Original Research

The Emotional and Cognitive Scale of the Human–Nature Relationship (ECS-HNR)

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Abstract

A bidimensional (cognitive–emotional) novel survey, the Emotional and Cognitive Scale of the Human–Nature Relationship (ECS-HNR), was designed and validated to measure Ecological Awareness (EAW) and Ecological Affectiveness (EAF) as vital aspects of the human–nature relationship. Data were collected in Chile between July and October 2019 from 474 participants ranging between 6 and 85 years old, using the snowball sampling technique. To examine the properties of the ECS-HNR we analyzed the results in terms of its content validity, reliability, factor structure, convergent validity, and discriminant validity. The ECS-HNR comprises 24 items divided into two subscales with three subscales each (EAF: Empathy, Enjoyment, and Connectedness; EAW: Understanding, Appreciation, and Perception). The results demonstrated that the ECS-HNR is a reliable instrument, as items (the two scales and their subscales) exhibited an acceptable internal consistency. Our findings demonstrate that the ECS-HNR allows the integration of both dimensions of the human–nature relationship and is appropriate to evaluate attitudes and feelings toward nature.

Keywords

ecological affectiveness, ecological awareness, connectedness, enjoyment of nature, Anthropocene, GeoHumanities

Introduction

Humans seem to be more disconnected from nature than ever before. The accelerated development of technology and the growth of the human population have contributed to a fast-evolving colonization of new environments (Henn et al., 2019), which has resulted in an unprecedented concentration of humans in densely populated areas. From an environmental point of view, this has naturally influenced the ways in which people relate to nature and in which they exploit and manage natural resources. This overwhelming global impact of humans on their environment has characterized the current historical period of human existence, accurately coined as the Anthropocene Epoch (see Lewis & Maslin, 2015). The concept of the Anthropocene not only refers to the environmental impact (or changes) of human activities on virtually all terrestrial environments (e.g., Khazaei et al., 2019) but also to the new ways in which humans interact with the natural world (see Moran, 2016). In this regard, the development of large-scale and densely populated urban and suburban environments has quickly pushed natural areas to the boundaries of human-occupied territories, sometimes to the point of extinction of natural spaces.

The fact that a large proportion of the human population lives in environments with little or no contact with natural environments at all (e.g., Kesebir & Kesebir, 2017) has resulted in a growing detachment of humans from natural environments. Pyle (1978) refers to this as the "extinction of experience" because the phenomenon results in people's poor awareness of and disaffection toward nature (Soga & Gaston, 2016). This "nature-detachment," that is, the feeling of not being part of nature, dominates the collective attitudes and ways of thinking and perceiving nature, particularly in Western societies (see Kesebir & Kesebir, 2017). As a result, this situation has exacerbated a utilitarian mindset toward nature, where nature itself is viewed only as a provider of resources for humans (e.g., Swart & Zevenberg, 2018). But the human–nature (henceforth, HN) relationship has not always been a utilitarian one. In fact, the HN relationship was somehow a "close" one during the first 2 million years

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of human existence (Kahn, 1999), when nomadic clan-style early humans roamed through the flatlands of Africa during the Pleistocene (consider Stringer, 2016). Until before the development of technology and particularly the establishment of a sedentary lifestyle, human populations were mainly constrained by environmental conditions, and nature and humans coexisted in a sustainable/harmonious balance of natural resource use (McNeill, 2019).

Against the backdrop of this ancestral connection, and in spite of the modern detachment between humans and nature, the HN relationship can still be understood as a primitive human necessity. As Wilson (1984) explains in the biophilia hypothesis he proposed, as a living organism humans are intrinsically compelled to share time and physical space with other living organisms (see, for example, Bacher et al., 2016; Røskaft et al., 2007). Guided by these conceptions, scholars have made exceptional efforts to understand the HN relationship, particularly using scales that examine different aspects of this relationship, such as affectiveness (e.g., Cheng & Monroe, 2012), connectedness (F. S. Mayer & Frantz, 2004), and environmental identity (Clayton, 2003). However, although the importance of understanding the HN relationship has been widely acknowledged in the literature, most scholarly efforts have focused on either one of the dimensions that are believed to constitute the HN relationship (see Nisbet et al., 2009; for a comprehensive review of studies see Ives et al., 2017). But, as all these studies put together show, individuals' relationship and behavior toward nature is guided by both their understandings and perceptions of nature (i.e., a cognitive component) and the way we feel toward nature (i.e., an affective component). We believe that if we develop a more thorough understanding of how people both perceive and feel toward nature, then we may understand how people behave toward nature to plan interventions that help us strengthen or build an affective bond with nature.

With this in mind, this study builds on the work of, in particular, Nisbet et al. (2009) and Cheng and Monroe (2012) to propose a scale that combines *and* further refines the components of the affective and the cognitive aspects of the HN relationship. Thus, drawing on previous scales that measure humans' connection to nature and understanding of the phenomenon, we created the Emotional and Cognitive Scale of the Human–Nature Relationship (ECS-HNR). The ECS-HNR is a self-reported attitudinal survey on the HN relationship that measures the degree of affectiveness and level of awareness of the Chilean population as a reflection of their relationship with nature. The scale includes the two dimensions (namely, Ecological Awareness [EAW] and Ecological Affectiveness [EAF]) that we believe support a comprehensive understanding of the phenomenon discussed above and that are reliable predicting variables of a positive attitude toward nature and its human-caused problems.

In what follows, we provide a review of the literature of these two dimensions of the HN relationship and present an exploratory validation study in which we examine the psychometric properties of the ECS-HNR in terms of its factor structure, internal consistency, convergent validity, and discriminant validity. Finally, we discuss possible uses of the scale in the context of a larger study undertaken by this team of researchers to (a) plan interventions that help promote the involvement of scientists and lay communities in scientific/artistic-interactive experiences in an effort to deal with the current environmental crisis (see Brand & Wissen, 2013), and (b) help develop EAW and EAF for the design of conservation strategies, such as sustainable development practices in education and policy-making, that aim to shorten the nature–culture divide.

Background

Before delving into the theoretical considerations for each dimension and subdimension of the proposed scale, two contributions this study hopes to make should be brought to attention. First, a point of departure from previous scales of HNR is that we view the behavioral and the experiential components not in themselves as *part* of humans' connection to nature but rather as the *result* of the influence/interaction between the emotional and the cognitive aspects of the HNR. Second, to reflect this understanding of the interaction between the emotional and the cognitive aspects of the HNR, the scale we propose constitutes a multidimensional measure rather than the often unidimensional consideration of the HNR. In this regard, the value of the proposed scale lies not only in the inclusion of several aspects of the HNR that have often only been regarded in isolation but also in how we combine these into this scale's dimensions and subdimensions to show this cognitive–emotional interaction. Thus, this scale will enable us to assess how each dimension (i.e., EAW and EAF) relates to specific outcomes, states, behavior, and/or experiences.

EAW in the ECS-HNR

Ecological and Environmental Awareness (henceforth, EAW) is a key element to assess the state of the HN relationship. While the terms ecological and environmental are used interchangeably for the purpose of this study, we define EAW here as "having knowledge about the things that are to be known or to be seen about the environment and paying attention to the things that should be comprehended" (see Erten, 2004 in Soydan & Samur, 2017, p. 80). EAW then refers to individuals' social consciousness in relation to the sphere of natural environment as perceived by humans (consider Wódz, 1995). Initially developed from the concept of environmental education (henceforth, EnvE), EAW has evolved toward a more postmodern perspective to incorporate empathic EnvE as a way to develop EAW (e.g., Wearing et al., 2017). In addition, the educational aspects of EAW have been incorporated into the concept of ecological sustainability (Ahmad et al., 2019), which considers aspects of

sustainability of ecological processes, in relation to the levels of EAW (e.g., Shobeiri et al., 2007). In this way, high levels of EAW have been observed to be strongly related to a number of psychographic and sociodemographic factors such as nature engagement during childhood and adulthood, involvement in growing food, and outdoor experiences (e.g., Bassi et al., 2019). Hence, considering how people perceive nature by measuring EAW in different types of human communities allows us to not only advance humans' understanding of the degree of people's awareness of nature but also help develop strategies that contribute to building a sense of involvement (Hinchliffe et al., 2005), empathy (Ampuero et al., 2015), or even affection toward nature (e.g., Van Der Hoeven Kraft et al., 2011).

In this light, we view EAW as a combination of human rational knowledge and intuition regarding the multidimensional nature of our environment (consider Capra, 1982). To measure EAW, then, we established three subdimensions that we believe capture the multidimensional nature of humans' awareness of nature, namely, understanding, appreciation, and perception, which are briefly described below.

Understanding nature. Understanding nature is an essential aspect of the cognitive dimension of the HN relationship, and the topic has been discussed from a wide variety of perspectives. On one hand, humans have often viewed nature as a provider of resources, rationalizing nature as a good (Barker, 2007) that can be managed and utilized for human profit (e.g., Low et al., 1999). This way of conceiving nature constitutes one of the basic principles of the currently dominating capitalist-based neoliberal society (Heynen & Robbins, 2005). Other perspectives of individuals' understanding of nature may come from an understanding based on spiritual beliefs (see Ashley, 2007), or from a more epistemological standpoint, as a "representation" built from the language of science (see Zwart, 2008). Moving away from such perspectives, the items of the scale that constitute this subdimension stem from a rather psychological perspective to include an often underexplored understanding of nature reflected in individuals' mindfulness of nature, that is, the way we perceive nature as a whole system where humans are part of and belong to (consider Wolsko & Lindberg, 2013).

Nature appreciation. Nature appreciation has shaped the HN relationship since the beginning of humankind. Since prehistoric times, nature appreciation has played an essential role in shaping the interaction between humans and their environment, as nature appreciation was mainly based on the simple assessment of how beneficial or harmful nature could be for the species' survival. With the establishment of sedentarism and the ability to modify our environment, human interaction with nature has shifted toward a more isolated and somehow disconnected appreciation of nature. Nature appreciation, then, began to gradually incorporate more anthropocentric ideas perceived as unique values of nature, such as mystery (e.g., Godlovitch, 1994), religiousness or spirituality (see Brady, 1998), beauty (e.g., Capaldi et al., 2017), and an inspiration for artistic expressions (see Hepburn, 2019). Thus, driven by such aesthetic values (rather than scientific criteria), the concept of scenic beauty (see Wood, 2017) has evolved to become highly prevalent in modern times and has been responsible for the creation of protected areas in modern Western societies (e.g., Ribe, 2002). Despite this growing way of appreciating nature, which has also often been incorporated into most modern versions of HNR scales, the items of the scale included in this subdimension reflect ways of valuing and appreciating nature from a utilitarian point of view, as we believe this is still the dominant perspective in today's society.

Perception of nature. Individuals' perception of nature can be considered a highly complex phenomenon influenced by a range of sensorial (e.g., sight and smell) and nonsensorial components, such as cultural beliefs of nature (Storch, 2011), their personal experiences related to nature (Broderick, 2007), and moral and ethical principles guiding their perceptions (Nielsen, 2004), among others. Very importantly, people's perception of nature has also been related to the development of cognitive functions such as learning (Hyun, 2005) and memory (Taylor, 2008) because it triggers the development of strong observational skills (Johnston, 2009). Sagarin and Pauchard (2012) go on to reflect on the importance of children's exposure to nature as a way to develop a connection with nature, and to stimulate and train their observational skills. Such skills, they explain, allow for "rapid information acquisition and pattern-finding ability, thus setting the basal conditions to be able to construct synthetic perceptions of complex ecologies" (Sagarin and Pauchard, 2012, p. 152). This kind of perception of nature has been used to tackle environmental issues, such as habitat destruction (P. Mayer, 2006), pollution, or the spread of invasive species (Ladle & Gillson, 2009), and it is used in this study as the baseline for the construction and selection of items for this subdimension of the scale.

EAF in the ECS-HNR

Ecological (and Environmental) Affectiveness (henceforth EAF) is here understood as the development of an array of emotions and feelings (i.e., affective factors) toward nature, including our love of nature (Kellert, 2002), emotional reactions to environmental changes (Bondi et al., 2005), the feelings stemming from a sense of being part of nature (Kellert, 2002), the sense of "socio-territorial belonging" (Pollini, 2005), and other kinds of cosmovisions relating to nature (consider Ishizawa, 2006). These feelings may contribute to the development of positive attitudes and the emergence of positive emotional reactions toward the independent requirements of living organisms and attributes of nonliving elements of the natural world. Along these lines, the relevance

of making this the second dimension of our proposed scale rests on the fact that affectiveness has been found to positively influence and promote conservation through the sustainable use of natural resources (e.g., Hosseini, 2011), an overarching aim of the larger research project in which the creation of this scale is embedded (consider section "Method"). In this light and for the purpose of this study, we have established three subdimensions—namely, empathy, enjoyment, and connectedness—as expressions of affectiveness.

Empathy for nature. Not surprisingly, a number of studies have shown that by helping to develop empathy for nature people report higher levels of engagement with environmental problems (e.g., Berenguer, 2007) and positive attitudes toward nature (e.g., Cheng & Monroe, 2012), which is why including empathy as one way in which we measure affectiveness is very valuable. In this study, we depict empathy for nature as a unifying construct (see Musitu-Ferrer et al., 2019) that involves not only emotional but also cognitive processes that trigger different feelings of caring about nature's well-being or destruction (see Wesley-Schultz, 2000).

Enjoyment of nature. As an expression of affectiveness, enjoyment of nature is here viewed as the values and feelings that emerge from one's contact with nature. Thus, these values and feelings may be connected to the enjoyment of, for example, doing outdoor activities and adventure sports (Marques et al., 2017), for which nature becomes a source of, for instance, positive emotions (see Milton, 2003), and inspiration in arts (Eisenberger et al., 2010). In this context, we view enjoyment of nature as a pivotal aspect of the HN relationship that can boost intervention efforts of conservation of natural areas and threatened species (Milton, 2003).

Connectedness to nature. The concept of connectedness refers to the idea of having a bond or being in touch with something and has been examined in different ways in the fields of geography (see Koylu et al., 2014) and environmental studies (Restall & Conrad, 2015), among others. Moreover, a number of studies have shown that connectedness plays an essential role in the HN relationship. For example, Schutte and Malouff (2018) in a meta-analysis involving students and general members of the community carried out to examine the HN relationship found a strong correlation between connectedness and mindfulness. Also authors such as Arendt and Matthes (2016), and Barbaro and Pickett (2016) have established strong relationships between connectedness, mindfulness, and pro-environmental behaviors, demonstrating that connectedness to nature plays a major role in the HN relationship and, therefore, is a valuable dimension to incorporate into any scale that examines this relationship (e.g., Pasca et al., 2018). In regards to the scale proposed here, we draw on environmental and psychological studies to view connectedness to nature as a feeling of physical and/or emotional connection that humans feel with biotic and abiotic elements (see Beery et al., 2015).

Having described the dimensions and subdimensions that constitute our proposed scale, it should be highlighted that to our knowledge only a few studies have contributed to exploring the HN relationship in, particularly, Chile, where this study has been developed (see, for example, Pavez-Soto et al., 2016). These studies have, however, also relied (as discussed for other studies reviewed so far) on the exploration of unidimensional approaches to the HN relationship (consider Fernández & Wu, 2018; Pino et al., 2015). In this context, this proposed scale provides an innovative instrument to measure the emotional *and* cognitive dimensions of the HN relationship in Chile as well as in other contexts. In what follows, we describe the methods and results of this exploratory validation study of the ECS-HNR.

Method

Design

To begin with, it is worth mentioning that this scale is part of a broader project that aims to develop a novel approach to shorten the nature–culture divide through a creative and productive interaction within GeoHumanities approaching contested aspects of sustainability and co-conservation within biosphere reserves in Chile—entitled *GeoHumanities and Creative (Bio)Geographies approaching sustainability and co-conservation by "rhizomatic immersion"* (Anillos SOC180040)—which was approved by the ethics committee of the Pontificia Universidad Católica de Valparaíso (BIOEPUCV-H 299-2019). In particular, this survey was created with the aim of addressing the third specific objective of this 3-year project: namely, developing methodologies that help build EAW. The validated version of ECS-HNR will, for instance, be employed in the upcoming years of the study to investigate participants' perceptions of their relationship with nature after having participated in a number of interventions that will aim to build EAW.

Participants

A non-probabilistic sample composed of 474 participants took part in this study. It should be noted that even though our sample comprised individuals from different provinces of Chile, the majority of them were from Curicó (38.40%), Talca (21.31%), Santiago (13.29%), and Concepción (7.17%). Moreover, and though our sample included participants with different occupations, majority of them were university students (40.71%), professionals with different backgrounds (including engineers, school teachers, university lecturers; 23.63%), and technicians (12.03%). Regarding the participants' gender, 55.49% were females and 43.88% were males. Overall, 25% were 20 years old or younger,

51.48% were between 21 and 40 years old, and the remaining 30.00% were 41 years or older. Last but not least, it is worth clarifying at this stage that participants aged between 6 and 15 years represented only 4.43% of the total sample used in this study.

The ECS-HNR

The ECS-HNR is based on the work of, in particular, Nisbet et al. (2009, 2011), Cheng and Monroe (2012), Perrin and Benassi (2009), Wolsko and Lindberg (2013), and Ulrich (1983), which served as the backbone for the creation of this scale. Thus, while some items were adapted from these surveys and translated into Spanish following the guidelines proposed in Muñiz et al. (2013), Behling and Law (2000), and Hambleton et al. (2006), others were created to address the purposes of this study following reflections in, for example, Galafassi (1998), de Canales et al. (2014), and previous studies by the team (e.g., Lazzaro-Salazar, 2019). In all cases, the theoretical considerations described in the previous section informed the adaptation and creation of the items for this scale.

The ECS-HNR comprises 24 items divided into two dimensions (EAF and EAW) using a 5-point Likert-type scale ranging from 1 ("*strongly disagree*") to 5 ("*strongly agree*"), except for reverse scored items. In turn, the EAF section has three subdimensions: empathy (with four items), enjoyment (with three items), and connectedness (with four items). The EAW section is also made up of three subdimensions: understanding (with three items), appreciation (with six items), and perception (with four items). The first section of the survey involved sociodemographic information, specifically, gender, age, country of origin, city where participants live, and occupation. The ECS-HNR was administered in Spanish (see Online Appendix for original scale), but its items have been translated for the purposes of this article. In the following sections, we describe the processes by which the scale was reduced from its initial 65 items to 24 items in total.

Procedures

Data were collected between July and October 2019, and participants were approached in two ways. Participants between 6 and 15 years old responded to a printed version of the survey while participating in planned school activities of the Anillos project in the Environmental Refuge Centre of Biota Maule in the Altos de Lircay National Reserve, which is located in the commune of San Clemente in the province of Talca, VII Region of El Maule, Chile. Participants more than 16 years old were contacted following the snowball sampling technique, which involves contacting one participant or groups of participants and asking them to help recruit other potential participants (Goodman, 1961; see Author2, 2018). This sampling methodology is useful for stimulating participants' involvement in the study. The survey was administered in two ways: an online and a printed version. In the case of the online survey, potential participants were invited to fill it in by clicking on a link to Google® forms through posts on social networks, in WhatsApp® groups, and/or by email. Participants were only granted access to the survey once they have read the description of the project and had clicked "yes" on the informed consent form. The printed version of the survey was preceded by an informed consent that was signed by all participants, and it was administered by lecturers who volunteered to share them in class with students and by other participants who acted as gatekeepers (see Lazzaro-Salazar, 2019) and shared the printed version with, for instance, their families and friends. The responses to the survey were anonymous and any personal information that may allow identification of the participants is strictly confidential.

Analysis

The psychometric properties of the ECS-HNR were examined in terms of internal consistency, factor structure, convergent validity, and discriminant validity. First, we assessed the factor structure of the EAW and the EAF subscales by performing a principal component analysis with an oblique, Promax rotation. Furthermore, we examined the reliability of the dimensions of each subscale by calculating Cronbach's alpha coefficients (see Nunnally, 1978). Next, we followed the procedure in Fornell and Larcker (1981) and examined the convergent validity of the EAW and the EAF subscales by calculating the average variance extracted (AVE). As suggested by Hair et al. (2010), AVE values higher than .50 indicate a satisfactory convergent validity. Finally, we compared each dimension's AVE estimates with their respective shared variance estimates to assess the discriminant validity of the ECS-HNR.

Content Validity and Adaptation

Following the work of Nisbet et al. (as mentioned above), the original version of the ECS-HNR was composed of 65 items which underwent a process of content validation. The validity of content—understood as the degree to which the set of items that make up the scale constitute a representative sample of the content domain that is intended to be measured—was examined through expert judges (Lawshe, 1975; Tristán-López, 2008). This evaluation was carried out by four Chilean and international expert judges (a specialist in survey creation and validation, a psychologist, and two biologists, who hold PhDs in ecology, biology, human behavior, and public health) with extensive experience in the design and validation of surveys and in research on topics related to those of this scale. Following the recommendations in Escobar-Pérez and Cuervo-Martínez (2008), the judges completed a form that contained a brief description of the project

Table 1. Rotated Factor Loadings for the EAW Subscale.

Dimensions and items	Factor 1	Factor 2	Factor 3
Appreciation			
I don't like natural environments because I find them dangerous (*reverse scored*)	**0.71**	0.14	−0.07
The establishment of a natural reserve near my house prevents my personal development (*reverse scored*)	**0.70**	0.15	−0.13
I don't like natural / protected areas because they have many restrictions (*reverse scored*)	**0.67**	0.09	−0.09
Human beings have the right to use natural resources in the way we want (*reverse scored*)	**0.63**	−0.17	−0.06
Nothing I do will improve problems in other places on the planet (*reverse scored*)	**0.61**	−0.19	0.24
Animals and plants have fewer rights than humans (*reverse scored*)	**0.51**	−0.10	0.28
Perception			
I observe nature when I go to the mountain or the coast	0.03	**0.80**	−0.04
I observe nature when I am on vacation	−0.04	**0.80**	−0.12
I watch wildlife wherever I am	−0.05	**0.69**	0.20
I observe nature when I walk through a park in the city	0.03	**0.58**	0.18
Understanding			
I always think about how my actions affect the environment	−0.07	0.02	**0.87**
I have a deep understanding of how my actions affect the natural world	−0.06	−0.01	**0.84**
I recognize and appreciate the intelligence of other living organisms	0.14	0.16	**0.53**

Note. Boldface type indicates the factor under which the item loads most strongly in cases with multiple factor loadings. $N = 474$. KMO = 0.81. Bartlett's Test of Sphericity, $\chi^2(78) = 1{,}408.63$. EAW = Ecological Awareness; KMO = Kaiser–Meyer–Olkin.
$p < .0001$.

and its aims, a detailed description of the survey, a definition of each dimension of the scale, the expected results of its application, and a grid where the judges had to evaluate the clarity, coherence, and relevance of each item of the scale according to a 4-point Likert-type scale, ranging from 1 ("when the item did not meet the criteria") to 4 ("where the item absolutely met the criteria"). Although overall the scale was positively assessed, as a result of this stage of the study, 17 items were eliminated for having been negatively evaluated by at least three of the expert judges. Once the content validation process was finished, the ECS-HNR contained 48 items. Moreover, we followed some of the judges suggestions on lexical changes (such as changing *heridos* for *lastimados* when referring to animals in *I feel sad when animals are hurt and plants are harmed*), regarding those items that were highly valued in their evaluations.

Results

Factor Structure

As a preliminary step, we reverse scored all appropriate items and verified that our data were adequate for performing factor analysis by calculating Kaiser–Meyer–Olkin (KMO) Test for Sampling Adequacy and by running Bartlett's Test of Sphericity (see Note in Tables 1 and 2). We then conducted a principal component analysis ($N = 474$) to examine the underlying factor-structure of the EAW and the EAF subscales of the ECS-HNR. Because we expected the factors of each subscale to be moderately correlated, in both cases, we chose an oblique, Promax rotation ($k = 4$), although we also explored slightly less satisfactory orthogonal rotations (e.g., varimax).

Regarding the EAW subscale in particular, the results from the principal component analysis revealed that seven factors accounted for 55.34% of the total variance. We proceeded to eliminate all those items that either exhibited factor loadings lower than 0.30 or showed a very similar pattern of loadings across more than one factor (10 items in total). We then conducted a new principal component analysis with an oblique, Promax rotation ($k = 4$). The results revealed that three factors accounted for 52.69% of the total variance. It should be noted that Cattell's scree plot also indicated that a three-dimensional model was the most interpretable solution.

Table 1 displays the final 13 items of the EAW subscale grouped by factor and ordered by loading size. The first factor, which was named Appreciation, comprised six items (e.g., "I don't like natural environments because I find them dangerous," reverse scored) and accounted for 28.18% of the variance. This factor reflects the extent to which participants value nature and natural spaces. The second factor, which was labeled Perception, comprised four items (e.g., "I watch wildlife wherever I am") and accounted for 14.80% of the variance. It can be conceptualized as how participants perceive nature and what aspects of it they observe. Finally, the third factor, which was named Understanding, included the remaining three items (e.g., "I have a deep understanding of how my actions affect the natural world") and accounted for 9.71% of the variance. This factor reflects the extent to

Table 2. Rotated Factor Loadings for the EAF Subscale.

Dimensions and items	Factor 1	Factor 2	Factor 3
Connectedness			
I am not separated from nature, but I'm part of nature	**0.82**	0.13	−0.11
I feel that all the inhabitants of the Earth, human and nonhuman, share a common place	**0.77**	−0.17	0.07
I feel part of the nature that surrounds me	**0.74**	0.24	−0.11
I know that my daily actions have an impact on nature	**0.71**	−0.25	0.16
Enjoyment			
I enjoy doing outdoor activities at least once a week	−0.20	**0.81**	0.03
I like to be outdoors, even in bad weather	0.06	**0.76**	−0.12
When I feel sad, I like to go out and enjoy nature	0.04	**0.65**	0.16
Empathy			
People who pollute nature make me angry	−0.12	−0.14	**0.85**
I feel sad when animals are hurt and plants are harmed	0.14	−0.02	**0.66**
Taking care of plants and animals is important to me	0.08	0.26	**0.52**
I like to see wild animals living in their natural environment	0.05	0.24	**0.51**

Note. Boldface type indicates the factor under which the item loads most strongly in cases with multiple factor loadings. $N = 474$. KMO = 0.84. Bartlett's Test of Sphericity. $\chi^2(55) = 1{,}234.07$. EAF = Ecological Affectiveness; KMO = Kaiser–Meyer–Olkin.
$p < .0001$.

which participants' understanding of nature is reflected in their mindfulness of nature as whole system where humans are just a part of it.

Regarding the EAF dimension, the results from the principal component analysis indicated that six factors accounted for 54.48% of the total variance. In total, 14 items were eliminated from this subscale because they either exhibited factor loadings lower than 0.30 or showed a very similar pattern of loadings across more than one factor. We then proceeded to run a new principal component analysis with a Promax solution ($k = 4$). The results demonstrated that three factors accounted for 56.43% of the total variance. It should be noted that Cattell's scree plot also revealed that a three-dimensional model was the most interpretable solution.

Table 2 shows the final 11 items of the EAF subscale grouped by factor and ordered by loading size. The first factor, which was named Connectedness, comprised four items (e.g., "I feel that all the inhabitants of the Earth, human and nonhuman, share a common place") and accounted for 34.21% of the variance. This factor can be conceptualized as a feeling of physical and/or emotional connection that humans feel with biotic and abiotic elements. The second factor, which was labeled Enjoyment, included three items and accounted for 12.59% of the variance. It reflected the extent to which individuals feel joy or pleasure when being in contact with nature or natural environments and comprised items such as "I like to be outdoors, even in bad weather." Finally, the third factor, named Empathy, comprised the remaining four items of the subscale (e.g., "I feel sad when animals are hurt and plants are harmed") and explained 9.62% of the variance. This factor can be understood as those feelings of caring about nature's well-being or destruction.

Internal Consistency

We estimated the internal consistency of the EAW and the EAF subscales by calculating Cronbach's alpha coefficient for each of their respective dimensions (Nunnally, 1978). As shown in Tables 3 and 4, the reliability estimates ranged from .71 to .73 and from .64 to .75 for the EAW and the EAF subscales, respectively. Most dimensions displayed Cronbach's alpha coefficients above the conventional level of acceptance of .70, which indicated an appropriate internal consistency (DeVellis, 2012). Only the Empathy and the Enjoyment dimensions exhibited reliability estimates that were slightly lower than .70. However, as argued by Loewenthal (2001), Cronbach's alpha coefficients above .60 might be acceptable in the early stages of development of an instrument.

Convergent Validity

To estimate the convergent validity of the EAW and the EAF subscales, we calculated the AVE for each of their respective dimensions. According to Fornell and Larcker (1981), the AVE estimate measures the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error. As shown in Table 5, AVE estimates ranged from .41 to .58 and from .42 to .58 for the EAW and the EAF subscales, respectively. Moreover, only two dimensions (i.e., Appreciation and Empathy) displayed an AVE

Table 3. Reliability Estimates and Descriptive Statistics for the EAW Subscale.

Dimension	Item	*M*	*SD*	Min	Max	α if the item is eliminated	α
Perception	PER 1	4.56	0.72	1	5	.70	.73
	PER 2	4.44	0.89	1	5	.69	
	PER 3	4.65	0.72	1	5	.64	
	PER 4	4.42	0.76	1	5	.65	
Appreciation	APP 1	3.78	1.18	1	5	.70	.71
	APP 2	4.50	0.84	1	5	.65	
	APP 3	4.22	1.16	1	5	.69	
	APP 4	3.93	1.10	1	5	.67	
	APP 5	4.28	1.01	1	5	.65	
	APP 6	4.11	1.10	1	5	.67	
Understanding	UND 1	4.57	0.71	1	5	.75	.71
	UND 2	4.33	0.77	1	5	.56	
	UND 3	4.15	0.86	1	5	.48	

Note. *N* = 474. EAW = Ecological Awareness; M = mean; SD = standard deviation; Min = minimum value; Max = maximum value; α = Cronbach's alpha coefficient. Items are shown in no particular order.

Table 4. Reliability Estimates and Descriptive Statistics for the EAF Subscale.

Dimension	Item	*M*	*SD*	Min	Max	α if the item is eliminated	α
Connectedness	CO 1	4.56	0.66	1	5	.73	.75
	CO 2	4.51	0.81	1	5	.71	
	CO 3	4.54	0.69	1	5	.67	
	CO 4	4.42	0.81	1	5	.65	
Enjoyment	ENJ 1	4.12	1.01	1	5	.55	.64
	ENJ 2	4.29	0.90	1	5	.53	
	ENJ 3	4.03	0.97	1	5	.55	
Empathy	EMP 1	4.57	0.87	1	5	.63	.64
	EMP 2	4.64	0.68	1	5	.55	
	EMP 3	4.48	0.79	1	5	.54	
	EMP 4	4.67	0.70	1	5	.58	

Note. *N* = 474. EAF = Ecological Affectiveness; M = mean; SD = standard deviation; Min = minimum value; Max = maximum value; α = Cronbach's alpha coefficient. Items are shown in no particular order.

value that was slightly lower than the conventional level of acceptance of .50 (see Hair et al., 2010). Taken together, these findings suggested that the ECS-HNR exhibits a satisfactory convergent validity.

Discriminant Validity

To assess the discriminant validity of the ECS-HNR, we compared each factor's AVE with its shared variance estimates (see Hubley, 2014). The shared variance between two factors represents the extent to which the variation of both factors tends to overlap, and it is measured by calculating the square of the correlation coefficient. Discriminant validity is demonstrated if each factor's AVE is greater than its squared correlations (i.e., shared variance) with other factors (see Fornell & Larcker, 1981). As shown in Table 5, AVE estimates were, in all cases, greater than shared variance estimates. Thus, these findings demonstrated the discriminant validity of the ECS-HNR.

Discussion and Conclusion

The purpose of this study was to develop an instrument that adequately assessed both the cognitive and affective aspects of the HN relationship, which we called the ECS-HNR, and to, subsequently, examine its psychometric properties in terms of its factor structure, internal consistency, convergent validity, and discriminant validity. First, the results demonstrated that the ECS-HNR is a reliable instrument as most dimensions of both of its core subscales exhibited an acceptable internal consistency. In this regard, it should be noted that only two subdimensions (i.e., Empathy and Enjoyment) exhibited reliability estimates that were slightly lower than .70. Because the original survey included 48 items (after undergoing a content validation process), its length might have affected the extent to which some of the participants were consistent when providing their responses. Thus, future studies should further test the internal consistency of the subscales using the final 24-item version of the ECS-HNR. In

Table 5. Convergent and Discriminant Validity of the Emotional and Cognitive Scale of the Human–Nature Relationship (ECS-HNR).

Dimensions	*M*	*SD*	1	2	3	4	5	6	AVE
1. Appreciation	4.14	0.68	.71						.41
2. Perception	4.52	0.58	.23 (.05)	.73					.52
3. Understanding	4.35	0.62	.28 (.08)	.44 (.19)	.71				.58
4. Connectedness	4.51	0.57	.37 (.14)	.45 (.20)	.56 (.31)	.75			.58
5. Enjoyment	4.15	0.73	.16 (.03)	.54 (.29)	.41 (.17)	.33 (.11)	.64		.56
6. Empathy	4.59	0.53	.24 (.06)	.53 (.28)	.57 (.32)	.49 (.24)	.40 (.16)	.64	.42

Note. $N = 474$. All correlations are statistically significant at the $p < .001$ level (two-tailed). Shared variance estimates are reported in brackets. M = mean; SD = standard deviation; AVE = average variance extracted. Items are shown in no particular order.

addition, future studies could administer a standardized version according to the age of the participants, incorporating questions that control elements such as social desirability.

Regarding the instrument's factor structure, the findings showed that the EAW subscale exhibited a three-dimensional structure (i.e., Appreciation, Perception, and Understanding). Similar results were found for the EAF subscale, which also showed a three-dimensional factor structure (i.e., Connectedness, Enjoyment, and Empathy). In this regard, both subscales showed enough reliability and validity to ensure that the questionnaire has relevant psychometric properties to explore the HN relationship. What is more, the results also showed that the ECS-HNR has adequate levels of convergent and discriminant validity.

All in all, our findings demonstrate that the ECS-HNR is a reliable and valid instrument to assess the affective and cognitive aspects of the HN relationship. In addition, this scale allows for the integration of these two dimensions, which may provide a departure point for the evaluation of not only attitudes and actions toward nature but also the effectiveness of the interventions promoted in different contexts, with the vision of curbing anthropocentric beliefs and actions and promoting a balanced and empathic relationship with nature and our environment. A further strength of this study is that this is the first scale applied in Chile to assess people's perceptions and feelings toward nature that can be applied and validated in other Spanish-speaking contexts. It also represents a useful tool applicable to a variety of research fields, such as, ecology, social sciences, public health, and environmental psychology, among others. In this context, we consider the ECS-HNR to be a suitable instrument to evaluate the impact of educational interventions in, for instance, the field of environmental education if the scale is, for example, applied after completing nature awareness-raising activities. Moreover, the scale is an easy-to-apply questionnaire that takes less than 20 min to fill in, allowing people of different ages (6–80 years), from different social, cultural, and geographical backgrounds to answer it.

A limitation of this study relies on the use of an exploratory approach to assess the psychometric properties of the ECS-HNR. In addition, and though nonrandom sampling is a standard procedure in the behavioral sciences that has been used in many validation studies in the past, it should be acknowledged that this sampling method precludes the possibility of extending the findings of the present research to the total population of Chile. Future studies should further test the psychometric properties of the scale using larger, more heterogeneous and more representative samples of individuals, and by adopting a confirmatory approach. Moreover, future research should also validate this English version of our scale in English-speaking contexts. Conducting studies of this nature will allow researchers to further test the cross-cultural validity of the ECS-HNR. Last but not least, future studies should also examine the nomological validity of our scale by analyzing how each of the proposed dimensions relate to other constructs of interest, including, for instance, nature-related behaviors.

Finally, yet very importantly, these findings contribute to advancing the current debate of the HNR in that it (re)positions aspects of ecological affection (such as connectedness with nature) back into the main stage of discussion. These two particular concepts have been lately under scrutiny within the HNR debate, because, according to some, they represent a westernized biased approach to the HNR that reinforces the separation between humans and nature (see Fletcher, 2017). In this regard, following Zylstra et al. (2019), we believe that enhancing affectiveness toward nature is an effective way to promote environmental education, and we hope this scale serves as a starting point to discuss the HN relationship during educational interventions in an effort to close the gap between HNR. Moreover, our study also contributes to refining the concept of connectedness with nature by showing its appropriacy as an affective rather than a cognitive dimension of HNR, understanding the interplay between cognitive and affective aspects of the HNR, and emphasizing the need to explore this relationship from a multidimensional perspective.

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Supplemental material

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