA	.22** [.15, .30]	.13* [.04, .22]	.06* [.04, .15]	.03 [-.02, .09]
Self- Transcendent emotions	.22** [.14, .30]	.11* [.02, .20]	.06* [.03, .11]	.05* [.0001, .11]
NA	-.06 [-.15, .04]	-.03 [-.15, .08]	-.03 [-.08, .007]	.006 [-.06, .07]
Meaning	.13 [-.007, .28]	.09 [-.08, .27]	.06* [.002, .13]	-.01 [-.12, .09]
Panel B				
	Unmediated direct effects of awe	Mediated direct effects of awe	Indirect effects of BPNS	
Hedonic Well-being	.19** [.10, .28]	.12* [.04, .20]	.07* [.02, .12]	
Eudaimonic Well-being	.18** [.09, .28]	.10* [.03, .18]	.08* [.02, .15]	

Note. Connectedness and small self were entered simultaneously and the analyses were run separately for each well-being outcome. PA = positive affect; NA = negative affect; Meaning = meaning in life, Purpose = purpose in life, BPNS = basic psychological needs satisfaction.

Figure 1. Theoretical model of relations among ten motivational types of value.

Note. Reprinted from “An Overview of the Schwartz Theory of Basic Values”, by Schwartz, S., 2012, *Online Readings in Psychology and Culture*, 2(1).

Appendix

Intrinsic and Extrinsic Values

An analogous (to self-transcendent values) set of analyses examined changes in intrinsic (helping, close relationships, and personal growth) and extrinsic (self-image, financial success, and being admired) value orientation as measured at baseline, post-test, and 1-week follow-up. Unfortunately, there was an error in the baseline survey where only males saw and responded to intrinsic and extrinsic value questions, which resulted in a sample $n = 96$ men available for analyses. Table 11 shows means and standard deviations of these value scores at baseline, post-test, and 1-week follow-up. There were no significant differences between the conditions on intrinsic values or extrinsic values reported immediately at post-test only (Intrinsic: $t(238) = -1.12, p = .26$; Extrinsic: $t(238) = -.02, p = .99$). Repeated measures ANOVAs were used to examine changes in intrinsic and extrinsic values from baseline to post-test. Results on this smaller subset of men indicated a significant effect of Time on both intrinsic and extrinsic values (intrinsic values: Wilks' Lambda = .89, $F(1, 94) = 12.18, p < .01, \eta^2 = .12$; extrinsic values: Wilks' Lambda = .92, $F(1, 94) = 8.03, p < .01, \eta^2 = .08$). Paired samples t -tests within the awe condition, from baseline to post-test, showed that participants reported a significant *decrease* in intrinsic ($t(51) = -3.12, p < .01$) and extrinsic values ($t(51) = -2.06, p = .044$). Paired samples t -tests within the amusement condition, from baseline to post-test, showed that there was a trend towards less intrinsic ($t(43) = -1.84, p = .07$) and extrinsic ($t(43) = -1.99, p = .053$) value endorsement. The Time x Condition interaction for intrinsic and extrinsic values was not significant for either value type (intrinsic values: Wilks' Lambda

$= .99, F(1, 94) = 1.13, p = .29 \eta^2 = .01$; extrinsic values: Wilks' Lambda = 1.00, $F(1, 94) = .015, p = .90 \eta^2 = .00$).

Once again these analyses on changes in intrinsic and extrinsic value orientation from baseline to 1-week follow-up were conducted on the subset of men with available data ($n = 74$; there was additional data missing from 1-week follow-up survey). Contrary to hypotheses, but consistent with results from baseline to post-test analyses, there was a significant decrease in intrinsic and extrinsic values over Time (intrinsic values: Wilks' Lambda = .85, $F(1, 92) = 12.34, p < .01 \eta^2 = .15$; extrinsic values: Wilks' Lambda = .90, $F(1, 72) = 8.25, p < .01 \eta^2 = .10$). Paired samples t -tests within the awe condition, from baseline to 1-week, showed that participants reported a significant *decrease* in intrinsic ($t(35) = 2.46, p = .019$) and extrinsic values ($t(35) = 1.92, p = .062$). Paired samples t -tests within the amusement condition, from baseline to 1-week, showed that there was a significant decrease in both intrinsic ($t(37) = 2.63, p = .012$) and extrinsic ($t(37) = 2.15, p = .039$) values. The Time (baseline, 1-week follow-up) x Condition (awe, amusement) interaction for intrinsic and extrinsic values was not significant (intrinsic values: Wilks' Lambda = .99, $F(1, 72) = .70, p = .41 \eta^2 = .01$; extrinsic values: Wilks' Lambda = 1.00, $F(1, 72) = .00, p = .99 \eta^2 = .00$). All these analyses were also conducted using a relative intrinsic versus extrinsic value orientation score (RIEVO; subtracting mean intrinsic value scores from mean extrinsic value scores) and revealed the same exact patterns of findings. Overall, hypotheses regarding increases in intrinsic value orientation and decreases in extrinsic value orientation following an experience of awe, compared to an experience of amusement, were partially supported: There were no differences in value

orientation changes between the two conditions, but both manipulations resulted in a decrease in extrinsic value endorsement.

Table 11

Means and standard deviations between conditions at baseline, post-test, and 1-week follow-up for intrinsic and extrinsic values.

Value	Awe Condition <i>M</i> (SD)	Amusement Condition <i>M</i> (SD)
Intrinsic		
Baseline	5.90 (.75)	5.92 (.83)
Post-test	5.68 (.71)	5.78 (.71)
1-week	5.68 (1.00)	5.68 (1.03)
Extrinsic		
Baseline	5.28 (.88)	5.09 (1.02)
Post-test	5.14 (.88)	5.14 (.87)
1-week	5.11 (.94)	5.24 (.96)
RIEVO		
Baseline	.62 (.64)	.83 (.88)
Post-test	.54 (.80)	.64 (.75)
1-week	.57 (.74)	.44 (.78)

Note. Baseline values only include 96 males (awe: $n = 52$; amusement: $n = 44$). RIEVO = relative intrinsic vs. extrinsic value orientation.

VITA

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