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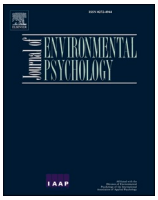

Eudaimonic self-expansion: The effects of eudaimonic reflections on nature connectedness

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ABSTRACT

Research has identified a relationship between eudaimonic wellbeing and nature connectedness. However, the direction of this relationship has not been fully explored. In three studies, the present research tests the possibility that eudaimonic experiences can *cause* the self to expand to include nature (i.e., can increase nature connectedness). Each study focused on a different component of eudaimonic experiences: meaning, authenticity, and growth. In Study 1 (n = 395), participants reflected on how a future nature experience would give them a sense of meaning in life (eudaimonic) compared to reflecting on how it would be fun (hedonic) or how it would be planned (mundane). In Study 2 (n = 460), participants in the eudaimonic condition instead reflected on authenticity. In Study 3 (n = 462), eudaimonic reflections focused on growth. Across the three studies—and in a combined analysis using data from all 1314 participants—reflection on meaning and growth, but not authenticity, resulted in greater nature connectedness than either hedonic reflection or mundane reflection. In the combined analysis, hedonic reflection resulted in greater nature connectedness than mundane reflection; however, this effect appeared weaker than eudaimonia's effect. Thus, this set of studies seems to indicate that eudaimonic experiences *can* cause the self to expand to include nature and that this is not attributable to the fact that eudaimonic experiences are a form of positive experience.

Current events have highlighted that the world is experiencing crises of both mental (e.g., Vindegaard & Benros, 2020) and planetary health (e.g., Falk et al., 2022). People are becoming increasingly disconnected from others (Palgi et al., 2020) and from the natural world (e.g., Richardson et al., 2022), so much so that many feel that reversing this disconnection may be a key factor in moving toward a more sustainable future for all (e.g., Lambert et al., 2020)—as evidenced by nature connectedness's growing appearance in international policy (e.g., Convention on Biological Diversity, 2022; Dasgupta, 2021; Natural England, 2020; SEI & CEEW, 2022; see Lengieza et al., 2023). Now, more than ever, feeling connected to the world around us—a fundamental source of wellbeing (e.g., Cleary et al., 2017; Nisbet et al., 2011) and pro-environmental action (e.g., Richardson et al., 2020)—is increasingly important. Thus, research not only furthering our understanding of the association between wellbeing and connectedness but also the ways we can leverage that association is much needed.

Indeed, recent research has identified a relationship between eudaimonic wellbeing—wellbeing stemming from growth, authenticity, or meaning in life (Huta & Waterman, 2014)—and nature connectedness (see Pritchard et al., 2020, for meta-analysis). However, the direction of this relationship has not been fully explored. Typically, this research follows the expected paradigm of treating wellbeing as the outcome, leaving connectedness as the predictor (e.g., Capaldi et al., 2014; Nisbet et al., 2011). Yet, could it also be possible that eudaimonic experiences, themselves, make one more likely to feel connected to nature?

Preliminary evidence suggests, yes, eudaimonic experiences—experiences involving growth, authenticity, or meaning in life (Huta & Waterman, 2014)—might *cause* increases in nature connectedness. For example, meaning is posited as one of the major pathways to nature connectedness (Lumber et al., 2017), and there is ample correlational evidence of an association between eudaimonia and nature connectedness (see Pritchard et al., 2020). Moreover, there is emerging evidence to expect a causal relationship whereby eudaimonic experiences lead to connectedness. For example, some research has shown that experimental manipulations of eudaimonia indirectly resulted in increased nature connectedness (Lengieza et al., 2021). Other research suggests that similar forms of connectedness (e.g., social connectedness) have a bi-directional relationship with eudaimonic experiences

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(Stavrova & Luhmann, 2016). To date, however, strong experimental evidence for causal claims regarding the relationship between eudaimonia and nature connectedness is lacking. Thus, the present research aimed to test the causal relationship between eudaimonic experiences and nature connectedness across three experiments, each targeting one of the three core components of eudaimonic experiences: Personal growth, authenticity, and a sense of purpose and meaning in life. In doing so, this research has the potential to inform our understanding of how to better promote nature connectedness.

1. Nature connectedness & self-expansion

Nature connectedness is defined as the psychological joining of nature and the self (i.e., including nature in the self; Schultz, 2002), manifesting as a sense of oneness with nature (Lengieza & Swim, 2021b; Mayer & Frantz, 2004). The present research, however, adopts a self-expansion perspective of nature connectedness, not unsimilar to self-transcendence perspectives of nature connectedness taken in other research (e.g., Lengieza et al., 2021; Lengieza & Swim, 2021b). Here, self-expansiveness is used to refer to the self's innate capacity to broaden itself beyond a narrow and rigid set of categories and traits (see Aron et al., 2013; Hughes et al., 2020). In essence, if there is a category in which the self is included as the primary referent and a category where "not-self" is the primary referent, then self-expansion occurs whenever the boundaries of the "self" category increase (expand) in size (see Pappas & Friedman, 2007). Some examples of self-expansion would be including new traits in one's self-concept (see Aron et al., 2013), including goals of others in the same category as self-goals (e.g., striving to contribute to the greater good; Huta & Waterman, 2014), including new roles and identities in the identities ascribed to the self (e.g., self-complexity; Linville, 1987), and including other people (Aron et al., 1992) or other beings (Schultz, 2002) in the self—that latter two phenomena are collectively referred to as self-transcendence in this article. Ultimately, self-expansiveness entails the ability to extend the boundaries of any given self-category to incorporate new elements. Thus, expanding the boundaries of the self to include nature is easily conceptualized as a form of self-expansiveness. Importantly, by viewing connectedness as a specific form of self-expansion, we can draw on a wider range of findings to inform predictions about how eudaimonic experiences might expand the self to include nature.

Of the many forms of self-expansion, nature connectedness is particularly timely because it relates to many societally relevant outcomes. In general, research has consistently shown that nature connectedness is positively associated with pro-environmental outcomes (see Mackay & Schmitt, 2019; Whitburn et al., 2020, for meta-analyses) and may also be associated with more general prosocial behavior (Lengieza et al., 2021), both of which are important considering the environmental crises facing the globe (e.g., Falk et al., 2022). Nature connectedness has also been linked to higher levels of psychological (Mayer et al., 2009) and social wellbeing (Howell et al., 2011; see also Capaldi et al., 2014). Thus, nature connectedness represents a particularly interesting form of self-expansiveness because of its potential as a stepping-stone to a host of societally relevant outcomes (e.g., Howell et al., 2011; Lengieza et al., 2021; Mayer et al., 2009).

1.1. Preliminary evidence linking nature connectedness and eudaimonia

There are a variety of antecedents of nature connectedness, several of which can be characterized as involving wellbeing and positive experiences, generally (see Lengieza & Swim, 2021b). Importantly, however, some evidence specifically connects the elements of eudaimonia to nature connectedness. Several studies have indicated a positive association between nature connectedness and meaning and purpose (Capaldi et al., 2017; Hinds & Sparks, 2009; Howell et al., 2011; Nisbet et al., 2011). Additionally, states associated with the experience of authenticity, such as decreased public self-awareness (Lenton et al., 2013) and mindfulness (e.g., Lakey et al., 2008), are similarly associated with nature connectedness (Frantz et al., 2005; Lengieza & Swim, 2021a; Mayer et al., 2009; Howell et al., 2011; Richardson & Sheffield, 2015; Schutte & Malouff, 2018; Unsworth et al., 2016, respectively). Most importantly, a recent meta-analysis focusing on the association between eudaimonic wellbeing and nature connectedness found that (a) general eudaimonic wellbeing is associated with nature connectedness and that (b) personal growth, authenticity, and purpose and meaning in life were facets of eudaimonia most strongly associated with nature connectedness (Pritchard et al., 2020). Finally, there is evidence that meaning, in particular, is one of seven pathways to increased nature connectedness (Lumber et al., 2017).

In sum, there is fairly strong evidence to expect nature connectedness and eudaimonia to be related in some fashion. However, it is both the case that (a) studies specifically focusing on eudaimonic experiences (vs. global wellbeing) and nature connectedness are rather limited relative to the wider body of literature related to eudaimonic experiences and self-expansion and (b), more importantly, the causal direction of the relationship is less than clear because of a lack of experimental studies. Consequently, the next section draws upon findings from the wider body of evidence related to eudaimonia and self-expansiveness more generally.

2. Eudaimonia

Psychologists have become particularly interested in eudaimonia and have generated many theories related to the topic, such as Self-Determination Theory (SDT; Ryan & Deci, 2001) and Eudaimonic Identity Theory (Waterman, 1993, 2011; Seligman, 2011). Each theory emphasizes a different set of elements, but they all focus on the idea of flourishing and living well (Huta & Waterman, 2014) and often represent an alternative to perspectives that primarily emphasize hedonic wellbeing (e.g., pleasure and fun; Lengieza et al., 2021). Moreover, although eudaimonia has varied treatment amongst the diverse psychological perspectives, the literature suggests at least three central elements commonly identified across the theories (see Huta & Waterman, 2014): a sense of meaning and purpose in life, authenticity, and personal growth.

2.1. Meaning and purpose in life

Eudaimonia, in both psychology and philosophy, is about the 'good life' or 'worthwhile life' (Haugan et al., 2022; Henderson & Knight, 2012; Huta & Waterman, 2014; Steger, 2016, pp. 175–182). While the life worth living will undoubtedly differ from person to person, eudaimonic theorists all seem to agree that, for any individual, the life worth living is the one experienced as having meaning. Meaning, in the context of eudaimonia, has a three-dimensional perspective. That is, it is comprised of comprehension, purpose, and mattering (see George & Park, 2017, for a more elaborate discussion).

The first dimension, comprehension, focuses on perceptions of one's life as being coherent (George & Park, 2017); in other words, the feeling that one's life makes sense. The second dimension, purpose, refers to experiencing one's life as being clearly guided by one's important values and goals (George & Park, 2017); in other words, a life filled with purpose is one where it is clear where one's life is headed, and also that trajectory is valued by oneself. The third dimension, mattering, refers to perceptions of one's life and behaviors as having some important (i.e., meaningful) impact on the world or, phrased more colloquially, making a difference (i.e., one's actions are *not* meaningless; George & Park, 2017).

2.1.1. Meaning and purpose in life and self-expansiveness

Some empirical evidence suggests that meaning and purpose may be associated with self-expansiveness. The most convincing evidence comes from a meta-analysis of studies investigating 65+ year-olds,

indicating a strong positive correlation between meaning in life and self-transcendence (Haugan et al., 2022), which is closely related to nature connectedness (see Lengieza et al., 2021). Importantly, this effect may not be isolated to older individuals, as a sizeable handful of studies using undergraduate samples have also reported positive correlations between the presence of meaning in life and self-expansiveness (e.g., Beaumont, 2009; Capaldi et al., 2017; Hinds & Sparks, 2009; Howell et al., 2011; Nisbet et al., 2011). Thus, there is strong correlational support for an association between meaning and expansiveness.

There is also some evidence of a potential causal relationship between a sense of meaning and purpose and self-expansiveness. A longitudinal study has revealed that meaning in life is bi-directionally associated with relational, social, and collective connectedness (Stavrova & Luhmann, 2016). In other words, social connectedness led to a greater sense of meaning in life, which, in turn, led to greater subsequent social connectedness (Stavrova & Luhmann, 2016). Though this evidence is especially indirect in its support for the association between meaning and self-expansiveness, the fact that meaning in life caused changes in one form of connectedness does suggest that it might, indeed, cause changes in other forms of connectedness, such as nature connectedness. Further, as noted in greater detail below, experimental manipulations of reflecting on meaning in life have been indirectly associated with increased self-transcendence (Lengieza et al., 2021), which further suggests the possibility of experiencing meaning in life leading to self-expansive outcomes. Thus, the signs point in a similar direction: Meaning and purpose may contribute to increased self-expansiveness.

2.2. Authenticity

While eudaimonia in psychology tends to center around meaning and purpose, eudaimonia is also a theory about the self and authenticity. *Daimon* is sometimes translated as one's true self (Henderson & Knight, 2012; Huta & Waterman, 2014; Waterman, 2011), hence the emphasis on acting in line with one's true self found in both modern and historical perspectives of eudaimonia (see Huta & Waterman, 2014). Accordingly, authenticity is a core part of eudaimonic experiences.

Authenticity has been referred to by multiple labels, at least within the frameworks used to study eudaimonia (see Huta & Waterman, 2014). Some research has discussed authenticity in terms of personal expressiveness, emphasizing the feeling that one is being who they truly are and doing what they were meant to do (e.g., Waterman, 2011). Other research—or, more generally, work on SDT—has used the term autonomy in ways that evoke the ideas of authenticity (e.g., Ryan & Deci, 2000, 2001; Weinstein et al., 2011). Within the framework of SDT, autonomy is defined as experiencing an internal locus of causality, in other words, experiencing motivations and behavior as emanating internally from within the self (Ryan & Deci, 2000, 2001; Weinstein et al., 2011). However, in practice, proponents of SDT have discussed autonomy and authenticity as closely related (e.g., Jongman-Sereno & Leary, 2019; Ryan & Deci, 2000). Additional research suggests that frequently experiencing and adhering to external pressures (i.e., pressures from others rather than one's internal pressures) is negatively associated with feeling like one is living authentically (Lutz et al., 2023). Consequently, here, self-expressiveness, autonomy, and authenticity are all used to refer to the idea of experiencing behavior as consistent with the internal force of the self.

2.2.1. Authenticity and self-expansiveness

Generally speaking, there is evidence that points to authenticity having self-expansive outcomes. The most direct support for the authenticity–self-expansiveness link comes from evidence of a positive correlation between autonomy-need-fulfillment in relationships and self-expansion both within and outside the relationship (Carswell et al., 2021). This raises the possibility that if one feels a lack of authenticity—a sense that their behavior is not emanating from within—then they might not be as willing or able to expand their self (Carswell et al., 2021).[1] Additionally, the more autonomous individuals feel, the more likely they are to integrate identity characteristics into their sense of self instead of trying to distance themselves from them (Weinstein et al., 2011, Studies 1 & 2). Most importantly, these findings were supported when using an experimental priming procedure, demonstrating that the experience of authenticity may *cause* some form of self-expansion (Weinstein et al., 2011, Studies 3–5).

Additional indirect evidence supports the hypothesis that authenticity leads to self-expansiveness. One important source of inauthenticity is a perceived abundance of inconsistent external pressures operating on the self (Lenton et al., 2013; Lutz et al., 2023; Slabu, Lenton, Sedikides, & Bruder, 2014). Thus, research on constructs associated with a greater degree of external pressures can inform the possible relationship between authenticity and self-expansiveness. One such construct is public self-awareness—a heightened focus on how one appears to others (Govern & Marsch, 2001)—which is believed to result in increased perceptions and influence of external pressures on the self (e.g., stronger influence of norms as opposed to personal standards). Accordingly, the negative association between public self-awareness and nature connectedness reported in past research (Frantz et al., 2005; Lengieza & Swim, 2021a; Mayer et al., 2009; see Lengieza & Swim, 2021b, for a review) is consistent with the hypothesis that authenticity might result in greater self-expansiveness. Thus, again, the signs point toward a similar conclusion: Authenticity may result in greater self-expansiveness.

2.3. Personal growth

Finally, the remaining core element of eudaimonia is personal growth (see Huta & Waterman, 2014). Growth is an inherent part of human life. No one is born their perfect self; therefore, we must continually grow to both (a) optimally adjust to present circumstances and (b) become our best self. Thus, for individuals to function optimally—to flourish—they must grow as an individual and strive to live up to their potential (Bauer, 2016). Moreover, eudaimonic growth is more than simple change or adaptation; it is change for the better. Here, both a willingness or motivation to grow *and* perceptions of growth are important (Bauer, 2016); to flourish, we must be open to becoming a better person, and we must feel that we are actually becoming better. One often-invoked idea in discussions of growth is the notion of the development of one's potentials and capacities (e.g., Keyes et al., 2002); that is, cultivating one's strengths and available resources to better serve one's purpose in life, often referred to as self-actualization or self-realization (e.g., Waterman, 2011). In other words, personal growth is about becoming a better version of ourselves (Bauer, 2016).

2.3.1. Personal growth and self-expansiveness

According to self-expansion perspectives of close relationships, we have a fundamental need to expand the self, and this need is why we seek out relationships (see Aron et al., 2013; Aron & Nardone, 2012; Hughes et al., 2020). More importantly, the assertion furthered by these self-expansion models is that we are motivated to expand the self so that we feel best prepared to handle future challenges (Aron et al., 2013; Hughes et al., 2020). The explicit connection between self-expansion and a desire for greater self-efficacy suggests that the *desire* to be our best selves—to grow as a person—is a motivational reason for expanding the self. In fact, trait measures of personal growth (e.g., Ryff, 1989) correlate positively with the desire for self-expansion (e.g., Hughes et al., 2020). Individuals who value and experience a greater degree of growth are more likely to feel a desire to expand the self.

[1] It is worth noting that the authors suggest a causal relationship where self-expansion causes autonomy need-fulfilment, however, the correlational nature of the evidence means that we cannot rule out the inverse.

The connection between personal growth and self-expansiveness may seem somewhat tautological. However, there is also direct evidence that motivations to develop the best in oneself are correlated with self-transcendence (Otway & Carnelley, 2013), supporting the proposition that personal growth results in self-expansiveness more broadly. That is, the more individuals are motivated to become the best versions of themselves, the more they expand their boundaries beyond the self. Additionally, one key personality marker of an orientation toward personal growth is openness to experience (Ryff, 1989), which, itself, has been associated with self-transcendent constructs such as nature connectedness in several studies (Brick & Lewis, 2014; Di Fabio & Bucci, 2016; Forstmann & Sagioglou, 2017; Lee et al., 2015; Nisbet et al., 2009; Nour et al., 2017; Richardson & Sheffield, 2015; Tam, 2013; Zhang et al., 2014; see Lengieza & Swim, 2021b, for a review). These findings all point toward a common conclusion: Personal growth may lead to increased self-expansiveness.

2.4. Causal direction of the Eudaimonia–Connectedness link

Thus far, direct evidence that eudaimonia and its components are associated with nature connectedness has been presented. There has also been indirect evidence, some of which was experimental, that each of the components of eudaimonia is associated with self-expansion. Together, this collection of findings provides support for the prediction that eudaimonic experiences may cause increases in nature connectedness—which is causally consistent with calls for research to investigate whether nature connectedness mediates the association between eudaimonic values and pro-environmental behavior (Shin et al., 2022). To date, however, no experimental evidence of such a relationship exists. The closest evidence for such claims comes from a study in which researchers sought to test the potential causal process through which eudaimonic reflection on recent travel experiences—compared to hedonic and mundane reflections—influenced self-transcendence and subsequent prosocial behavior (Lengieza et al., 2021).

The researchers hypothesized that eudaimonic reflections focused on meaning and purpose in life would result in eudaimonic affect (see Lengieza et al., 2021), which would, in turn, influence self-transcendence—treated as a latent construct reflected by both nature connectedness and to humanity—which would predict donation behavior. The researchers also hypothesized that eudaimonic reflections would directly affect self-transcendence. Based on the data, the proposed serial mediation was upheld. Individuals randomly assigned to reflect on meaning and purpose, compared to mundane reflection, experienced greater eudaimonic affect, which was positively associated with self-transcendence, which, itself, was positively associated with donations. Ultimately, these associations formed a significant indirect pathway both to self-transcendence (i.e., an internal indirect path) and to donations. However, individuals who reflected on pleasure and fun did not show such an effect. On the whole, these results are promising. Unfortunately, the data did not reveal a total effect of the reflection on self-transcendence (Lengieza et al., 2021) and cannot adequately speak to the causal effect of the reflections. Thus, further research is warranted.

2.5. Eudaimonia versus hedonia

Ultimately, there is ample evidence to suggest that eudaimonia may cause increases in nature connectedness. However, it is important to acknowledge that the evidence for this effect might not be attributable solely to eudaimonia. Instead, it is possible that eudaimonia is associated with nature connectedness simply because it falls into the category of positive experiences (Huta & Waterman, 2014). Indeed, positive experiences (e.g., positive affect; see Lengieza & Swim, 2021b) are a known predictor of nature connectedness, meaning that it is important to differentiate the unique effects eudaimonia might have from the more general effect of positive experience by comparing it to other positive experiences, such as hedonic experiences (Lengieza et al., 2021). Hedonic experiences are experiences focused on seeking pleasure, fulfilling desires, and avoiding pain (e.g., Huta & Ryan, 2010; Huta & Waterman, 2014; Lengieza et al., 2019; Shin et al., 2022) and are often brought up as a foil to eudaimonic experiences.

Generally, evidence would suggest that hedonic experiences might have a consistently positive effect on nature connectedness and self-expansiveness, especially compared to eudaimonia. For example, as noted above, there is robust evidence of positive associations between positive affect and nature connectedness (see Capaldi et al., 2014), and some studies show that positive affect is associated with including others in the self (e.g., Waugh & Fredrickson, 2006). Moreover, the general principles of the Broaden-and-Build Theory (Fredrickson, 1998, 2004) of positive emotions—which asserts that positive emotions serve to broaden and expand the psychological repertoire of the self—strongly suggest that positive (hedonic) experiences may lead to increased self-expansiveness. Therefore, one might predict that hedonic experiences can also cause increases in nature connectedness.

However, despite this evidence, there is some reason to suspect that hedonia might not always lead to self-expansiveness. Compared to eudaimonically motivated activities, hedonically motivated activities are less predictive of outcomes such as elevating experiences, which include feeling connected to a larger whole (Huta & Ryan, 2010). Additionally, some scholars have distinguished between hedonia and eudaimonia based on hedonia's association with self-centeredness (see Steger, 2016, pp. 175–182). Indeed, self-centered values, but not self-transcendent values (Dambrun, 2017), are more associated with forms of happiness more similar to hedonia (Dambrun, 2017; Dambrun et al., 2012), and self-centeredness is not generally thought to be conducive to connectedness (Schultz, 2002). Further, hedonic affect, such as joy, is characterized by focusing on the self rather than on others (Stellar et al., 2017), suggesting, at the very least, that hedonia may be associated with self-centeredness rather than self-transcendence and self-expansion. Finally, when controlling for eudaimonic affect, there was no longer a relationship between hedonic affect and self-transcendence in the previously mentioned experimental study (Lengieza et al., 2021). Therefore, based on the above, one could also predict that hedonia might not always cause increases in nature connectedness, or at least not as strongly as eudaimonia. Thus, one could argue equally well for similar effects or differential effects between eudaimonia and hedonia.

3. General purpose & overview

The present research aimed to investigate the implications that eudaimonia, as an experience, has for nature connectedness using an experimental paradigm. In doing so, this research provides a more comprehensive picture of eudaimonia and its potential to contribute to the wellbeing of the planet. Consequently, three studies—all collected over the Fall and Spring semesters of the 2021–2022 US academic year with IRB approval—were conducted to test the effects of eudaimonic experiences on nature connectedness. To advance our holistic understanding of the relationship between eudaimonia and nature connectedness, each study focused on a different one of the core components of eudaimonia relative to mundane (reflecting on planning) and hedonic reflection (reflecting on fun). Study 1 focused on the effects of reflecting on meaning and purpose to extend the findings of Lengieza et al. (2021). Studies 2 and 3 subsequently focused on the effects of reflecting on authenticity and on growth, respectively, as a means of further extending this work. All three studies examined the effect of reflections about a future hypothetical experience in nature.

3.1. Hypotheses

Across all three studies, the prediction was that eudaimonic reflection—as a means of inducing subjective eudaimonic

experiences—would result in greater nature connectedness nature than mundane reflection (the control). However, eudaimonia reflects a form of positive experience more broadly, as noted above. Therefore, hedonic reflection was included as an additional contrast to help isolate the effects of reflecting upon positive experiences, generally, from the effect of reflecting upon eudaimonia specifically. No explicit hypothesis was made concerning the effect of hedonia. Fig. 1 presents the conceptual model.

4. Study 1

Study 1 builds upon the study conducted by Lengieza et al. (2021), which tested the causal relationship between meaning and purpose on self-expansiveness. As noted above, only an indirect effect—and not a total effect—from meaning and purpose to self-expansiveness was established. Thus, Study 1 was conducted to better confirm that eudaimonic experiences are causally related to self-expansiveness using a modification of Lengieza et al.'s (2021) design to focus on imagined future nature experiences. This study then laid the groundwork to test whether the other specific elements of eudaimonia have the same causal relationship, as tested in Studies 2 and 3.

4.1. Method

4.1.1. Participants

In October of 2021, 487 undergraduate participants were recruited with the intent of retaining a final sample of 412 based on an approximate 15 % exclusion rate and power analyses using G*Power (Faul et al., 2007), assuming a small effect size ($f^2 \approx 0.03$) at a power of .95.[2] A total of 92 participants were excluded (full details can be found in the supplemental materials). Specifically, 50 were excluded for selecting problematic responses on exit items designed to assess self-reported data quality; another 2 were excluded for straight-lining on all items, including reverse-coded items on the nature connectedness scale, and another 40 were excluded based on problematic data-quality metrics (i.e., survey duration; writing task effort based on words per minute [WPM]; flagged outliers with other suspicious responses).

The final sample (n = 395) was primarily white (77 %) and female (80 %) and leaned liberal ($M = -0.34$; on a −3 [Liberal] to 3 [Conservative] scale) with a mean age of 18.67 years ($SD = 1.03$). Participants began the study already somewhat connected to nature ($M = 128.39$, $SD = 51.06$). Participant numbers by condition for all three studies can be found in the supplemental materials.

4.1.2. Measures and procedure

Participants were recruited to the study via a psychology student subject pool, where they were informed that the study was interested in the imagined experiences of the university's students and that they would have to complete a writing task (see supplemental materials for specific details).

Baseline Connectedness and Demographics. Participants first answered a series of demographic questions. Embedded in these questions was a version of the Inclusion of Nature in the Self scale (INS; Lengieza & Swim, 2021a; Schultz, 2002). The scale depicted two circles, one labelled self, the other nature, and a sliding knob below the circles. Participants indicated how much nature was a part of their sense of self by moving the circles to overlap more or less. Scores ranged from 0 (full separation) to 250 (full overlap).

Reflection Manipulation. Participants were then informed of what to expect from the upcoming writing task and given instructions that encouraged them to give rich, honest descriptions and to not worry about editing or grammar (see supplemental material). After reading this information, participants were randomly assigned to one of the three conditions (meaning, fun, and mundane control).

The reflection manipulation was adapted from Lengieza et al. (2021) and involved two pages ("Page 1" and "Page 2" below), both of which displayed the image depicted in Fig. 2. Page 1 contained a preview of the same condition-specific information participants found on Page 2 but with slight differences (e.g., no text boxes, slightly different sentence structure and order, etc.; see supplemental materials). The purpose of Page 1 was to give participants an idea of what they would be asked to write about before being asked to write. Accordingly, Page 1 also included instructions at the bottom of the page, asking participants to take some time to collect their thoughts before advancing to the next page. Participants were not able to advance until 30 s had elapsed. This was deemed necessary in order to explicitly separate the time it takes for participants to gather their thoughts from the time it takes them to write down their thoughts given the use of WPM as a data-quality metric.

After the thinking period had elapsed, participants could advance to Page 2, which contained almost identical information to Page 1, with the primary addition of two text boxes. Specifically, Page 2 read (italics added to highlight phrases that differed between conditions):

> Imagine that, sometime in the next week, you are going to be spending part of the day outside somewhere similar to the picture displayed below.
>
> (scroll down for text boxes)
>
> <image>
>
> **Try to imagine how this experience would [be planned/allow you to have fun/create a sense of meaning in your life].**
>
> First, write about how this experience would [*need to be planned/allow you to have fun/contribute to a sense of meaning or a sense of purpose in your life*]. For example, what would you do first? [*What about after that?/what would be fun about it? What about after that, what would be fun about it?/ what would be meaningful about it? What about after that, what would be meaningful about it?*] Etc.
>
> <text box1>
>
> Now, write about how nature would [*influence the planning of the experience/play an important role in the fun of the experience/play an important role in the meaning that came from this experience*]. For example, what part of nature would most [*influence the planning of the experience/contribute to the fun of the experience/would most contribute to the meaningfulness of the experience*]? Why?
>
> <text box2>
>
> You should write for at least 5 minutes, but it is okay if you write for a little longer.
>
> <timer counting up to 5 minutes>

Participants were able to take as long as they wished on the task. However, they could not advance to the next page until the 5 min had elapsed.

Nature connectedness. After completing the reflections, participants were presented with a state version of the 14-item Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004). Participants responded to items on the scale based upon how they were feeling "right now" (e.g., "I feel a sense of oneness with the natural world around me") using a 7-point scale from "Strongly Disagree" (−3) to "Strongly Agree". Since the interest here was self-expansiveness vis-à-vis nature connectedness, a 15th item, "Nature is a part of my sense of self", was included—and always appeared last in the scale to limit its influence on the other items in the event that it had some unintended effect. The addition of this item did not affect the scale's reliability. However, two reverse-coded items

[2] The final sample for this study fell below the intended sample size for a power of .95 given the expected effect size. However, the final sample was still well above the required sample for a power of .90 (n = 334) for the same expected effect.

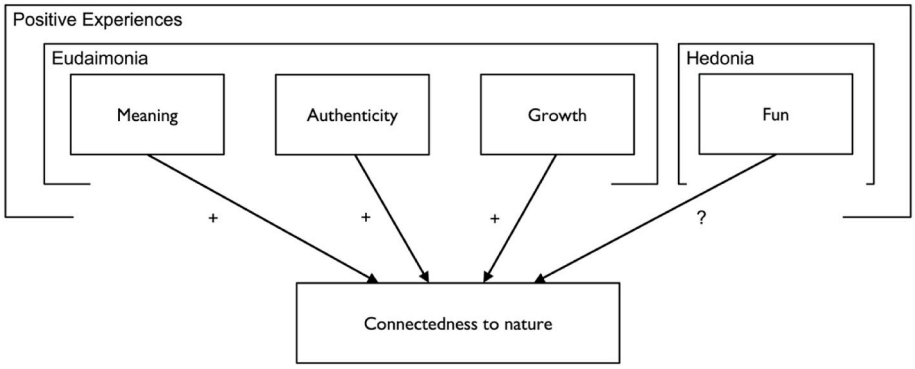

Fig. 1. The Conceptual Model of How Eudaimonia Affects Self-expansiveness.
Note. *These predictions are relative to the absence of such experiences (i.e., relative to mundane reflection condition).*

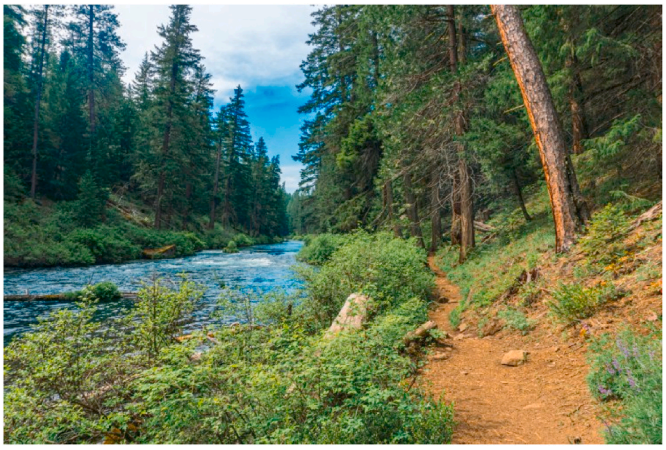

Fig. 2. The image accompanying the reflection instructions.

were flagged as hindering reliability and were dropped (i.e., "My personal welfare is independent of the welfare of the natural world." and "When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.").[3] The final scale demonstrated strong reliability (alpha = .87).

Exit items. After completing the final dependent measures, participants were asked to indicate whether they experienced glitches in the survey (see supplemental materials).

4.1.3. Data analysis

All analyses were conducted using R version 4.0.4.

Latent Variables. To capitalize on the advantages of modern advances in statistical modeling (i.e., more precise estimation), CNS was treated as a latent variable using *lavaan* (Rosseel, 2012) and was internally standardized (i.e., std.lv = T). Structural Equation Models (SEM) were tested using robust maximum-likelihood estimation with a Satorra-Bentler correction (MLM in *lavaan*), and three indices were used to assess the fit of the models: The comparative fit index (CFI; values below 0.90 suggest poor fit; Bentler & Bonett, 1980; Hu & Bentler, 1999), standardized root mean residual (SRMR; values less than or equal to 0.08 indicate good fit; Bentler & Bonett, 1980), and root mean square error (RMSEA; values higher than 0.10 warrant model rejection, values near 0.05 suggest good fit; Browne & Cudeck, 1992; Hu & Bentler, 1999).

Coding scheme. The three comparisons of interest were comparing meaning to fun, comparing meaning to the control, and comparing fun to the control. Since the dependent variable was treated as a latent variable, a regression approach to testing the effects of typer of reflection (i.e., sets of contrast codes) was necessary to test these comparisons rather than a typical ANCOVA. Thus, to test for the effects of reflection on connectedness, CNS was first regressed onto orthogonal contrast codes comparing the Meaning (1) and Fun (−1) conditions to each other and both experimental conditions (1) to mundane reflection (−2) while controlling for baselines INS scores. Comparisons between each condition and mundane reflection were probed using dummy codes comparing meaning to mundane reflection (Meaning = 1, Fun = 0, Control = 0) and comparing fun to mundane reflection (Meaning = 0, Fun = 1, Control = 0).

Pre-existing differences. Prior to conducting analyses, differences between conditions in the representation of gender, ethnicity (both logistic regressions), and political orientation (linear regression) were investigated. There were no differences between conditions in political orientation (*ps* > .738), ethnicity (*ps* > .163), or gender (*ps* > .140).

4.2. Results

Correlations between all variables from Study 1 can be found in Table 1.

The contrast-coded SEM predicting nature connectedness as a latent variable from type of reflection, when controlling for baseline nature connectedness, fit well, $X^2(101) = 143.85$, CFI = 0.97, SRMR = 0.037, RMSEA = 0.037, 90 %CI = [0.022, 0.050], indicating that the latent construct was captured well by the measurement model. The model revealed that individuals who reflected on meaning and purpose (M = 0.20, SE = 0.08) experienced greater nature connectedness than individuals who reflected on fun (M = −0.13, SE = 0.08), b = 0.16, p = .013, 95 %CI = [0.03, 0.29]. However, both experimental conditions, combined, were not different from mundane reflection (M = −0.08, SE = 0.08), b = 0.04, p = .316, 95 %CI = [−0.04, 0.11]. The dummy-coded SEM indicated that reflecting on meaning resulted in greater connectedness compared to mundane reflection, b = 0.28, p = .034, 95 %CI = [0.02, 0.54], whereas reflecting on fun did not, b = −0.05, p = .712, 95

Table 1
Correlations between connectedness and demographics in study 1.

Variable		1.	2.	3.	4.	5.	6.
1.	CNS	–	.43***	−.10†	.03	.26***	.08
2.	INS		–	.01	−.13*	.15**	.09†
3.	Gender			–	−.18***	−.21***	.13*
4.	Ethnicity				–	−.08	.03
5.	Ideology					–	.04
6.	Age						–

Note. Gender was coded as Male = 1; Female = 0. Ethnicity was coded as. White = 1; Not white = 0. †p < .10; *p < .05; **p < .01; ***p < .001.

[3] These items were flagged in Study 2 & 3, as well, and were also dropped. The final scales demonstrated strong reliability in all studies.

%CI = [−0.31, 0.21]. The estimated means and *SE*s for the CNS for Study 1, as well as for Studies 2 and 3, are reported in Table 2.

5. Study 2

5.1. Method

Study 2 employed the same methodology and analytic procedure as Study 1, except for replacing the meaning reflection with a reflection on authenticity.

5.1.1. Participants

Given the effect sizes found in Study 1 and the exclusion rate, the recruited sample size was increased for both Study 1 and Study 2 by approximately 100 participants. Consequently, in November of 2021, 585 undergraduate participants were recruited. A total of 125 participants were excluded (see supplemental materials). Specifically, 71 participants were excluded for selecting problematic responses on self-reported data quality exit items, 54 were excluded based on the data-quality metrics, and 2 based on the outlier inspection procedure used in Study 1. The final sample, which was comprised of 460 participants, was primarily white (75 %) and primarily female (78 %) and leaned liberal ($M = -0.31$) with a mean age of 18.80 years ($SD = 2.10$). Participants in this sample appeared to begin the study already somewhat connected to nature ($M = 129.41$, $SD = 49.96$).

5.1.2. Measures and procedure

The procedure for this study was virtually identical to that used in Study 1 except for changing the eudaimonic manipulation.

Reflection Manipulation. The reflection on meaning and purpose was replaced with a reflection on authenticity. Specifically, the stems to the three prompts read "… how this experience would give you the opportunity to be your true self."; "… how this experience would contribute to feeling like you were being your true and authentic self. For example, what would you do first, what would be authentic about it? What about after that, what would be authentic about it? Etc."; and "how nature would play an important role in the feeling of being your true self that would come from this experience. For example, what part of nature would most contribute to the personal authenticity of the experience? Why?"

5.1.3. Data analysis

The same analytic procedure used in Study 1 was used for Study 2.

Pre-existing differences. There were no differences in ethnicity between the conditions (*ps* > .428). However, there were more conservative participants ($p = .011$) and men ($p = .022$) in the authenticity condition than the control. Thus, all analyses in this study controlled for these pre-existing differences between groups.

5.2. Results

The contrast-coded SEM predicting nature connectedness as a latent variable from type of reflection, when controlling for baseline nature connectedness, fit well, $X^2(125) = 244.89$, CFI = 0.927, SRMR = 0.042, RMSEA = 0.049, 90 %CI = [0.040, 0.058]. Contrary to predictions, the analysis indicated that individuals who reflected on authenticity ($M = -0.08$, $SE = 0.07$) experienced lower nature connectedness than individuals who reflected on fun ($M = -0.19$, $SE = 0.07$), $b = -0.14$, $p = .026$, 95 %CI = [−0.26, −0.02]. However, both experimental conditions, combined, were not different from mundane reflection ($M = -0.11$, $SE = 0.07$), $b = 0.05$, $p = .121$, 95 %CI = [−0.01, 0.12]. The dummy-coded analysis indicated that reflecting on authenticity resulted in equivalent levels of connectedness compared to mundane reflection, $b = 0.03$, $p = .838$, 95 %CI = [−0.23, 0.28], whereas reflecting on fun resulted in greater connectedness than mundane reflection, $b = 0.30$, $p = .010$, 95 %CI = [0.07, 0.53]. See Table 3 for correlations.

6. Study 3

6.1. Method

Study 3 employed the same methodology and analytic procedure as Study 2, except for replacing the authenticity reflection with a reflection on growth. Additionally, the lack of an effect of authenticity on nature connectedness in Study 2 was unexpected. Consequently, a few self-report items were included at the end of the survey to explore whether the non-effect was a reproducible finding.

6.1.1. Participants

In February of 2022, 585 undergraduate participants were recruited for this study. A total of 123 participants were excluded. Specifically, 64 participants were excluded from selecting problematic responses on exit items designed to assess self-reported data quality, 1 for straight-lining, and another 58 were excluded based on the problematic data-quality metrics used in Studies 1 and 2. The final sample, which was comprised of 462 participants, was primarily white (76 %) and primarily female (78 %) and tended to lean toward liberal ($M = -0.30$) with a mean age of 19.40 years ($SD = 2.93$). Participants in this sample appeared to begin the study already somewhat connected to nature ($M = 130.38$, $SD = 50.48$).

6.1.2. Measures and procedure

Reflection Manipulation. In this study, the reflection on authenticity was replaced with a reflection on personal growth. The three stems to the prompts read as follows: "… how this experience would allow you to grow as an individual."; "… how this experience would allow you to grow as a person. For example, what would you do first, in what ways might you grow as an individual? What about after that? How would it help you grow? Etc."; and "… how would nature play an important role in the growth that would come from this experience? For example, what part of nature would most contribute to the personal growth from the experience? Why?"

Exploratory self-report items. To better understand the unexpected effect produced by authenticity, several exploratory measures of experienced eudaimonia and hedonia were included as exit items at the end of the survey, all rated from "Strongly Disagree" (−3) to "Strongly Agree" (3). Three of the items were aimed at assessing the extent to

Table 2
Means and standard errors for CNS scores for studies 1-3.

Study	Condition		
	Eudaimonic	Hedonic	Mundane
Study 1	$M = 0.20$, $SE = 0.08_a$	$M = -0.13$, $SE = 0.08_b$	$M = -0.08$, $SE = 0.08_b$
Study 2	$M = -0.08$, $SE = 0.07_a$	$M = 0.19$, $SE = 0.07_b$	$M = -0.11$, $SE = 0.07_a$
Study 3	$M = 0.16$, $SE = 0.07_a$	$M = 0.00$, $SE = 0.07_{ab}$	$M = -0.16$, $SE = 0.08_b$

Note. Means with different subscripts within rows differ significantly.

Table 3
Correlations between connectedness and demographics in study 2.

Variable		1.	2.	3.	4.	5.	6.
1.	CNS	–	.39***	−.07†	.01	.19***	.10
2.	INS		–	−.03	−.04	.08†	.10*
3.	Gender			–	.00	−.16***	.13**
4.	Ethnicity				–	−.17***	−.01
5.	Ideology					–	−.10*
6.	Age						–

Note. Gender was coded as Male = 1; Female = 0. Ethnicity was coded as. White = 1; Not white = 0. †p < .10; *p < .05; **p < .01; ***p < .001.

which participants experienced the three components of eudaimonia (i.e., "My reflection made me feel more authentic", "My reflection gave me a greater sense of meaning and purpose", and "My reflection made me feel more capable of personal growth"). Two of the items were aimed at capturing hedonia (i.e., "My reflection made me feel good" and "My reflection made me feel happy").

6.1.3. Data analysis

The same analytical procedure used in Studies 1 and 2 was used for Study 3.

Pre-existing differences. There were no differences in ideology (*ps* > .419), ethnicity (*ps* > .147), or gender (*ps* > .776).

6.2. Results and discussion

The contrast-coded SEM predicting nature connectedness as a latent variable from type of reflection, when controlling for baseline nature connectedness, fit well, $X^2(101) = 221.59$, CFI = 0.928, SRMR = 0.045, RMSEA = 0.055, 90 %CI = [0.046, 0.065]. The model indicated that individuals who reflected on growth ($M = 0.16$, $SE = 0.07$) experienced similar levels of nature connectedness compared to individuals who reflected on fun ($M = 0.00$, $SE = 0.07$), $b = 0.08$, $p = .202$, 95 %CI = [−0.04, 0.21]. However, both experimental conditions combined resulted in greater connectedness than mundane reflection ($M = -0.16$, $SE = 0.08$), $b = 0.08$, $p = .017$, 95 %CI = [0.01, 0.15]. The dummy-coded analysis indicated that reflecting on growth resulted in higher levels of connectedness compared to mundane reflection, $b = 0.33$, $p = .007$, 95 %CI = [0.09, 0.56], whereas reflecting on fun resulted in equivalent levels of connectedness compared to mundane reflection, $b = 0.16$, $p = .174$, 95 %CI = [−0.07, 0.40]. See Table 4 for correlations among measures used in Study 3.

6.2.1. Correlational analyses

Study 2 revealed an unexpected non-effect of authenticity. Consequently, several self-report items reflecting experienced eudaimonia and experienced hedonia were included in this study as a way of (a) exploring the unexpected effect of authenticity and (b) potentially offering additional support for the association between meaning and growth and nature connectedness. The SEM predicting the latent variable of connectedness from baseline INS and the three self-reported eudaimonic variables simultaneously fit well, $X^2(113) = 262.09$, CFI = 0.913, SRMR = 0.049, RMSEA = 0.059, 90 %CI = [0.050, 0.068].

The model indicated that nature connectedness was positively predicted by both experienced growth, $b = 0.15$, $p = .047$, 95 %CI = [0.001, 0.29], and experienced meaning, $b = 0.18$, $p = .03$, 95 %CI = [0.02, 0.34]. In contrast, experienced authenticity did not predict connectedness, $b = 0.01$, $p = .901$, 95 %CI = [−0.12, 0.14]. Thus, this is generally consistent with the effects reported thus far, meaning (Study 1) and growth (Study 3) both seem to have a positive effect on connectedness, while authenticity does not (Study 2).

Additionally, one may wonder how these eudaimonic items compare to the hedonic items. Thus, another SEM model was tested where (a) authenticity, growth, and meaning were treated as indicators of a eudaimonic latent variable and (b) "good" and "happy" were treated as indicators of a hedonic latent variable. The latent variables—which were allowed to correlate—served as predictors of connectedness along with baseline INS. The model fit well, $X^2(149) = 311.794$, CFI = 0.939, SRMR = 0.055, RMSEA = 0.054, 90 %CI = [0.046, 0.063]. Both experienced eudaimonia, $b = 0.25$, $p = .001$, 95 %CI = [0.10, 0.39], and experienced hedonia, $b = 0.31$, $p < .001$, 95 %CI = [0.16, 0.45], positively predicted nature connectedness. Thus, it seems that both eudaimonia and hedonia have significant but unique effects on connectedness.

7. Combined analyses

Because the only major difference between each study was the type of eudaimonic reflection, there was the unique opportunity to conduct a combined analysis to provide a more powerful test of the comparisons between the different types of reflections. Specifically, combining the samples would provide a more robust estimate of scores for the hedonic and mundane conditions, in particular, which would represent a better referent for comparing the effect of the eudaimonic conditions. To be fully transparent, this analysis was considered post-hoc, and the contrasts used were driven entirely by the trends that emerged from the planned analyses described above.

Thus far, Studies 1 and 3 both provide evidence that eudaimonic reflection results in greater nature connectedness than mundane reflection (further supported by the correlational analysis in Study 3). What remains relatively less clear is how eudaimonic reflection compares to hedonic reflection. In Study 1, eudaimonic reflection resulted in greater connectedness than hedonia, but this was not the case in Study 3 (or Study 2). Thus, one purpose of this combined analysis was to test whether eudaimonia and hedonia have differential effects. Additionally, experimental evidence from Study 2 and correlational evidence from Study 3 seemed to indicate that authenticity does not have a self-expansive effect. Accordingly, the combined effects of only meaning and growth against the effects of hedonia were tested. Further, this combined analysis resulted in a large enough sample (n = 1314) to adequately test for interactions and thus presented the opportunity to test if the effect of the reflections depended on individuals' baseline connectedness.

Accordingly, first- and second-order analyses were conducted using an exploratory set of orthogonal contrasts (illustrated in Fig. 3). The contrast of primary interest compared meaning and growth to fun (meaning = 1, growth = 1, fun = −2, auth = 0, control = 0). In order to complete the orthogonality, however, the set of contrasts also included a contrast comparing meaning to growth (meaning = 1, growth = −1, fun = 0, auth = 0, control = 0), authenticity to mundane reflection (meaning = 0, growth = 0, fun = 0, auth = 1, control = −1), and

Table 4
Correlations between connectedness, demographics, & experienced eudaimonia and hedonia in study 3.

Variable		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	CNS	–	.34***	−.05	−.02	.07	.10*	.34***	.24***	.32***	.35***	.31***
2.	INS		–	−.00	−.02	−.04	.10*	.15**	.14**	.12**	.13**	.11*
3.	Gender			–	−.01	−.19***	.06	−.03	.01	−.07	−.05	−.05
4.	Ethnicity				–	−.16***	−.02	.01	−.02	−.02	.01	.01
5.	Ideology					–	.03	−.10*	−.05	−.05	−.04	−.10*
6.	Age						–	.00	−.08	−.05	.04	−.01
7.	Meaning							–	.62***	.81***	.47***	.43***
8.	Authentic								–	.59***	.41***	.34***
9.	Growth									–	.46***	.44***
10.	Good										–	.71***
11.	Happy											–

Note. Gender: Male = 1; Female = 0. Ethnicity: White = 1; Not white = 0.
†p < .10; *p < .05; **p < .01; ***p < .001.

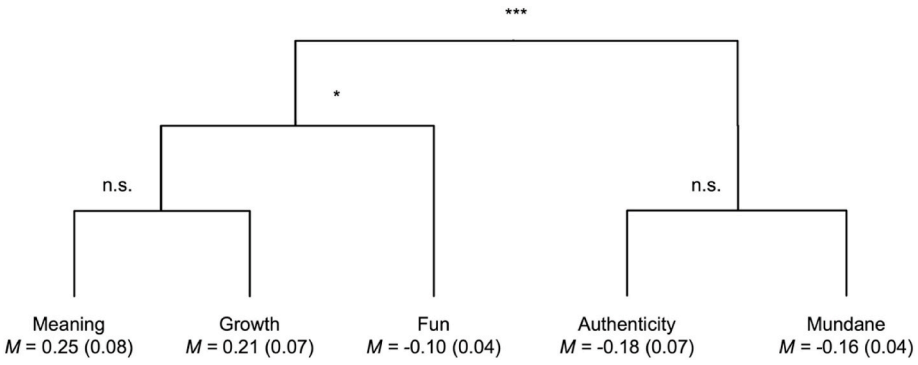

Fig. 3. The Comparisons Tested in The Combined Analysis
*Note. Numbers in parentheses are SEs. †p < .10; *p < .05; **p < .01; ***p < .001.*

comparing the reflections that turned out to be self-expansive (meaning, growth, and fun) to the ones that did not (i.e., authenticity and mundane reflection; meaning = 2, growth = 2, fun = 2, auth = −3, control = −3). For clarity, the last three contrasts were included out of necessity to complete the orthogonality and were not of particular interest on their own. Further, to account for extraneous differences between the samples, the analyses also controlled for available demographic variables (i.e., ideology, ethnicity, gender, and age) and sample (i.e., whether participants were from Study 1, 2, or 3). See Table 5 for correlations based on the combined samples.

7.1. Results & discussion

The first-order contrast-coded SEM model—based on the combined data from all three samples and controlling for baseline INS as well as ideology, ethnicity, gender, and age and sample—fit well, $X^2(197) = 612.80$, CFI = 0.92, SRMR = 0.042, RMSEA = 0.042, 90 %CI = [0.038, 0.046] (first-order means are reported in Fig. 3). The model revealed there was a significant main effect of reflecting on meaning/growth versus fun, $b = 0.11$, $p = .014$, 95 %CI = [0.02, 0.20], whereby reflecting on meaning/growth resulted in greater connectedness than fun. Meaning and growth, however, resulted in equivalent levels of connectedness, $b = 0.02$, $p = .805$, 95 %CI = [−0.14, 0.18]. Additionally, reflecting on authenticity did not differ from mundane reflection, $b = -0.01$, $p = .818$, 95 %CI = [−0.12, 0.10]. Lastly, all three self-expansive reflections, combined, resulted in greater connectedness than mundane reflection and authentic reflection combined, $b = 0.06$, $p < .001$, 95 %CI = [0.03, 0.08].

The comparison between hedonia and mundane reflection was also tested in a second complementary analysis, which indicated that hedonic reflection resulted in greater connectedness than mundane reflection, $b = 0.16$, $p = .021$, 95 %CI = [0.02, 0.30]. This complementary analysis also corroborated the effects from Study 1 and Study 3, showing that both meaning and growth, individually, resulted in greater connectedness than mundane reflection ($ps < .003$). Thus, meaning and growth were greater than fun, which was greater than authenticity and mundane reflection.

Table 5
Correlations between connectedness and demographics combining Studies 1-3.

Variable		1.	2.	3.	4.	5.	6.
1.	CNS	–	.39***	−.07**	.00	−.17***	.09**
2.	INS		–	−.01	−.06*	−.07*	.09***
3.	Gender			–	−.06*	.19***	.09**
4.	Ethnicity				–	.14***	−.01*
5.	Ideology					–	−.02
6.	Age						–

Note. Gender: Male = 1; Female = 0. Ethnicity: White = 1; Not white = 0.
†p < .10; *p < .05; **p < .01; ***p < .001.

The addition of the interaction terms between baseline INS and each of the contrasts reflecting the type of reflection did not substantively alter the fit of the model, $X^2(245) = 667.32$, CFI = 0.920, SRMR = 0.038, RMSEA = 0.038, 90 %CI = [0.034, 0.041], and revealed a significant interaction between INS and the meaning/growth vs. fun contrast, $b = -0.01$, $p = .030$, 95 %CI = [−0.20, −0.01]. Accordingly, the interaction was followed up with a floodlight analysis (Spiller et al., 2013) to determine the point at which the difference between meaning/growth and fun became significant. The analyses revealed that reflecting on meaning/growth resulted in higher connectedness than reflecting on fun at 0.22 SD or lower on the baseline INS but resulted in similar levels of connectedness for all higher levels of INS. In other words, hedonia and eudaimonia (meaning/growth) were only different for individuals who were not already connected to nature.

8. General discussion

This set of studies aimed to better understand the association between eudaimonic experiences and nature connectedness. In general, the evidence suggests that eudaimonia—at least two of its most central features, meaning and growth—can cause the self to expand to include nature (see Fig. 4). In Study 1, this was shown in direct comparison to both mundane and hedonic reflections. In Study 3, this was shown in comparison only to mundane reflection. Additionally, in Study 3, self-reported meaning and growth each independently predicted nature connectedness and the latent construct of eudaimonia predicted a unique portion of variance in connectedness relative to the latent construct of hedonia. Further, in the combined analysis, reflection on meaning or growth resulted in greater connectedness than mundane and hedonic reflections. Together, these findings suggest that eudaimonic experiences can expand the self to include the natural environment.

On the whole, these findings are consistent with past literature. For example, in addition to robust correlations with eudaimonic wellbeing and nature connectedness (Pritchard et al., 2020), meaning has been identified as one of the key pathways to nature connectedness (Lumber et al., 2017), and eudaimonic reflection has been indirectly associated with a combined measure of connection to nature and to humanity (Lengieza et al., 2021). Thus, the findings of the present study extend this past work to show that eudaimonic experiences can directly cause nature connectedness.

Interestingly, in contrast to meaning and growth, authenticity seemed not to have a self-expansive effect (as depicted in Fig. 4). In both Study 2 and in the combined analyses, authenticity was statistically equivalent to mundane reflection. Moreover, the correlational analyses in Study 3 suggest that self-reported authenticity has no association with nature connectedness when controlling for meaning and growth. Thus, while there is evidence that meaning and growth contribute to expanding the self to include nature, the evidence also suggests that authenticity might not. Further elaboration on the non-effect of

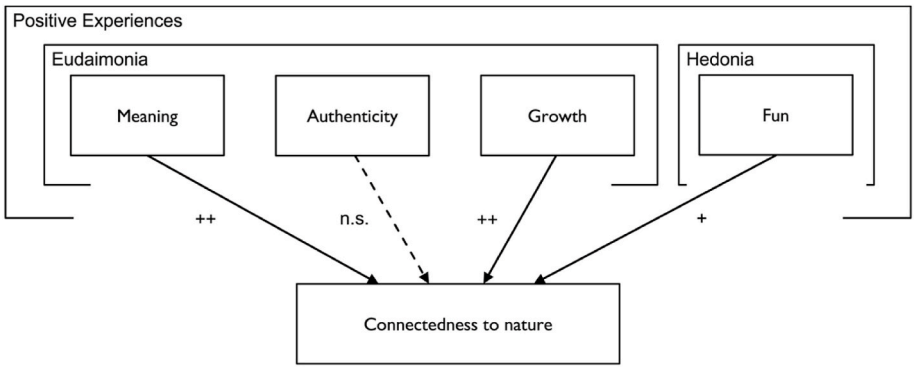

Fig. 4. The Empirical Model Depicting the Pattern of Results Across the Studies
Note. Dashed lines represent non-significant effects. Paths with ++ indicate stronger effects than paths with +.

authenticity appears in the limitations and future directions section.

In addition to revealing the effect of eudaimonia on nature connectedness, these studies also revealed that hedonia might contribute to increased connectedness as well—albeit to a weaker extent. In particular, the combined analyses suggested that, when combining the hedonic conditions across all three studies and comparing them to mundane reflection across all three studies, hedonic reflection does result in greater nature connectedness than mundane reflection. The correlational analyses in Study 3 also support the self-expansive effect of hedonia; even when controlling for eudaimonia, hedonia had a significant positive association with nature connectedness. Thus, the results of these studies are consistent with research suggesting that positive affect predicts nature connectedness (see Capaldi et al., 2014; Nisbet & Zelenski, 2011).

Overall, these findings regarding the effect of hedonia and eudaimonia are interesting to consider in light of the assertions of the Broaden-and-Build Theory (Fredrickson, 1998, 2004). According to an unnuanced view of the Broaden-and-Build Theory, one might expect any reflection on positive experiences, including reflecting on fun, to consistently predict self-expansion (Fredrickson, 1998, 2004). On the whole, this was supported by the combined analysis; the collapsed effects of meaning, growth, and fun (i.e., broadly positive experiences) resulted in greater nature connectedness than the collapsed effects of mundane reflection. Thus, positive experiences, as a whole, do seem to have the capacity to broaden the self (Fredrickson, 1998, 2004), in this case, to include nature.

Yet, even within the Broaden-and-Build Theory, there is nuance to the broadening effects of positive emotions (see Fredrickson, 2013), which is supported by the present findings. That is, both the combined analysis and the analyses from each study individually highlight that different *types* of positive affective experiences have dissociable effects. This implication is similarly found in other available evidence, which suggests that various positive emotions have differential effects on nature connectedness (Jacobs & McConnell, 2022; Lengieza & Swim, 2021b; Nisbet et al., 2019). Indeed, according to The Broaden-and-Build Theory, some positive states, such as inspiration, are more associated with a desire to expand the self than others (Fredrickson, 2013). Inspiration, as it turns out, was one of the key affective indicators of the eudaimonic affect that resulted from eudaimonic reflections—but not hedonic reflections—in past research (Lengieza et al., 2021) and has been emphasized as a eudaimonic emotion in other research contexts (Oliver & Raney, 2011). In sum, a blanket prediction about all positive affect's capacity to broaden the self to include other entities, such as nature, may not adequately capture reality and research should continue to consider the nuances of the relationship between positive experiences and nature connectedness.

Incidentally, the findings of this study also contribute to research suggesting that *what* people do and experience in nature is just as important, if not more important, than merely whether they are spending time in nature (see Lengieza et al., 2023, Lengieza & Swim, 2021b or Sheffield et al., 2022, for relevant discussion). This study deliberately used an active control condition in which people still thought about nature, meaning that a focus on nature was common across conditions; thinking about nature did not differ between conditions. Instead, what differed between conditions, and therefore can be attributed to the differences in nature connectedness, was what participants were thinking about in the context of nature. Therefore, from this study we can conclude that having people merely think about nature will not impact nature connectedness the most; instead, it matters *what* they are thinking about in the context of nature. This closely parallels calls to go beyond mere contact in real-world attempts to increase nature connectedness (Lengieza et al., 2023); merely spending time in nature will not impact nature connectedness the most; instead, it matters what people are doing in the context of nature (e.g., Passmore & Holder, 2017).

Finally, the individual analyses do highlight that the hedonic self-expansive effect might be somewhat elusive. Only in Study 2 was there a significant difference between the mundane and hedonic reflection on nature connectedness. Thus, while hedonia may have a positive effect on nature connectedness, variability in means across studies for hedonic reflection and the inability to consistently detect its effects in the present research indicate the effect may be somewhat tenuous. This possibility is consistent with research sometimes showing non-expansive qualities of hedonic phenomena, such as weaker associations with elevating experiences (Huta & Ryan, 2010), stronger associations with self-centeredness (see Steger, 2016, pp. 175–182) and focusing on the self rather than on others (Stellar et al., 2017). Moreover, in Study 3, both experienced eudaimonia and experienced hedonia predicted nature connectedness when controlling for each other. Yet, in the work that this paper extends, hedonic affect no longer had an effect when controlling for eudaimonic affect (Lengieza et al., 2021). This inconsistency further highlights the instability of hedonia's self-expansiveness (and the stability of eudaimonia's). Ultimately, the tenuous nature of the relationship between hedonia and self-expansiveness, and nature connectedness specifically, seems to warrant further investigation into the nuances and boundary conditions of the association.

One possible boundary condition suggested by the present findings is pre-existing levels of nature connectedness. Specifically, the combined analysis suggests that the degree to which different types of positive experiences have distinct effects may depend upon the characteristics of the reflector. That is, for individuals already connected to nature relative to the sample (>.22 SD), there was not much of a difference between the self-expansive effects of eudaimonia and hedonia in terms of nature connectedness. However, hedonia seemed to have a weaker effect than eudaimonia amongst individuals who were not already connected to nature. Thus, it is possible that the reason hedonia had a somewhat tenuous effect was because it worked differently for different people.

One possibility for this effect is that eudaimonia is self-expansive across all levels of nature connectedness, whereas hedonia is less able to make those who are not already connected to nature feel more connected. In other words, eudaimonia might work for everyone, and hedonia might only work for those who already feel connected. Another possibility, however, is that hedonia becomes indistinguishable from eudaimonia for people who are already connected to nature. That is, for someone who is already somewhat connected, a hedonic reflection might effectively be eudaimonic. In contrast, for someone disconnected, a hedonic reflection might be distinctly different from a eudaimonic reflection. Both possibilities would be an interesting topic of study.

8.1. Limitations and future directions

8.1.1. Authenticity

As noted above, authenticity seems not to have a self-expansive effect in terms of nature connectedness. However, before forming a final conclusion on the self-expansive properties of authenticity, future research investigating the nuances of authenticity as it relates to eudaimonia might be valuable. For example, our manipulation primarily had participants focus on being their "true self." However, this may not be the manifestation of authenticity *necessary* to bring out eudaimonic experiences. For example, Waterman (2011) discusses authenticity in terms of "personal expressiveness". Symbolically, the opportunity to *express* oneself seems to be a more expansive orientation than focusing on being your true self—which, admittedly, seems inherently self-centered.

Similarly, autonomy (Weinstein et al., 2011) is discussed in a way that is more consistent with freedom from undue external pressures to do something inconsistent with oneself. Once again, *freedom from pressure* seems more symbolically expansive than directing attention to a relatively concrete sense of your *true self*. Thus, if the manipulation of authenticity were instead "how this experience would allow you to express yourself" or "how this experience would give you freedom from pressure to be someone you are not", it may increase expansiveness relative to "how it would allow you to be your true self".

Such research not only has the potential to further clarify how eudaimonia impacts nature connectedness but also has the potential to inform our understanding of eudaimonia in general. If we find that reflecting on self-expressive or autonomous experiences results in greater eudaimonic experiences (e.g., eudaimonic affect, self-reported ratings of eudaimonia) and self-expansive outcomes (e.g., nature connectedness), in comparison to reflecting on true-self experiences, then it may suggest that greater precision in defining the components of eudaimonia is necessary.

8.1.2. Generalizability

As is the trade-off with any convenience sample relying on college students, there are some limitations to the potential generalizability of the effects uncovered in this set of studies. First, the age range of participants was quite narrow. Participants in all three studies were all young adults in a very specific period in their lives (i.e., college). It is possible that if one sampled from a broader range of ages, they might find different effects. However, the differences in those effects are somewhat hard to predict.

On the one hand, older adults may have had more time to accrue a solid understanding of what is and is not eudaimonically important to them (e.g., meaningful), which could lead to an exaggeration of the difference between eudaimonia and hedonia because older adults would potentially have more content to reflect upon in the eudaimonic reflections. Framed from the opposite angle, what is hedonic and eudaimonic for college-aged students might be more similar than at a later point in life. On the other hand, however, almost by the same logic, if college students have not had as much time to accrue eudaimonic experiences, they may have a greater drive to fulfill the *need* for eudaimonic experiences (e.g., search for meaning; Frankl, 1985; see Steger, 2016, pp. 175–182). This would potentially make eudaimonic reflection more impactful in this group (e.g., because they may be more sensitive to it). Further still, on the third—exclusively proverbial—hand, college students are at a transitionary time in their life filled with change and meaning-making, which, once again, may prime them to be more receptive to eudaimonic ideas. The variety of possibilities highlights that research investigating these processes across the lifespan is both valuable and necessary to understand how eudaimonic experiences affect nature connectedness and, more generally, the expansiveness of the self.

In addition to age, the samples contained more women than men. However, the influence of gender on connectedness is small at best (e.g., trivial correlations here; see Lengieza & Swim, 2021b, for a review), and it seems unlikely that gender overly influenced the results of these studies.[4] Still, it *is* possible that the disproportionate number of women in these studies may have influenced the findings. Therefore, future research should investigate these processes in more representative samples with a balanced gender distribution.

Finally, beyond considerations of sample, it is worth acknowledging the contextual generalizability of these findings. In this study, participants were asked to imagine an experience that explicitly involved nature. Thus, while these results seem directly applicable to eudaimonic experiences in nature, it is unclear whether non-nature-based eudaimonic experiences would likewise influence nature connectedness.

On the one hand, if eudaimonic reflections prime *receptivity* to self-expansion generally (e.g., temporarily make the self more permeable), it would suggest that nature- and non-nature-based eudaimonic reflections would potentially both lead to nature connectedness. Such an effect would be consistent with the indirect effect of eudaimonic reflection on both connection to nature and humanity, which occurred following reflections that were not exclusively nature-based (Lengieza et al., 2021). Additionally, other popular predictors of nature connectedness, such as meditation, are effective in (Unsworth et al., 2016) and out of nature (Adventure-Heart & Proeve, 2017), highlighting that predictors of nature connectedness *can* operate in non-nature-based contexts.

On the other hand, if eudaimonic reflections function to directly integrate specific targets in the self, it would be less likely that the self would expand to include nature without nature being part of the eudaimonic experience. In essence, one possibility is that eudaimonia softens the self, indiscriminately allowing other entities to become integrated. The other possibility is that eudaimonia pulls specific entities into the self. Thus, future research exploring the causal effect of eudaimonic experiences on nature connectedness—and other forms of self-expansiveness—in other contexts is much needed.

8.1.3. Small effects

Finally, it is worth acknowledging that the effects uncovered here are undoubtedly small. However, the primary purpose of this research was to serve as basic research demonstrating that such effects can, indeed, occur under ideal circumstances. That is, the effects demonstrated here are important for *theory* because they suggest that eudaimonic experiences do *cause* the self to expand. Moreover, the presence of a detectable effect on nature connectedness after a simple randomly-assigned 5-min reflection can be viewed as an alternative metric of importance (see Prentice & Miller, 1992). The effect occurred after a rather minimal manipulation of eudaimonia (i.e., a 5-min imagined reflection). Relative to finding the same size effect following an extensive and highly-involved week-long intervention, the uncovered effect of the reflection is comparatively more impressive (Prentice & Miller, 1992). The simplicity of the effect also makes it more likely that such experiences could occur organically and repeatedly in everyday life and may accumulate to create a much larger practical effect (Abelson, 1985). In

[4] A combined analysis exploring for interactions between gender and the type of reflection revealed no significant interactions.

other words, if 5 min of reflection on a hypothetical experience causes the self to expand to include nature, then one may wonder just how large an effect might occur following repeated eudaimonic experiences over the course of a week, such as camping with loved ones. Attempting to study such effects *in-situ*, perhaps with a longitudinal design, would be an interesting and valuable line of future research.

8.1.4. Other pro-collective outcomes

One of the implications of this research implied by the introduction is that eudaimonia may contribute to pro-collective outcomes (i.e., pro-social or pro-environmental behavior). Here, there is promising evidence that eudaimonic experiences can lead to increased nature connectedness which, itself, is robustly associated with pro-environmental behavior (see Mackay & Schmitt, 2019; Whitburn et al., 2020). *This*, more generally, suggests that eudaimonic experiences may lead to down-stream pro-collective outcomes (i.e., prosocial and pro-environmental; see Lengieza et al., 2021). Now, with preliminary causal evidence that eudaimonic experiences can lead to connectedness, a valuable next step in this line of research will be to investigate whether the effect of eudaimonia on connectedness spills into other, more concrete pro-collective outcomes (e.g., charitable behavior, pro-environmental behavior, etc.).

8.2. Conclusion

Life is filled with positive experiences, many of which are eudaimonic. Based on the present research, it appears that such experiences have the potential to cause the self to expand to include nature. Importantly, this may be most true for eudaimonic experiences that heavily feature personal meaning and growth, in particular. Moreover, these effects seem to go above and beyond the fact that eudaimonia reflects a form of positive experiences (i.e., hedonia has a weaker and distinct effect). Eudaimonic experiences, therefore, may, indeed, be able to cause us to expand our sense of self to include nature. This means that it is likely important to consider building eudaimonic experiences into efforts and programming designed to increase nature connectedness.

Author statement

Michael Lengieza: Conceptualization, Methodology and Survey Design, Data curation and Analysis, Writing.

Compliance with ethical standards and informed consent statement

This research was conducted with approval from institutional ethics boards, and informed consent was received from participants prior to their participation.

Declaration of competing interest

The author has no conflicts of interest to report.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2024.102231.

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