Implicit connections with nature ☆

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Abstract

Previous research has suggested that attitudes about environmental issues are rooted in the degree to which people believe that they are part of the natural environment. Researchers have distinguished between egoistic concerns, which focus on self, and biospheric concerns, which focus on all living things. In the current paper, we argue that the type of concerns a person develops about environmental issues is associated with the extent to which the individual believes that s/he is part of nature. We argue that this connection is implicit, and exists outside of conscious awareness. Two studies are reported on the relationship between implicit connections with nature and explicit environmental concerns, and on the cognitive strategies associated with egoistic and biospheric attitudes. Study 1 reports the results from a modified Implicit Association Test (IAT) designed to measure the degree to which people associate themselves with nature. Results showed a moderate positive relationship between biospheric concerns and implicit connections with nature, and a negative relationship between implicit connections with nature and egoistic concerns. Study 2 replicated this basic effect, and also examined the test–retest (immediate, 1 week, and 4 weeks) reliability of the explicit and implicit measures. Results are interpreted within a broad model of environmental inclusion.
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1. Introduction

With each passing year, we are presented with more and more evidence that human behavior is adversely affecting the natural environment. Newspapers, magazines, television news shows, and every other form of media routinely convey information on a range of topics from pollution, to energy conservation, to global warming. Survey data indicate that a high percentage of people in the United States, and many other countries throughout the world, know about, and express concern for these issues (Dunlap, 1991; Dunlap, Gallup, & Gallup, 1993; Dunlap, Van Liere, Mertig, & Jones, 2000; Ray & Anderson, 2000). In this paper, we propose that the types of environmental attitudes a person develops are associated with the extent to which an individual believes that s/he is part of the natural environment. Data from two studies are presented on implicit connections with nature using the Implicit Association Test (IAT).

Before summarizing the previous research on this topic, it is useful to offer some definitions for the terms used in the research literature. In the sections that follow, we will use the terms "concerns," "attitudes," "values," and "worldview," and the distinctions between these concepts may not be readily apparent. Indeed, these terms are often used interchangeably in the research literature. We use the term *environmental concern* to refer to the affect (i.e., worry) associated with beliefs about environmental problems. For example, a person may be concerned about the harmful consequences of air pollution for his or her health, or concerned about the long-term consequences of improper disposal of hazardous household waste. *Attitude* refers to a person's evaluative judgment about a particular entity (Eagly & Chaiken, 1993). Attitudes are typically expressed in degrees of favorability, as in "I am in favor of establishing a curbside recycling program," or "I support deposits on beverage containers." The construct of *environmental attitudes* refers to the collection of beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues.

We use the term *worldview* to refer to a person's belief about humanity's relationship with nature. A person's

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worldview serves as a cognitive paradigm or belief system. Dunlap and Van Liere (1978) and Dunlap et al. (2000) have argued that a person's environmental paradigm constitutes a fundamental part of a person's belief system; it is a ''primitive belief'' and influences a wide range of concerns and attitudes. At the broadest level are *values*, which are conceptualized as important life goals or principles (Rokeach, 1973; Olson & Zanna, 1993). Values function as an organizing system for attitudes and beliefs, and they are viewed as determinants of attitudes. Examples of values would include ''equality,'' ''wisdom,'' ''ambition,'' and ''freedom'' (cf. Schwartz, 1994). The term *environmental values* refers to those values that are specifically related to nature or that have been found to correlate with specific environmental attitudes or concerns.

2. Conceptualizing environmental concern—why do people care?

For the last 30 years, researchers have examined the underlying factors that influence people's attitudes and concerns about the environment and environmental issues. A host of demographic variables, experiences, personality dimensions, beliefs about control, efficacy, and responsibility have all received considerable research attention (Schultz, Oskamp, & Mainieri, 1995; Hwang, Kim, & Jeng, 2000; Kals & Maes, 2002). Most of this research has been based on traditional attitude theory, in which attitudes about environmental issues are measured on cognitive, affective, and behavioral dimensions. Although fruitful, this approach to the study of environmental attitudes lacks a clear theoretical foundation for *why* a person develops the types of attitudes s/he does.

One notably different approach was that taken by Dunlap and his colleagues in the New Environmental Paradigm (NEP; Dunlap & Van Liere, 1978; Dunlap et al., 2000). Rather than measuring specific attitudes, Dunlap and his colleagues developed a series of items to assess ''ecological worldview.'' In examining the core message of the environmental movement during the 1970s, Dunlap and Van Liere (1978) noted that there was more than just attitudes and concerns about environmental issues—the movement was challenging fundamental views about the relationship between people and nature. The NEP scale was designed to measure this new emerging worldview which included: beliefs about the limits to growth, humanity's ability to upset the balance of nature, and humanity's right to rule over nature.

More recently, research has begun to differentiate between different types of environmental attitudes, and to develop a theoretical model for the relationship between worldview and specific attitudes. Stern and his

colleagues have developed a Value-Belief-Norm (VBN) model to explain environmental attitudes and behaviors (Stern, Dietz, & Guagnano, 1995; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, 2000). The VBN theory postulates a causal chain of variables that leads to behavior: values, worldview, awareness of adverse consequences for valued objects, perceived ability to reduce the threat, and personal norms for proenvironmental behavior. In essence, the theory predicts that an individual's values interact with specific perceptions of a given situation (perceived adverse consequences to a valued object, and perceived ability to do something about it) to yield behavior.

Within the VBN theory, values provide the source of concern for environmental issues and for proenvironmental behavior. Stern and his colleagues (cf. Stern & Dietz, 1994; Stern et al., 1995) have identified three sets of values associated with environmental attitudes which they labeled egoistic, altruistic, and biospheric. *Egoistic* values are focused on self, and self-oriented goals (e.g. social power, wealth, personal success); *altruistic* values focus on other people (e.g. family, community, humanity, friends); *biospheric* values focus on the well-being of living things (e.g. plants, animals, trees). Conceptually, each of these sets of values can lead to attitudes of concern for environmental issues, and ultimately to behavior when activated.

There is considerable evidence for the existence of value-based environmental concerns (Thompson & Barton, 1994; Stern et al., 1995a, b; Schultz & Zelezny, 1999; Schultz, 2000, 2001). For example, Schultz (2001) asked participants in 14 countries to rate their concern for the harm caused by environmental problems to a number of objects. Analyses showed a clear structure, corresponding to egoistic (me, my lifestyle, my health, and my future), altruistic, (people in my community, all people, children, future generations), and biospheric (plants, marine life, birds, animals) concerns. The structure of these concerns was largely consistent across the 14 countries sampled. See also Schultz (2000, 2002b).

These findings are consistent with the VBN theory, but we have provided a slightly different interpretation. We have argued that an individual's belief about the extent to which s/he is part of the natural environment provides the foundation for the types of concerns a person develops, and the types of situations that will motivate them to act. At one extreme is the individual who believes that s/he is separate from nature—that people (and specifically, him or her) are exempt from the laws of nature and superior to plants and animals (see also Opotow, 1994; Opotow & Weiss, 2000). At the other end of the continuum is the individual who believes that s/he is just as much a part of nature as are other animals and (taken to the extreme) that the same rights that apply to humans should apply to plants and

animals. We have referred to this core belief as *connectedness with nature* (Schultz, 2002a).

The notion of *connectedness* has a rich history in the environmental literature. Philosophers have long argued for the importance of the belief that "I" am part of nature (cf. Leopold, 1949; Bateson & Bateson, 1987; Callicott, 1999, 2002). These philosophical underpinnings have found their way into sociology (Weigert, 1997; Dunlap et al., 2000), and psychology (Kahn, 1999; Kidner, 2001). Researchers and scholars writing about this topic use terms like "ecological identity," "relationship," "identification," or "oneness" to refer to this core belief. At the individual level, connectedness is a psychological variable, and yet it has not been carefully studied or operationalized by psychologists. In my own work (Schultz, 2001, 2002a), I have used a single-item measure, modified from Aron's (Aron, Aron, Tudor, & Nelson, 1991; Aron, Aron, & Smollan's, 1992) work on interpersonal relationships, consisting of a series of overlapping circles labeled "self" and "nature" (see also Dutcher, 2000). We refer to this measure as the Inclusion of Nature in Self scale (INS). The results from studies using this measure (Schultz, 2001) have found connectedness to correlate with biospheric concerns ($r = 0.31$) and with self-reported environmental behavior ($r = 0.41$).

Despite the encouraging results with the INS scale, there is reason to believe that it might not be the best way to assess connectedness. First, it is only a single item, and therefore not subject to tests of internal reliability. Second, and more importantly, it relies on self-report. This requires that the participant *have* an explicit belief about his or her relationship with nature. In debriefing sessions with participants it became clear that many of our respondents had not thought about this issue, and did not have an existing belief to express (although they were able to create one in response to our question). Dunlap et al. (2000) has suggested that a person's worldview is "primitive." Indeed, it seems possible that a person's sense of connectedness is not a conscious one, or at least not a belief that is thought about on a regular basis or readily available for retrieval.

Recent developments in social cognition have provided an alternative measurement technique for assessing the degree to which people associate themselves with nature. Importantly, this relatively new measure does not require conscious awareness of the association. Greenwald, McGhee, and Schwartz (1998) have developed the Implicit Association Test (IAT) to measure automatic concept-attribute associations. The IAT measures associations through reaction time to pairs of concepts presented on a computer screen. For each trial, participants are instructed to match an item (e.g., Daisy or Moth) with the appropriate concept (e.g., Flower or Insect) as quickly as possible. Two concepts are then combined (Flower and Good; Insect and Bad).

The degree of association between the two concepts is measured by the difference in response time to compatible (Flower and Good; Insect and Bad) and incompatible (Flower and Bad; Insect and good) trials. Research using the IAT has found it to correlate moderately with explicit measures (i.e., self report) of attitudes (Greenwald & Banaji, 1995; Greenwald et al., 1998; Farnham, Greenwald, & Banaji, 1999). Greenwald and Banaji (1995) suggest that implicit attitudes are automatic, and influence decisions and actions without awareness.

The IAT has been utilized in various types of research. Greenwald and Farnham (2000) described how the IAT can be used as an indirect measure of self-esteem and how it can further the understanding of an individual's social identity. The study suggests that explicit measures can be biased, but that implicit measures like the IAT are not affected by such biases. Another study using the IAT found that racial prejudice was more accurately measured through implicit measures, such as the IAT (Greenwald et al., 1998), rather than with self report measures. Indeed, the IAT does not appear to be subject to the same desireability effects routinely found in self-report measures, and it is difficult to "fake" a good score on the IAT (see Greenwald et al. (2002) for a review of IAT research).

The current set of studies were designed to develop an IAT procedure to measure connectedness with nature. Our primary goal was to test hypotheses about the relationship between implicit associations with the natural environment and explicit environmental concerns, as well as to examine the stability of implicit and explicit measures across time. Specifically for the purpose of this paper, we predicted that low connectedness would be associated with egoistic concerns about environmental issues, while high connectedness would be associated with biospheric concerns. In the first study reported below, we developed an Implicit Association Test to measure the extent to which an individual associated "self" with "nature." We expected to find that differences on this IAT task would correlate with explicit measures of environmental concerns. Given the previous research using the IAT to measure self concept (cf. Greenwald & Farnham, 2000), we expected the correlations between explicit measures of environmental attitudes and the IAT to be small ($r \sim 0.20$).

3. Study 1

3.1. Method

3.1.1. Participants

Participants in the study were 160 undergraduates from California State University, San Marcos. Participants were recruited from the Psychology Department's

Human Participant Pool. A sample size of 160 was selected in order to provide 80% power for a correlation coefficient of 0.20 (Cohen, 1988, p. 87).

3.1.2. Materials

A questionnaire and computerized test were developed to measure environmental attitudes, implicit attitudes toward natural and built environments, values, and demographics. Measures included: the revised version of Dunlap's New Environmental Paradigm Scale (NEP), Schultz's Environmental Motives Scale, and a revised version of Greenwalds' Implicit Association Test (IAT).

New Environmental Paradigm Scale: The revised version of the NEP scale was used, containing 15 items. Items in the scale were rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument is designed to measure the degree to which people view humans as a part of nature, rather than as consumers or protectors of nature (Dunlap et al., 2000).

Environmental Motives Scale: This instrument measures concern about environmental problems caused by human behavior (Schultz, 2000, 2001). Concern for environmental issues is divided into three categories: egoistic, altruistic, and biospheric. Participants rated 12 items about which they were concerned from 1 (not important) to 7 (supreme importance). Egoistic items were: me, my future, my prosperity, and my health; altruistic items were: future generations, humanity, people in the community, children; biospheric items were: plants, animals, marine life, and birds.

Implicit Association Test: A modified version of Greenwald's IAT was used to assess automatic concept–attribute associations (cf. Farnham et al., 1999). A computerized test was created to measure response time (in ms) needed to classify words associated with natural and built environments. The procedure consisted of seven blocks of trials. Prior to beginning the test, participants were informed that the task involved matching words with categories. They were then given example items, and allowed to ask questions. Participants were instructed to go as quickly as possible, and to keep their fingers on the keyboard at all times. The IAT was administered using Superlab 1.74 running on a Powermac 7300 computer with a 15″ color monitor.

Following the introduction, participants were presented with seven blocks of 10 trials. Each trial consisted of a word (selected at random from the relevant categories shown in Table 1) and a set of categories. There were four categories of words used: Me, Not me, Nature, and Built. The five words, and their correct category classification, are shown in Table 1. The Me and Not me words were taken from previous studies using the IAT to measure self-concept. The Nature and

Table 1
Categories and words used to measure connectedness with nature

Categories			
Nature	Built	Me	Not me
Animals	Building	I	It
Birds	Car	Me	Other
Plants	City	Mine	Their
Whales	Factory	Myself	Them
Trees	Street	Self	They

Built words were selected on the basis of face validity. The blocks were presented as follows:

- Block 1: Nature–Built
- Block 2: Me–Not me
- Block 3: Nature/Me–Built/Not me
- Block 4: Nature/Me–Built/Not me
- Block 5: Built–Nature
- Block 6: Built/Me–Nature/Not me
- Block 7: Built/Me–Nature/Not me

An instruction screen, along with examples of Blocks 1, 3, and 6 are presented in Fig. 1. The words were presented in random order within each of the blocks. Blocks 1 and 2 were considered practice, as was Block 5. Blocks 3 and 4 were considered "compatible" pairings, and Blocks 6 and 7 were considered "incompatible." The strength of the association between "self" and "nature" is reflected in the ease with which a participant could complete the compatible trials, relative to the incompatible trials. That is, if a person has a cognitive association between self and nature, then it should be easier for them to complete those trials than when the categories are incompatible. The reverse would be true for a person with a strong association with built environments.

Two versions of the IAT procedure were developed in order to counter-balance for order of Nature/Me (Blocks 3 and 4 above) and Built/Me (Blocks 6 and 7 above) trials. In the first rotation (shown above) Nature/Me was presented first; in the second rotation Built/Me (shown as Blocks 6 and 7 above) was presented first (as Blocks 3 and 4). Participants were randomly assigned to one of two rotations. The average error rate across the 70 trials was 4.13, or 5.9%. One subject had a high error rate and was dropped, yielding a working sample of 159. Response latencies were averaged within each of the blocks. Prior to averaging, the data were screened for outliers and errors. Reaction time for trials that were answered incorrectly were removed. The data were then screened for outliers on an individual basis, such that reaction times that were more than 3 standard deviations above or below the participant's mean score were removed.

NATURE   BUILT
  OR   OR
  ME   NOT ME

Instructions:

* Press 'd' FAST for words described by the left concept name.

* Press 'k' FAST for words described by the right concept name.

* Nothing will happen if you press the wrong key, press the other key immediately.

* When you are ready, press the spacebar to proceed. GO FAST. Some mistakes are OK.

Sample Instructions

NATURE   BUILT

ANIMALS

Block 1 Sample: Practice Trials. The correct response here is "NATURE."

NATURE   BUILT
  OR   OR
  ME   NOT ME

CAR

Block 3 Sample: Compatible Trials. The correct response here is "BUILT OR NOT ME."

BUILT   NATURE
  OR   OR
  ME   NOT ME

MINE

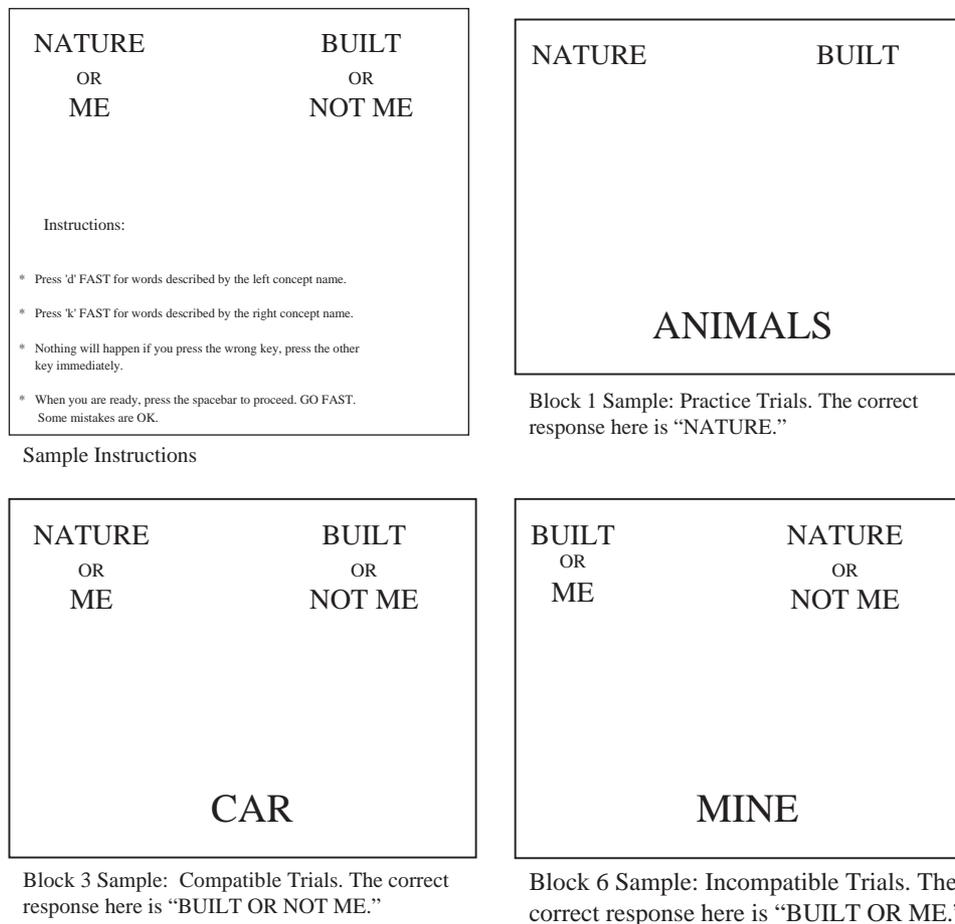Block 6 Sample: Incompatible Trials. The correct response here is "BUILT OR ME."

Fig. 1. Sample screenshots from the Implicit Association Test developed to measure connectedness with nature.

The IAT effect was then produced by subtracting the average response latency for the compatible trails (Blocks 3 and 4 above) from the average response latency for the incompatible trials (Blocks 6 and 7 above). Higher scores indicate faster responses for Nature/Me trials, which we interpret as a greater association between self and nature (i.e. connectedness).

3.1.3. Procedure

Upon arrival, participants provided informed consent. Each participant was then randomly assigned to rotation (1 or 2) and order (1 or 2). Rotation refers to the sequence of IAT blocks described above. Order refers to whether the participants completed the IAT or the questionnaire first. Once the researcher determined the order and rotation, they proceeded to administer the test. Participants were then debriefed.

3.2. Results

The first set of analyses examined the psychometric properties of each of the measures. The 12 items from the Environmental Motives scale were factor analyzed using a Principal Axis analysis, with an oblimin rotation. The results revealed a three-factor structure

Table 2
Factor loadings from the Environmental Motives Scale, with oblimin rotation

Item	Factor 1 (egoistic)	Factor 2 (biospheric)	Factor 3 (altruistic)
Plants		0.76	
Marine life		0.88	
Birds		0.88	
Animals		0.82	
Me	0.81		
My future	0.78		
My prosperity	0.65		
My health	0.93		
Future generations			0.72
Humanity			0.70
People in the community			0.60
Children			0.77

Note: Factor loadings smaller than 0.20 are not shown. The results reported in this table are from Study 1. Factor loadings from Study 2 were nearly identical.

that explained 66% of the total variance, with a clear pattern of factor loadings. The results are shown in Table 2. The factors were consistent with those found in previous research, and represent biospheric, egostic, and altruistic concerns. Correlations between the rotated

factors were $r = 0.02$ (egoistic and biospheric), $r = 0.28$ (biospheric and altruistic), and $r = 0.51$ (egoistic and altruistic). Scores for each were created by averaging the items: Biospheric ($M = 5.54$; s.d. $= 1.39$), Egoistic ($M = 5.49$; s.d. $= 1.40$), Altruistic ($M = 6.20$; s.d. $= 0.96$). To create scores that controlled for differences in response tendency, a mean correction procedure was used. The average response to all 12 of the environmental motives items was computed for each respondent. This score was subtracted from each of the three scale scores to produce mean corrected biosperic ($M = -0.20$), egoistic ($M = -0.25$) and altruistic ($M = 0.46$) scores.

Alpha reliability for the NEP scale was 0.78. The mean score was 3.57 (s.d. $= 0.46$).

Scores for the IAT-Nature scale were produced by averaging the 10 trials within each block. The IAT effect, produced by subtracting the mean score for the two blocks of Nature/Me items ($M = 1049$; s.d. $= 350$) from the mean score for two blocks of Built/Me trials ($M = 1335$; s.d. $= 418$), was 286 (s.d. $= 286$; $N = 159$). An IAT effect of 0 would indicate no association, and a positive IAT effect in this context indicates a general tendency among our participants to associate self more with nature than with built environments. We also analyzed the IAT data separately by rotation. The scores were similar for the two rotations, with the IAT effect for the rotation with Nature/Me, Built/Not me (i.e. compatible trials) presented first of 264 ($N = 83$). The second rotation with Built/Me, Nature/Not me (i.e. incompatible trials) first had an IAT effect of 309 ($N = 76$).

The second set of analyses examined the relationship between implicit associations with nature (connectedness), and explicit measures of environmental concern. We hypothesized that participants with a greater implicit connection with nature (measured with the IAT) would tend to have higher biospheric concerns, and lower egoistic concerns. Correlations were calculated using the mean corrected egoistic, altruistic, and biospheric scale scores, NEP, and IAT-Nature scores. As seen in past research, all three environmental concerns correlated significantly with the NEP: egoistic ($r(158) = -0.38$; $p < 0.001$) and altruistic ($r(158) = -0.18$; $p < 0.01$) negatively, and biospheric ($r(158) = 0.49$; $p < 0.01$) positively.

Biospheric and egoistic concerns had similar relationships to the IAT-Nature scores. Biospheric concerns were positively correlated with the IAT, $r(158) = 0.21$; $p = 0.009$, while egoistic concerns were negatively correlated, $r(158) = -0.16$; $p = 0.04$.

4. Study 2

The results from Study 1 showed a small but interpretable pattern of relationships between implicit associations with nature, and specific types of environmental attitudes. In order to more fully understand these relationships, a second study was conducted using a similar procedure. Our goals in this second study were to replicate the findings from Study 1 (particularly the relationship between connectedness, biospheric, and egoistic concerns), to examine the relationship between global–local processing styles and environmental attitudes (both explicit and implicit), and to examine the stability of IAT-Nature scores across time using a test–retest procedure.

4.1. Method

4.1.1. Participants

Data were obtained from 100 undergraduate students (40 males, 60 females; mean age $= 23.62$; s.d. $= 5.68$). Participants were recruited from the Psychology Department's Human Participant Pool at California State University San Marcos. A sample size of 99 was selected in order to allow for 33 participants in each of three retest conditions, providing 80% power to detect a large effect (estimated $r = 0.50$). The anticipated effect size of 0.50 was used, rather than the anticipated effect of 0.20 used in Study 1, because our focus in this study was on test–retest reliability which we expected to be large.

4.1.2. Materials

A questionnaire was used to measure environmental attitudes and the demographic variables of age and gender. The questionnaire consisted of four environmental measures: a revised version of Dunlap et al.'s New Environmental Paradigm (NEP, 2000), Schultz's Environmental Motives scale (2001), a self-reported proenvironmental behavior scale (Schultz & Zelezny, 1998), and a revised version of Aron's Inclusion of Other in Self scale (1992; see Schultz, 2001). The IAT-nature computer program developed for Study 1 was used to measure implicit connections with natural and built environments.

One of the items included in the questionnaire was a measure of the perceived relationship between self and nature. The item was an adaptation of Aron et al. (1992) Inclusion of Other in Self (IOS) scale (see also Aron et al., 1991). Participants were asked to select one of seven different sets of overlapping circles labeled "self" and "nature." The item read "Please circle the picture that best describes your relationship with the natural environment. How interconnected are you with nature?" Scores ranged from 1 (where the circles touched but did not overlap) to 7 (where the two circles entirely overlapped). We refer to this modified scale as the Inclusion of Nature in Self (INS) scale (see Schultz, 2001).

The questionnaire also contained Witkin's *Embedded Figures Test* (EFT; Witken, 1950; Witken, Oltman,

Raskin, & Karp, 1971). The EFT measures the extent to which participants are either global or local processors of information (see also Kuhnen, Hannover, & Schubert, 2001). The test consists of 25 complex figures and 8 simple figures. Participants are instructed to locate and trace a simple geometric figure located inside a more complex figure. The 25 items are divided into three timed test sections. Participants are given 2 min to complete the first section, 5 min to complete the second section, and 5 min to complete the third section. During the testing period, participants look at a designated simple figure located on the back of the test booklet, and then attempted to find that figure in the more complex figure. Scale scores for this measure were produced by summing the number of correct responses in the second and third sections. Higher scores are indicative of more local processing. Conversely, lower scores are indicative of more global processing such that it was more difficult to separate the small part from the whole.

We included the EFT in order to test for differences in information processing styles associated with egoistic and biospheric concerns. We reasoned that a more local style of information processing might be positively related to egoistic concerns, while a more global style of processing might be associated with biospheric concerns. The global–local distinction is used widely in cognitive psychology, but to our knowledge it has yet to be extended to studies of environmental attitudes.

4.1.3. Procedure

Testing occurred in two sessions. Participants were randomly assigned to receive one of two rotations of the IAT, and one of three retest conditions (immediate, 1 week, or 4 weeks). Upon arriving at the lab, participants read and signed a consent form. Next, participants were seated in front of the computer to complete the IAT. The researcher read the instructions to the participant and informed the participant that the IAT would take approximately 5 min to complete, and that they should go as quickly as possible. Once the IAT was completed, the questionnaire was administered.

After completing the questionnaire, the researcher administered the Embedded Figures Test. The researcher instructed the participant to read the directions and to complete two practice problems. Once the participant finished the practice problems, the researcher reminded the participant of the important aspects of the directions such as erasing completely, and being careful to trace all of the lines of the simple figure. Once the EFT was completed, participants were informed which of the three retest conditions they were assigned to. During the retest session, participants were first given the same version of the IAT that they had taken in the first session, and then they were given the questionnaire to complete a second time. Because test–retest data is

already available for the EFT, it was not administered during the second testing session.

Participants in the immediate retest condition were thanked, debriefed, and asked not to discuss the study with their peers until the end of the semester. Participants in the 1- and 4-week retest conditions were told that they would be fully debriefed when they returned and completed the second portion of the study.

4.2. Results

Of the initial 100 participants, two were dropped because of incomplete data, leaving a useable sample of 98 participants. Of the 98 participants, 32 were in the immediate retest condition, 33 were in the 1-week retest, and 33 were in the 4-week.

Chronbach's alpha was used to evaluate the reliability for all of the questionnaire measures. All scales showed an acceptable level of reliability: NEP (0.80 test, 0.87 retest), biospheric environmental concerns (0.90 test, 0.90 retest), altruistic concerns (0.80 test, 0.83 retest), egoistic concerns (0.91 test, 0.93 retest), self-rated behavior (0.80 test, 0.83 retest).

A principal axis factor analysis of the 12 environmental motives items (with an oblimin rotation) revealed a 3-factor structure that accounted for 68% of the variance. The pattern of item loadings was similar to that found in Study 1. Factor 1 (egoistic): me (0.90), my lifestyle (0.72), my health (0.82), my future (0.95). Factor 2 (biospheric): plants (0.85), marine life (0.86), birds (0.82), animals (0.80). Factor 3 (altruistic): people in the community (0.62), future generations (0.63), humanity (0.92), and children (0.54). Correlations between the rotated factors were $r = 0.07$ (egoistic and biospheric), $r = 0.16$ (biospheric and altruistic), and $r = 0.43$ (egoistic and altruistic). Scores for the three environmental motives scales were produced by averaging the four items in each: biospheric ($M = 5.47$; s.d. = 1.10), egoistic ($M = 5.13$; s.d. = 1.58), and altruistic ($M = 6.06$; s.d. = 0.95). Following the analytic procedure used in Study 1, a mean corrected score was created by subtracting the total of all 12 items (grand mean = 5.51) from the scale score for each of the three measures. A similar procedure was used for the retest data.

On the IAT, participants made an average of 3.64 (s.d. = 3.52) errors, and had an average of 1.02 (s.d. = 2.04) outliers (response latencies below 300 ms or above 3000 ms).[1] Participants were faster for the compatible (Nature/Me, and Built/Not me) trials ($M = 963$; s.d. = 256.94), than they were for the

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[1] Following Greenwald et al. (1998), we screened for outliers on an individual basis. Any score below 300 ms was replaced with a score of 300; any score above 3000 was replaced with a score of 3000. Response times for trials answered incorrectly were excluded.

incompatible (Built/Me and Nature/Not me) trials ($M = 1207$; s.d. = 329.65). Thus the overall IAT effect showing a preference for nature was 244 ms. The IAT effect was also examined separately by rotation. Results showed a slightly smaller IAT effect when the compatible (i.e., Nature/Me, Built/Not me) trials were first: participants were faster (mean compatible = 928; mean incompatible = 1211; IAT effect = 283; $N = 49$) than when the incompatible (Built/Me, Nature/Not me) trials were presented first (mean compatible = 882; mean incompatible = 1066; IAT effect = 428; $N = 49$). Rotation did not have a significant effect on any of the correlations reported below.

The test/re-test reliability was evaluated for all explicit measures, as well as the computerized IAT using correlation coefficients. The results are shown in Table 3. As seen in the table, the level of re-test reliability across the measures was extremely high. The explicit measures showed a higher degree of stability across time, but the IAT-nature test also showed a reasonable level of test–retest reliability: $r = 0.45$; $p =$

0.001 (immediate condition), $r = 0.46$; $p = 0.01$ (1-week condition), $r = 0.40$; $p = 0.02$ (4-week condition).

To test the hypotheses predicting a relationship between the explicit measures and the computerized implicit test, Pearson correlations were calculated using the data from the first testing session. The resulting matrix is shown in Table 4. As predicted, there was a significant and positive relationship between the biospheric environmental concerns and the IAT-nature measure $r = 0.27$; $p = 0.01$. Also as predicted, there was a significant and negative relationship between the egoistic concerns and IAT scores, $r = -0.22$; $p = 0.04$. Finally, there was a significant and positive correlation between the Inclusion of Nature in Self scale ($M = 3.74$, s.d. = 1.32) and IAT-Nature scores, $r = 0.26$; $p = 0.01$. Similar results were obtained using the data from the retest testing session.

Correlation coefficients were also used to test the relationship between environmental attitudes (both implicit and explicit) and information processing style (lower scores indicate global processing, and higher scores indicate local processing). As predicted, there was a significant and negative relationship between IAT scores and the embedded figures test ($M = 11.12$, s.d. = 4.74), $r = -0.23$; $p = 0.02$. There were no significant relationships between the EFT and the mean corrected egoistic, altruistic, or biospheric scales.

5. Discussion

The two studies reported in this paper were designed to examine implicit connections with nature. Our goals were (1) to develop an implicit measure of the extent to which individuals associate themselves with the natural environment, (2) to examine the relationship between these implicit connections and explicit measures of environmental attitudes, and (3) to examine the stability of implicit connections with nature across time.

The results provide clear evidence for the usefulness of implicit measures in environmental research, and of the

Table 3
Test/retest correlations for immediate, 1 and 4 weeks

Scale	Immediate retest ($N = 32$)	1-Week retest ($N = 33$)	4-Week retest ($N = 33$)
New Environmental Paradigm (NEP)	0.94**	0.92**	0.83**
Inclusion of Nature in Self (INS)	0.98**	0.90**	0.84**
Self-reported environmental behavior	0.97**	0.88**	0.86**
Egoistic concerns (mean corrected)	0.93**	0.80**	0.76**
Altruistic concerns (mean corrected)	0.87**	0.74**	0.88**
Biospheric concerns (mean corrected)	0.95**	0.86**	0.86**
Implicit Association Test (IAT)	0.45**	0.46**	0.40*

$*p < 0.05$, $** p < 0.01$.

Table 4
Correlation matrix

	NEP	INS	EFT	Behavior	Egoistic	Biospheric	Altruistic
INS	0.30**						
EFT	0.07	−0.09					
Behavior	0.27*	0.26*	−0.08				
Egoistic	−0.19	−0.28**	−0.11	−0.25*			
Biospheric	0.36**	0.40**	0.08	0.24*	−0.85**		
Altruistic	−0.32*	−0.25*	0.04	−0.00	−0.21	−0.34**	
IAT	0.18	0.26*	−0.23*	0.06	−0.22*	0.27*	−0.11

Note: Results based on data from the first testing session. Similar results were obtained for the retest data. INS: Inclusion of Nature in Self; EFT: Embedded Figures Test (higher scores indicate more local processing); IAT: Implicit Association Test. $*p < 0.05$; $**p < 0.01$. $N = 98$.

importance of connectedness with nature in understanding environmental attitudes. The data showed a basic IAT effect, wherein it was easier for participants to associate themselves with nature, than with built environments. In Study 1, the basic IAT effect was 286 ms, and in Study 2 the effect was 244 ms. This positive IAT must be interpreted with caution. One interpretation would suggest that people have a basic tendency to associate themselves with nature—an interpretation that is consistent with the biophilia hypothesis (cf. Kellert, 1996). Relatedly, it could be that people prefer natural over built environments (Kaplan & Kaplan, 1989), and this preference makes the association with self easier. Such an interpretation is consistent with Greenwald et al.'s (2002) recent theorizing about implicit attitudes. However tempting such interpretations are, it is also possible that the tendency toward connectedness is a result of our college student sample, and that a more representative sample would not show the same tendency. Thus, the interpretation of the positive IAT scores in our two studies remains to be addressed in future research.

The results across the two studies also showed a small but consistent pattern of correlations between IAT scores and explicit measures of environmental attitudes. Implicit connections with nature were positively correlated with biospheric environmental concerns ($r = 0.21$ in Study 1 and $r = 0.27$ in Study 2) and negatively correlated with egoistic environmental concerns ($r = -0.16$ in Study 1, and $r = -0.22$ in Study 2). In addition, the results from Study 2 showed a positive relationship between the implicit IAT measure and an explicit measure of inclusion with nature ($r = 0.26$), and with scores on the Embedded Figures Test ($r = -0.23$).

On the surface, these effects may appear small. However, previous research with the IAT has also found correlations between implicit and explicit measures to be around 0.20. For example, Cunningham, Preacher, and Banaji (2001) report correlations ranging from 0.08 to 0.26 between an IAT measure of prejudice, and an explicit measure of prejudice. However, Cunningham et al. (2001) also reported a confirmatory factor analysis showing a clear higher order factor for implicit measures of prejudice, and a latent correlation coefficient of 0.45 between implicit and explicit prejudice. See also Greenwald et al. (1998). Although the size of the relationships between implicit and explicit measures is small, we believe that the statistical significance of the correlations combined with the overall pattern of correlations, is theoretically meaningful, and suggest that implicit measures can be useful in future research on environmental attitudes.

Scores on the IAT-Nature procedure were relatively stable across time. The results from Study 2 showed a test–retest correlation of 0.45, 0.46, and 0.40 for immediate, 1-week, and 4-week periods, respectively.

These are consistent with findings by other researchers using the IAT. For example, Cunningham et al. (2001) reported test–retest correlations ranging from 0.16 to 0.50 across four retest periods separated by 2 weeks, with an average correlation of 0.32. It is interesting to note that the retest correlations in our study were similar across time. Often in test–retest analyses, the relationship between the measures decreases over time. That is, with explicit measures of attitudes, recall for previous responses, changes in attitudes, or fluctuations due to daily experiences lead to a decrease in the stability of the scores. We believe that an individual's implicit connection with nature is more stable across time than explicit measures because it is not affected by memory, it is not concealable or influenced by response bias, and it is less affected by day-to-day experiences. This is not to suggest that implicit connections with nature do not change across time or are not influenced by surroundings but merely that they are less influenced by such variables than are explicit measures. See Karpinski and Hilton (2001) for an examination of the contextual influence on implicit attitudes.

5.1. Implications

The finding that implicit connections with nature are correlated with environmental attitudes has several theoretical implications. The issue of whether humans are part of nature or separate from nature has been discussed and debated at length among philosophers and environmentalists (Lovejoy, 1936; Pepper, 1984; Rothenberg, 1987). Beliefs about the relationship between self and nature is a core element of the writing and theorizing of deep ecology (Naess, 1988); land ethics (Callicott, 1999, 2002), ecological identity (Bragg, 1996; Light, 2000), and ecopsychology (Cohen, 1997; Spilner, 1997). As Ponting (1991) stated in his *Green History of the World*:

> One of the fundamental issues addressed by all traditions is the relationship between humans and the rest of nature. Are humans an integral part of nature or are they separate from it and in some way superior to it? The answer to this question is crucial in determining how different thinkers and religions decide which human actions can be regarded as legitimate or morally justified. From this flow other related questions about whether all plants and animals in the world are there solely for the benefit of humans; about whether humans have a responsibility to guard and take care of the rest of nature (p. 141).

The data reported in this paper affirm the importance of *connectedness* in understanding attitudes about environmental issues. At a psychological level, the degree to which an individual associates him or herself

with nature is directly related to the types of attitudes that s/he develops. In essence, individuals who associate themselves with the natural environment tend to hold broader sets of concerns for environmental issues (i.e., biospheric attitudes). An individual with less of an association between self and nature can still be concerned about environmental issues, but these concerns are more narrow, and focused on issues that directly affect the individual. Yet despite the centrality of the concept of *connectedness* in the environmental literature, only a few studies have operationalized it using explicit measures, and the studies reported in the current article represent the first attempt to do so implicitly.

But why use an implicit measure? Indeed, implicit measures are more difficult to develop and administer, the effect sizes tend to be smaller, and the amount of variability and "noise" in the data are larger. An explicit measure, like the Inclusion of Nature in Self scale used in Study 2, provides an useful tool for measuring connectedness. However, in addition to the standard issues of response set and bias common in self-report measures, explicit measures also make a very important assumption: they assume that the individual knows and can articulate his or her belief. If, as Dunlap et al. (2000) have suggested, such beliefs are "primitive," they may not be readily available for recall, or easily articulated on a self-report questionnaire. In this case, an implicit measure provides a useful alternative and may offer a better technique for measuring the strength of an association.

Two other aspects of our results warrant additional comment. First are the results found with the Embedded Figures Test. To our knowledge, this is the first reported study in which the EFT has been used to predict environmental attitudes, and the purpose of using it and the meaning of the findings may not be readily apparent. In developing our inclusion model of environmental attitudes, we have argued that egoistic concerns are more narrowly focused on issues that directly affect the individual, while biospheric concerns reflect a broader (i.e. more inclusive) set of concerns (Schultz, 2000, 2002b). Indeed, this was the basis for our interpretation of earlier research showing that biospheric attitudes were positively related to Schwartz' self-transcendent values, while egoistic attitudes were positively associated with values of self-enhancement (cf. Schultz & Zelezny, 1999; Schultz, 2001).

Following this line of reasoning, and supported with recent research by Kuhnen et al. (2001) on the semantic–procedural interface model of the self, we postulated that there may be differences in information processing style associated with connectedness, egoistic, and biospheric concerns. We predicted that less connection with nature would be associated with more local information processing, while a greater connection would be

associated with global processing. Although our findings with the EFT were somewhat disappointing, the small-but-significant correlation with IAT nature does suggest processing differences. We believe this finding, and the basic line of reasoning, deserves further research.

The second aspect of our results that warrants discussion is our approach to measuring egoistic, altruistic, and biospheric attitudes. Following Stern and Dietz's (1994) influential article on the value bases of environmental attitudes, we set out to develop a set of items to measure each of these concerns (rather than the values associated with them). However, unlike Stern and Dietz (1994), we view these three sets of attitudes as related, rather than distinct. Our basic approach is to view egoistic, altruistic, and biospheric attitudes as aspects of a second-order factor, which is reflected in our use of correlated (i.e., oblique) factor structures. In previous research, we have used the mean score of the items to form 3 subscales. This approach generates a high Chronbach's alpha (even with only four items). However, the scale scores appear to reflect a fair degree of response set across the items as well as social desirability.

In an attempt to correct for these problems, the analyses reported in this paper are based on mean-corrected scores. Although more sophisticated transformations or partialling procedures could be developed, we find that the mean-correction procedure yields scale scores that are meaningful, stable across time, and that generate consistent patterns of relationships with other measures. It is interesting to note, however, that results based on the full score (not mean corrected) yields results that are very similar to those generated by the mean corrected scores. In future research using the Environmental Motives scale, we recommend using the mean-correction procedure adopted in this paper.

5.2. Directions for future research

The finding that associations between self and nature are relatively stable across time, and that they correlate with explicit attitudes of concern, raises several other testable hypotheses. First, are implicit connections with nature associated with specific patterns of behavior, lifestyle, or life decisions? Several recent publications have suggested that many people living in industrialized countries have begun to reject the consumptive lifestyles so prevalent today (Ray & Anderson, 2000; Degenhardt, 2002). Are people who choose to live alternative lifestyles higher in connectedness with nature? Similarly, are associations with nature related to specific day-to-day behaviors like energy conservation, green buying, and recycling? The VBN theory of Stern et al. (1999) and Stern (2000) would suggest that connectedness

would only lead to behavior in instances where values associated with the beliefs are activated.

Second, does connectedness vary across cultures? Several recent publications have documented country-level differences in attitudes about environmental issues (Dunlap et al., 1993; Schultz, 2001). In essence, respondents from the United States and Western Europe tend to be less biospheric and more egoistic in their approach to environmental issues, while respondents from Central America and South America tend to be more biospheric. Perhaps, these differences are the result of underlying differences in inclusion? Considerable social psychological research has suggested that one of the fundamental dimensions along which cultures vary is self-construal. In some cultures, self is defined broadly and interconnected with other people, while in other cultures self is defined more narrowly and independent of other people (cf. Markus & Kitayama, 1991; Singelis, 1994; Kuhnen et al., 2001). Perhaps, a connection with nature is simply an extension of an interdependent self; not only is who I am dependent on my relationship with other people, but who I am is also dependent on my relationship with the environment around me. As Bateson and Bateson (1987, p. 177) stated, "What we believe ourselves to be should be compatible with what we believe of the world around us".

Finally, how malleable is connectedness? Our results show a moderate degree of stability in connectedness across time. However, our measures were obtained in a controlled laboratory environment. Perhaps, connectedness would vary depending on the context in which it was assessed (e.g. a lab room, a classroom, an office building, a park, a forest)? A considerable amount of environmental research has demonstrated the transforming ability of encounters with nature (Nabhan, & Trimble, 1994; Chawla, 1998; Palmberg & Kuru, 2000). Perhaps, one of the ways in which encounters with nature can transform an individual is through a sense of connectedness. Similarly, environmental education has long sought to promote proenvironmental attitudes and behaviors, but has achieved only limited success (Zelezny, 1999). Perhaps, educational activities that promote a connection with nature will have longer lasting effects?

In closing, the research reported in this paper has provided evidence for individual differences in the extent to which people associate themselves with nature. We developed an Implicit Association Test to measure connectedness with nature. The results suggest that connectedness is fairly stable across time, and that it is associated with biospheric concerns (positively) and egoistic concerns (negatively). Armed with this new tool for measuring implicit connections with nature, future research can begin to explore a number of theoretical and applied questions.

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