The Relative Metaphysical Indicator: Linking philosophy and psychology to understand environmental behavior

Robin Rothfeder

Abstract Why have humans so thoroughly degraded the global ecosystem, upon which our own livelihood depends? The answer put forth in this work is that dominant modern institutions share an implicit assumption of universal and personal disconnectedness. The cultural prevalence of this assumption has engendered widespread feelings of dissociation from, and destructive behaviors towards, the environment. To further investigate this theory, psychological surveys were administered to UC Berkeley undergraduates. A system of relationships between three variables was explored: metaphysical orientation (personal philosophy), affective connectedness to nature, and environmental behavior. As part of this battery of tests, a Relative Metaphysical Indicator (RMI) was developed to assess respondents' beliefs about universal principles and human agency. Results showed (a) that the RMI is a reliable (alpha = 0.72) and empirically effective scale (b) that metaphysical orientation significantly correlates with feelings of connectedness to nature (r = 0.41) and environmental behavior (r = 0.29) (c) that connectedness to nature is a significant but partial mediator between philosophy and behavior, and (d) that explicitly metaphysical instruction has a noticeable influence on the basic beliefs held by students. These findings, which are commensurate with a developing body of similar scholarship in environmental psychology, imply that metaphysical assumptions are empirically accessible, and that how connected people feel to the environment is notably influenced by how connected they assume themselves to be. This elucidates the role of personal choice in efforts at reversing current destructive trends.

Keywords: metaphysics, worldview, paradigm, environmental ethics, environmental history, environmental philosophy, environmental psychology, connectedness to nature, environmental behavior

If history is any guide, much (of) what we take for granted about the world simply isn't true. But we're locked into these precepts without even knowing it oftentimes. That's a paradigm.

John Hagelin

The habit of observing natural objects and natural processes in their isolation… produced the specific narrow-mindedness of the last centuries…

Friedrich Engels

Scientific discoveries affect the way we understand the world and our place in it. This has consequences for our behavior.

(His Holiness the) Dalai Lama

The power of the dominant theories has been such that their objectifying categories are readily extended to human beings… and has both shaped and expressed our dominant perceptions and sensibility…

John Cobb, Jr.

We've been spoiling the environment just dreadfully and thinking we were fine, because we were using the techniques of science… We were making assumptions we had no right to make… and as a consequence it is slapping us back in the face very hard.

Barbara McClintock

Introduction

The following study is predicated on two assertions: that the global ecosystem has been degraded to the point of environmental crisis, and that this condition is principally the result of human action. 'Environmental crisis' (so to speak) is a loaded term, vulnerable to critiques of determinism and unfounded normative objectivity similar to those below. Nevertheless, the present condition of the environment poses a real and unique threat to global well-being: "pollution, depletion, and poverty are (now) systematically interlinked on a scale not previously experienced on the planet" (Merchant, 2005). In this sense, the environment is in a *critical* state which requires immediate response; attitudes adopted and decisions made now will drastically influence the general quality of life on this planet in the upcoming decades and centuries. These ideas have seen growing support in recent years. The United Nations' Millennium Ecosystem Assessment (MEA, 2005) links air and water pollution, loss of plant and animal life, and general macro-scale ecosystem instability primarily to anthropogenic (human driven) causes. The Intergovernmental Panel on Climate Change (IPCC, 2007) states that the evidence for global warming is now unequivocal and that human activity is the main driver of this phenomenon. Costanza et. al (1998) place a minimum valuation of global ecosystem services[1] at $16-54 trillion (US) per year, "most of which is outside the market." The value of the global ecosystem as an entity which secures and maintains human livelihood – and the costs and consequences of destroying it – are thus 'externalized,' or ignored.

Pervasive ecosystem degradation seems patently irrational, or self-destructive, from the perspective that human beings are dependent upon the environment for survival[2]. The motivating questions for this study are aimed at resolving this apparent contradiction. Why do individuals and businesses consistently make choices[3] with consequences known to undermine the integrity of their own ecological support system? How did a culture supporting apathy and violence towards the environment develop? As these questions imply, the analysis below addresses the 'environmental crisis' at two scales: individual, and societal/cultural. It is argued that anthropogenic ecosystem destruction has become a self-perpetuating tendency, driven by a tacit

[1] Services provided by the environment to humans as a natural bi-product of ecosystem functioning
[2] Environmentally destructive behavior seems even *less* rational in light of the fact that humans are capable of studying ecology and 'knowing' that species and ecosystems are mutually co-dependent.
[3] Regarding transportation and fuel use, conservation and recycling, politics and economics, etc.

interchange between dominant cultural assumptions[4] and individual predilections towards particular beliefs, patterns of decision making, and actions. This argument reveals the particular influence of metaphysics, or basic ideas about reality, on the relationship between humans and the environment. Psychological surveys were employed to investigate (a) if metaphysical assumptions are empirically accessible and (b) if metaphysical assumptions can be explicitly observed to impact concrete human-environment variables, namely affective connectedness to nature and behavior with regards to the environment[5]. The results of these surveys suggest that metaphysics is a promising arena for generating progressive environmental change, since even at this critical juncture the influence of underlying ideology is rarely addressed by policymakers, activists, or educators.

Environmental Psychology Why do individual people degrade the environment, or consistently make 'environmentally unfriendly' choices? This is a question of thought and action, or psychology. Psychologists argue that *environmental behavior is mediated by the degree of connectedness an individual feels to nature* (Stern and Dietz, 1994; Roszak et. al, 1995; Schultz and Zelezny, 1999; Schultz, 2000; Stern, 2000; Schultz, 2001; Kidner, 2001; Mayer and Frantz, 2004; Mayer et. al, 2005; Worthy, 2005). Bamberg (2003) cautions that human behavior invariably shows a significant context-dependency which renders causal generalizations dangerous and necessarily incomplete; 'dispositional features' such as feelings of connectedness to nature must be understood as *indirect* determinants of environmental behavior. Nevertheless, there is mounting evidence (Schultz, 2001; Mayer and Frantz, 2004) that feelings of "resonance" (Kidner, 2001) with the natural world play an important role in environmentally relevant decision making. Schultz (2001) observes that "objects (e.g. plants, animals, other people) are valued because of the degree to which they are included within an individual's cognitive representation of self." Worthy (2005) places disconnectedness ('dissociation') at the core of current environmental ills, arguing that modern humans exist in a state of geographical, temporal and psychological isolation – from other people, from the environment, and from the consequences of their actions.

In this work 'connectedness' is considered an affective variable, meaning that a 'connected' individual *feels* like he is altering the climate when he drives his car, *feels* like he is

[4] Rooted in a particular philosophical history
[5] Environmental behavior

marginalizing impoverished farmers when he eats subsidized agricultural products, etc. The concept of affective connectedness is extremely useful for understanding the apparent contradiction of anthropogenic ecosystem destruction; *environmentally unfriendly decisions are not irrational to an individual who feels disconnected from his environment.* Such an individual is not actively aware that his behavior harms other life forms (human and otherwise) and/or does not have the sense that actions which harm others ultimately harm himself as well, and therefore does not recognize ecosystem destruction as self-destruction[6]. The scope and degree of degradation today suggest that a large number of individuals are operating in this type of disconnected context. Therefore, the critical question is: what might cause individuals to perceive themselves as disconnected from nature, in large enough numbers and over a long enough time for 'environmental crisis' to set in?

Environmental History/Philosophy This is equivalent to the 'macro' question posed above: how, and why, have apathy and violence towards the environment become the cultural norm in modern societies? This is a question of philosophy and history. The concept of the *paradigm*, from environmental philosophy, is critical to understanding the answer detailed below. A paradigm is a "mental image of… reality that guides expectations in a society" (Devall, 1980). This "mental image" consists of basic assumptions about 'how the world works,' or, more precisely, about the operating principles of the universe and the role of the individual human as a self-conscious agent. Such ideas are generally referred to in this paper as *metaphysical assumptions*, following the standard definition of metaphysics as "The branch of philosophy that examines the nature of reality" (APA, 2000). An individual's personal set of metaphysical assumptions is referred as his *metaphysical orientation* or *personal philosophy*. Other terms used interchangeably with metaphysics in this work include *worldview*, *ideology*, and *cultural framework*.

Scholars of environmental history (Naess, 1973; Merchant, 1980 and 2005; Baumister, 1987; Norgaard, 1994) argue that what is now *the* dominant worldview emerged during the Enlightenment (17th century) and Scientific Revolution (17th and 18th centuries) as a new

[6] Conversely, it is logical that an individual who feels connected to nature would tend to exhibit environmentally friendly behavior, as it would cause actual discomfort to do otherwise. This is not necessarily the case when the individual simply *thinks* or *understands* that he is connected to the environment. For this reason, cognitive connectedness may be more immediately relevant to environmental behavior than affective connectedness. Mayer and Frantz (2004) recognized this fact in developing a measure of connectedness to nature which is explicitly affective and experiential.

paradigm, which is generally referred to as mechanistic. Mechanistic metaphysics are characterized by the following mutually supportive assumptions:

Atomism – The 'universe' is the sum total of interactions between discrete component parts[7]. The human agent is an isolated and unitary actor possessing individual liberties, personal property and a stable 'self' identity which is disconnected from other selves and from the external environment.

Linear Causality – Component parts react according to mechanical rules. Fully predictable mechanism facilitates (and legitimates a priori) manipulation and control.

Objectivity – There is one tangible 'world out there' which operates according to consistent universal laws. Legitimate fact consists of that which can be observed and repeated.

Statics – Change is a transition from one fixed state to another. Change is driven by external forces, and is therefore superficial: objects and persons maintain a fundamental permanence which allows them to exist as separate functional units. (Merchant, 1980 and 2005; Norgaard, 1994).

The new mechanistic paradigm – which embodied ideals of competition, control, and *general universal disconnectedness* – achieved a high degree of social dominance through extremely successful institutionalization. Capitalist economics, representative democracy and empirical science[8] all stem from a fundamentally mechanistic ideology (Horkeimer and Adorno, 1944), which shares much with the general anthropocentrism[9] of mainstream Judeo-Christian theology (White, 1967). The observable consequence has been the domination of less powerful human groups[10] by more powerful human groups, and of the environment by humans in general (Marcuse 1972; Leiss, 1972).

Merchant (1980) argues that prior to the Enlightenment an *organic* worldview was more prevalent which in philosophical terms is the dialectical opposite of mechanism. The primary characteristics of organic metaphysics are:

Holism – The universe exists as a systematic whole which is not fully described by the aggregate functioning of its component parts. The fundamental nature of reality is not

[7] Atoms, humans, galaxies, etc.
[8] These are the institutional mainstays of the modern world, and are the most successfully global institutions in the history of human culture.
[9] Strict focus on human well-being
[10] The impoverished, the feminine, and the melanin possessing

differentiation, but unity. The human agent is not an isolated individual but is inextricably and by definition connected to his surroundings and to other people.

Non-linear Causality – The universe does not function according to linear chains of cause and effect. Rather, each part of the system influences every other part (and the system as a whole) to maintain equilibrium or achieve new levels of order (or chaos). These processes occur by way of negative or positive feedback, respectively. Stochasticity is an inherent property of all systems, ultimately limiting the potential to extend causal control.

Subjectivity – There is no single, tangible 'reality.' Human experience, knowledge and identity are entirely context-dependent.

Dynamics – Flux is constant and change is inherent in all systems. Impermanence applies to every facet and object of the universe. (Macy, 1991; Norgaard, 1994; Merchant, 2005)

Organic assumptions are highly commensurate with a surprisingly diverse range of fields[11]: ancient Eastern philosophy (Walker, 1996; Shantananda, 2003), critical history of science (Kuhn, 1962; Sardar, 2000), alternative Western philosophy (Spinoza, 1674; Gottleib, 2006), post-modern science (Capra, 1988; Bohm, 1988; Prigogine, 1988; Hawking and Mlodinow, 2005), and progressive theology (Cobb, 1982). Nearly identical metaphysical assumptions can be found in the philosophy and experiential practice of meditation (personal interviews; Easwaran, 1993; Kempton, 2002), which is therefore considered in this work as a prototypical case of organic metaphysics, much in the way that neo-classical capitalism or positivist science could be said to represent a prototypical case of mechanistic metaphysics.

The four metaphysical dichotomies detailed above define the boundaries of a spectrum of beliefs ranging from 'fully organic' at one end to 'fully mechanistic' at the other (table 1). Since metaphysical assumptions are fundamental and unfalsifiable, any combination of these concept categories can be coherent and legitimate from the standpoint of the 'believer,' be it society or individual. However, the institutional dominance of mechanism in modern culture has allowed a single ideology to become normalized and to self-perpetuate *implicitly* (Norgaard, 1994); an individual who adheres to cultural norms by accepting (without questioning) the legitimacy of commonplace institutions[12] and standards for success[13] has adopted a mechanistic metaphysical

[11] The works cited in defense of this statement do not often actually employ the term 'organic.' However, all of these works make explicit organic assumptions, or have very obvious organic implications.
[12] The "free" market, the academy, the courthouse, etc.
[13] Modernity, progress, development, prosperity, etc.

orientation *a priori* (from the get-go). In the words of Chomsky (2002): "The system of presuppositions and principles that constitute an elite consensus[14] (is) a system so powerful as to be internalized largely without awareness."

The influence of implicit mechanistic ideology on individuals is greatly magnified by a common human tendency towards naïve, superficially grasped, or generally unconscious metaphysics, in which the individual rarely explicitly considers the basic interpretive lens through which he interacts with world (Nisbett et. al, 2001; Choi et. al, 2003; Worthy, 2005). *Together, tacit cultural assumptions and naïve individual assumptions have encouraged modern individuals to think and act as if the world operates according to mechanistic principles, without recognizing that they have done so.* Since disconnectedness is fundamental in mechanism, it is clear that the italicized statement above answers the question which began this discussion, namely: what might cause individuals to perceive themselves as disconnected from nature, in large enough numbers and over a long enough time for 'environmental crisis' to set in?

TABLE 1: Metaphysical concept categories which constitute personal philosophy

Fully Organic	**Fully Mechanistic**
Holism (non-dualism)	Atomism (differentiation)
Non-linear Causality (webs of systematic interactions)	Linear Causality (chains of cause and effect)
Subjectivity (context-dependency)	Objectivity (context independence)
Dynamics (change is constant and ubiquitous)	Statics (change is superficial)

Thesis The series of arguments above explains the global ecological crisis in 'rational' terms by linking personal philosophy to affective connectedness and environmental behavior *in* people, while simultaneously considering the presumptive ideological exchange *between* modern societies and individuals. These ideas are encapsulated in the diagrams below (figure 1, figure 2, figure 3). Figure 1 illustrates the basic organization of the relationships describe above. Although the implicit paradigm transfer from 'macro' to 'micro' is strictly theoretical, the individual-level system of relationships between metaphysics, connectedness, and behavior was investigated using psychological surveys. Figure 2 clarifies the aspects of the model which were explored

[14] The mechanistic set of metaphysical assumptions

empirically. Figure 3 illustrates the tendency towards mechanistic metaphysical assumptions, feelings of disconnectedness from nature, and apathetic or destructive environmental behavior[15], through the elimination of feedback on personal philosophy. This model is not causally deterministic, as it may appear, because in actuality there would be thousands of arrows pointing to and between every box in the diagram. However, the model is perfectly illustrative of the general trend detailed above.

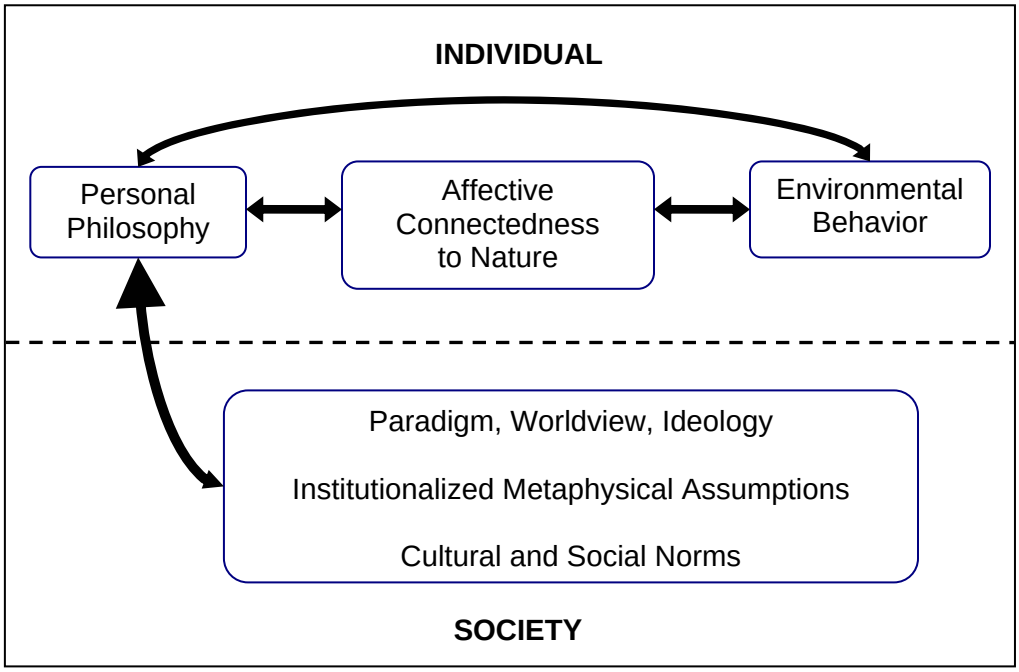


FIGURE 1: Basic model

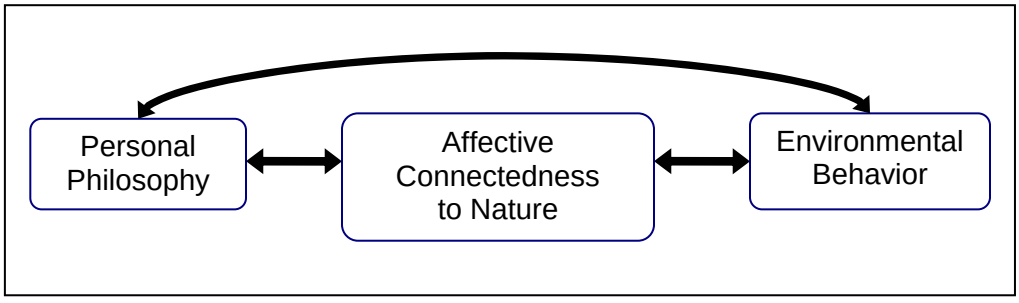


FIGURE 2: Basic empirical model

[15] Despite the seeming irrationality of this final step

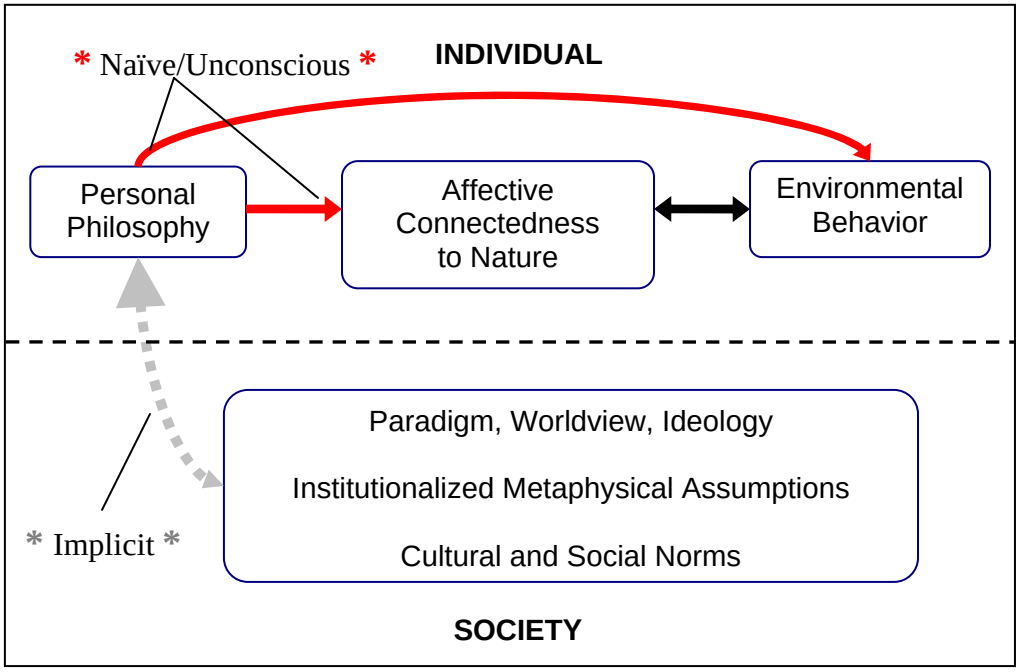


FIGURE 3: Specific theoretical argument

Hypotheses The first hypothesis in this study was that each of the relationships depicted in figure 2 is a significant positive correlation (each individual-level variable is correlated with the other two). Of particular interest was the correlation between personal philosophy and affective connectedness to nature, as this relationship is central to the above argument and has not previously been subjected to empirical study. Specifically, mechanistic metaphysics were predicted to correlate with relative feelings of disconnectedness, while organic metaphysics were predicted to correlate with relative feelings of connectedness. The second hypothesis was that affective connectedness to nature is a significant mediator between metaphysical assumptions and environmental behavior. In other words, it was predicted that the **[**metaphysics ←→ connectedness ←→ behavior**]** pathway constitutes a more significant relationship between personal philosophy and environmental behavior than the direct correlation between the two. The third hypothesis investigated the influence of personal choice and institutional input on metaphysical orientation: university students exposed to and self-selecting for a generally more mechanistic education (business and engineering students) were predicted to exhibit significantly more mechanistic metaphysical assumptions, while students exposed to and self-selecting for a generally more organic education (conservation studies, peace studies, meditation studies) were

predicted to exhibit significantly more organic metaphysical assumptions. These hypotheses are summarized below (table 2).

TABLE 2: Hypotheses

Hypothesis	**Description**
1	- Personal philosophy positively correlates with connectedness to nature. - Personal philosophy positively correlates with environmental behavior. - Connectedness to nature positively correlates with environmental behavior.
2	- Connectedness to nature mediates between personal philosophy and environmental behavior.
3	- Mechanistic education is associated with mechanistic metaphysical orientations in students. - Organic education is associated with organic metaphysical orientations in students.

Reliable scales for assessing individuals' feelings of connectedness to nature (Mayer and Frantz, 2004) and environmental behavior (id.) have been developed, and these variables have recently been observed to correlate strongly with one another (Kidner, 2001; Schultz, 2001; Mayer and Frantz, 2004; Mayer et. al, 2005). However, no measure currently exists which assesses the general nature of individuals' metaphysical assumptions. Filling in this gap was necessary for an investigation of the model above. In addition, it seems that a general measure of metaphysical orientation has potential utility in a wide range of academic disciplines. For these reasons, the central empirical aspect of this study was the development of the Relative Metaphysical Indicator (RMI), an original metric designed for the purpose of nominally ranking respondents according to personal philosophy. The absence of a basic metaphysics scale up to now is likely due to the seeming impossibility of accurately assessing beliefs which are so often unconscious or naively understood. The position advocated here, however, is that these beliefs are so basic that they can be accessed in a relatively simple and straightforward way.

Methods

The primary methodological instrument in this study was the Likert-scaled[16] questionnaire. In order to test the hypotheses in table 2, respondents were asked to complete four anonymous surveys. The Ecological Behavior Scale (EBS) (Mayer and Frantz, 2004) was administered to assess behavior with regards to the environment. The Connectedness to Nature Scale (CNS) (Mayer and Frantz, 2004) was administered to assess affective connectedness to nature. The Relative Metaphysical Indicator (RMI) was administered to assess personal philosophy. The Holistic Tendencies Scale[17] (HTS) (Choi et. al, 2003) was administered as a proxy measure of metaphysical orientation[18]. These measures were substituted into figure 2 to generate a statistically testable empirical model (figure 4).

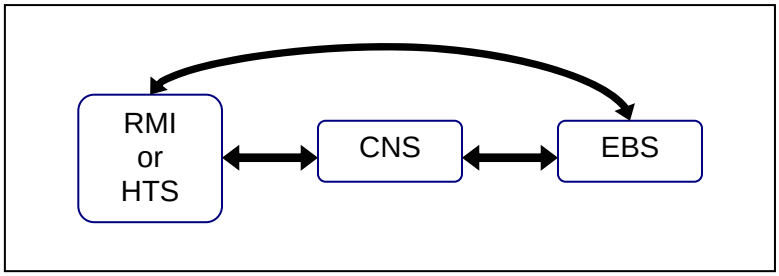


FIGURE 4: Statistically testable empirical model

CNS The Connectedness to Nature Scale (Appendix A) is a relative measure of respondents' affective and experiential connection to the natural world. Made up of fourteen simple statements, the CNS has performed well as an empirical tool: the survey loads on a single factor, shows high test-retest consistency and high internal accuracy, and correlates with related scales but not with possible confounders (Mayer and Frantz, 2004). Interestingly, the survey has been shown to correlate positively with 'spirituality' but negatively with 'religiosity' (Frantz, 2007, pre-publication, personal communication), lending empirical support to the above idea that the traditional orthodoxy of major religions would tend to be associated with mechanistic metaphysics while 'progressive,' 'alternative' and generally more obscure spiritual traditions would tend to be associated with organic metaphysics. The CNS has also been shown to correlate

[16] 1 – strongly disagree, 5 – neutral, 7 – strongly agree
[17] Originally termed an "analytics/holism" scale by the authors, this survey is referred to differently here for the sake of notational consistency.
[18] To protect against the possibility of the RMI failing to generate meaningful or statistically valid data

with pro-environmental behavior. As discussed above, no simple model can adequately account for the complexity of human thought and action. Nevertheless, as the authors note:

> 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 (Mayer and Frantz, 2004).

EBS The survey for assessing environmental behavior (Appendix B) used in this study is the same instrument used by Mayer and Frantz (2004) in the development of the CNS. This questionnaire consists of twenty-three statements in which respondents indicate how often they engage in a variety of behaviors with obvious environmental implications.

HTS The Holistic Tendencies Scale (Appendix C) was designed to measure "holistic versus analytic reasoning" as part of a study investigating cultural differences between Koreans and Americans (Choi et. al, 2003). The scale consists of ten simple Likert-scaled statements, each of which pertains directly either to the concept of holism or to the concept of non-linear causality as detailed above. The HTS was found to be a "valid and reliable" measure of these variables, and was therefore included in this study as a standard of comparison for the RMI; as a valid measure of half of the metaphysical concept categories, the HTS would be expected to exhibit a strong positive correlation with the RMI.

RMI The Relative Metaphysical Indicator (below) situates subjects on a spectrum ranging from 'fully mechanistic' (the lowest possible RMI score) to 'fully organic' (the highest possible RMI score) using a single index score. The RMI consists of sixteen simple metaphysical statements, or statements with clear metaphysical implications. Each statement pertains to either the organic or the mechanistic extreme of one of the dichotomies detailed above: atomism/holism, linear/non-linear causality, objectivity/subjectivity or statics/dynamics. Each statement also fits different categories associated with the formal definition of metaphysics: epistemological/ontological and social/universal (Merchant, 1980; Norgaard, 1994)[19]. Thus, the RMI facilitated a precise and nuanced nominal ordering of respondents according to personal philosophy.

[19] Objectivity/Subjectivity and Statics/Dynamics can not be meaningfully differentiated in terms of making social versus universal statements.

These questions address your beliefs about basic universal principles. Please respond in terms of the way you generally feel. There are no right or wrong answers. Using the scale provided, simply respond as honestly and candidly as you can to each question.

1	2	3	4	5	6	7
Strongly Disagree		Slightly Disagree		Slightly Agree		Strongly Agree

__ 1. Society is no more than a collection of people, just as nature is no more than a collection of atoms. (Atomistic, Social, Ontological)
__ 2. Events and objects cannot exist independently of how we observe them; observations change whatever is observed. (Subjective, Epistemological)
__ 3. It is possible to predict outcomes in nature because all change occurs in a linear sequence of events. (Linear, Cosmological, Ontological)
__ 4. Because it produces universal and objective knowledge, science will eventually tell us everything there is to know. (Objective, Epistemological)
__ 5. A system in equilibrium may also be changing constantly. (Dynamic, Ontological)
__ 6. Every social problem, such as pollution, poverty, and crime, could be solved separately, without solving the others. (Linear, Social, Epistemological)
__ 7. Earth is a single, integrated, living entity. (Holistic, Cosmological, Ontological)
__ 8. There is an objective reality that exists independently of my thoughts and perceptions. (Objective, Ontological)
__ 9. Because everything is constantly changing, anything that is true today may not be true tomorrow. (Dynamic, Epistemological)
__ 10. Everything in nature can be understood by taking it apart and studying the parts separately. (Atomistic, Cosmological, Epistemological)
__ 11. Human actions cannot be fully explained by simple laws of cause and effect. (Non-linear, Social, Ontological)
__ 12. It is impossible to know all of the causes of an event because everything in the universe affects everything else and the universe as a whole. (Non-linear, cosmological, Epistemological)
__ 13. Nature is made up of passive, inert parts, much like a machine. (Static, Ontological)
__ 14. If two people observe something but do not agree about what they see, they may both be correct. (Subjective, Ontological)
__ 15. Peoples' actions cannot be understood without considering the social context in which they live. (Holistic, Social, Epistemological)
__ 16. Nature is composed of interchangeable parts that can be repaired or replaced. (Static, Epistemological)

FIGURE 5: RMI

Data Collection The four surveys were administered together, in a randomized order, by means of the online data collection instrument surveymonkey.com. The subject pool consisted of five different sub-populations of UC Berkeley undergraduates: meditation students, peace and conflict studies (PACS) students, college of natural resources (CNR) students, engineering students, and business students (Appendix D). Respondents were invited to participate via an e-

mail consisting of a brief introduction and a link to the survey on a separate web page[20]. This letter was sent out three times between March 15 and April 5, 2007. In accordance with a protocol developed for the protection of human subjects, respondents were asked to confirm their consent to participate and were provided with detailed instructions prior to filling out the surveys. In addition to administering questionnaires, brief interviews were conducted with meditation teachers Christopher Wallis[21] and Michael Nagler[22], and several sessions of both instructors' courses were attended. These steps were taken to confirm the above argument that organic metaphysics are highly consistent with the basic principles and practice of meditation.

The students surveyed in this study represent a purposive sample population. This facilitated a thorough investigation of hypothesis 3. With regards to this hypothesis, it was predicted that the average RMI score of each sub-population would rank as follows (from highest to lowest), and that each difference in averages[23] would be statistically significant:

1. Meditation students receiving explicit instruction in organic metaphysics
2. PACS students receiving instruction in critical and progressive social theory
3. CNR students receiving ecological and conservation-oriented instruction
4. Engineering students receiving explicitly mechanical instruction emphasizing technological application
5. Business students receiving instruction intended to confer comparative individual advantage in competitive fields

Data Analysis All data analysis was conducted using the statistical software package R. The internal consistency and validity of the RMI was tested with orthogonal factor analysis. Hypothesis 1 (the correlations between surveys) was tested using Pearson's product-moment correlation, as was the correlation between the RMI and HTS. Hypothesis 2 (that CNS mediates between RMI and EBS) was tested with orthogonal mediation analysis. Hypothesis 3 (the ranking of sub-populations' RMI scores) was tested using a one-way ANOVA with Tukey's Honestly Significant Difference (HSD) between means. Several items on each scale required reverse scoring (Appendix E) prior to data analysis. This ensured that a response of 'strongly agree' would consistently correspond with feelings of connectedness (rather than

[20] See http://www.surveymonkey.com/s.asp?u=703773679907 for an example.
[21] A graduate student co-instructor of the meditation course which was surveyed
[22] A professor who teaches another meditation course on the UC Berkeley campus
[23] Meditation-PACS, PACS-CNR, CNR-Engineering, Engineering-Business

disconnectedness) on the CNS, with environmentally friendly (rather than environmentally harmful) behavior on the EBS, with holistic (rather than atomistic) tendencies on the HTS, and with organic (rather than mechanistic) metaphysical assumptions on the RMI.

Results

There were 229 total respondents, with 34 dropped on the basis of having left three or more questions blank, for a total of 195 analyzable subjects. Table 3 shows the number of respondents in each sub-population. Table 4 shows the overall average (aggregating sub-populations), standard deviation, reliability[24], and number of factors for each scale.

TABLE 3: # of Respondents

Sub-population	***N***
CNR	115
Business	30
PACS	20
Engineering	16
Meditation	14

TABLE 4: Scale Properties

Scale	**Mean**	**SD**	**alpha**	**# of factors**
RMI	5.184	0.623	0.72	2
HTS	5.714	0.842	0.82	2*
CNS	4.70	0.752	0.89	1
EBS	4.75	0.730	0.76	NA

* 2nd factor dropped due to low reliability

Performance of the RMI / Hypothesis 1 The RMI loaded on two factors, with a reliability of alpha = 0.72 and 31.3% variance explained. Five questions were dropped due to distribution (question 7) or high uniqueness levels (questions 5, 8, 11, and 16). The correlation between the RMI and HTS was strong ($r = 0.53$) and highly significant ($p << 0.001$). Table 5 shows the sixteen RMI questions grouped into eight mechanistic questions and eight organic questions. Table 6 shows the results of two-factor analysis on the RMI. The results of hypothesis 1 are shown in table 7.

Hypothesis 2 The CNS was a partial mediator between RMI and EBS, with a significance level of $p = 0.005$. The results of hypothesis 2 are shown in figure 6.

[24] alpha = % variance shared between questions

TABLE 5: Break down of RMI questions

Mechanistic Questions	Organic Questions
1	2
3	5
4	7
6	9
8	11
10	12
13	14
16	15

TABLE 6: Results* of orthogonal factor analysis with 2 factors

Factor 1	Factor 2
1 (0.413)	2 (0.494)
3 (0.533)	9 (0.442)
4 (0.589)	12 (0.560)
6 (0.455)	14 (0.611)
10 (0.757)	15 (0.532)
13 (0.390)	

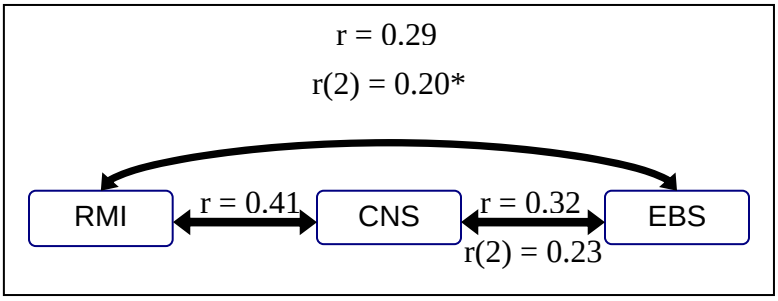
* question # (factor loading)

TABLE 7: Results of Pearson's product-moment correlations – Hypothesis 1

Relationship	Correlation	Significance	95% C.I.	t-value*
RMI – CNS	r = 0.41	p < 0.001	0.285 - 0.520	6.224
RMI – EBS	r = 0.30	p < 0.001	0.161 - 0.418	4.289
RMI – HTS	r = 0.53	p < 0.001	0.420 - 0.623	8.659
CNS – EBS	r = 0.32	p < 0.001	0.183 - 0.437	4.619
CNS – HTS	r = 0.46	p < 0.001	0.339 - 0.562	7.159
HTS – EBS	r = 0.084	p = 0.241	-0.057 - 0.222	1.173

* df = 193 for all values

FIGURE 6: Results of orthogonal mediation analysis – Hypothesis 2



* r(2) refers to new correlation coefficients obtained after mediation analysis was performed (see discussion, hypothesis 2)

Hypothesis 3 Table 8 compares the predicted ordering of average sub-population RMI scores to the observed ordering. Table 9 shows the significance of the differences between sub-population averages.

TABLE 8:Results of Hypothesis 3

Hypothesized order	Observed order	Ave. RMI Score
Meditation	Meditation	5.90
PACS	PACS	5.28
CNR	Business	5.17
Engineering	CNR	5.16
Business	Engineering	4.64

TABLE 9: Results of 1-way ANOVA with Tukey HSD

Relationship	Significance
Meditation > PACS	$p = 0.02$
Meditation > Business	$p << 0.001$
PACS > Business	$p = 0.97$
Business > CNR	$p = 0.99$
PACS > CNR	$p = 0.89$
CNR > Engineering	$p < 0.01$

Discussion

The relationship between the theoretical and empirical aspects of this study must be clearly understood for a meaningful analysis of the results. The theoretical aspect posits an answer to the question: why have humans so thoroughly degraded the global ecosystem, upon which their own livelihood depends? The empirical aspect of the study is not intended to 'legitimate' or 'verify' the theoretical framework, which is independently robust. However, assessing the predictive efficacy of a theoretical construct enables an assessment of the *practical utility* of that idea. In other words, quantitative analysis has value in this study not as a tool for answering the question 'Is this theory right?' but rather as a method for evaluating the question 'Could these ideas be applied towards widespread progressive change?' With this in mind, the discussion below

considers the performance of the RMI as an empirical tool, the results of each hypothesis, and the various problems and caveats associated with the empirical process. The conclusion will consider this second inquiry in light of the data presented above.

Validity of the RMI The factor loading characteristics of the RMI indicate that the survey is a precise and internally consistent scale. The numerous structural elements of the RMI (social/cosmological, epistemological/ontological, etc.) render a range of factors theoretically explicable, but a simple division into half mechanistic questions and half organic questions is the most logical break down of the survey. As tables 5 and 6 demonstrate, the RMI loads on two factors: factor 1 consists of mechanistic questions and factor 2 consists of organic questions, exactly as expected. 31.3% cumulative variance explained by two factors and 72% variance shared between questions are acceptable values, though lower than optimal. Considering the highly abstract nature of metaphysics, however, these results are an extremely promising (bordering on surprising) indication that the RMI is a valid scale and that metaphysical assumptions are empirically accessible.

After factor analysis was performed, five of the original questions on the RMI were dropped. In the items dropped for high uniqueness (5, 8, 11 and 16), it is particularly difficult to determine exactly what question is being asked. It is therefore understandable that these items would load on unique factors, because the answers would cover a broad range of ideas relative to other questions. Question seven was dropped because a disproportionately high number of respondents agreed with it. This also makes sense, as the statement “Earth is a living entity” is quite easy to agree with; respondents seem to have simply ignored the modifiers “single” and “integrated” in this question. Interestingly, four of the dropped items are ontological while only one is epistemological. It thus appears that questions about ‘how the universe works’ are more difficult to interpret than questions about ‘how we can apprehend the workings of the universe.’

The strong correlation between the RMI and HTS (table 7) indicates that the RMI is also an accurate measure of metaphysical orientation. There are two key differences between the RMI and the HTS. First, the HTS addresses only half of the metaphysical concept categories (table 1), and was therefore considered a ‘proxy’ measure of metaphysical assumptions. Second, the RMI is structured by a more precise delineation of concept categories, and is therefore a more exact measure of metaphysical orientation as defined in this work. Nevertheless, there is clearly a high degree of conceptual overlap between the two scales:

- HTS 1 – Everything in the universe is somehow related to each other.
- HTS 3 – Any phenomenon has a numerous number of causes although some of the causes are not known.
- RMI 12 – It is impossible to know all of the causes of an event because everything in the universe affects everything else and the universe as a whole. (Non-linear, cosmological, Epistemological)

In short, the RMI is strongly correlated with related scales, has factor-loading characteristics entirely in line with theoretical expectations, and has reasonable reliability and explanatory power. These results support the use of the RMI to test the hypotheses in table 2.

Hypothesis 1 Each aspect of hypothesis 1 was borne out with a high degree of statistical significance (table 7). Personal philosophy was strongly correlated with affective connectedness to nature and moderately correlated with environmental behavior, and these latter variables (connectedness and behavior) were moderately correlated with one another[25]. The strongest correlation observed was between the RMI and the CNS, which is in fitting with the above idea that personal philosophy has a particularly important influence on affective connectedness to nature. The implication of these findings is simple but has rarely received explicit empirical support: metaphysical assumptions are highly relevant to the relationship between humans and the environment.

Interestingly, the HTS also correlated strongly with the CNS but did not correlate at all with the environmental behavior (table 7). This indicates (a) that philosophy in general is significantly linked with affective connectedness and (b) that while the RMI and HTS are clearly related scales, there is a fundamental difference between them which renders the former more relevant to environmental behavior than the latter. It is likely that this difference is due at least in part to the more complete and precise nature of the RMI as a measure of personal philosophy[26].

Hypothesis 2 Affective connectedness to nature was a partial mediator between personal philosophy and environmental behavior (figure 6). Due to the correlation between personal philosophy (the independent variable) and affective connectedness to nature (the mediator), there is 'double counting' in the correlations (table 7) between these variables and environmental behavior (the dependent variable). Mediation analysis corrects for this problem. In full

[25] This is a replication of previous findings (Mayer and Frantz, 2004)
[26] Hypothesis 2 was also tested using the HTS in place of the RMI. No mediation effect observed, which is likely due to the same differences.

mediation, the correlation coefficient between the mediator (CNS) and the dependent variable (EBS) decreases but the relationship remains significant, while the correlation coefficient between the independent variable (RMI) and the dependent variable (EBS) falls to zero and becomes highly insignificant. In testing hypothesis 2, the correlation between the independent variable (RMI) and the dependent variable (EBS) did fall, but not to zero; the mediation effect was highly significant ($p = 0.005$), but incomplete. This indicates that if the independent variable and the mediator 'switched places' in the model, a partial mediation effect would still be observed. In fact, such a result should have been expected in this study, because the concept of 'connectedness' is present in both the RMI (as an abstract and cognitive variable) and the CNS (as a concrete and affective variable):

- RMI 7 – Earth is a single, integrated, living entity.
- CNS 1 – I often feel a sense of oneness with the natural world around me.

In positing hypothesis 2, the importance of this reflexivity between affective connectedness and atomism/holism was not immediately apparent. In retrospect, therefore, the observed partial mediation makes more sense than a full mediation effect would have. This is not to say, however, that the RMI and CNS are interchangeable. As argued in footnote 5, "affective connectedness may be more immediately relevant to environmental behavior than cognitive connectedness". This argument is borne out by the observation that, with or without double counting, affective connectedness correlates more strongly with environmental behavior ($r = 0.32$, $r(2) = 0.23$) than personal philosophy does ($r = 0.29$, $r(2) = 0.20$).

Hypothesis 3 Some of the results of hypothesis 3 were exactly in line with the predictions above (table 8), while other findings were compelling inconsistencies. The basic trend in the data was as follows: meditation students 'on top' with the highest (most organic) RMI scores, engineering students 'at the bottom' with the lowest (most mechanistic) RMI scores, and the remaining students (PACS, business, CNR) grouped 'in the middle,' statistically identical to one another (table 9). In other words, students who self selected for and received explicitly organic instruction exhibited significantly more organic metaphysical assumptions, while students who self selected for and received explicitly mechanical instruction exhibited significantly more mechanistic metaphysical assumptions. Students in more interdisciplinary fields with a wider range of philosophical input held more mixed beliefs. The range of metaphysically distinctive majors in the College of Natural Resources is particularly indicative of this point:

- Conservation and Resource Studies
- Environmental Economics and Policy
- Environmental Sciences
- Forestry and Natural Resources
- Genetics and Plant Biology
- Microbial Biology
- Molecular Environmental Biology
- Molecular Toxicology
- Nutritional Sciences
- Society and the Environment

The finding that meditation students have significantly more organic metaphysical orientations than any other sub-population is probably the most telling result of hypothesis 3; meditation students receive explicit philosophical instruction on a weekly basis, and should therefore be better prepared than other students to accurately answer questions about metaphysics. Moreover, the significantly higher RMI scores exhibited by the meditation class are consistent with the argument that meditation is a prototype of organic metaphysics. The most surprising finding is that business students have significantly more organic metaphysical assumptions than engineering students, and are in fact completely indistinguishable from CNR students as far as personal philosophy is concerned. It was predicted that the competitiveness of the business world would permeate business education, and would manifest in metaphysical assumptions more mechanistic than those exhibited by engineers, despite the strictly mechanical nature of engineering. This idea was clearly incorrect – the explicitly mechanical nature of engineering instruction outweighed the implicitly individualistic nature of business instruction.

In retrospect, again, the differences between predictions and observations in hypothesis 3 should have been expected. Business may be more mechanistically cutthroat in spirit, but engineering is clearly more mechanical in day-to-day practice. In fact, the finding that engineering students exhibit significantly more mechanistic metaphysical assumptions than any other sub-population is uniquely commensurate with the theory at the heart of this work. Underlying ideological assumptions are almost never explicitly acknowledged in engineering studies, and engineers seem particularly unable to recognize that their beliefs about how the universe works are assumptions, not facts[27]. Thus, engineering students would have a tendency to satisfy both of the requirements for the tacit propagation of institutional ideology into individual thought and action as specified in figure 3: implicit metaphysical input from a commonplace institution (academia), and naïve or unconscious personal philosophy.

[27] These statements are unfair generalizations, but they are based solely upon the personal testimony of engineers regarding other engineers.

The alternative explanation for the results of hypothesis 3 is that the meditation and engineering classes represent the smallest sub-population samples (table 3), and that larger numbers of respondents would pull the engineering average up and drive the meditation average down. This explanation seems unlikely. The observed differences in sub-population averages are both extremely theoretically reasonable and highly statistically significant. Larger sample sizes could clarify and perhaps slightly moderate emerging trends, but it is highly improbable that these trends would actually be observed to reverse. Thus, it is reasonable to conclude that overt organic instruction is associated with organic metaphysics, while overt mechanical instruction is associated with mechanistic metaphysics, exactly as predicted.

Problems, Caveats, and Future Work There are two types of problems in this work. The first are methodological issues which could be addressed with further study. The second are problems inherent to the empirical formalization of philosophy which can not be controlled for but which should be made explicit.

One area in which future work could expand on this study is the inclusion of socioeconomic analysis. Socioeconomic factors would enter the model as an input to personal philosophy (figure 1). The most important factors would likely not be the typical socioeconomic variables – gender, race, income, etc. – but rather more nuanced issues such as whether the respondent was raised in an urban or rural environment. Another area for improvement, as mentioned above, is larger and more evenly distributed sub-population sample sizes. Finally, a broader sample population and entirely random sampling are necessary to clarify the above trends and to explore whether or not these trends hold in groups of people more diverse than Berkeley undergraduates.

In addition, there are serious problems inherent to the empirical process of ‘measuring’ philosophy. Practically, the Likert-scaled survey has obvious limitations as an overall measure of an abstract and ambiguous variable such as metaphysical orientation. Incompatible diction alone could well cause respondents to interpret the RMI questions differently than the author does. Theoretically, the possibility that many respondents possess naïve metaphysics adds the additional problem of accidentally dishonest responses to the usual problem of purposefully dishonest responses in self-reported surveys. These observations do not impeach the results of this study, but should be openly acknowledged as problems which are inherent in the use of psychological surveys and which are almost impossible to control for.

There is an important caveat to the discussion of hypothesis 3 above. Since students self-select for educational opportunities, there is no way to infer causality between instruction and beliefs; students with a predilection towards organic metaphysics are more likely to take a meditation class than students with a predilection towards mechanistic metaphysics. This 'natural' philosophical stratification of the university makes the exact implications of the findings in hypothesis 3 unclear, but also elucidates the idea that *personal choice plays an integral role in reinforcing beliefs and behaviors, and must therefore also play a role in any earnest attempt to mitigate harm to the environment.*

A final caveat is the difference between statistical significance and practical importance. Most of the key hypotheses in this study were borne out with a high degree of statistical significance. However, considering hypothesis 3 in particular, it is fair to ask whether the differences in sub-populations are meaningful or simply quantitative artifacts: while the difference between the average RMI scores of meditation students and engineering students is *highly* significant ($p << 0.00001$), this difference is only 1.3 points (table 8).

Conclusion

In general, the results of this study are meaningful as well as significant. Most important is the finding that metaphysical assumptions are empirically accessible. The success of the RMI as an empirical tool indicates that it is possible to ask people questions about basic beliefs and to receive substantive answers. It is therefore possible to have conversations with people about the same ideas. As argued above, the self-perpetuating ubiquity of mechanism is due to the fact that fundamental assumptions are unacknowledged (implicit) at the societal level and unrecognized (naïve) at the individual level. Explicitly addressing the role of metaphysics would therefore be a logical component of a progressive environmental platform, yet open discussion of underlying ideology has been essentially non-existent in recent decades, despite growing concern over degradation and inequality.

Encouraging metaphysical dialogue is the role of institutional leaders: academics and scientists, traditional theologians and clergy, educators, CEO's, news media, and (of course) politicians. At the same time, it is clear that change must come in the form of different choices made by individuals. The results of this work show that how connected an individual feels to the environment, and how he behaves towards it, are significantly influenced by how connected he

assumes himself to be. Metaphysical assumptions are unfalsifiable, and hence are subject to free choice. Conditioned affective or behavioral responses based upon unrecognized assumptions are less free and less 'chosen.' Thus, an environmentally destructive individual who naively assumes that the universe is a disconnected place and that he is a disconnected agent within it may be unable to adopt more eco-friendly behaviors, even if he wants to. This suggests something fundamental and fascinating about the relative efficacy of different types of choices. More concretely, the fact that metaphysics are so rarely employed as a legitimate realm of discourse exposes an opportunity for motivating progressive environmental change which has not yet been fully realized in the public sphere. For this reason, the ideas in this work could be immediately applicable towards the reversal of environmentally destructive trends, and the mitigation of potentially drastic future consequences.

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APPENDIX A:
The Connectedness to Nature Scale

These questions address how connected you feel to the natural environment. Please respond in terms of the way you generally feel. There are no right or wrong answers. Using the scale provided, simply respond as honestly and candidly as you can to each question.

1	2	3	4	5	6	7
Strongly Disagree		Slightly Disagree		Slightly Agree		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.

APPENDIX B:
The Ecological Behavior Scale

Please rate how often you do each of the following things. There are no right or wrong answers. Using the scale provided, simply respond as honestly and candidly as you can to each question.

1	2	3	4	5	6	7
Very Rarely						Very Often

__ 1. Drive a car
__ 2. Compost your food waste
__ 3. Turn off your computer when you have finished using it
__ 4. Leave the water running while brushing your teeth
__ 5. Recycle
__ 6. Minimize the length of your showers
__ 7. Bring shopping bags with you to the grocery store
__ 8. Avoid genetically engineered products
__ 9. Turn off the light when the room is vacant
__ 10. Use disposable paper products like paper towels and paper napkins
__ 11. Use public transportation
__ 12. Print double-sided
__ 13. Buy local food
__ 14. Avoid pesticides and chemicals in products you buy
__ 15. Use Styrofoam or other disposable containers
__ 16. Eat meat
__ 17. Support oil companies you know have oil spills
__ 18. Purchase biodegradable or recycled goods
__ 19. Fly in planes
__ 20. Wear leather
__ 21. Drop cigarette butts or other trash on the ground
__ 22. Leave your heat or air conditioning turned up when no one is home
__ 23. Take baths

APPENDIX C:
The Holistic Tendencies Scale

These questions address whether you think systems are separated into individual parts or unified holistically. Please respond in terms of the way you generally feel. There are no right or wrong answers. Using the scale provided, simply respond as honestly and candidly as you can to each question.

1	2	3	4	5	6	7
Strongly Disagree		Slightly Disagree		Slightly Agree		Strongly Agree

__ 1. Everything in the universe is somehow related to each other.
__ 2. Even a small change in any element of the universe can lead to substantial alterations in others.
__ 3. Any phenomenon has a numerous number of causes although some of the causes are not known.
__ 4. Any phenomenon has a numerous number of results although some of the results are not known.
__ 5. Nothing is unrelated.
__ 6. It's not possible to understand the pieces without understanding the whole picture.
__ 7. The whole is greater than the sum of its parts.
__ 8. Paying attention to the field is more important than paying attention to its elements.
__ 9. A marker of good architecture is how harmoniously it blends with other buildings around it.
__ 10. Sometimes, the empty space in a painting is just as important as the objects.

APPENDIX D:
Sample Populations

CNR: All students on the voluntary College of Natural Resources e-mail list (~1,700)

Business: All students on the Haas school of business undergraduate e-mail list (~700)

PACS courses:
- Peace Theory (~70)
- Human Rights and Global Politics (~50)
- Non-violence Today (~50)

Engineering courses:
- Chemical Process Design (~50)

Meditation courses:
- Meditation, Mysticism and Mind (~60)

APPENDIX E:
Reverse Scored Questions and Dropped Questions

Relative Metaphysical Indicator (RMI)
- Reverse Scored: 1, 3, 4, 6, 10, 13
- Dropped: 5, 7, 8, 11, 16

Connectedness to Nature Scale (CNS)
- Reverse Scored: 4, 12, 14

Environmental Behavior Scale (EBS)
- Reverse Scored: 1, 4, 10, 15, 17, 21, 22
- Dropped: 16, 19, 20, 23

Holistic Tendencies Scale (HTS)
- Dropped: 6, 7, 8, 9 (low reliability of factor 2)