

# Exploring the Relationship Between Connectedness With Nature, Environmental Identity, and Environmental Self-Identity: A Systematic Review and Meta-Analysis

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## Abstract

A meta-analysis was carried out to investigate the relationship between connectedness with nature, environmental identity, and environmental self-identity. Through meta-analyzing these relationships, we are able to assess the true estimate of their magnitude. The results revealed a strong correlation between measures of connectedness with nature and environmental identity ( $r = .75$  [0.67, 0.83],  $k = 11$ ) as well as environmental self-identity ( $r = .57$  [.31, .84],  $k = 5$ ). Further moderation analysis indicated that the relationship between connectedness with nature and environmental identity is different for graphical and questionnaire instruments used for assessing connectedness with nature; the aggregated correlation for graphical instruments ( $r = .62$  [.56, .67],  $k = 9$ ) was significantly lower than for questionnaires ( $r = .82$  [.74, .91],  $k = 9$ ). We suggest revisiting the various instruments assessing human–nature relatedness to maximize unique variance among them.

## Keywords

systematic review, meta-analysis, connectedness with nature, environmental identity, environmental self-identity

## Introduction

Researchers have been spending considerable effort over the last couple of decades on developing the constructs of human–nature relations, as well as the instruments that measure them (Brügger, Kaiser, & Roczen, 2011; Martin & Czellar, 2016; Olivos & Clayton, 2017; Restall & Conrad, 2015; Tam, 2013). The result of this effort is a plethora of psychological constructs, such as connection with nature, environmental identity, and others. Many of the constructs stem from the self-concept theory (Baumeister, 1998; Marsh, 1990); despite their common theoretical roots, the instruments measuring them focus on different aspects and have differing aims and evaluation forms (e.g., graphic vs. text). In many cases, these constructs are highly correlated (e.g., Brügger et al., 2011; Davis, Le, & Coy, 2011; Martin & Czellar, 2016; Tam, 2013), and we sought a meta-analytical estimate of the strength of this relationship. We have carried out a systematic review and a meta-analysis of the correlations between constructs that deal with connectedness with nature, environmental identity, and environmental self-identity. Specifically, we tested the relationship between connectedness with nature and environmental identity, and

connectedness with nature and environmental self-identity. We also tested the moderating effect of assessment instrument type on the relationship between connectedness with nature and environmental identity. In the following sections, we discuss each concept that is relevant to the analysis.

## Connectedness With Nature

Schultz (2002) was among the first to conceptualize the constructs of human–nature relations through the perspective of conservation psychology. Schultz (2002) describes inclusion of self in nature as “the understanding that an individual has of her place in nature, that s/he places on nature, and his/her actions that impact the natural environment” (p. 67). Connection with nature is said to have three psychological components—cognitive, affective, and behavioral—as well

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as three core structural components—connectedness, caring, and commitment (Schultz, 2002). In Schultz's (2002) general framework of human–nature relations, connectedness leads to caring, which, in turn, leads to proenvironmental actions.

Focusing on these specific aforementioned components of connectedness with nature, there is a variety of means through which the concept can be operationalized, for example, experiential (Nisbet & Zelenski, 2013), attitudinal (Brügger et al., 2011), or physical connection with the natural environment (Nisbet, Zelenski, & Murphy, 2009). From these components stem a number of specific operationalizations: disposition to connect with nature (Brügger et al., 2011); an emotional connection to the natural world (Hinds & Sparks, 2008; Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004); connectivity with nature, which refers to the sense of empathy in terms of unity with nature and self (Dutcher, Finley, Luloff, & Johnson, 2007); psychological attachment and a long-term orientation toward nature (Davis, Green, & Reed, 2009); the perception of the relationship between nature and self (Martin & Czellar, 2016; Schultz, 2001, 2002; Schultz, Shriver, Tabanico, & Khazian, 2004); and an implicit association with nature (Schultz & Tabanico, 2007). It can be measured with regular text-based questionnaire items (e.g., Brügger et al., 2011) or spatial metaphor representations (e.g., Martin & Czellar, 2016; Schultz, 2001). This variety is based on ample theoretical differences and enables a comprehensive picture of connectedness with nature, yet these constructs are strongly related (Tam, 2013).

### *Environmental Identity*

Another construct that reflects some part of human–nature relations is environmental identity (Clayton, 2003), which is defined thusly:

. . . environmental identity is one part of the way in which people form their self-concept; a sense of connection to some parts of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the way in which we perceive and act towards the world; a belief that the environment is important to us and an important part of who we are. (Clayton, 2003, pp. 45–46)

Authors claim, that connectedness with nature and environmental identity are similar, but instruments that measure them focus on different aspects of the same underlying construct (Frantz & Mayer, 2014; Tam, 2013). For example, Brügger et al. (2011) found that environmental identity, but not connectedness with nature, inclusions of nature in self, or implicit association with nature had a statistically significant relationship with a general measure of proenvironmental behavior. Furthermore, Tam (2013) found that even though environmental identity and connectedness with nature

(among other nature relatedness constructs) do converge into a single higher factor, these measures contribute unique variance. By the same token, Olivos and Aragonés (2011) suggest that environmental identity consists of four dimensions: environmentalism, appreciation of nature, enjoying nature, and environmental identity. A closer inspection of the environmental identity measure reveals that its scales “enjoying nature” and “appreciation of nature” strongly resemble measures of connectedness with nature, whereas “environmental identity” (as a separate subscale) is distinct and offers unique variance in predicting proenvironmental behaviors (Olivos & Aragonés, 2011).

### *Environmental Self-Identity*

Environmental self-identity is conceptually distinct from environmental identity developed by Clayton (2003), Van der Werff, Steg, and Keizer (2013b), and Olivos and Clayton (2017), as well as from connectedness with nature introduced by Schultz (2002). However, some authors suggest that it can be potentially interrelated with concepts that reflect human–nature relationships (Van der Werff et al., 2013b), or that environmental self-identity is a certain type of operationalization of environmental identity (Kashima, Paladino, & Margetts, 2014).

Environmental self-identity is defined as “the extent to which one sees oneself as a type of person whose actions are environmentally-friendly” (Van der Werff et al., 2013b, p. 1258). Environmental self-identity can be investigated in specific or in generic terms; one can address specific proenvironmental behaviors or general ones (Van der Werff et al., 2013b; Whitmarsh & O'Neill, 2010). Specific environmental self-identities refer to relevant outcomes of one's identity, for example, one can identify as a cyclist, a recycler, a reuser, thus in effect identifying with a certain group. Generic environmental self-identity refers to a mixture of relevant outcomes, for example, one identifies as proenvironmental if one cycles, recycles, and reuses. Thus, environmental self-identity is strongly linked to specific proenvironmental actions (Cook, Kerr, & Moore, 2002; Dean, Raats, & Shepherd, 2012; Sparks & Shepherd, 1992; Stets & Biga, 2003; Van der Werff et al., 2013b; Whitmarsh & O'Neill, 2010) or a mixture of these actions (Kashima et al., 2014; Van der Werff, Steg, & Keizer, 2013a; Van der Werff et al., 2013b; Van der Werff, Steg, & Keizer, 2014a; Van der Werff, Steg, & Keizer, 2014b; Whitmarsh & O'Neill, 2010). On one hand, environmental identity (feeling as a part of nature) might be related to environmental self-identity, in the sense that people who enjoy nature might be more likely to act in a proenvironmental manner (e.g., Nisbet et al., 2009). On the other hand, enjoying nature does not guarantee that one will actively engage in proenvironmental actions (Van der Werff et al., 2013b); similarly, involvement in proenvironmental actions does not necessarily reflect one's connectedness with the natural environment (Olivos & Clayton, 2017).

**Table 1.** Search Sources and Results.

Database	Number of articles found
Clarivate Analytics Web of Science	235
ERIC	185
Google Scholar	580
GreenFile	272
Science Direct	278
Scopus	139
SocINDEX	322
PsycARTICLES	440
Total	2,451

### *The Present Study*

As was mentioned, connectedness with nature and environmental identity have common conceptual roots, yet distinct theoretical paradigms. Instruments that measure them differ in their focus and aim. Research indicates that connectedness with nature and environmental identity are strongly related, and, thus, we assess this relationship meta-analytically. Based on the assumption that environmental self-identity could potentially reflect some parts of human–nature relationship, we also included it into the analysis. Thus, the aim of the present study is to investigate the relationship between connectedness with nature and environmental identity, and connectedness with nature and environmental self-identity by conducting a systematic review and meta-analysis on the correlations between these constructs. To our knowledge, the relationship among these constructs has not yet been meta-analyzed. An aggregated effect size would provide a robust estimate of the true correlation between the constructs in question. First, we have chosen to look at the relationship between connectedness with nature and environmental identity. Second, we investigated links between connectedness with nature and environmental self-identity. Finally, we conducted a moderated analysis of the relationship of connectedness with nature with environmental identity by splitting the sample into groups where connectedness with nature was assessed either with graphical or with questionnaire measures.

### **Method**

The following describes all meta-analytic decisions that were made in gathering the data.

#### *Eligibility Criteria*

Studies were included in the analysis if they met the following criteria: (a) a correlation between connectedness with nature and either environmental identity or environmental self-identity was obtainable from the study, and (b) the source is scholarly and peer-reviewed. Editorials, reviews, meta-analyses, and conference papers were excluded from the analysis.

### *Search Strategy and Data Sources*

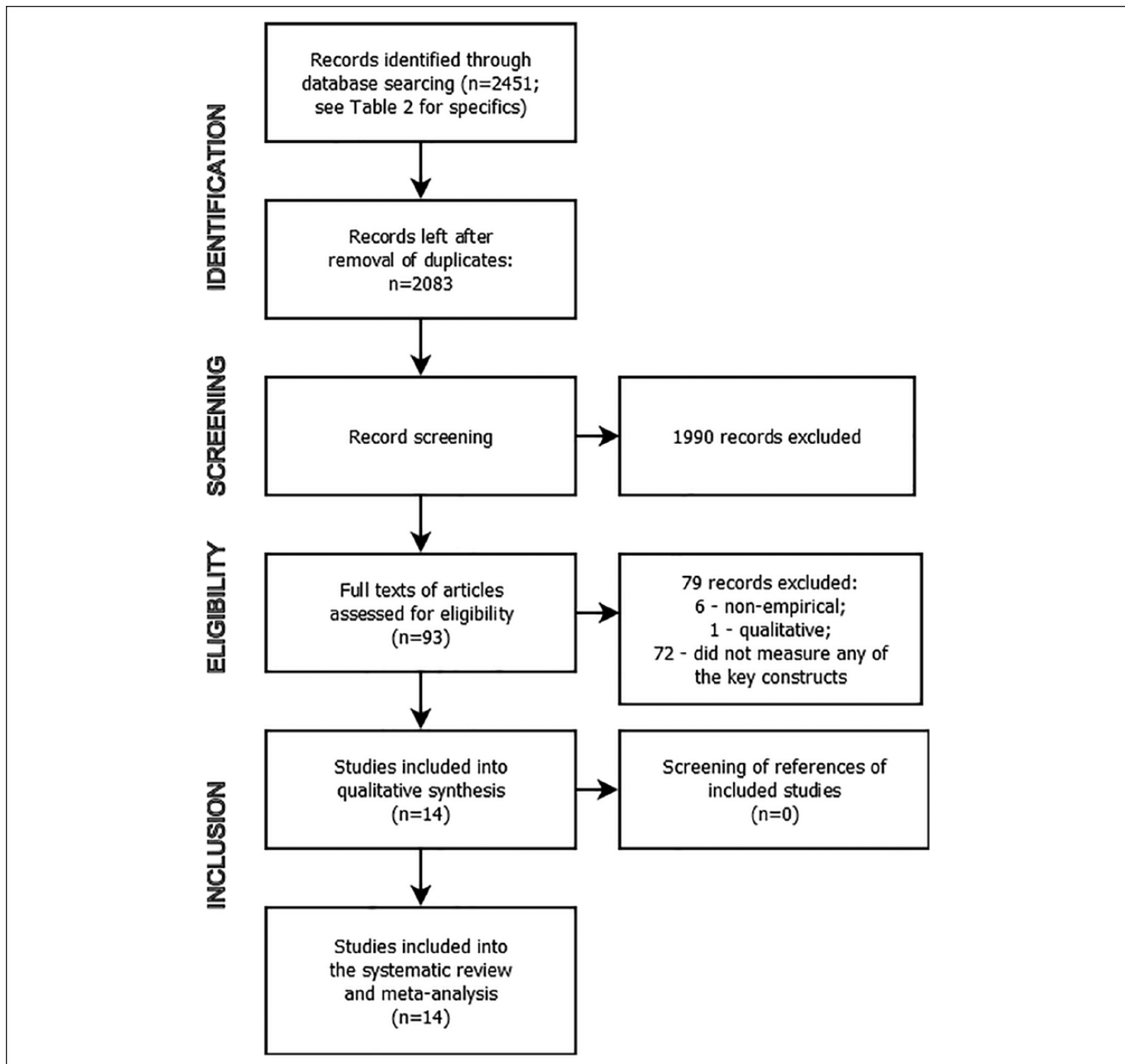
Two of the authors of the present study independently carried out a search in eight databases. The search string used in the present study was the following: (“environmental identity” OR “environmental self!identity” OR “pro!environmental self!identity”) AND (“connectedness with nature” OR “connectedness to nature” OR “nature connectedness” OR “human nature relationship” OR “inclusion of nature in self” OR “nature relatedness” OR “implicit association with nature”). The search string was modified slightly in several cases to function properly on some search platforms. The publication date range was set from onset of the database to October 2017. The total number of articles that matched the search string from each database is presented in Table 1.

### *Study Selection*

We used ENDNOTE to identify and exclude duplicates from the analysis. After the duplicates were removed, two reviewers independently screened the titles and abstracts of the remaining studies, and any study that did not contain connectedness with nature, environmental identity, or environmental self-identity was removed from further analysis. If it was unclear from an article’s title and abstract whether the article is suitable for inclusion, the article was read in full. Those articles that were chosen as eligible were read thoroughly, and, based on our eligibility criteria, any irrelevant articles were excluded from further analysis. The reference lists of the selected articles were screened for relevant studies; no additional studies were found based on reference screening. A step-by-step description of our screening process is presented in Figure 1.

A standardized form was used for coding. The form included the following: (a) authors of the study; (b) publication year; (c) publication type; (d) sample characteristics (region, type, size, gender distribution, age range, and mean); (e) measures used in the study to assess connectedness with nature, environmental identity, and environmental self-identity; (f) correlation coefficients between constructs of interest; and (g) internal consistency of the measures used.

To ensure interrater reliability, we followed the procedure suggested by Crocetti (2016). Two researchers with expertise in environmental psychology literature selected and evaluated the selected studies separately. The agreement score between the two raters (McGinn et al., 2004) was  $\kappa = .88$  in selecting studies based on their eligibility criteria. A Cohen’s  $\kappa$  of .6 or above indicates acceptable interrater reliability and anything above .8 is considered very reliable (Landis & Koch, 1977). The initial misunderstanding and incongruence in determining eligibility was due to the convoluted nature of the constructs being evaluated (see Dutcher et al., 2007), and after some debate, all inconsistencies between the raters were resolved.



**Figure 1.** Article screening and inclusion procedure.

### Validity of Included Studies

It is common to incorporate the assessment of the validity of the studies included in systematic reviews (Higgins & Green, 2011), as well as to consider this as an eligibility criterion (Johnson & Eagly, 2014). We agreed to confer whether any of the studies raised any questions; however, we did not formalize any specific validity criteria when screening for studies. Throughout the screening process, we did not encounter any cases that would raise our concerns regarding their validity.

### Results

The 14 studies that fit the eligibility criteria of the present study are listed in Table 2. One of the included studies can be considered to be truly representative (i.e., Hine et al., 2013), while most studies included in the analysis were conducted with student samples. Two of the included studies were conducted in the United States, two in Australia, and one in China, whereas the rest were conducted in Europe, indicating that the results are mostly biased toward representing Europeans. As is often the case with convenience samples of

**Table 2.** Characteristics of the Included Studies.

Number, author(s)	Year	Sample type	Region	Participant age range, M (SD)	Females (%)
1. Brügger, Kaiser, and Roczen	2011	Students	Switzerland	18-80, 34.05 (15.30)	45.16
2. Davis, Le, and Coy	2011	Students	United States	17-38, 22.00 (3.07)	57.26
3. Hinds and Sparks	2008	Students	United Kingdom	18-53, 21.70 (NA)	83.40
4. Hine et al. <sup>a</sup>	2013	General population	Australia	15-108, 45.82 (14.89)	53
5. Karlegger <sup>b</sup>	2010	Convenient	Germany	NA	NA
6. Kashima, Paladino, and Margetts	2014	General population	Australia	18-70, 34.05 (15.30)	67
7. Lokhorst, Hoon, le Rutte, and de Snoo	2014	Convenient (landowners)	The Netherlands	NA, 35.17 (10.16)	11.30
8. Mayer and Frantz	2004	Students	United States	NA	58.82
		Other		14-89, 36.00 (19.00)	65.92
9. Olivos and Aragonés	2011	Students	Spain	NA, 21.04 (3.58)	81
10. Olivos and Aragonés	2013	Students	Spain	NA, 21.59 (4.98)	85
11. Olivos, Aragonés, and Amerigo	2011	Student	Spain	NA, 20.00 (2.25)	82
12. Piskóti	2015	Students	Hungary	NA, 21.55 (NA)	58.70
13. Prévot, Clayton, and Mathevet	2018	Students	France	NA	NA
14. Tam	2013	Students	China	NA, 20.36 (1.34)	45.34
		Other		17-81, 33.43 (13.20)	63.78

<sup>a</sup>This is the only included study that used a stratified representative sample.

<sup>b</sup>The author was contacted to provide information about the study; the author provided information on the correlation coefficients among the constructs of interest, but did not provide full information about the sample characteristics.

students, females are more represented in the included studies.

A total of 41 effect sizes could be extracted from the included studies (Table 3). However, to remove intrastudy bias, only one effect size was used per sample. A single effect size from each sample was derived by averaging all eligible effect sizes from that sample, providing a robust estimate of the effect in that study. The standard errors for correlations were computed based on their sample size (Cohen, Cohen, West, & Aiken, 2003), thus automatically weighing the studies in the meta-analysis, to give more weight to effects derived from larger samples. Where possible, the correlation coefficients were corrected for attenuation of the measures to produce the actual effect sizes (Charles, 2005; Howitt & Cramer, 2011).

JASP v0.8.6 was used for statistical analysis (JASP Team, 2018). A random-effects restricted maximum likelihood estimation revealed that the effect was extremely high ( $r = .75$  [.67, .83],  $k = 11$ ) for the relationship between connectedness with nature and environmental identity (Figure 2). The rank correlation test for the funnel asymmetry (Kendall's  $\tau = .02$ ,  $p = .1$ ) showed no bias, whereas the Egger's test ( $Z = -2.36$ ,  $p = .02$ ) indicated asymmetry in the funnel plot (Figure 3). A fail-safe  $N$  of 34,022, with a target significance of .05 and an observed significance of zero would be needed to make the overall effect insignificant.

The same estimation was applied for the relationship between connectedness with nature and environmental self-identity (Figure 4). The effect was also found to be very high ( $r = .57$  [.31, .84],  $k = 5$ ). Both the rank correlation test for

the funnel asymmetry (Kendall's  $\tau = -.20$ ,  $p = .82$ ) and Egger's test ( $Z = 0.32$ ,  $p = .75$ ) indicated that the effect is not biased (Figure 5). A fail-safe  $N$  of 4,567, with a target significance of .05 and an observed significance of zero would be needed to make the overall effect insignificant. Mathematically, there is no significant difference between the strength of the relationship of connectedness with nature with environmental identity or connectedness with nature with environmental self-identity.

Heterogeneity tests indicated that the included effects for the relationship between connectedness with nature and environmental identity are heterogeneous—residual heterogeneity,  $Q(10) = 373.9$ ,  $p < .01$ ;  $I^2 = 95.71\%$ —supporting further investigation of moderated effects. Two separate analyses were run to identify whether the observed relationship is different with different assessment methods of connectedness with nature (questionnaire items vs. graphical assessment). In both cases, this only slightly improved heterogeneity indicators; however, the observed results indicated significant differences among conditions, showing that the effects are moderated (see supplementary material for detailed outputs of separate analyses and for data files: <https://osf.io/tnk7c>). Moderation analysis is not reported for the relationship between connectedness with nature and environmental self-identity due to insufficient number of cases.

In effects derived through questionnaire measures of connectedness with nature and measures of environmental identity, the overall effect is higher ( $r = .82$  [.74, .91],  $k = 9$ ) than when connectedness with nature was assessed graphically ( $r = .62$  [.56, .67],  $k = 9$ ). Based on the nonoverlapping



**Table 3. Measures and Effect Sizes of the Included Studies.**

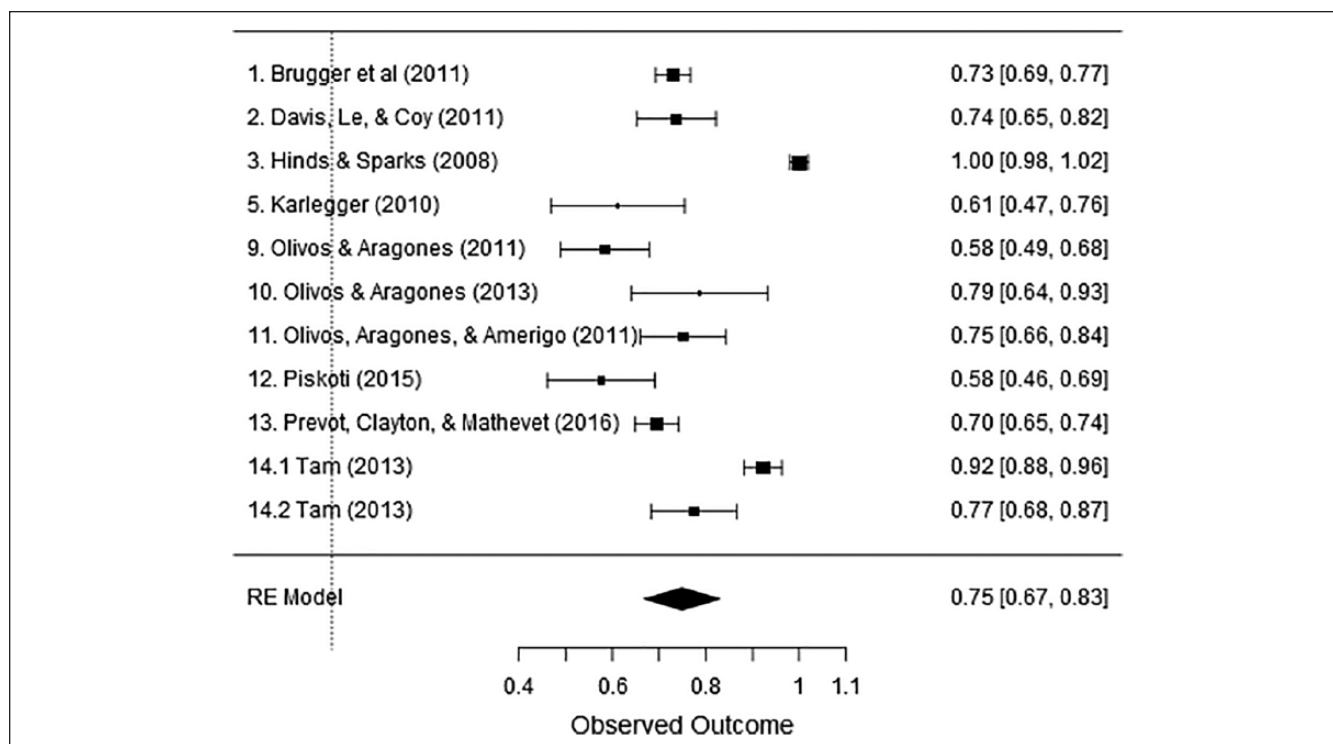
Number, reference	Connectedness with nature		Environmental identity and environmental self-identity				Corrected $r$ (SE)
	Measure		$\alpha$	Measure	$\alpha$	N	$r$ (SE)
1. Brügger, Kaiser, and Roczen (2011)	CNS (Mayer & Frantz, 2004) INS (Schultz, 2001)		.80	EID (Clayton, 2003)	.93	1,309	.67 (0.02)
2. Davis, Le, and Coy (2011)	Disposition to connect with nature (Beckers, 2005)		.89				.60 (0.02)
	INS (Davis, Green, & Reed, 2009; INS; Schultz, 2001)			EID (Clayton, 2003)	.95	248	.72 (0.02)
	CNS (Mayer & Frantz, 2004)		.85				.57 (0.05)
3. Hinds and Sparks (2008)	Affective connection (was measured with the items adapted from Thompson & Barton, 1994)		.77	EI Questions (Hinds & Sparks, 2008)	.75	199	.80 (0.04)
4. Hine et al. (2013)	Connection to nature six items adopted from earlier studies (impossible to track from which studies)		.94	Green self-identity three items adopted from earlier studies (impossible to track from which studies)	.85	3,096	.62 (0.01)
5. Karlegger (2010)	CNS (Mayer & Frantz, 2004)		.85	EID (Clayton, 2003)	.91	119 <sup>c</sup>	.71 (0.07)
	NR (Nisbet, Zelenski, & Murphy, 2009)		.60				.36 (0.09)
	Single item capturing the bond with nature (Nisbet et al., 2009)						.58 (0.08)
	INS (Davis et al., 2009) INS (Schultz, 2001)						.52 (0.08)
6. Kashima, Paladino, and Margetts (2014)	Human-nature relationship (Schultz, 2002)		.73	Environmental identity (EI; Whitmarsh & O'Neill, 2010)	.73	1,093	.15 (0.03)
7. Lokhorst, Hoon, le Rutte, and de Snoo (2014)	CTN (Gosling & Williams, 2010)		.80	Environmental strivings (Emmons, 1986)	.87		.12 (0.03)
				Self-identity (Terry, Hogg, & White, 1999)	.86		.33 (0.03)
8.1 Mayer and Frantz (2004)	CNS (Mayer & Frantz, 2004)		.84	IE (Mayer & Frantz, 2004)	.74	102	.56 (0.08)
8.2 Mayer and Frantz (2004)	CNS (Mayer & Frantz, 2004)		.79	IE (Mayer & Frantz, 2004)	.55	135	.61 (0.07)
9. Olivos and Aragonés (2011)	CNS (Mayer & Frantz, 2004)		.79	EID (Clayton, 2003; extracted four factors: EID, enjoying nature, appreciation of nature, environmentalism)	.90	282	.69 (0.04)
							.47 (0.05)
							.56 (0.05)
							.47 (0.05)
10. Olivos and Aragonés (2013)	INS (Schultz, 2001)			EID (Clayton, 2003)	.92	71	.70 (0.09)
	CNS (Mayer & Frantz, 2004)		.79				.72 (0.08)
	CNS (Mayer & Frantz, 2004)		.79	EID (Clayton, 2003)	.89	204	.63 (0.05)
	Implicit association test (IAT-Nature, Schultz, Shriver, Tabanico, & Khazian, 2004)			EID (Clayton, 2003)	.88	196	.54 (0.06)
11. Olivos, Aragonés, and Amérigo (2011)	INS (Schultz, 2002)			EID (Clayton, 2003)	.82	919	.63 (0.03)
	COM (Davis et al., 2009)		.83	EID (Clayton, 2003)	.89	355	.85 (0.03)
	CNS (Mayer & Frantz, 2004)		.79				.81 (0.03)
	CWN (Dutcher, Finley, Luloff, & Johnson, 2007)		.61				.75 (0.04)
12. Piskóti (2015)	EATN (Kals, Schumacher, & Montada, 1999)		.84				.76 (0.03)
	INS (Schultz, 2001)						.67 (0.04)
	NR (Nisbet et al., 2009)		.83				.85 (0.03)
	COM (Davis et al., 2009)		.93	EID (Clayton, 2003)	.96	185	.85 (0.04)
13. Prévot, Clayton, and Mathevet (2018)	CNS (Mayer & Frantz, 2004)		.89				.77 (0.05)
	CWN (Dutcher et al., 2007)		.86				.66 (0.06)
	EATN (Kals et al., 1999)		.93				.79 (0.05)
	INS (Schultz, 2001)						.46 (0.07)
14.1 Tam (2013)	NR (Nisbet et al., 2009)		.90				.82 (0.04)
14.2 Tam (2013)							.88 (0.03)

Note. All reported correlations are significant at least at the .01 level. CNS = connectedness to nature scale; CTN = connectedness to nature; EI = environmental identity; EID = environmental identity scale; INS = inclusion of nature in one's self; NR = nature relatedness; IE = identity as an environmentalist; COM = Commitment to Nature; CWN = connectivity with nature; EATN = emotional affinity toward nature.

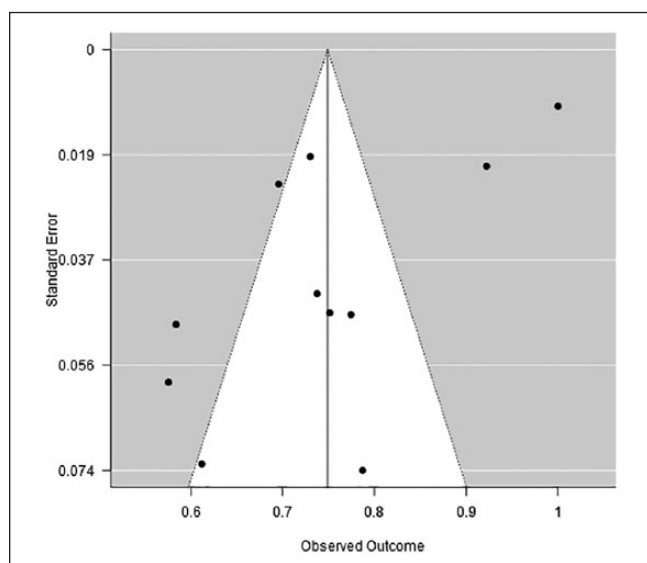
<sup>a</sup>In cases where connectedness with nature was assessed graphically or assessed with a single item, the internal consistency of the measure was assumed to be 1.

<sup>b</sup>In cases where the corrected  $r$  was equal to or exceeded 1, the SE was assumed to be .01 for computational purposes. Rows with a gray background indicate cases where connectedness with nature was correlated with environmental self-identity, whereas rows with a white background indicate cases where connectedness with nature was correlated with EID.

<sup>c</sup>Sample size, correlations among constructs, and internal consistency values were provided by the author.



**Figure 2.** Forest plot of correlations between connectedness with nature and environmental identity.



**Figure 3.** Funnel plot for correlations between connectedness with nature and environmental identity.

confidence intervals, this difference is statistically significant at least at the .05 level. This indicates that the relationship between connectedness with nature and environmental identity is stronger when both constructs are assessed using a common method. However, it must be noted that although correlation coefficients between questionnaire measures

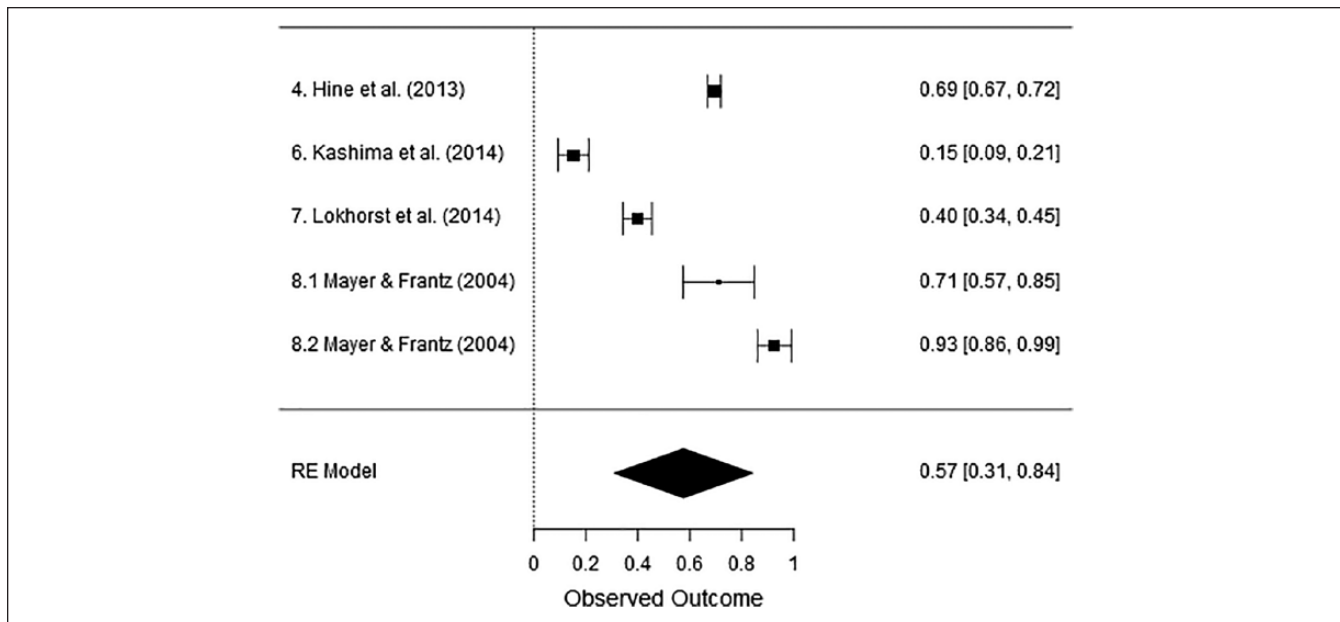
were corrected for attenuation, this correction is only one-sided when correlating with graphical measures because we are forced to assume a single-item measure to be functioning perfectly. This difference between measures might account for at least a part of the observed difference in overall effects.

## Discussion

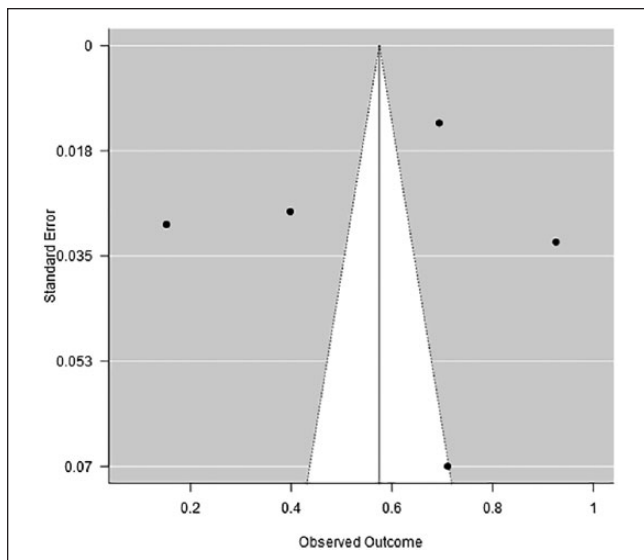
### *Relations Between Connectedness With Nature and Environmental Identity, and Between Connectedness With Nature and Environmental Self-Identity*

Researchers in the field came up with different constructs of one's relationship to nature, which are sound in theory, yet highly correlated (Brügger et al., 2011; Davis et al., 2011; Martin & Czellar, 2016; Tam, 2013). The results of the present meta-analysis are in line with past studies and indicate that connectedness with nature and environmental identity are indeed very highly correlated. In addition, a similarly high correlation was found between connectedness with nature and environmental self-identity. In the following sections, we discuss the implications of these strong relationships between the constructs of human–nature relations.

A correlation coefficient higher than .50 is traditionally assumed to indicate a strong effect (Cooper & Findley, 1982), while more recent research shows that the average effect size for a correlation in social psychology is only .21, with effects



**Figure 4.** Forest plot of correlations between connectedness with nature and environmental self-identity.



**Figure 5.** Funnel plot for correlations between connectedness with nature and environmental self-identity.

higher than .50 being very uncommon (Richard, Bond, & Stokes-Zoota, 2003). In this study, there is an indication that measures of connectedness with nature and measures of environmental identity share a great amount of variance. According to classical test theory (Campbell & Fiske, 1959; Cronbach & Meehl, 1955; Reichardt & Coleman, 1995; Westen & Rosenthal, 2003), this high shared variance could potentially point to these measures being indistinguishable in some cases; thus, having different instruments for them might be superfluous. However, some studies have shown

that measures of connectedness with nature and environmental identity do have some unique predictive power (Brügger et al., 2011; Tam, 2013). We argue that strong links among various theoretically distinct constructs representing the human–nature relationship imply strong links among the elements of these concepts (e.g., identification with the natural environment, Clayton, 2003; and the emotional aspect of connection with nature, Schultz, 2001, among others). This is in line with what was theorized by Schultz (2001), where he argued that the broader inclusion with nature construct comprised causally interrelated elements such as caring, connection, and commitment, where commitment is possible only in the presence of caring and connection. Similarly, the theory of environmental identity developed by Clayton (2003) emphasizes the interrelated aspects of the human–nature relationship. Specifically, contact with nature (or certain elements of nature) can invoke the sense of belonging to or being a part of nature; this, in turn, could lead to the development of the relationship between a person and nature, which further can have an effect on behavior that is relevant in maintaining this relationship, for example, volunteering in anti-logging campaigns or wildlife protection organizations.

We took these two independent concepts of environmental identity and inclusion with nature as a case in point, to demonstrate that the human–nature relationship can be seen through differing theoretical lenses (either rooted in identity/self-concept or cognitive-affective-behavioral structures), yet at the same time being of equal importance in this relationship and having the potential, as it was already suggested by Tam (2013), to be unified by a common conceptual framework. The purpose of this unifying approach could be to find communalities of various human–nature relationship constructs, yet emphasizing



their unique contribution on the conceptual as well as the methodological and measurement level. A comprehensive assessment of the various human–nature relations constructs could potentially indicate which particular aspects of these constructs lead to desirable proenvironmental outcomes; this would enable more precise interventions for promoting proenvironmental behavior. Furthermore, a comprehensive instrument of all human–nature relatedness constructs would allow a holistic pattern-based understanding of various individuals through the exploration of typical profiles of various samples.

### *The Effect of Instrument Type*

The form in which a question is asked and the response form can affect the answers to a question (Christian & Dillman, 2004). Thus, the observed significant difference in the relationship between connectedness with nature and environmental identity when the assessment method of connectedness with nature is either graphical or through a questionnaire might partly be due to the difference in response tendencies to questions that differ in form. Operationalizing connectedness with nature through graphical means introduces method variance (Westen & Rosenthal, 2003) that is different from instances, when connectedness with nature is assessed through questionnaires. We, therefore, argue that having two distinct approaches in assessing one's connectedness with nature (through semiprojective means and through self-report) is needed, and one approach should not be abandoned in favor of the other, because different means are effective in reaching different demographics or specific samples (Martin & Czellar, 2016).

### *Recommendations*

Internal consistency could potentially be an important factor in understanding correlations between human–nature relationship constructs. This study shows that, in some cases, the internal consistency of environmental identity (Clayton, 2003) is as modest as .57; in other cases, it reaches a whopping .96. Measures of connectedness with nature are similar in this regard. Although having good internal consistency is preferred, one must be mindful of alpha coefficients that are too high (Streiner, 2003). If a measure that is said to reflect a broad construct has very high internal consistency, it might be indicative of the measured construct only being represented in part (Streiner, 2003). Because both connectedness with nature and environmental identity are quite broad concepts, one would expect the measures of these constructs to have more moderate alpha coefficients, let alone being correlated with one another with effects so high that they might lose their uniqueness (see Table 3 for examples of correlations of .9 and above).

One of the possible solutions to the aforementioned problem is to perform factor analysis to identify whether a

construct is uni- or multidimensional. Some authors have used factor analysis to crystallize the various components of measures that deal with human–nature relations. For example, Olivos and Aragonés (2011) factorized the Clayton's (2003) environmental identity scale and extracted four subscales that represented different aspects of human–nature relations. Furthermore, Navarro, Olivos, and Fleury-Bahi (2017) performed factor analysis on the connectedness to nature scale (Mayer & Frantz, 2004). This helped to refine the instruments by excluding items that failed to represent constructs as well as threatened internal consistency of the instrument. Similarly, Pasca, Aragonés, and Coello (2017) refined the connectedness to nature scale (Mayer & Frantz, 2004) by checking the scale's dimensionality within the framework of item response theory and found that several items failed to represent the construct of connectedness with nature.

Reworking the particular items used in scales assessing connectedness with nature and environmental identity could be helpful to overall improve the unique predictive power of these instruments. For example, Brügger et al. (2011) state that the “connectedness to nature scale and the environmental identity measure also partly reflect people's environmental concern and not exclusively connection with nature” (p. 330). In addition, the various questionnaire measures of human–nature relationships include items that refer to past behavior, attitudes, identification with groups, affective measures, and so forth (Brick, Sherman, & Kim, 2017; Hinds & Sparks, 2008; Sparks & Guthrie, 1998; Stets & Biga, 2003). For example, the disposition to connect with nature scale (Brügger et al., 2011) consists of items that not only reflect connectedness with nature (e.g., “I feel the need to be out in nature”) but also reflect behavior (e.g., “I collect objects from nature such as stones, butterflies, or insects”), affective aspects (e.g., “I mourn the loss of pets”), and personal attitudes (e.g., “Indoor plants are part of the family”). Furthermore, the commitment to nature scale (Davis et al., 2009), which is intended to operationalize the commitment part of human–nature relations (Schultz, 2001), comprises items that reflect not only commitment (e.g., “I feel committed to keeping the best interests of the environment in mind”) but also connection with nature (e.g., “It seems to me that humans and the environment are interdependent”) or attachment (e.g., “I feel very attached to the natural environment”).

Another aspect that should be taken into account is the way the measures are presented in a questionnaire. There is a substantial possibility that the constructs that are the object of the present study might prime respondents' answers because of question order effects. We suggest, where possible, to present questionnaire items of all measures in random order so as not to prime respondents with specific constructs. Presenting all items together in random order makes everything salient at the same time (Poškus & Sadauskaitė, 2015; Siminski, 2006); thus, the respondent answers to items with

a common framework, but there is less opportunity for specific directional priming of one measure affecting the other. Only a few studies that were included in this meta-analysis addressed such biases. For example, in a study conducted by Tam (2013), the presentation order of measures was randomized; the test–retest procedure was performed in studies conducted by Olivos, Aragonés, and Amérigo (2011) as well as Mayer and Frantz (2004). Future studies that deal with constructs of human–nature relatedness should pay more attention to order effects and other possible biasing factors.

### Future Directions and Limitations

There are several other constructs of human–nature relatedness besides the ones we included in the present study. Future research that explores the methodological soundness of human–nature connectedness and the various instruments and conceptual differences of these concepts could look into such constructs as visions of nature (van den Born, de Groot, & Lenders, 2006) or the new environmental/ecological paradigm (Dunlap, 2008).

In the present study, we did not have enough cases to draw firm conclusions on the instruments used to assess environmental self-identity; nevertheless, this construct could also be included in exploratory analyses of various human–nature relatedness instruments. In addition, as can be seen in Table 2, Western countries are overrepresented in the present meta-analysis and the results might not be as representative of non-Western societies.

### Concluding Remarks

Connectedness with nature is very strongly correlated to environmental identity as well as to environmental self-identity. The correlation between connectedness with nature and environmental identity is moderated by the type of assessment method used for connectedness with nature: The effect is significantly higher when both connectedness with nature and environmental identity are assessed with questionnaire items and is lower when connectedness with nature is assessed graphically.

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