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Article *in* Journal of Environmental Psychology · December 2004

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The connectedness to nature scale: A measure of individuals' feeling in community with nature ☆

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Abstract

Five studies assessed the validity and reliability of the connectedness to nature scale (CNS), a new measure of individuals' trait levels of feeling emotionally connected to the natural world. Data from two community and three college samples demonstrated that the CNS has good psychometric properties, correlates with related variables (the new environmental paradigm scale, identity as an environmentalist), and is uncorrelated with potential confounds (verbal ability, social desirability). This paper supports ecopsychologists' contention that connection to nature is an important predictor of ecological behavior and subjective well-being. It also extends social psychological research on self–other overlap, perspective taking, and altruistic behavior to the overlap between self and nature. The CNS promises to be a useful empirical tool for research on the relationship between humans and the natural world.

1. Introduction

The topic of environmental sustainability may very well become the major social issue of the present century (Wilson, 2001). Current rates of population growth, consumption, and the use of nonrenewable resources are not sustainable (Oskamp, 2000); thus individual, societal, and structural changes on a fairly large scale will have to occur in the near future. Because issues of environmental sustainability are in large part about human choices and actions, psychologists have much to contribute to understanding and formulating how such change might occur.

To date, social psychologists interested in environmental sustainability have applied knowledge from the research literatures on attitudes (Kellert, 1993; Rauwald & Moore, 2002), persuasion (Gonzales, Aronson, & Costanzo, 1988; Davis, 1995), commitment (Pallak, Cook, & Sullivan, 1980; Werner, Turner, Shipman, & Twitchell, 1995), normative influence (Aronson & O'Leary, 1982; Cialdini, Reno, & Kallgren, 1990), and incentives (Stern et al., 1985; Levitt & Leventhal, 1986). Early research in this field addressed very specific, local environmental issues, such as energy use in the home (Pallak et al., 1980), littering (Cialdini et al., 1990), and the re-use of materials (Burn, 1991; Heckler, 1994; Oskamp et al., 1994). However, more recent efforts have moved away from specific, localized approaches to broader reconceptualizations of our relationship to nature: cultural values (Stern & Dietz, 1994; Stern, 2000), how concern for nature can be increased through empathy (Schultz, 2000), and how our identity is shaped by the natural environment (Clayton & Opotow, 2003).

Although primarily nonempirical, ecologists and ecopsychologists have long theorized about humans' psychological relationship to the natural world. The importance of feeling connected to nature is an early theme in the writing of both ecologists (Leopold, 1949; Orr, 1994; Berry, 1997; Norberg-Hodge, 2000; Pretty, 2002) and ecopsychologists (cf. Roszak, Gomes, & Kanner, 1995; Roszak, 2001; Fisher, 2002). They have

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doi:10.1016/j.jenvp.2004.10.001

argued that this connection to nature is a key component of fostering ecological behavior. For example, the influential ecologist Leopold (1949) wrote years ago: 'We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.' Ecopsychologists (cf. Roszak et al., 1995; Roszak, 2001; Fisher, 2002) have echoed Leopold's statement that feeling a sense of belonging to the broader natural community may be a prerequisite for increasing environmental protection. They argue for fostering ecological behavior through expanding our sense of self, for 'if the self is expanded to include the natural world, behavior leading to destruction of this world will be experienced as self-destruction' (Roszak, 1995).

Such an argument is inherently psychological, and also plausible in light of recent empirical work by social psychologists on interpersonal closeness, perspective taking, and altruism. The extent to which one includes another person as part of the self is a core operationalization of relationship closeness (Aron, Aron, Tudor, & Nelson, 1991). Further, as relationship closeness increases, so does empathy and willingness to help (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). Similarly, acts that lead to a greater self–other overlap, such as perspective taking (Davis, Conklin, Smith, & Luce, 1996; Galinsky & Moskowitz, 2000), also increase willingness to help (Coke, Batson, & McDavis, 1978). Among humans, then, expanding one's sense of self does lead to more empathic and altruistic behavior. In the empirical literature, however, this logic has never been extended to the context of the natural world.

Thus, measuring one's affective sense of connectedness to nature is important for empirical progress to be made on these issues. This article presents a scale designed to measure individuals' experiential sense of oneness with the natural world. We also begin to evaluate whether this sense of feeling connected to nature does in fact lead to ecological behavior. To place our scale in perspective, we will now examine three previous approaches to measuring humans' fundamental relationship with the natural world.

The new environmental paradigm (NEP) scale (Dunlap, Van Liere, Mertig, & Jones, 2000) is a 15-item self-report measure that aims to measure individuals' 'primitive beliefs' concerning their relationship to the natural world. These beliefs, which comprise an individual's worldview, are thought to form the basic core of individuals' belief systems, the foundational truths about self, the physical world, and social reality (Rokeach, 1968), and are thought to impact more specific attitudes and beliefs about environmental issues. Measuring these core beliefs is clearly important. However, the NEP is not an adequate measure of one's affective, experiential relationship to the natural world, for two reasons. First, it seems to measure cognitive beliefs rather than affective experience. For example, the item 'We are approaching the limit of the number of people the earth can support' taps a cognitive belief about environmental sustainability, not an emotional reaction to nature. Second, items such as 'Humans are severely abusing the environment' measure beliefs about humans in the aggregate, not the individual's personal relationship to nature.

Connectedness to nature has been discussed more directly by Schultz (2002, p. 67) as 'the extent to which an individual includes nature within his/her cognitive representation of self'. Schultz has used a single item measure, the inclusion of nature in the self (INS) scale (Schultz, 2001) to operationalize this construct. The INS consists of seven pairs of circles—labeled 'me' and 'nature'—that range from barely touching to almost completely overlapping. Respondents are asked to choose the pair that best represents their sense of connection to the natural world. However, as Schultz, Shriver, Tabanico, and Khazian (2004) note, single item scales cannot be assessed for reliability. Further, to complete the scale participants must have—or form—an abstract representation of their relationship with nature. People may not be able to accurately report their connection to nature at this abstract level.

Schultz, et al., (2004) have also used a modified version of the implicit associations test (IAT, Greenwald, McGhee, & Schwartz, 1998) to measure connectedness to nature. The IAT asks participants to categorize two different types of words using two keys on a computer. In this case, participants distinguish between words that suggest 'me' (I, mine) and 'not me' (it, their). They also distinguish between 'nature' words (animals, trees) and 'built' words (car, city). Participants perform these two kinds of categorization tasks simultaneously, once while pairing 'me' and 'nature' together on the same computer key, once while pairing 'me' and 'built' together on the same key. The extent to which one pairing is easier than the other indicates how implicitly associated 'me' is with 'nature'. This approach has much to recommend it, as it has been used to measure attitudes that have a strong affective component (reaction to insects, see Greenwald et al., 1998; racial attitudes, see Dasgupta & Greenwald, 2001) and does not rely on accurate self-report. However, researchers typically find startlingly low correlations between IAT scores and measures of relevant behaviors (e.g. Schultz et al., 2004), raising questions about what the IAT actually measures (Karpinski & Hilton, 2001). In addition, the computer apparatus needed to take the IAT makes it logistically more difficult to administer than paper and pencil measures.

In this paper, we present the connectedness to nature scale (CNS), a measure designed to tap an individual's affective, experiential connection to nature. The CNS

follows from Leopold's contention that people need to feel they are part of the broader natural world if they are to effectively address environmental issues. For Leopold, this meant understanding the extent to which people experientially view themselves as egalitarian members of the broader natural community; feel a sense of kinship with it; view themselves as belonging to the natural world as much as it belongs to them; and view their welfare as related to the welfare of the natural world.

The CNS scale is designed to be different from the empirical work reviewed above in several ways. Unlike the NEP and Schultz's conception of connection to nature, our measure is affective. Unlike the INS, it is a reliable, multi-item scale. And unlike the IAT, it is easy to administer and predicts behavior quite well. In five studies using both community and college samples, we demonstrate the internal consistency, unidimensionality, test–retest reliability, and convergent validity of the scale. We also show its ability to predict lifestyle patterns (Study 1), ecological behavior (Studies 2, 4, and 5), and curriculum decisions among students (Study 3).

2. Study 1

Study 1 had two aims. First, we wanted to test whether the items that comprise this scale have an internal coherence. Second we sought to establish both convergent and discriminant validity with theoretically related variables. Participants took the CNS, the NEP, and completed a series of questions describing their lifestyle patterns and time spent outdoors. Given our previous reasoning that feeling a sense of connectedness to nature should give rise to greater environmental concern, we predicted a moderate positive correlation between the CNS and NEP scale. However, because the CNS measures one's experiential, emotional connection to nature while the NEP focuses on more rational, cognitive beliefs about humans' relationship to the environment, we hypothesized different correlates. For instance, we expected that the amount of time participants spent in nature would be positively associated with their CNS score, but not their NEP score. After all, more time spent in nature should be associated with a greater sense of connection to it, whereas we do not expect that time spent in nature will impact, independently of CNS, individuals' estimation that humans can upset the balance of nature, their sense that there is a limit to growth of human societies, or their views of domination.

We also predicted that the CNS would predict ecological behavior better than the NEP. This prediction is based on three arguments. First, as suggested above, if individuals' sense of connectedness to nature is based on their direct experience of being in nature to a greater extent than NEP scores, then CNS scores should be more strongly associated with actual ecological behavior than NEP scores, since a variety of studies have demonstrated the impact that direct experience has on increasing attitudinal/behavioral consistency (see Fazio & Zanna, 1981). Second, research (Iozzi, 1989; Kals, Schumacher, & Montada, 1999; Pooley & O'Connor, 2000) also has demonstrated that an affective relationship with nature may have a stronger impact on ecological behavior than more knowledge-based information, such as the more rational, cognitively based NEP scale. Lastly, helping behavior, which in this instance can be viewed as ecological behavior, is impacted by the degree of 'we-ness' that exists between a person and the object of concern. Given this relationship, the CNS should clearly be a better predictor of ecological behavior than the NEP, for the CNS is fundamentally a measure of the 'we-ness' that individuals experience in their relationship with nature.

Additionally, Study 1 investigates ecopsychologists' argument that modern Western culture undermines our sense of belonging and a sense of being in community with nature. Ecopsychologists argue that modern life has led to a greatly decreased self-nature overlap, and that this fundamental change in our relationship to nature explains, at least in part, our slow response to the modern environmental crisis.

The magnitude of these modern changes should not be underestimated. For instance, Pretty (2002) estimates that for 350,000 generations humans lived close to the land as hunter–gatherers, and that a sense of belonging, place, and feeling embedded within the broader natural world characterizes these cultures. As illustrated in a description of an Inuit boy growing up in Northern Canada,

> You must be in constant contact with the land and the animals and the plants… When Gamaillie was growing up, he was taught to respect animals in such a way as to survive from them. At the same time, he was taught to treat them as kindly as you would another fellow person. (from Pretty, 2002, p. 8)

Only since the industrialization and urbanization of the Enlightenment have we moved away from close contact with nature.

One consequence of industrialization and urbanization is that we characteristically spend increasing amounts of time indoors in both our leisure and work life. In fact, Evans and McCoy (1998) estimate that we spend 90% of our lives within buildings. However, the hypothesis that increasing amounts of time indoors leads to a decrease in individuals' feeling a sense of connectedness to nature has not been tested in any empirical way. If time spent indoors correlates with

people's experiential sense of feeling connected to nature, this would provide initial support for ecologists' claim about the structural effects of modern life on individuals' sense of feeling connected to nature.

2.1. Method

2.1.1. Subjects

Sixty individuals (31 male, 29 female) ranging in age from 18 to 68 were approached in public places in the community of Oberlin. The average age was 31 years (S.D. = 13 years). Of this sample, 30 were students; occupations of the others ranged from homemaker to office worker to attorney. The sample was better educated than the general American public: 58% had completed some college, 21% had a bachelor's degree, and 20% had completed some graduate school. Twenty-three percent of participants grew up in a city, 57% in the suburbs, and 20% in rural areas.

2.1.2. Procedure

Potential participants were approached by a researcher, provided with a general verbal introduction to the study, and were then asked to volunteer to complete the survey. Those who agreed completed a questionnaire anonymously. They supplied basic demographic information, including gender, education level, age, and whether they grew up in a rural, suburban, or urban environment. In addition, all participants completed the following scales.

2.1.3. Connectedness to nature scale

This scale was initially developed in an Environmental Psychology Course. After reading Leopold's work and related approaches, the instructor and students generated a host of possible items. Items that seemed either to be redundant with other items, unclear, or not reflective of the general approach were then eliminated. The resulting scale consisted of 17 items designed to measure the extent to which participants generally feel a part of the natural world (see Appendix A). Participants responded on a 5-point scale, where 1 = strongly disagree and 5 = strongly agree. The reliability of the initial scale was fairly low, alpha = .72. This was primarily due to three items that had negative inter-item correlations. These three items were dropped, which increased the reliability considerably, alpha = .84. To ensure that the scale consisted of only one factor, we subjected the items to factor analysis (using a nonorthogonal rotated solution). In this data set and all others, three items (numbers 4, 12, and 14 in the final scale) were reversed scored before conducting factor analysis. Based on eigenvalues and the scree plot, we determined that a one-factor solution was best. The eigenvalue of the first factor was 5.29, explaining 38% of the variance. All items loaded on it positively, from .28 to .83, average factor loading = .61 (see Table 1). The next factor had an eigenvalue of 1.76, explained only 12% of variance, and had only two items (8 and 12) with loadings above .5. The mean score on the CNS was 3.65, S.D. = .64

Table 1
Studies 1–5: factor loading for individual items of the CNS

Item	Study 1	Study 2	Study 3	Study 4	Study 5
1	.680	.661	.769	.709	.767
2	.802	.799	.729	.593	.165
3	.728	.531	.561	.604	.487
4	.550	.535	.313	.436	.689
5	.587	.740	.633	.558	.787
6	.762	.335	.395	.606	.463
7	.341	.697	.624	.577	.511
8	.403	.429	.286	.431	.673
9	.829	.382	.659	.687	.472
10	.822	.242	.226	.671	.790
11	.667	.748	.694	.742	.218
12	.284	.569	.366	.392	.395
13	.470	.730	.594	.335	.282
14	.680	.607	.769	.443	.767

2.1.4. New environmental paradigm

The NEP, originally developed by Dunlap and Van Liere (1978) and recently updated (Dunlap et al., 2000), assesses "primitive beliefs' about the nature of the earth and humanity's relationship with it' (p. 427). Participants rate items such as 'Humans are severely abusing the environment' on a 5-point scale (1 = strongly disagree, 5 = strongly agree). The mean across all participants was 3.94, S.D. = .50. In this sample, the NEP was acceptably reliable, alpha = .75.

2.1.5. Lifestyle indices

A series of questions were devised to assess the extent to which participants had contact with natural settings. The first set of 15 lifestyle questions asked participants to reflect on what their 'typical day' was like. They were asked to respond to items such as 'My work keeps me indoors most of the day' (reverse scored) and 'I can see the weather outside from my office' on a 5-point scale (1 = strongly disagree, 5 = strongly agree). These items were averaged together for an index of *Lifestyle A*. The mean score was 3.39, S.D. = .59. A second set of questions (*Lifestyle B*) asked participants to describe how much time they spend in various locations (in front of a computer, in a car, outdoors) on a typical 'work day', ($M = 3.59$, S.D. = .32) on a 5-point scale (1 = not at all, 5 = a great deal). A corresponding third set of questions asked participants to indicate how much time they spent in various locations on a typical 'free day' ($M = 3.64$, S.D. = .41).

Table 2
Study 1: correlation between CNS, NEP, and lifestyle measures

Lifestyle index	CNS	NEP	CNS[a]	NEP[b]
(A) Typical day	.55***	.35**	.46***	.10
(B) Time spent/work day	.37**	.24*	.30**	.06
(C) Time spent/free day	.43***	.25*	.36**	.04

***$p<.001$, **$p<.05$, and *$p<.10$.
[a]Partialling out the effects of NEP.
[b]Partialling out the effects of CNS.

2.2. Results and discussion

2.2.1. Demographics

We used a series of one-way ANOVAs to determine whether different segments of the population scored differently on the CNS. For comparison purposes, we also looked for demographic differences on the NEP. There were no differences on either CNS or NEP scores due to level of education or childhood residence, F's<2.57, p's$>.15$, average $F = 1.54$. Age did not relate to either scale, r's$<.12$. However, while men ($M = 3.54$, S.D. $= .74$) did not differ significantly from women ($M = 3.76$, S.D. $= .47$) on the CNS, $F(1, 58) = 1.77$, n.s., there was a significant difference between men and women on the NEP, $F(1, 58) = 7.02$, $p<.01$. Women scored higher on the NEP ($M = 4.10$, S.D. $= .37$) than men ($M = 3.78$, S.D. $= .56$). This gender difference on the NEP has been observed before (Zelezny, Chua, & Aldrich, 2000).

2.2.2. NEP, CNS, and lifestyle indices

Not surprisingly, the correlation between CNS and NEP was high, $r = .52$, $p<.001$. Both the CNS and NEP were correlated with the three Lifestyle scales (see Table 2). In addition, we conducted partial correlations to determine the extent to which the variance in the lifestyle questions could be explained by the CNS or the NEP. Both the CNS and NEP related significantly to all three lifestyle scores. However, the correlations between CNS and lifestyle remained significant when controlling for NEP, while the correlations between the NEP and lifestyle were not significant when controlling for CNS (see Table 2). That this finding theoretically makes sense and adds further support to our argument that the CNS is measuring something different than the NEP.

3. Study 2

Study 1 provides evidence for the internal consistency of the CNS and evidence for the discriminant and convergent validity of the CNS with the NEP. Study 2 not only adds additional evidence for the internal consistency of the CNS, but also extends this work to the critical question of whether the CNS is actually associated with ecological behaviors and identity as an environmentalist.

Study 2 also attempts to place this research within the context of previous work on perspective taking and self–other overlap. As noted before, perspective taking leads to greater self–other overlap. Extending this to the natural world, we predicted that experiencing a greater sense of connectedness to nature would be positively related to the extent to which people take the perspective of the natural world. This may also be associated with individuals' chronic tendency to take the perspective of another person.

In addition, Study 2 seeks to further establish the discriminant validity of the CNS by examining its relationship to verbal and quantitative SAT scores and social desirability scores. We hypothesized that the CNS would not significantly correlate with these measures, as there is not theoretical reason to suppose that CNS is influenced by scholastic aptitude or self-presentational concerns. Also, a subset of participants was asked to take the CNS again, to establish test–retest reliability.

3.1. Method

3.1.1. Participants

Participants were introductory psychology students (42 males and 60 females) participating in research for course credit.

3.1.2. Procedure

Data were collected at several points in the semester: during a prescreening procedure on the first day of class, midway through the semester during class, and as part of a laboratory study.

3.1.3. Measures

The NEP (alpha $= .72$) and the CNS (alpha $= .84$) were administered during a mass-testing procedure on the first day of class. A nonorthogonal rotated factor analysis of the CNS (with negatively worded items reversed prior to factor analysis) again confirmed a one-factor solution. The first factor accounted for 35% of variance, with an eigenvalue of 4.96. All items loaded on it positively, from .24 to .80, average factor loading $= .57$ (see Table 1 for factor loadings). The next eigenvalue was 1.33, accounting for 9.5% of variance. Only three items (5, 8, and 12) had factor loadings over .5 on the second factor. The same scale was given a second time in class 2 months later (the number of students present at both testing sessions $= 65$). Reliability at this second testing was also high, alpha $= .82$.

The prescreening procedure also included two other relevant measures. First, participants completed two items designed to assess participants' identity as an

environmentalist (alpha = .74). These items were 'Environmental concerns outweigh all other concerns in my life' and 'I would call myself an environmentalist'; participants responded on the same scale used for the CNS. In addition, participants completed the seven items perspective taking subscale of the Davis Interpersonal Reactivity Index (1980) as a measure of dispositional perspective taking ability. The scale includes items such as 'I sometimes find it difficult to see things from the 'other guy's' point of view' (reverse scored) and 'I try to look at everybody's side of a disagreement before I make a decision'. Participants respond using a 7-point scale, where 1 = strongly disagree and 7 = strongly agree. The scale was reliable, alpha = .79.

A subset of these participants ($N = 65$) volunteered to participate in a laboratory study in exchange for course credit. In the laboratory portion of the study, participants were presented with an environmental dilemma. They read about a fictitious town in which a proposed courthouse would be built on protected public lands that provided habitat to a locally endangered species. In the description of the dilemma, equal numbers of arguments were presented in favor of building the courthouse (it would create needed jobs) and against (it would harm the town's eco-tourism industry). After writing open-ended responses to the dilemma, participants responded to six questions designed to measure the extent to which they viewed different perspectives to be important. For example, 'It is important to consider possible environmental consequences of the construction project like the fact that some plants and animals may die or suffer' assessed the extent to which participants believed the perspective of the environment was important. The item 'It is important to consider that the preservation of the woodland around Falton may stifle the economic growth of the town and reduce the convenience and effectiveness of the judicial system' assessed the extent to which participants believed the human perspective was important. Participants used a 7-point scale, 1 = 'strongly disagree' and 7 = 'strongly agree'.

This subset of participants was also asked how often they performed each of 24 behaviors relevant to environmental protection. Behaviors included 'turn off the lights when a room is vacant' and 'use Styrofoam or other disposable containers' (reverse scored). Participants responded on a 7-point scale with 1 = very rarely and 7 = very often. These items were averaged to form a single measure of ecological behavior; the scale was reliable, alpha = .79.

Additionally, participants completed the Marlowe–-Crown Social Desirability Scale (alpha = .59). They were also asked to report their SAT quantitative and verbal scores. Response rate for these two questions was unfortunately quite low ($n = 36$).

3.2. Results and discussion

The genders did not differ on CNS, $t(1\,0\,1) = 1.59$, n.s., and, in contrast to Study 1 and previous research, women also did not score higher on the NEP than men, $t(1\,0\,1) = .22$, n.s. Similar to Study 1, the CNS and NEP were observed to be moderately positively correlated with one another, $r = .35$, $p < .01$. The CNS time 1 and time 2 scores correlated highly, $r = .78$, $p < .001$[1].

Table 3 shows that when controlling for NEP scores, the CNS and ecological behavior correlate positively with each other. In contrast, the relationship between ecological behavior and NEP disappears when controlling for CNS. This finding provides support for Leopold's assertion that feeling a sense of connectedness to nature, and not simply our cognitive beliefs, shape how we treat the environment.

The CNS was also significantly associated with both the general perspective taking measure and the more specific measure of perspective taking for the environment, while the NEP was significantly associated with only the environmental perspective taking measure. Once again, then, the CNS and NEP are found to diverge from one another, and this particular divergence suggests why the CNS is related to ecological behavior, while when controlling for CNS the NEP is not.

Although the sample size is small and thus conclusions must be tentative, another interesting divergence between the CNS and NEP can be seen in their relationship to SAT verbal scores. The CNS is negatively correlated with verbal ability, while the NEP is positively correlated. This finding is also consistent with our argument that, in comparison to the CNS, the NEP is more of a knowledge-based, cognitive measure. As for SAT quantitative and social desirability scores, both the CNS and NEP were found to be independent from these measures.

Overall, then, the pattern of results provides strong support for the argument that the CNS is related to ecological behavior, and is not confounded with the extraneous influence of social desirability or scholastic aptitude. Moreover, these findings strongly argue that, although related, the CNS and the NEP are clearly distinct from one another.

4. Study 3

Study 3 makes a known-group comparison to establish the validity of the CNS and its ability to

[1]The war against Iraq began between Time 1 and Time 2, and may have influenced scores. To assess this possibility, we asked participants to indicate the extent to which they were influenced and disturbed by the war, and whether or not they agreed with the war. There was no relationship between the CNS at Time 2 and the answers to these questions, however.

Table 3
Study 2: correlations between the CNS, NEP, and environmental variables

	N	CNS	NEP	CNS[a]	NEP[b]
Ecological behavior	65	.44**	.20*	.42**	.15
Environmentalism	102	.56**	.23*	.53**	.04
Dispositional perspective taking	102	.37*	.11	.36*	.10
Environmental perspective taking	65	.50**	.32**	.47**	.32**
SAT verbal	36	−.23	.26	−.32*	.32*
SAT quantitative	36	.14	.16	.13	.05
Social desirability	65	.17	−.01	.17	−.03

**$p<.01$ and *$p<.05$.
[a]Partialling out the effects of NEP.
[b]Partialling out the effects of CNS.

predict real life decisions. Students enrolled in an introductory environmental studies class were compared to samples of introductory psychology, math, and chemistry students. We hypothesized that environmental studies students, who are motivated to study the connectedness of humans to nature, would score higher on the CNS than students in the other three areas of study.

4.1. Method

Students enrolled in introductory chemistry ($n = 27$), environmental studies ($n = 78$), math ($n = 44$), and psychology courses ($n = 121$) completed the CNS at the start of class. The total sample showed high reliability on the CNS, alpha = .82. A nonorthogonal rotated factor analysis of the CNS (with negatively worded items reversed prior to factor analysis) again confirmed a one-factor solution. The first factor accounted for 32% of variance, with an eigenvalue of 4.46. All items loaded on it positively, from .23 to .77, average factor loading = .54 (see Table 1). The next eigenvalue was 1.30, accounting for 9.2% of variance. Only two items (items 3 and 13) had factor loadings over .5 on the second factor. These items were not the same items that loaded onto the second factor in Studies 1 and 2.

4.2. Results and discussion

A one-way ANOVA was conducted comparing the four classes' scores to each other. There was a main effect of sample source, $F(3, 266) = 14.86$, $p<.001$. Scheffe comparisons revealed that environmental studies students ($M = 3.82$, S.D. = .48) had significantly higher connectedness to nature scores than chemistry students ($M = 3.4$, S.D. = .59, $p<.02$), math students ($M = 3.2$, S.D. = .55, $p<.001$), and psychology students ($M = 3.37$, S.D. = .62, $p<.001$). Those who chose to study environmental issues were indeed more connected to nature that those who chose to study other topics. This provides evidence that the CNS does in fact capture a personality trait relevant to real world decisions.

5. Study 4

Study 4 seeks to locate the CNS in relation to the more current work in psychology on subjective well-being. The biophilia hypothesis (cf. Wilson, 1984; Kellert & Wilson, 1993) argues that people have a biologically based need to affiliate with and feel connected to the broader natural world. This work emphasizes the psychological benefits associated with being exposed to nature (Kellert & Wilson, 1993).

A similar argument is made in mainstream social psychology for the need to belong to human groups (e.g. Myers, 2000). For example, Baumeister and Leary (1995) have proposed that individuals have a basic need to feel a sense of belonging, to feel like a valued member of a community. From an ecopsychological and biophilia perspective, however, this sense of belonging extends beyond our city limits (Roszak, 1995), and includes a sense of belonging to the natural world. If in fact people derive a sense of well-being from feeling connected to nature, those who are more connected should experience higher life satisfaction. We hypothesized that the CNS would correlate with life satisfaction.

Study 4 also investigates how the CNS relates the motivations behind ecological behavior. Stern and Dietz (1994) and Stern, Dietz, and Guagnano (1995) have identified three general value orientations (biospheric, altruistic, and egoistic) associated with environmental behavior. Biospheric values are related to concern for the natural world (e.g. plants, trees, and animals); altruistic values are related to concern for other people (e.g. family, community, and friends); and egoistic values are centered on self-concerns (e.g. one own personal well-being). Research support for the existence of these three general value orientations comes from a variety of sources (Thompson & Barton, 1994; Stern et al., 1995; Schultz & Zelezny, 1999; Schultz, 2000; Schultz, 2001), including a 14-country study by Schultz and Zelezny (1999). Because connectedness to nature involves feeling like an equal member of the ecological community, we hypothesized that biospheric values would correlate with the CNS, while the more human-centric altruistic and egoistic values would not.

5.1. Method

5.1.1. Participants

Members outside the college community served as our sample. There were 135 respondents total (31 men, 89 women, and 15 who did not disclose their gender). Their ages ranged from 14 to 89 years, with a mean of 36 years (S.D. = 19.) Twenty-two were college students. The

sample was predominantly Caucasian (89%), with 5% identifying as African America, 2% has Latino/a, and 4% as Asian.

5.1.2. Procedure

Members of the community were approached in public places (libraries, coffee shops, schools, etc.) by a researcher, who provided them with a general verbal introduction to the study. They were then asked to volunteer to complete the survey. Those who agreed completed a questionnaire anonymously.

5.1.3. Measures

Participants completed the CNS ($M = 3.52$, S.D. = .56, alpha = .79). A nonorthogonal rotated factor analysis of the CNS (with negatively worded items reversed prior to factor analysis) again confirmed a one-factor solution. The first factor accounted for 29% of variance, with an eigenvalue of 4.04. One item (item 8) had a weak, negative factor loading in the single factor solution ($= -.10$). All other items loaded on it positively, from .34 to .74, average factor loading = .56 (see Table 1). The next eigenvalue was 1.29, accounting for 9% of variance. Only two items had factor loadings over .5 on the second factor (items 10 and 11), and these were not the same items that loaded on factor 2 in the other three studies. Thus, there is no empirical support for a reliable second factor.

Participants also completed the NEP (alpha = .79), the ecological behavior scale used in Study 2 (alpha = .80), and the measures of environmentalism (alpha = .55) and consumerism (alpha = .68) used in previous research. They answered five items designed to measure life satisfaction (e.g. 'I am satisfied with my life') on a 7-point scale, 1 = strongly disagree and 7 = strongly agree. The scale was reliable, alpha = .84.

They also completed the general value scale (cf. Schultz, 2000), a measure of biospheric, altruistic, and egoistic motivations for environmental protection. In this measure, participants read 'people around the world are generally concerned about environmental problems… However, people differ in the consequences that concern them most'. They then rated each of 12 items (e.g. animals, children, and me) on a 7-point scale (1 = not important, 7 = supreme importance) in response to the prompt 'I am concerned about environmental problems because of the consequences for_'. Four items represented each of three value orientations. All three subscales were reliable, egoistic (alpha = .85), altruistic (alpha = .84), and biospheric (alpha = .93).

Finally, participants indicated where they grew up (rural, suburban, or urban environment), where they live now, their political orientation (liberal, moderate, and conservative), their income, and level of education.

5.2. Results and discussion

5.2.1. Demographics

Taking advantage of the community nature of our sample, we examined whether CNS scores differed on a variety of demographic measures. Once again there were no gender differences on the CNS, $t(118) = .56$, n.s. There was a slight tendency for liberals ($M = 3.85$, S.D. = .42) to scores higher on the CNS than moderates ($M = 3.59$, S.D. = .71) and conservatives ($M = 3.44$, S.D. = .66), but this was not significant, $F(2, 53) = 2.10$, $p = .13$. CNS scores did not differ as a function of income, but did differ among education levels, $F(5, 114) = 9.25$, $p < .001$. High school and college students ($M = 3.27$, S.D. = .53) were less connected to nature than those with college or graduate degrees ($M = 3.87$, S.D. = .48), $t(118) = 6.43$, $p < .001$.

5.2.2. Perspective taking, general value orientations, environmentalism/consumerism, and green behavior

Table 4 illustrates that, similar to Study 2, the CNS was significantly associated with the general perspective taking measure. In contrast to Study 2, however, the NEP was significantly but weakly associated with this measure after controlling for CNS. This divergence of the CNS and NEP is also highlighted in their relationship to the environmentalism and consumerism measures: controlling for NEP, CNS was still observed to be positively related to environmentalism and negatively related to consumerism. However, when controlling for CNS, the NEP was not significantly related to either of these measures. Lastly, in contrast to Study 2, in the present study both CNS and NEP related to green behavior when controlling for the other variable.

As expected the CNS was positively associated with the general biospheric value orientation, but not with the more human-centric altruistic and egoistic value

Table 4
Study 4: correlations between CNS and NEP with environmental values and behaviors

Measures	CNS	NEP	CNS[a]	NEP[b]
Perspective taking	.51**	.40**	.39**	.18*
Biospheric	.45**	.48**	.27**	.33**
Altruistic	.13	.07	.11	.00
Egoistic	−.07	−.29**	.09	−.29**
Environmentalism	.61**	.40**	.51**	.14
Consumerism	−.36**	−.27**	−.27**	−.12
Ecological behavior	.45**	.49**	.28**	.32**
Life satisfaction	.20*	.12	.17*	.03
Age	.33**[c]	.21*	.27**	.05

**$p < .01$ and *$p < .05$.
[a]Partialling out the effects of NEP.
[b]Partialling out the effects of CNS.
[c]$r = .02$ when education is controlled for.

orientations. The NEP was also correlated with biospheric value orientation. The CNS and NEP diverged, however, in that the NEP exhibited a negative relationship with the general egoistic value orientation while the CNS did not.

5.2.3. Life satisfaction

As predicted, the CNS correlated positively with the subjective well-being scale, but the NEP did not. It is also important to note that the magnitude of this correlation, although small, is similar to the magnitude for variables like marriage ($r = .14$, reported by Haring-Hidore, Stock, Okun, & Witter, 1985), education ($r = .13$, reported by Witter, Okun, Stock, & Haring, 1984), and income within countries ($r = .17$, reported by Haring, Okun, & Stock, 1984; $r = .12$, reported by Diener, Eunkook, Lucas, & Smith, 1993, in a nationally representative sample in the United States). In this context, then, various factors can be viewed as contributing to overall life satisfaction, and connectedness to nature appears to be as important a contributor as other variables more traditionally associated with subjective well-being.

6. Study 5

In Study 5, we compare the CNS to measures used in previous research (Schultz, 2001; Schultz et al., 2004) to measure connectedness to nature. As discussed earlier, Schultz has used the INS to measure connection to nature, as well as a version of the IAT. Because Schultz's conception of connection to nature is cognitive, whereas ours is affective and experiential, we hypothesized only moderate correlations between the CNS and the INS and IAT. In addition, we hypothesized that the CNS would predict ecological behavior better than the INS and IAT.

6.1. Method

6.1.1. Participants

Undergraduate psychology majors ($N = 57$) were invited to take part in a study on memory in exchange for $10. Computer data for 11 participants were lost due to computer malfunction; thus, only 46 people completed the IAT portion of the study.

6.1.2. Procedure

Data collection relevant to this study was embedded between the encoding and retrieval parts of a study on memory. Participants were run in groups of six, seated in front of a computer screen.

After viewing words on the computer, participants took the IAT, as administered by the software DirectRT. The stimulus words were identical to those used by Schultz et al. (2004). The reaction time data were prepared as described in Greenwald et al. (1998): extremely short (rt < 300 ms) or long (rt > 3,000 ms) reaction times were changed to 300 and 3000 ms, respectively, and reaction times for trials on which an error was made were deleted. No participant was eliminated due to excessive error rates (average error rate = 5.1%). All scores were log-transformed, and the difference between the me/nature trial and the me/built trial was calculated for each subject. Positive scores indicate a stronger association between 'me' and 'nature', while negative scores indicate a stronger association between 'me' and 'built'. The average IAT score = .22, S.D. = .19.

Upon completion of the IAT, participants completed the CNS, which showed acceptable reliability, alpha = .79. A nonorthogonal rotated factor analysis of the CNS (with negatively worded items reversed prior to factor analysis) again confirmed a one-factor solution. The first factor accounted for 32% of variance, with an eigenvalue of 4.51. All items loaded on it positively, from .17 to .79, average factor loading = .53. The next eigenvalue was 1.66, accounting for 12% of variance. Only three items (items 3, 8, and 14) had factor loadings over .5 on the second factor.

Participants also completed the general value scale used in Study 4. All three subscales were reliable, egoistic alpha = .82, altruistic alpha = .60, biospheric alpha = .84. Finally, they completed the INS and the ecological behavior scale used in Studies 2 and 4 (alpha = .74).

6.2. Results and discussion

The sample size of this study is relatively small for correlational techniques, so the results should be viewed as tentative. However, the data largely confirmed our predictions. The CNS correlated moderately with the INS ($r = .55$, $p < .001$) and marginally with the IAT ($r = .27$, $p = .07$). The INS and IAT were also marginally correlated, $r = .25$, $p = .10$.

Table 5 presents the correlations of the CNS, IAT, and INS with the three value orientations and ecological behavior. The CNS again correlated with biospheric values and with ecological behavior, but not with

Table 5
Study 5: correlations between CNS, IAT, and INS with ecological values and behaviors

Measures	CNS	IAT	INS
Biospheric	.35***	.24*	.28**
Altruistic	.18	−.05	.09
Egoistic	−.23*	−.01	.11
Ecological behavior	.39***	.19	.28**

***$p < .01$, ** $p < .05$, and* $p < .10$.

altruistic and egoistic values. As expected, the IAT did not correlate significantly with behavior. The INS, however, yielded a similar, albeit weaker pattern of correlations as the CNS. The results from this study are tentative, but the moderate correlation between the CNS and INS, combined with their similar pattern of correlates, suggests that the INS may prove to be an adequate measure of connection to nature when time and space are limited.

7. General discussion

Using both student and community samples, the combined findings from the five studies reported in this article provide strong evidence that the CNS is a reliable and valid scale. Besides the high test–retest consistency, the items comprising the scale repeatedly have been shown to load on a single factor and exhibit high internal consistency. The scale relates to other scales that are conceptually related (NEP, identity as an environmentalist, perspective taking for nature, INS, and IAT), but does not relate to potential confounds (verbal ability and social desirability).

The studies presented here also provide evidence for the coherence of Leopold's vision that feeling a sense of community, kinship, egalitarianism, embeddedness, and belongingness to nature are all aspects of a broader sense of feeling connected to it. They support Leopold's contention that connectedness to nature leads to concern for nature, as the CNS has also been shown to relate to a biospheric value orientation, ecological behavior, anticonsumerism, perspective taking, and identity as an environmentalist. Lastly, they suggest that personal well-being is linked to a sense of feeling connected to nature.

A general perspective of this work, then, is that if people feel connected to nature, then they will be less likely to harm it, for harming it would in essence be harming their very self. While we view this statement as generally true, it is worth noting that many people knowingly engage in self-destructive behavior. Additionally, people are also at times simply unaware that their actions are destructive. In other words, if an SUV driver really is unaware that his or her behavior is destructive to nature, then increasing this person's feeling of being connected to nature in all likelihood will have little if any impact on this person's driving habits. Nevertheless, our findings demonstrate that, in general, there is a moderately strong positive relationship between the CNS and eco-friendly actions, meaning that while this relationship may not hold for everyone, it does hold for most people and in a rather robust manner. Future research, however, does need to investigate the limiting conditions associated with this general perspective.

Another issue that future research needs to address concerns the relationship between the CNS and eco-friendly acts. At this time we have established that a significant positive relationship exists between these measures. Establishing a causal relationship between a person's sense of feeling connected to nature and eco-friendly acts is another matter, however. Additionally, it may very well be the case that there is a bi-directional relationship between these variables, such that feeling a connection to nature leads to eco-friendly acts and that eco-friendly acts leads people to feel more connected to the natural world. Furthermore, future research needs to elaborate on whether simply feeling a sense of connectedness to nature in itself leads to eco-friendly acts, or whether feeling connected to nature establishes the necessary condition that makes a request for eco-friendly acts more effective. While these alternative views of the relationship between connectedness to nature and eco-friendly acts are not mutually exclusive, clarification is called for.

Future research is also required to establish whether there is a causal path between connectedness to nature and life satisfaction. If connection to nature leads to greater subjective well-being, this would allow environmentalists to put a more positive spin on ecological behavior than the doom and gloom messages that warn the public to change or die. As excessively fearful messages often lead recipients to either engage in denial or to discount the message as being alarmist, a positive framing may in the long run provide a more effective means of promoting environmentally friendly behavior.

8. Conclusion

There is growing consensus that individuals in the Western world need to change their behavior and consumption patterns in profound ways to create an environmentally sustainable society. And while interventions aimed at specific environmental issues have been shown to be effective, increasingly it is also becoming apparent that the magnitude of the environmental problems we face necessitate a broader intervention aimed at changing our cultural worldview. The CNS is a tool for activists and researchers alike to monitor the extent to which they are effective in promoting these necessary changes. For example, the CNS is already being used to test the effects of situational factors and personality characteristics that might impact connection to nature (Mayer, Frantz, Norton, & Rock, 2003). It could also be used to evaluate whether interventions aimed at increasing the contact of children or adults with nature actually increase their sense of feeling connected to nature. Another potential application includes assessing the

impact of architectural factors, such as windows looking out onto natural settings, on connection to nature.

We also see the CNS as a vehicle that can bring the less research oriented discussion of ecologists and ecopsychologists into the research oriented realm of psychology. The collaboration of empirical approaches and ecopsychological perspectives promises to be fruitful for both disciplines. For example, our results add substance, persuasiveness, and clarity to the argument made by others (Roszak, 1995; Pretty, 2002) that aspects of our modern lifestyle relate to our sense of feeling connected to nature. Similarly, the ecopsychological perspective has something to offer more empirically minded researchers. Conceiving of the need to belong (Baumeister & Leary, 1995) more broadly as need for connectedness to others *and* to nature adds another dimension to the social psychological theorizing that broadens this perspective in important ways. That a sense of feeling connected to nature has now been shown to predict life satisfaction adds an empirical finding to a discussion that has lacked empirical facts. This finding highlights the psychological significance of the human–nature relationship not just for well-being of nature, but for humans as well.

Appendix A

Please answer each of these questions in terms of *the way you generally feel*. There are no right or wrong answers. Using the following scale, in the space provided next to each question simply state as honestly and candidly as you can what you are presently experiencing.

1	2	3	4	5
Strongly disagree		Neutral		Strongly agree

____1. I often feel a sense of oneness with the natural world around me.
____2. I think of the natural world as a community to which I belong.
____3. I recognize and appreciate the intelligence of other living organisms.
____4. I often feel disconnected from nature.
____5. When I think of my life, I imagine myself to be part of a larger cyclical process of living.
____6. I often feel a kinship with animals and plants.
____7. I feel as though I belong to the Earth as equally as it belongs to me.
____8. I have a deep understanding of how my actions affect the natural world.
____9. I often feel part of the web of life.
____10. I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'.
____11. Like a tree can be part of a forest, I feel embedded within the broader natural world.
____12. When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.
____13. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees.
____14. My personal welfare is independent of the welfare of the natural world.

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