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Assessing the structure and correlations of connectedness to nature, environmental concerns and environmental behavior in a Greek context

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Abstract

The current study examines connectedness to nature feelings, environmental concerns and environmental behavior in a Greek population. The structure of these constructs and their relations were assessed with the help of Factor Analysis and Structural Equation Modeling (SEM). Data were collected from two random Greek citizen samples using questionnaire survey method. We used the Connectedness to Nature Scale (CNS) to measure connectivity to nature feelings and Environmental Motives Scale (EMS) to assess peoples' environmental concern in both studies. Items from previous research were adopted to measure peoples' environmental behavior. In study 1, Exploratory Factor Analysis (EFA) suggested that connectedness to nature is a uni-dimensional measure, while environmental behavior and environmental concerns are multidimensional constructs. In study 2, Confirmatory Factor Analysis (CFA) confirmed the proposed structure of all constructs in the study. The SEM model tested the associations among connectedness to nature, environmental concern, and the behavioral domains and showed an acceptable fit. The results indicated that, after controlling for age, gender and education, connectedness to nature, egoistic and biospheric concerns were significantly related to personal practices, while altruistic concerns had a significant but negative correlation with personal practices. Only egoistic concerns showed a significant and positive relationship with environmental action. The reported findings have implications on policy related to the promotion of pro-environmental behavior and contribute to social science research that aims to understand human responses to a changing environment.

Keywords Environmental behavior · Connectedness to nature · Environmental concern · Structural equation modeling · Demographic variables

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Introduction

Several environmental problems are rooted in the human behavior, thus it is crucial for environmental psychology to identify the underlying motives and factors that influence people to adopt a sustainable lifestyle (Gifford 2008; Ardoin et al. 2013). A growing body of research has studied environmental behavior, examining a variety of predictive factors including general attitudes (Milfont and Duckitt 2010), values (e.g De Groot and Steg 2010), normative beliefs (Lindenberg and Steg 2007; Nolan et al. 2008), connectedness to nature (Schultz 2001; Mayer and Frantz 2004; Gosling and Williams 2010) and environmental concern or motives (Dunlap et al. 2000; Schultz 2002; Rhead et al. 2015). A rigorous examination of the effects of these factors is a prerequisite in order to promote environmental behavior.

Definition of Environmental Behavior and Potential Domains

Defining the types of behaviors that are considered environmental has proven quite difficult (Schultz and Kaiser 2012; p.662) since scholars emphasize either on the intention or the impact of these actions.[1] Following the impact-oriented perspective, Steg and Vlek (2009) define pro-environmental behavior as "behavior that harms the environment as little as possible or even benefits the environment" (p. 309). On the other hand, Kollmuss and Agyeman (2002) define pro-environmental behavior as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world" (p. 240), a definition that comes along with the intention-oriented approach. Stern (2000) propose two different definitions for environmentally friendly actions. Environmentally significant behavior represents the "extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself" (Stern 2000; p.408). This definition is impact-oriented and refers to a variety of behaviors that have a positive direct or indirect impact on the natural environment. Environmental significant behavior is "any behavior that is undertaken with the intention to change the environment" (Stern 2000; p.408), a definition that encompasses the intention-oriented conceptualization.

Steg and Vlek (2009) argue that pro-environmental behavior, whether goal-directed or not, should be distinguished from the broader term environmental behavior. They adopt the impact-oriented definition of Stern (2000) and consider as environmental all types of behaviors that affect natural environment's ecological balance and biodiversity (p. 309). This contains both environmentally damaging as well as beneficial for the environment behaviors. Alisat and Riemer (2015) propose the term "environmental behavior" to refer to "any behavior intended by the individual to have a positive impact on the environment" (p.14). In this work, we follow the latter definition to refer to any possible eco-friendly action.

In environmental psychology, various studies conceptualize environmental behavior as multidimensional (Gatersleben 2013; p.137), suggesting that it is not valid to cluster a range of different behaviors along one dimension. According to Stern (2000), there are four major types of conservation behavior that people can engage in. The first broad category, environmental activism, includes highly committed behaviors such as participation in public demonstrations and being an active member of an environmental organization. The next category, non-activist behaviors in the public sphere, refers to low commitment active citizenship and policy support actions, including signing a petition to demand nature protection and approval of environmental regulations. Another type of environmentally significant behavior is private sphere practices and subsumes other relevant behaviors such as recycling, transportation choices and purchase decisions. The last type of conservation behavior is called 'other environmentally significant behaviors' and considers actions such as 'influencing the actions of the organizations to which they belong' (Stern 2000; p.410). Kaiser and Wilson (2004), however, suggest that environmental behavior is goal-directed and represents a unidimensional measure, implying that people generally are motivated to act considering only one underlying goal, environmental conservation. This, in turn, means that different behaviors (e.g recycling, transportation habits, donate money for environmental causes) can be mapped onto one dimension, and therefore these behaviors are distinct only in terms of their difficulties.

Other researchers report empirical evidence of only two distinct categories of environmental behavior, personal practices and civic or environmental actions (Hunter et al. 2004; Dono et al. 2010; Hadler and Haller 2011; Alisat and Riemer 2015; Tam and Chan 2017; Pisano and Lubell 2017). Environmental actions are engaged citizen behaviors (Riemer et al. 2013) and refer to actions such as donating money to environmental causes, signing petitions, organizing a boycott, voting, participation in environmental organizations or in protests, and talking to others about environmental issues. 'Personal practices' is an umbrella term to refer to any behavior take place in the private sphere, such as waste management in the household setting, as well as energy and water conservation behaviors, transportation choices and consumerism. Personal practices are commonly referred in the literature as "pro-environmental behavior" (e.g Kollmuss and Agyeman 2002; Bamberg and Möser 2007), conservation lifestyle behaviors (Larson et al. 2015) or private behaviors (Pisano and Lubell 2017). Private-sphere behaviors have been the focus of most studies in the EB literature (e.g Stern 2000; Gatersleben et al. 2002; Steg and Vlek 2009). This category encompasses many potential domains including recycling (Corral-Verdugo 1997; Oreg and Katz-Gerro 2006; Kaiser et al. 2007), water and energy conservation (Gatersleben et al. 2002; Abrahamse et al. 2005; Kaiser et al. 2005), transportation choices (Kaiser et al. 2005; Oreg and Katz-Gerro 2006) and green purchasing (Kaiser and Wilson 2004; Young et al. 2010). Environmental actions illustrate multiple domains, including policy support (Stern 2000; Poortinga et al. 2004; Larson et al. 2015) and environmental citizenship (Stern 2000; Alisat and Riemer 2015). Following the above recommendations, in this study, environmental behavior is theorized as a two-dimensional construct reflecting environmental actions and personal practices.

[1] Two dominant approaches have been used to study environmental behaviors: one focused on impact, and a second focused on intention (Larson et al. 2015). The intention perspective refers to behaviors that contribute to the sustainability of the natural environment and emphasizes the outcome of the behavior, rather than the motivation behind it. The impact-oriented approach makes no assumptions about underlying motivations and focuses on behaviors that move the individual in the direction of a smaller impact (Poortinga et al. 2004).

Connectedness to Nature and Environmental Behavior

An increasing amount of empirical work reveals the importance of humans' connection with nature for explaining pro-environmental behavior (e.g Schultz 2001; Mayer and Frantz 2004; Davis et al. 2011; Lokhorst et al. 2014; Restall and Conrad 2015). Scholars use multiple terms in the literature to refer to this connectivity notion, including connectedness to nature (Mayer and Frantz 2004), inclusion of nature in self (Schultz 2001), nature relatedness (Nisbet et al. 2009) dispositional empathy with nature (Tam 2013), or love and care for nature (Perkins 2010). Connectedness to nature refers to a core belief that places the individual on a continuum with two edges: On the one end of the continuum is a person who feels distinct from the natural environment (Schultz et al. 2004), and on the other end of the continuum, is a person who believes that all living organisms, including human beings, are equal parts of the same physical environment. In general, the connectivity to nature construct encompasses an individual's belief about the extent to which s/he is part of the natural environment (Schultz 2002).

A considerable amount of scales has been developed to measure connectedness to nature (Clayton and Saunders 2012; p.209), including Emotional affinity toward nature (EATN, Kals et al. 1999), Inclusion of Nature in Self Scale (INS, Schultz 2002), Connectedness to Nature Scale (CNS, Mayer and Frantz 2004), Nature Relatedness Scale (NR, Nisbet et al. 2009) and Implicit Associations Test (Schultz et al. 2004) (for an overview see Restall and Conrad 2015). All these the measures, despite some conceptual differences, argue that relatedness to nature varies among individuals and can be considered a relatively stable trait that can contribute to understanding the motivational basis of environmental behavior (Kals and Müller 2012; p. 172). Research shows that the notion of connectivity with nature is significantly associated with environmental behaviors and commitment to these behaviors increases when individuals include nature to their self-construal (Perkins 2010; Brügger et al. 2011; Barbaro and Pickett 2016), indicating that feeling connected to nature is an important factor that can lead to eco-friendly behaviors. Dutcher et al. (2007, 2015) concluded that the notion of connectivity with nature was significantly associated with pro-environmental behaviors. Moreover, Arnocky et al. (2007) argue that commitment to environmental behaviors increases when individuals included nature to their self-construal. Davis et al. (2011) show that people's related concept of interconnectedness is a strong predictor of pro-environmental behavior. Gosling and Williams (2010) point out that connectedness to nature is a significant but moderate predictor of environmental behavior. Brügger et al. (2011) report a significant positive relationship among connectedness to nature and ecological behavior measured by General Ecological Behavior scale (Kaiser and Wilson 2004). Along with the insights that connectivity to nature provides into the environmental behavior research, increasing our understanding on how people form their relationship with the physical environment and their connectedness feelings 'can effectively contribute to environmental management goals' (Restall and Conrad 2015; p.1).

In the current study, we focus on a well-established measure, the Connectedness to Nature Scale (CNS), to specifically measure 'individuals' experiential sense of oneness with the natural world' (Mayer and Frantz 2004, p.504). CNS is an affective measure of experiential connection to nature and lies upon the contention that humans will be able to effectively address environmental issues if only they feel truly connected to the physical environment. Past research has shown a significant positive relationship between CNS and ecological behavior or intentions (Kals et al. 1999; Mayer and Frantz 2004; Dutcher et al. 2007; Perkins 2010; Brügger et al. 2011, Barbaro and Pickett 2016; Davis and Stroink 2016), indicating that feeling connected to nature is an important factor that can lead to eco-friendly behaviors.

Most of the studies reviewed above focus on the personal practices domain of environmental behavior and failed to test the relationship between connectedness to nature and activism (e.g Kals et al., 1999; Mayer and Frantz 2004; Arnocky et al. 2007; Gosling and Williams 2010; Barbaro and Pickett 2016). Other studies include into their analysis behavioral measures that contained both personal practices and environmental action items, but they treat these measures as unidimensional (e.g Dutcher et al. 2007; Davis et al. 2011; Brügger et al. 2011). Thus, there is a gap in the existing literature regarding the relationship between connectedness to nature and environmental action domain.

Environmental Concern and Environmental Behavior

Many scholars over the last 30 years have studied environmental concern as a specific aspect of environmental attitudes (Bamberg 2003) or related to broader concepts like value orientations and accounted it as a necessary precursor of behavior change (Milfont et al. 2006). Environmental attitudes are 'a psychological tendency to evaluate the natural and built environments, and factors affecting their quality, with some degree of favor or disfavor' (Milfont and Schultz 2016; p.94). Environmental concern refers to the evaluation of environmental issues (Steg and De Groot 2012; p.122), including general attitudes toward the environment (Fransson and Gärling 1999), beliefs on natural conservation, worries about environmental problems and the importance of consequences of environmental problems for oneself, others, and the biosphere (Stern et al. 1993; Bamberg 2003; Biel and Nilsson 2005). According to Schultz et al. (2004; p.31), environmental concern is the "affect associated with beliefs about environmental problems". Others suggest that environmental concern is the degree to which

people are aware of environmental problems and indicate a willingness to contribute personally to their solution (Dunlap and Michelson 2002; p.485). The latter indicates that environmental concern is a very broad construct 'covering a wide range of phenomena with multiple aspects and dimensions' (Rhead et al., 2015; p.175). The most popular measures of general environmental concern are the Ecology Scale (Maloney and Ward 1973), the Environmental Concern Scale (Weigel and Weigel 1978), and the New Environmental Paradigm (NEP) Scale (Dunlap and Van Liere 1978; Dunlap et al. 2000). These scales examine multiple aspects of concern, such as beliefs and attitudes toward various environmental topics.

Empirical research on environmental psychology has brought into light evidence supporting the existence of value-based environmental concern (Thompson and Barton 1994; Stern and Dietz 1994; Stern et al. 1995; Schultz and Zelezny 1999; Schultz 2001; Schultz et al. 2004). Drawing on Schwartz's norm-activation model of altruism, Stern et al. (1993) suggest that there are three value orientations toward environmental concern. Egoistic value orientation indicates self-enhancement attitudes toward the environment, the altruistic value highlights the concern about the welfare of other human beings, while a biospheric value orientation shows concern about the non-human species. Schultz (2001) based his work in these value orientations to develop the Environmental Motives Scale (EMS) to measure egoistic (me, my future, my health, my lifestyle), altruistic (all people, people in my community, future generations, children) and biospheric concerns (plants, birds, animals, marine life) and identify those motives that could drive people to adopt a sustainable lifestyle.

Prior research in environmental psychology has examined environmental concern as a predictive component of pro-environmental behavior. Schultz (2001) report significant correlations between pro-environmental behavior and biospheric concerns measured via the EMS scale. Schultz et al. (2004) also reveal a positive correlation of biospheric concerns and environmental behavior, a negative relationship between egoistic concerns and behavior and no correlation at all between altruistic concerns and behavior. On the contrary, altruistic concerns are found to be significantly and positively correlated with behavior in other cases (Schmuck and Vlek 2003). Likewise, other researchers suggest that both individuals who hold biospheric and egoistic environmental concerns are likely to engage in pro-environmental behaviors (Milfont et al. 2006; Schultz et al. 2005; Steg et al. 2011). Sörqvist et al. (2015) report only moderate correlations between the environmental concern domains and environmental behavior, but they base their results in a quite small sample of students ($n = 48$). More recent, Aprile and Fiorillo (2017) show that egoistic and altruistic environmental concerns were positive drivers of water-saving behavior, while biospheric environmental concern is a positive determinant of water consumption behavior. These inconsistencies regarding the relationship between environmental concern and environmental behavior are due to cultural and sample differences across the studies (Milfont et al. 2006).

Other scholars study the relationship between connectivity to nature and environmental concern and find that biospheric concerns were significantly associated to CNS (Mayer and Frantz 2004; Perkins 2010; Raymond et al. 2011; Davis and Stroink 2016). Egoistic concerns are found to negatively correlate with CNS (Mayer and Frantz 2004; Raymond et al. 2011), while altruistic concerns have a positive relationship with CNS (Perkins 2010). Egoistic, altruistic and biospheric environmental concerns are typically found to be significantly and positively related (Schultz 2001; Snelgar 2006; Hansla et al. 2008; Alibeli and White 2011; Sörqvist et al. 2015), although exceptions may occur (Schultz et al. 2004).

Nevertheless, most of these scholars do not consider the impact of environmental concerns on environmental action but rather focus on personal practices. Only a few studies have tested the relationship between various forms of environmental concern and activism (e.g Dietz et al. 1998; Wakefield et al. 2006; Lubell 2002; Tam and Chan 2017). Stern and Dietz (1994) for instance, report that biospheric and egoistic concerns directly affect political action. McFarlane and Boxall (2003) show that higher biospheric beliefs lead to less involvement in activist behaviors. Lubell (2002) and Lubell et al. (2007) reveal that collective interest predicts political participation as a form of environmental action. The collective interest model posits that people will participate in public sphere actions when the expected value of participation will positively affect other people and the collective good generally, which in turn depicts altruistic concerns. Binder and Blankenberg (2016) study the impacts of environmental concern on well-being as mediated by environmental activism and find that there is a significant positive effect of egoistic concerns on volunteering as an activist behavior. Taken together, these limited findings suggest that the concern-action relationship is understudied and we cannot make a safe conclusion for it.

At this point of the literature review, it is important to emphasize that general environmental concern is typically found to be positively related to pro-environmental intentions and behavior, although relationships are often weak (Thøgersen and Olander 2006). Recent studies highlight the concern- behavior gap (e.g Rhead et al., 2015) and 'examine the mediating role of the so-called psychological barriers' which depict four major factors, Denial, Interpersonal Influences, Conflicting Goals and Aspirations, and Tokenism[2](Gifford

[2] Denial factor reflects a denial that environmental problems exist. Interpersonal Influences pertain to the difficulty of changing one's behavior, potential risks inherent in change, lack of time, financial stake and other barriers. Conflicting Goals and Aspirations barrier refers to positive environmental behavior change which is deemed incompatible with other valued goals. Tokenism represents actions that the person has already adopted and contentment with current behaviors. These barriers were mentioned for literature review reasons but there were not part of the study's objective. For an overview see Gifford et al. (2011) and Gifford & Chen (2017).

& Chen, 2017; Tam and Chan 2017). The current work focuses on the correlation between environmental concerns and the environmental behavior's domains and thus, the above mediating psychological constraints are not considered in the study's objective and are missing from the analysis.

Objectives

CNS and EMS scales are used to study connectedness to nature and environmental concerns. We selected these scales as being well-established and regularly used measures that have been the focus of numerous scholars (e.g Restall and Conrad 2015; Davis and Stroink 2016). While other studies also explore the relations between environmental concerns and environmental behavior (e.g Schultz et al. 2005; Milfont et al. 2006; De Groot and Steg 2007; Rhead et al., 2015) or between connectedness to nature and environmental behavior (e.g Brügger et al. 2011; Barbaro and Pickett 2016), none of these use a multidimensional measure of environmental behavior. In our study, environmental behavior is theorized as a multidimensional construct and therefore, we examine the association among connectivity to nature feelings, environmental concerns and the resulted behavioral domains. Additionally, the relationships of environmental activism domain with both connectedness and environmental concerns are rarely studied in the international literature indicating a gap in the existing research.

Additionally, it is of great value to assess connectedness to nature and environmental concerns in a Greek sample, since there are no relative empirical data. Only a few works placed in Greece study single environmental behavior's domains (e.g recycling and energy use) with regard to other variables such as norms, specific attitudes and perceived behavioral control (e.g Botetzagias et al. 2015; Pothitou et al. 2016). The majority of the environmental studies that focus on psychological constructs are placed within the United States or other Non-Western European countries indicating a gap in the literature.

In this context, the goal of the current study is to explore environmental concerns, connectedness to nature and environmental behavior in a Greek population. We established the following specific objectives to reach the main goal: 1) evaluate the dimensionality of these constructs, 2) confirm their structure and 3) assess the interrelationships between these constructs.

Drawing on the previous literature review on environmental behavior, connectedness to nature and environmental concerns presented in the Introduction section, we deduce the following hypotheses. In Study 1, we expect two behavioral domains to emerge, environmental action and personal practices (e.g Pisano and Lubell 2017). Furthermore, we expect to verify the tripartite structure of environmental concerns (Schultz 2001) and find a single CNS factor (Mayer and Frantz 2004). Additionally, we hypothesize that personal practices are positively associated with connectedness to nature and egoistic and biospheric concerns. We hypothesize a positive relationship between altruistic concerns and personal practices, although relative research shows inconsistencies regarding the direction or the significance of this relation. The literature review in the introduction suggests that there is no empirical evidence, to our knowledge, that explores the correlation of environmental action domain and connectivity feelings nor environmental concerns. We also expect egoistic, altruistic and biospheric concerns to be positively related to connectedness to nature.

Based on the theoretical and empirical findings described in the introduction, connectedness to nature, egoistic and biospheric concerns are positively correlated with the personal practices domain. On the contrary, the relationship between altruistic concerns and personal practices is inconsistent across the multiple research studies, although a positive association has been observed in a few studies. Furthermore, the association between the environmental action domain and the constructs of connectedness to nature and environmental concerns is an understudied subject in the literature. Consequently, we can assume that a relationship might occur, but no safe conclusions can be drawn regarding the direction or the significance of this relationship (see Introduction section for an overview). Therefore, in study 2, we expect to confirm the following Hypotheses.

Hypothesis 1a. Connectedness to nature is related to individual's environmental action after controlling for demographic variables.
Hypothesis 1b. Connectedness to nature is positively related individual's personal practices after controlling for demographic variables.
Hypothesis 2a. Biospheric concerns are associated with individual's environmental action after controlling for demographic variables.
Hypothesis 2b. Biospheric concerns are positively related to individual's personal practices after controlling for demographic variables.
Hypothesis 3a. Altruistic concerns are associated with individual's environmental action after controlling for demographic variables.
Hypothesis 3b. Altruistic concerns are positively related to individual's personal practices after controlling for demographic variables.
Hypothesis 4a. Egoistic concerns are associated with individual's environmental action after controlling for demographic variables.
Hypothesis 4b. Egoistic concerns are positively related to individual's personal practices after controlling for demographic variables.

Study 1

Methods

Participants and Procedure

We conducted a representative survey between February and March 2017 to examine the structure of connectedness to nature, environmental concerns and environmental behavior. We applied a random systematic sampling using the telephone directory of the city of Thessaloniki, which is the second largest- in population- city of Greece and represents a rural area that faces major environmental problems (Tafidis et al. 2017). Citizens of 18–75 years old were chosen as the target group for this study. In total, out of the 500 calls made, 400 interviews were successfully completed[3] (Response Rate 80%). At least 3 callbacks were allowed. In particular, 63 people hung up immediately (12.63%) and 37 (7.37%) refused to be interviewed or did not complete the interview. The sample characteristics did not differ from those of the city's population based on the Census of 2011 (Hellenic Statistical Authority 2011) (Table 1).

Measures

The measures of environmental behavior, connectedness to nature and environmental concerns in both studies were originally written in English. The following environmental scales were adapted to Greek. To ensure the quality of translation in Greek, we used the back-translation method recommended by Brislin (1970).

Environmental Behavior Following previous works that had found a two-factor structure of environmental behavior (e.g Pisano and Lubell 2017), we used 10 behavioral items derived from previous studies (e.g Kaiser and Wilson 2004; Larson et al. 2015) to measure environmental action (e.g item 1 'I vote a political party that supports environmental conservation policies through legislations'; item 2 'I contribute financially to environmental organizations/ donate money for conservation causes'; item 3 'I am an active member of an environmental organization/ group'; item 4 'I systematically write letters to politicians or candidates for environmental issues'; item 5 'I systematically take part in protests against current environmental conditions) and personal practices domains (e.g item 1 'I recycle paper, glass and aluminum packages'; item 2 'I ride a bicycle or take public transportation to work or school'; item 3 'I buy green products; item 4 'I leave electric appliances in a stand-by mode; item 5 'I turn down the heater/ cooler when I leave my apartment for more than 4 hours or at night'). Participants responded how often in the last six months performed each of these behaviors, rating each item on a 5-point Likert scale (1 = never and 5 = always/every day).

Connectedness to Nature We used the Connectedness to nature Scale (Mayer and Frantz 2004) to assess the degree to which people feel emotionally interconnected with nature. CNS includes 14 items (e.g 'I often feel a sense of oneness with the natural world around me') and respondents were asked to rate each item on a 5- point Likert scale (1 = completely disagree; 5 = completely agree). In order to create a composite index for the scale, we averaged participants' responses (Table 3).

Environmental Concerns The Environmental Motives Scale (Schultz 2001) is a measure of concern regarding environmental problems or motives toward the physical environment. Respondents were asked to rate 12 valued objects from 1 (not important) to 5 (supreme importance). The EMS is designed to illustrate egoistic (me, my future, my prosperity, my health), altruistic (future generations, humanity, people in the community, children) and biospheric (plants, animals, birds, marine life) concerns. Participants responded to each item on a 5-point Likert scale ranging from 1 (not important) to 5 (supreme importance).

Statistical Analysis

We performed an Exploratory Factor Analysis (E.F.A) to explore the structure of environmental behavior, connectedness to nature and environmental concerns. E.F.A is a multivariate statistical technique to identify the underlying structure of a set of variables or the research constructs (Field 2013). In particular, we ran a Principal Axis Factoring Analysis with an oblique rotation (direct oblimin) for environmental behavior, connectedness to nature and environmental concerns respectively. Eigenvalues above 1.0 and scree plots indicated the number of factors that best fitted the data for each construct (Costello and Osborne 2005). We retain those items that did not cross-loaded to more than one factors and their factor loading, as well as their corrected item-total correlation, was above the cutoff value of.4 (Tabachnick and Fidell 2013; p.671). We reran the analysis every time that an item was deleted. We preferred the exploratory procedure because there are no empirical data from Greece that confirm the proposed structure of these constructs. These results were then used in order to confirm the structure of each construct in a subsequent study (Study 2). We also tested all items for bivariate normality and possible outliers. The statistic values of skewness and kurtosis for all the variables divided by its standard error should be below the range of ±2.58, while z scores should be less than 3.29 to ensure the absence of influential outliers (Field 2013).

[3] Those citizens who accepted to take part in the study received their printed questionnaires through the local post- office.

Table 1 Socio-demographic descriptive statistics of both samples

Variables	EFA Sample ($n_1 = 400$)				CFA/SEM Sample ($n_2 = 400$)			
	n	%	SD	Mean	*n*	%	SD	Mean
Sex								
Women	209	52.3			208	52		
Men	191	47.7			192	48		
Age	400	100	15.11	39.85	400	100	14.29	38.36
Marital Status								
Single	152	38			186	46.5		
Married	221	55.3			188	47		
Other	27	6.7			26	6.5		
Education (years)	400	100	2.69	13.36	400	100	2.27	13.43
Income/ month (€)	300		532.17	898.73	267	66.75	509.08	755.36

Additionally, bivariate Pearson correlations and correlations corrected for attenuation were computed for all the variables to show how these components are related and if these correlations are in line with previous studies.

We tested our data for common method bias since we used a single questionnaire for all the measures in this study. Common method bias (CMB) or common method variance (CVM) refers to a bias in the data due to external factors that can affect the responses to the measures included in a study. Empirical research that use a single survey method to collect the data for both independent and dependent variables, for instance, a questionnaire or an online survey, may introduce systematic response bias that will either inflate or deflate participants' responses. According to Richardson et al. (2009, p.763), CMV represents the "systematic error variance shared among variables measured with and introduced as a function of the same method and/or source." CMV has an extended influence on modeled relationships and affects both the magnitude and direction of the relationships (Podsakoff et al. 2016). The most common source of CMB in Psychology is individuals' tendency to respond in a socially desirable way. There are several a priori and post-hoc statistical remedy types that allow researchers to control for CMB.[4] Considering that Study 1 is an exploratory study and there were no marker variables available in the data, Harman's Single Factor Test was used to examine the extent to which common method bias is present in the data. This technique requires utilizing an exploratory factor analysis to detect the amount of variance in the variables that can be explained by a single factor and examine the unrotated factor solution. If either all the items of all constructs load on one strong factor or a single factor accounts for the majority of the variance explained (>50%), common method bias is probably present in the data (Podsakoff et al. 2012).

Results

Common Method Bias

The Harman's one-factor test was performed to assess the common method bias (Harman 1976). The results showed that all items of all the constructs loaded into six factors with eigenvalues greater than 1.0 and accounting for 74.32% of the total variance. These factors represented the six distinct constructs: environmental action, personal practices, and connectedness to nature, egoistic concerns, biospheric concerns and altruistic concerns. The first unrotated factor explained 36.41% of the variance which is less than the threshold value of 50.0%. These findings indicated that common method variance might not be a severe problem in this study.

Exploratory Factor Analysis

Initially, normality tests showed that the skewness and kurtosis were within acceptable limits for all the variables (±2.58), while z scores ranged from −.99 to 2.13, indicating the absence of influential outliers (Field 2013). Then, Factor Analysis (Principal Axis Factor Analysis with an oblique rotation) revealed the structure of the constructs. We reran the analysis several times for environmental concern and connectedness to nature since four items of the CNS scale and one EMS scale item did not load on any factor or demonstrated low factor loadings (below .4). Due to cross-loadings, two additional CNS scale items were removed from the analysis. Finally, based on eigenvalues

[4] There are "A Priori" Statistical Remedies and "Post Hoc" Statistical Remedies to test for CMB. "A Priori" Statistical Remedies include the Directly Measured Latent Method, Instrumental Variable and Ideal Marker Variable techniques, while "Post Hoc" Statistical Remedies refer to Unmeasured Latent Factor Model, Non-Ideal Marker Variable, and Harman's Single Factor Tests. For a detailed description of each procedure see Podsakoff et al. (2003, 2012).

above 1 and the scree plots, a two-factor solution emerged for environmental behavior and a three-factor structure for EMS scale. These results are in line with previous research that suggested the tripartite structure of the EMS scale. The two behavioral domains were environmental action and personal practices, a distinction that other studies have also found. CNS formed a unidimensional factor, since 7 items loaded on the first factor and only 1 item loaded on a separate factor. Results from the E.F.A, including factor loadings, item communalities and scales' reliabilities, are shown in Table 2.

Correlations

Table 3 shows the bivariate Pearson correlations for all constructs and the corrected for attenuation correlations due to measurement error (Charles 2005). Overall, the findings suggested that there is a significant relationship among the three domains of environmental concern and agree with past research. The results confirmed our hypothesis that connectedness to nature ($r = .47$) and biospheric concerns ($r = .57$) are positively and significantly related to personal practices domain. Connectedness to nature is significantly and positively

Table 2 Results from exploratory factor analysis

Constructs	Items	Loadings	I.T.C	η^2	Eigenvalues	Cronbach's a	K.M.O	Bartlett's test of sphericity
Environmental action	E.A1	.84	.80	.72	4.54	.90	.88	$\chi^2 = 2773.53$
	E.A2	.80	.77	.66				df = 45
	E.A3	.78	.74	.62				$p = .00$
	E.A4	.78	.75	.64				
	E.A5	.83	.77	.69				
Personal practices	P.P1	.91	.73	.83	2.87	.90		
	P.P2	.75	.84	.59	74.15%*			
	P.P3	.92	.84	.85				
	P.P4	.74	.71	.59				
	P.P5	.73	.72	.56				
Connectedness To nature	CNS1	.66	.57	.44	4.64	.88	.87	$\chi^2 = 1575.11$
	CNS2	.77	.69	.59	56.85%**			df = 28
	CNS5	.70	.61	.49				$p = .00$
	CNS8	.74	.68	.55				
	CNS9	.70	.65	.49				
	CNS10	.73	.67	.54				
	CNS11	.79	.73	.63				
	CNS14	.78	.70	.61				
Biospheric motive concerns	BIO1	.76	.80	.68	1.77	.94	.89	$\chi^2 = 3882.33$
	BIO2	.86	.87	.84				df = 55
	BIO3	.85	.90	.82				$p = .00$
	BIO4	.89	.91	.90				
Egoistic motive Concerns	EGO1	.76	.82	.77	6.28	.92		
	EGO2	.83	.85	.83	82.81%*			
	EGO3	.74	.91	.73				
	EGO4	.69	.77	.66				
Altruistic motive concerns	ALTR1	.72	.78	.72	1.49	.87		
	ALTR2	.90	.83	.90				
	ALTR3	.63	.69	.54				

I.T.C is corrected item total correlation; E.A is Environmental Action Factor of Environmental behavior; P.P is Personal Practices Factor; BIO is Biospheric subscale; EGO is Egoistic subscale; ALTR is Altruistic subscale; E.A1, E.A2, E.A,E.A4,E.A5 are the 5 items that loaded on Environmental Action Factor; P.P1,P.P2,P.P3,P.P4,P.P5 are the 5 items that loaded on Personal Practices Factor; CNS1,CNS2,CNS5,CN8,CNS9,CNS10,CNS11,CNS14 are the 8 items of Connectedness to Nature Scale that were retained after the E.F.A; EGO1,EGO2,EGO3, EGO4 are the 4 items of the Egoistic Motive Concern Factor; BIO1,BIO2,BIO3,BIO4 are the 4 items of the Biospheric Motive Concern Factor; ALTR1,ALTR2,ALTR3 are the 3 items of the Altruistic Motive Concern Factor

* These values indicate the cumulative amount of variance that the E.A and P.P and BIO, EGO, ALTR factors explained respectively. ** Indicates the amount of variance that the single CNS factor explained

Table 3 Bivariate and corrected for attenuation inter-construct correlations

	Mean	S.D	P.PRACTICES	E.ACTION	CNS	BIO	EGO	ALTR
P.PRACTICES	3.73	.82		.26	**.53**	**.60**	.33	.19
E.ACTION	1.76	.87	.23**		.21	.27	.21	.15
CNS	4.08	.74	.47**	.19**		**.61**	−.45	.46
BIO	3.91	.98	**.57****	.25**	**.56****		**.56**	.49
EGO	4.21	.79	.30**	.19**	−.41**	**.52****		**.69**
ALTR	4.20	.76	.17**	.14**	.40**	.44**	**.62****	

Below the diagonal figures represent the Pearson correlations: uncorrected (below the diagonal) and corrected for measurement error attenuation (above the diagonal). A generic correction adjusts correlations for the unreliabilities of the two measures involved (Charles 2005). Bold coefficients represent large effect sizes (i.e., $r > .50$)

**Correlation is significant at the .01 level (2-tailed)

related to biospheric concerns ($r = .56$) but negatively associated with egoistic concerns ($r = -.41$). The latter confirms our initial hypotheses and agree with other studies that also found that connectedness to nature has a positive relationship with biospheric concerns and a negative relation with egoistic concerns. Altruistic concerns showed a positive but weak correlation with personal practices ($r = .17$). We expected a significant correlation between egoistic concerns and personal practices, but their relationship was rather weak ($r = .30$). We consider all correlations below .4 as weak, although they are significant due to big sample size. The relationships among environmental action domain and all the other constructs were significant but weak ($.14 \leq r \leq .26$).

Study 2

Methods

Participants and Procedure

The objective of Study 2 was to confirm the structure and the validity of environmental behavior, connectedness to nature and environmental concerns and explore their correlations. Following the same procedure reported for Sample 1, we applied a random systematic sampling using the telephone directory of the city of Thessaloniki, Greece. Citizens of 18–75 years old were chosen as the target group for this study. In total, out of the 532 calls made, 400 interviews were successfully completed (Response Rate 75.19%). At least 3 callbacks were allowed. In particular, 86 people hung up immediately (16.17%) and 46 (8.65%) refused to be interviewed or did not complete the interview. The sample characteristics did not differ from those of the city's population based on the Census of 2011 (Hellenic Statistical Authority 2011).

Measures

We used the same 10-item measure of environmental behavior as in Sample 1 and the EMS and CNS scales to assess environmental concerns and connectedness to nature respectively. The retained items for each subscale were those that emerged through the exploratory procedure described for Sample 1.

Statistical Analysis

We used Confirmatory Factor Analysis (C.F.A) and Structural Equation Modeling (SEM) techniques to analyze our data with the help of Amos 21.0 and SPSS 23.0 software packages. SEM is a commonly used method to define relations when dealing with latent variables (Hair et al. 2010). There are two fundamental models in SEM analysis, the measurement model and the structural model (Byrne 2010). The measurement model was used to specify the relations between the observed (items) and unobserved-latent variables, and the structural model was used to define the relationships among these latent variables (environmental action, personal practices, connectedness to nature, egoistic-altruistic-biospheric concerns).

An important assumption associated with CFA and SEM is that the data have a multivariate normal distribution (Byrne 2016). We assessed both univariate and multivariate normality of the data prior to the CFA. Skewness values for all the variables should be $< |2.0|$ and kurtosis values $< |4.0|$ (Tabachnick and Fidell 2013; p.78). We performed Mardia's test, Henze-Zirkler and Doornik-Hansen tests and checked the critical ratios (c.r) in order to assess multivariate normality. We can assume multivariate normality when these tests are non-significant ($p > .001$) and c.$r < 10.0$. Mahalanobis distance was used to test for potential multivariate outliers ($p > .05$ indicates no outliers). Another critical issue in CFA and SEM is the selection of the estimation method. In most studies, Maximum Likelihood (ML) or Generalized Least Squares (GLS) estimation are typically used, both of which demand

multivariate normal data. An alternative approach to address the issue of multivariate non-normal data is the use of bootstrapping (Byrne 2016; p.366). In our analyses, we performed tests of multivariate normality and outliers in order to decide the estimation method in both CFA and SEM. The findings are presented in the result section.

Hair et al. (2010) suggest examining the goodness of fit indices (GOF) in order to assess the validity of the measurement model. The most popular GOF are chi-square statistic (χ^2), Comparative fit index (CFI ≥ .95), Tucker-Lewis index (TLI ≥ .95), Goodness of fit index (GFI > .90), Normed fit index (NFI ≥ .95), Incremental fit index (IFI ≥ .95) and Root mean square error of approximation (RMSEA<.08) (Hu and Bentler 1999).The χ^2 must be non-significant to have a good fit of the proposed model, although a significant *p*-value is expected for big samples (>250) (Hair et al. 2010). Factor loadings in CFA should exceed the value of .70, but .60 is also acceptable.

Construct validity of the measures was assessed through discriminant and convergent validity using composite reliability and average variance extracted (AVE) (Hair et al. 2010). We additionally calculated Cronbach's alpha values for the constructs and their composite reliability (C.R), which must exceed .70 to ensure internal consistency and reliability (Biswas and Roy 2015). AVE values must be above or equal to the critical value of .50, CR > AVE for all the latent variables, and all standardized factor loadings should be significant at $p = .001$ level to have convergent validity (Kline 2016). To test for discriminant validity among the constructs, we compared the squared roots of AVE values to the corresponding inter-construct correlations and the Maximum Shared Variance to the AVE (Chen 2014).

To test for Common Method Bias (CMB) we followed Podsakoff et al. (2012) recommendation and included an unmeasured Common Latent Factor (CLF) in the CFA pooled model. This procedure was preferred due to the lack of an ideal marker variable in the data. According to this procedure, every single item is an indicator not only of its substantive latent variable, but also of the CLF. This model controls for CMB via the factor loadings between the methods factor and the indicators. In this way, the variance of the responses to a specific measure is partitioned into three components, trait, method, and random error (Podsakoff et al. 2003; p.891). In order to detect whether there is a CMB problem in the data, an unconstrained and a fully- constrained or zero-constrained CLF model is computed and a chi-square difference test between these models is performed.

In the final step, we estimated the structural model to define the relations among the hypothesized latent constructs. The model was built based on the hypotheses for the interrelations between the constructs of the study. To run the SEM model we merged the samples of Study 1 and Study 2.First, we assessed the goodness of fit indices and then the significance, the direction and the size of the structural parameter estimates. A path is considered to be significant if the t-value exceeds ±1.96 at $p = .05$ significance level (Hair et al. 2010). Based on the above recommendations, the results of the CFA and SEM models are presented in the results section. Finally, in the structural model, age (in years), gender (0 = felame; 1 = male) and education (0 = does not belong to the category, e.g. have university diploma; 1 = belong to the corresponding category) were entered as control variables.

Results

Common Method Bias

To test for Common Method Bias (CMB) we included an unmeasured Common Latent Factor (CLF) in the CFA pooled model. We computed an unconstrained and a fully-constrained or zero-constrained CLF model is computed and performed a chi-square difference test between the models. Ultimately, the CMB test indicated that the chi-square difference test between the unconstrained and the zero constrained Common Method Factor Model was significant ($\Delta\chi^2 = 106.29$, $\Delta df = 26$; $p > .001$). These results suggest that there is significant shared variance and it is necessary to retain the CLF to all the following analyses.

Confirmatory Factor Analysis

We performed a Confirmatory Factor Analysis to further confirm the dimensional structure of all constructs. First, we assessed the normality of the data and checked for possible outliers. Although univariate skewness and kurtosis were within acceptable limits (skewness < |2.0| and kurtosis < |4.0|) for all the items, tests for multivariate normality (Mardia's test, Henze-Zirkler and Doornik-Hansen tests; $p > .001$) and multivariate normality critical ratios (c.r) greater than 10 indicated the data were not multivariate normal data. Mahalanobis distance showed that there were no influential multivariate outliers ($p > .05$). Since our data were non-normal, we ran the model using a bootstrapping method (1000 samples) to obtain a Bollen-Stein corrected probability (*p*) value and estimate standard errors without any distributional assumptions.

All the reported results accounted for the shared variance explained by the CLF, and therefore, all the estimates are common method bias adjusted. The CFA findings indicated that there were three CNS items (CNS1, CNS2, CNS5) with factor loadings below the threshold of .50. These items were deleted and CFA analysis was conducted again. The results of the pooled CFA are reported in Table 4. Model fit was assessed using χ^2 value and multiple fit indices to evaluate acceptable model fit. Although χ^2 values indicated that the measurement model did not advocate for a good fit of the model ($\chi2 = 366.02$; $df = 253$; $p > .001$), a common finding when dealing with a big sample size, fit indexes revealed

Table 4 Results of CFA

Latent construct	Items	Standardized factor loadings	CR	AVE	ASV
Environmental action	EA1	.80***	.86	.56	.01
	EA2	.75***			
	EA3	.71***			
	EA4	.68***			
	EA5	.78***			
Personal practices	PP1	.60***	.84	.53	.20
	PP2	.83***			
	PP3	.93***			
	PP4	.61***			
	PP5	.60***			
CNS	CNS8	.66***	.83	.50	.24
	CNS9	.68***			
	CNS10	.70***			
	CNS11	.78***			
	CNS14	.72***			
Biospheric motive concerns	BIO1	.71***	.84	.57	.27
	BIO2	.73***			
	BIO3	.81***			
	BIO4	.78***			
Egoistic motive concerns	EGO1	.84***	.89	.69	.41
	EGO2	.92***			
	EGO3	.79***			
	EGO4	.74***			
Altruistic motive concerns	ALTR1	.84***	.85	.66	.40
	ALTR2	.89***			
	ALTR3	.68***			

AVE is Average Variance Extracted; ASV is Average Shared Variance; CR is Composite Reliability; All values are common method bias adjusted

***$p < .001$

adequate fit: df/χ^2 = 1.44; Bollen –Stine bootstrap χ^2 $p = .04$; CFI = .98, TLI = .98, GFI = .93, NFI = .95, IFI = .98, RMSEA = .04. Modification indexes showed that fit could be improved by adding covariance paths between some items' errors, but these changes were not supported by the theoretical model and were omitted.

Construct Validity and Reliability

All constructs exhibited high Cronbach's alpha values and high C.R values (>.70), thus, we have evidence for internal consistency and reliability (Biswas and Roy 2015). AVE values were above or equal to the critical value of .50, CR > AVE for all the latent variables and all standardized factor loadings were significant at $p = .001$ level, providing evidence for convergent validity (Table 4). We compared the squared roots of AVE values to the corresponding inter-construct correlations and the Maximum Shared Variance to the AVE and the results confirmed that the measurement model presents adequate discriminant validity (Table 5). Thus, construct validity of the measures have been supported.

Structural Model

To assess the interrelations between connectedness to nature, environmental concerns and environmental behavior domains we used Structural Analysis. First, we merged the samples from Studies 1 and 2 and then we ran a pooled CFA to evaluate the new measurement model. The proposed merged model indicated a good fit (χ2 = 732.96, df = 314 and χ^2/df = 2.89; Bollen –Stine bootstrap χ^2 $p = .05$; CFI = .97, IFI = .97, GFI = .94, NFI = .95, TLI = .96, RMSEA = .05).[5] CR values for all constructs were above .7 and AVE values exceeded the threshold of .50, providing evidence for convergent validity and reliability. The results suggested that the proposed model had an acceptable model fit (χ^2 = 900.00, df = 314 and χ^2/df = 2.86; Bollen –Stine bootstrap χ^2 $p = .05$; CFI = .96, IFI = .96, GFI = .93, NFI = .94, TLI = .95, RMSEA = .04) and explained 5.62% of the variance in the individual's environmental action and 37.77% in personal practices. Table 6 shows the results of the hypothesis testing. The parameter estimates depicted in Fig. 1 and Table 6 are standardized regression coefficients. Five out of eight hypothesized paths have been significantly supported as being shown in Table 6 and Fig. 1.

***Note**. Note. The estimates are controlled for age, education and gender. Standard errors ranged were below .5, while all critical ratios for the significant paths (z values) were above ±1.96. *$p < .05$, **$p < .01$, ***$p < .001$.

The variables connectedness to nature (β = .42, $p < .001$), biospheric concerns (β = .45, $p < .001$) and egoistic concerns (β = .18, $p < .05$) were significantly and positively related to personal practices domain. These results are in line with our initial hypotheses that connectivity to nature feelings, biospheric and egoistic concerns have a positive impact on personal practices (H1b, H2b, H4b). Egoistic concerns had a significant impact on environmental action (β = .23, $p < 0.01$), while altruistic concerns had a significant but negative relationship with personal practices (β = −.42, $p < .001$), thus, the hypothesized positive relationship is not confirmed (H3b). However, altruistic, biospheric concerns and connectedness to nature had an insignificant impact on environmental action. These findings oppose to the hypotheses that environmental action domain is related to altruistic, biospheric concerns and connectedness to nature (H1a, H2a, H3a, H4a). Egoistic concerns had a significant and positive relationship with personal practices (β = .18, $p < .05$), which provide support to our hypotheses (H4b).

[5] The results are common method bias adjusted. We compared the unconstrained with the zero- constrained model: $\Delta\chi^2$ = 112.86; Δdf = 26; $p = .00$). The detailed results of the pooled CFA in the merged sample are not presented here but are available on request.

Table 5 Inter-construct correlations and squared root of AVE

	EGO	E.ACTION	P.PRACTICES	CNS	ALTR	BIO
EGO	**0.83**					
E.ACTION	0.12	**0.75**				
P.PRACTICES	0.26	0.09	**0.73**			
CNS	0.39	0.01	0.37	**0.70**		
ALTR	0.64	0.05	0.07	0.35	**0.81**	
BIO	0.52	0.06	0.45	0.49	0.39	**0.76**

These values were computed with the Common Latent Factor present. Bold values on the diagonal represent the squared root of AVE

General Discussion

This study attempted to assess individuals' connectedness to nature and environmental concerns and environmental behavior and explore their relations. Using data from two random samples and the psychology literature, we found empirical support to our core hypotheses that connectivity to nature feelings and biospheric, egoistic and altruistic motives behind environmental concern affect the performance of various different environmental behaviors.

In our Greek samples, we found that environmental concerns represent three distinct domains that encompass egoistic, altruistic and biospheric concerns, while connectedness to nature is a uniform construct. These findings from Study 1 are in line with previous studies that previously proposed a tripartite structure of environmental concerns (Schultz 2001; Schultz et al. 2004; Milfont et al. 2006; Snelgar 2006; Alibeli and White 2011; Davis and Stroink 2016) and others who suggested that connectedness to nature is a uniform construct (Mayer and Frantz 2004; Brügger et al. 2011; Restall and Conrad 2015). Our results showed that environmental behavior represents two domains, personal practices and environmental action. Personal practices are private sphere behaviors (e.g recycling, transportation choices, water and energy conservation) and environmental action refers to public-sphere behaviors (e.g sign a petition, take part in demonstrations, or give money to environmental organizations). Others studies found a similar two-factor model of environmental behavior (Hunter et al. 2004; Dono et al. 2010; Hadler and Haller 2011; Alisat and Riemer 2015; Pisano and Lubell 2017), suggesting that private sphere behaviors can be considered as a general factor that entails other subdomains that emerged in the literature like recycling, transportation and consumerism.

Table 6 Standardized regression estimates

Paths	Estimate	*p*- values	Hypothesis	Results
CNS → E.Action	−.02	.70	H1a	Not supported
CNS → P.Practices	.42	.00***	H1b	Supported
BIO → E.Action	.02	.67	H2a	Not supported
BIO → P.Practices	.45	.00***	H2b	Supported
EGO→ E.Action	.23	.00**	H4a	Supported
EGO→ P.Practices	.18	.01*	H4b	Supported
ALTR→ E.Action	−.09	.28	H3a	Not supported
ALTR→ P.Practices	−.42	.00***	H3b	Supported

The estimates are controlled for age, education and gender. Standard errors ranged were below .40, while all critical ratios for the significant paths (z values) were above ±1.96

*$p < .05$, **$p < .01$, ***$p < .001$

The reported correlations for Study 1 agree with the findings of other relative studies on connectedness to nature, environmental concerns and behavior. Specifically, CNS scale was significantly and positively related to biospheric and altruistic concerns (Mayer and Frantz 2004; Perkins 2010; Raymond et al. 2011; Davis and Stroink 2016), but negatively related to egoistic concerns (Mayer and Frantz 2004; Raymond et al. 2011). Connectedness to nature showed a significant positive correlation with personal practices domain, thus, the initial hypothesis that these constructs are associated was supported. On a similar vein, other studies showed that connectedness to nature is an important predictor of environmental behavior (Mayer and Frantz 2004; Davis et al. 2011; Gosling and Williams 2010; Barbaro and Pickett 2016; Davis and Stroink 2016). The correlations among biospheric, altruistic and egoistic environmental concerns replicated the findings of other works that showed positive interrelationships (Schultz 2001; Snelgar 2006; Hansla et al. 2008; Davis and Stroink 2016). All three environmental concerns' subscales were positively associated with both personal practices domain, thus, we found empirical evidence to support our initial hypotheses that they are related. These results are partially supported by other researchers who reported that biospheric (e.g Davis and Stroink 2016; Aprile and Fiorillo 2017), egoistic (e.g Schultz et al. 2005; Steg et al. 2011) and altruistic concerns (e.g Schmuck and Vlek 2003; Dietz 2015; Aprile and Fiorillo 2017) have a significant impact on environmental behaviors in a private sphere. There are only a few studies that investigated the impact of environmental concern on activism (Stern and Dietz 1994; Lubell et al. 2007; Binder and Blankenberg 2016), while there are no studies exploring the association of connectedness to nature and environmental action, suggesting that more research is needed to enlighten these interrelationships.

In Study 2, we observed that significant and positive relationships emerged among connectedness to nature, biospheric concerns, egoistic concerns and personal practices domain, while a negative association occurred between personal practices and altruistic concerns. These constructs explained a considerable amount of personal practices (37.77%), suggesting that connectedness to nature and environmental concerns

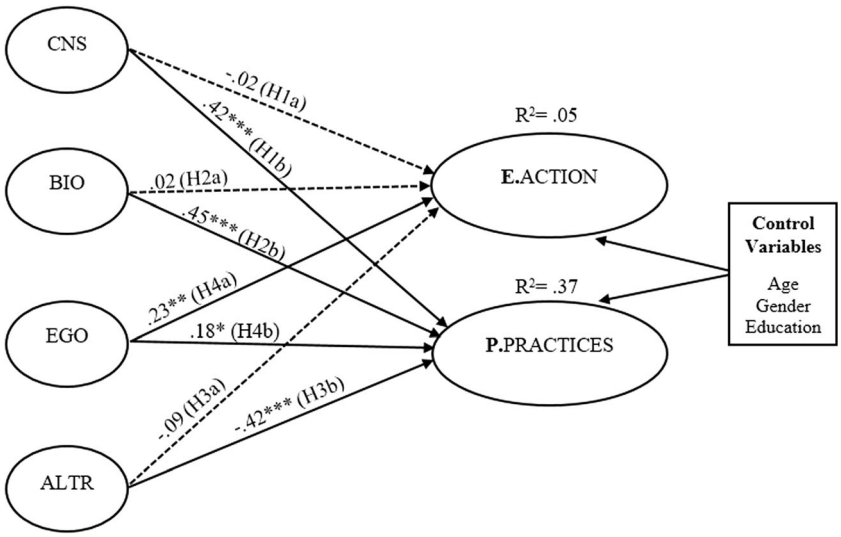

Fig. 1 The final model. Note. Solid lines indicate significant paths and dotted lines are for non-significant paths. CNS is connectedness to nature, BIO [biospheric motive concerns]; EGO [egoistic motive concerns]; ALTR [altruistic motive concerns]; E.ACTION [environmental action]; P.PRACTICES [personal practices]. *$p < .05$, **$p < .01$, ***$p < .001$

are important predictors of private-sphere behaviors. Other scholars have also shown that connectivity feelings can determine the performance of pro-environmental personal practices (Mayer and Frantz 2004; Davis et al. 2011; Barbaro and Pickett 2016; Davis and Stroink 2016). Several studies emphasized the role of egoistic and biospheric concerns in enhancing private sphere environmental behaviors (e.g Milfont et al. 2006; De Groot & Steg 2007; Steg et al. 2011; Davis and Stroink 2016). On the contrary, the impact of altruistic concerns on personal practices was negative which opposed to the findings of relevant studies (e.g Schmuck and Vlek 2003; De Groot and Steg 2009; Dietz 2015; Aprile and Fiorillo 2017). This might be down to individuals' tendency to base their actions on self-interest and less on altruistic considerations, especially in the case of high-cost behaviors or behaviors that minimize comfort and gain (deGroot & Steg, 2009).

Overall, the proposed model failed to effectively predict environmental activism because connectedness to nature along with environmental concerns explained 5.62% of action's variance, while only egoistic concerns had a significant relation with environmental action. In general, the variables explaining private-sphere behaviors (e.g. consumerism, recycling, transportation, household setting) have been found to be relatively poor determinants of activism, indicating that public sphere behaviors and personal practices predictors substantially differ (Stern et al. 1999; Fielding et al. 2008; Dono et al. 2010; Marquart-Pyatt 2012; Dalton 2015). Taken together, the results of the current study imply that several limitations exist and showcase the need for future research which is discussed in the following sections.

Strengths and Implications

Most of the studies on environmental concern either focus on private sphere behavioral domain or included activism and personal practices on a one-dimensional measure (e.g Schultz et al. 2004; Milfont et al. 2006; Davis and Stroink 2016), and only a few empirical works study the impact of general environmental concern on activism (Stern and Dietz 1994; McFarlane and Boxall 2003; Binder and Blankenberg 2016; Tam and Chan 2017). Likewise, past research on connectedness to nature, to our knowledge, avoided to include activism on behavioral measures and consequently, there are no empirical data with regard to the relationship of the connectivity notion with environmental activism. This work aimed to address this gap in the literature and investigate the impact of connectedness to nature and environmental concerns on environmental action domain. Furthermore, the results of the current study are essential since there are no other works in Greece investigating these particular constructs but rather a few works focus on specific behaviors and other constructs including norms, intentions and perceived behavioral control (e.g Botetzagias et al. 2015; Pothitou et al. 2016). Furthermore, it should be emphasized that the current study constitutes the first empirical attempt to adapt and validate these particular scales to Greek. Finally, there are not many studies on environmental concern or connectedness to nature based outside of the U.S.A or other parts of Western Europe are regularly included in the general literature, hence empirical reports from Greece can extend the research on psychological determinants of environmental behavior. The proposed implications for environmental policy focus on two aspects, the utility of connectedness to nature to achieve environmental management goals, and environmental concern's role in enhancing environmental behavior or its contribution to behavioral change purposes.

From a sustainability perspective, it is crucial to understand the benefits of interacting with nature. The solutions to the current environmental degradation are complex and will depend on broad-scale conservation efforts on an individual and

societal level (Keniger et al. 2013). Therefore, the increased environmental behavior could contribute to environmental protection. The present work, as well as past research on connectedness to nature (e.g Restall and Conrad 2015), highlighted the importance of connectivity feelings toward the physical environment in promoting private sphere environmental behaviors. The connectivity notion leads to 'an expanded sense of self and greater valuing of non-human species' (Gosling and Williams 2010), and thereafter to pro-environment behavior. This implies that the level of connectedness an individual feels towards nature will affect the level of concern and management decisions towards nature (Schroeder 2007; Vining et al. 2008). Interactions with nature might be important for influencing peoples' sympathy for conservation goals, thus, corroborating the need and relevance of applying more affective strategies in environmental management (Restall and Conrad 2015). In this rapidly urbanizing world, policy makers should design and implement conservation campaigns that will promote connectedness to nature in order to achieve sustainability goals and increase society's environmental behavior (Keniger et al. 2013; Davis and Stroink 2016).

The findings of the current study indicated that egoistic concerns were related to both environmental activism and personal practices, suggesting that self-interest might become an alternative pathway to sustainability. A recent work by De Dominicis et al. (2017) corroborated the importance of protecting the environment for self-interest reasons in contrast to the dominant socio-altruistic approach. They proposed that altruism is inclusive of self-interest, and therefore, egoistic and altruistic concerns can both motivate people to act pro-environmentally. People can be strongly motivated by both self- interest (e.g personal health, economic motives) and altruistic reasons to engage in environmental behaviors, thus, policy makers could highlight self-enhancing reasons first and then move to a *'more self-transcendent value-based communication'* (De Dominicis et al. 2017). Regarding policy interventions, environmental communication campaigns should focus on both self-enhancing and self-transcendent concerns to effectively promote collective environmental action (Dietz 2015; De Dominicis et al. 2017; Steinhorst and Matthies 2016). We, therefore, suggest that behavioral change in a more sustainable lifestyle is possible through environmental campaigns and behavioral management strategies that target humanity's egocentric nature as well as bio-altruistic concerns by reducing their conflicts (deGroot & Steg, 2009; Levy et al. 2016).

Limitations and Future Studies

In this study, only self-report environmental behavior, not real behavior, was measured. Although self-report measures are extremely useful in international survey methods (Kormos and Gifford 2014), it is possible that people may over-report their behaviors and this raises social desirability bias concerns. We suggest that future research should include measures of actual environmental behavior. Data analysis revealed another considerable limitation, that is, a significant amount of shared variance that occurred due to self-report and social desirability biases, implying that future works should implement both procedural and statistical methods to control for common method variance (Malhotra et al. 2017).

Future research is crucial to examine other potential antecedents than those reported in this study, such as norms, gain and hedonic motives (Lindenberg and Steg 2007), as predictors of the multiple domains of environmental behavior. Contextual factors are also of great importance in examining the manifold construct of environmental behavior, because, besides environmental considerations, many other factors affect behavior, such as status, comfort, effort, and behavioral opportunities, availability of facilities and services' quality (Thøgersen 2005; Santos 2008; Steg and Vlek 2009). Environmental concern scholars should consider the role of psychological barriers in explaining the concern-behavior gap (Tam and Chan 2017) when designing environmental policy interventions. It is also suggested that future studies on psychological predictors of environmental activism should measure other constructs beyond egoistic motive concerns. For instance, other studies found that social identity is an important determinant of environmental actions (Dono et al. 2010; Fielding and Hornsey 2016) because strong social identity increases the possibility to engage in committed environmental actions by comforting to the group's norms. In conclusion, future research should consider the complex motivational base and the numerous determinants of environmental behavior in order to result in a more environmentally aware society.

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Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

This article does not contain any studies with animals performed by any of the authors.

Author's Contribution Anastasia Gkargkavouzi contributed to conception and design, the collection of the data, analysis, and interpretation of data, and drafting the article.

Stefanos Paraskevopoulos contributed to the drafting of the data.

Steriani Matsiori contributed to the drafting of the data and supervised the entire study procedure.

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Compliance with Ethical Standards

Conflict of Interest Author Gkargkavouzi Anastasia declares that she has no conflict of interest. Author Paraskevopoulos Stefanos declares that he has no conflict of interest. Author Matsiori Steriani declares that she has no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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