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RESTORATIVENESS AND ECOLOGICAL BEHAVIOURS

From methodological issues in self-report instruments to
investigation of pattern of association

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Coordinatore: Prof./ssa Manuela Lavelli

Tutor: Prof./ssa Margherita Pasini

Firma Margherita Pasini

Dottorando: Dott./ssa Elisa Menardo

Firma Elisa Menardo

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Restorativeness and Ecological Behaviors: From methodological issues in self-report instruments to investigation of pattern of
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ABSTRACT

According to some studies, the positive, rewarding and restorative experiences that people have in natural environments could be one of the motivations to preserve and protect nature (Byrka, Hartig, & Kaiser, 2010; Collado & Corraliza, 2015; Hartig, Kaiser, & Strumse, 2007; Nisbet & Zelenski, 2011). Exposure to natural environments (and the obtained benefits) could influence the probability of implementing Ecological Behaviours (EBs) (Coldwell & Evans, 2017), that is those behaviours aimed at the care and protection of the environment (Hartig, Kaiser, & Bowler, 2001; Steg & Vlek, 2009). The research in this field is quite recent, and many issues are still open. Among the other, the present dissertation tries to face three main issues: the assessment of ecological behaviours, some methodological concerns about restorative effect of natural environment, and the role of other related constructs.

The lack of consistency of instruments for EBs assessment makes it difficult to compare the studies and reflects a lack of consensus regarding which behaviours should actually be measured. In particular, psychologists often assess ecological behaviours with measurement instruments whose influence on the ecological system is not considered.

A huge amount of studies regarding restorative experience and restorative environments are based on the assumption that the natural environments are more restorative than the urban ones. However, studies addressing this issue use a variety of research methods (concerning for example research design, measurement instruments, participants, kind of exposure to the environments) making it difficult to compare the findings and to draw conclusions.

Finally, empirical evidences suggest that the effect of restorativeness on EBs is not a direct effect but is mediated by environmental attitudes (Berto & Barbiero, 2017; Byrka et al., 2010; Hartig et al., 2007; Whitburn, Linklater, & Milfont, 2019). Moreover, some authors suggest that the ability to perceive nature as a restorative environment is influenced by Connection to nature (e.g., Berto &

Barbiero, 2017; Whitburn et al., 2019) that, in turn, is a requirement for action to protect nature (e.g., Berto & Barbiero, 2017; Clayton, 2012; Mayer & Frantz, 2004). Finally, some studies suggested that EBs and their antecedents (e.g., Hartig et al., 2001; Milfont, 2009; Noppers, Keizer, Bolderdijk, & Steg, 2014) could be biased by social desirability (SD) (Paulhus, 1984). However, no study has investigated all these variables in a single model.

The present research intends to contribute to the study of association between restorativeness and EBs overcoming the limitations described above.

First, the Pro-Environmental Behaviours Scale (PEBS; Markle, 2013) is, to our knowledge, the only scale based on an impact-oriented approach and on empirical evidence recognized by the environmental scientific community (Brower & Leon, 1999) to cover the three categories of EBs proposed by literature (Stern, 2000). For this reason, in the first study of this project we adapted the original PEBS to the Italian context (qualitative phase) and we verified its psychometric properties (e.g., factor structure) (quantitative phase). The original scale was slightly modified following a suggestion obtained in a focus group (n = 17) and in a pilot study (n = 18). On a sample of 765 Italian adults (70% female, mean [SD] age = 41.7 [12.2], 2 missing) results revealed a 4-factor structure (conservation, environmental citizenship, food, and transportation) of the Italian PEBS, like the original version (Markle, 2013), maintaining 15 of the 19 original items (CFI = .973; RMSEA = .037; WRMR = 1.047; $\chi^2(84) = 170.63$, $p < .001$; explained variance = 42%). Other psychometrics properties were “good” or better. Results suggest that the Italian PEBS is a valid and reliable tool for assessing the principal EBs proposed by the literature as having a great impact on the environment.

The second study of this project uses a meta-analysis aimed at estimating how much natural environments are perceived as being more restorative than urban environments. We investigated the role of moderator variables such as research design, kind of natural environment, participants, measurement instruments used or the context in which data were collected. PsycINFO, PsycARTICLES, Scopus, SpringerLINK, Web Of Science online databases were used to identify all peer-review articles on restorativeness published to date (k = 167). Reference sections

of obtained papers were examined for additional studies. Only 22 studies met inclusion criteria (direct exposure to environment, comparison between one outdoor environment with natural element and one without natural element, and restorativeness measured by self-report scale) and were included in meta-analysis. Results showed that natural environments are perceived to be more restorative than urban environments (Cohen's d [C.I.] = 1.99 [1.38 - 2.61]). Significant heterogeneity between studies was found ($Q(19) = 503.16, p < .001$) and variability within studies was very high ($I^2 = 97\%$). However, subsequent univariate moderator analyses were not significant. Other methodological differences (e.g., lighting conditions) could explain this variability. We concluded that the variability in studies is more likely to be due to individuals differences (e.g., age, connections to nature, and environmental attitude) than to methodological differences.

Finally, in the third study we investigated relationship between the perceived restorativeness, the environmental attitudes, the connection to nature, and the social desirability. The first aim of this study is to cover this lack by proposing an integrated model of antecedents of EBs. The second aim is to verify if the proposed model is valid for all the different EBs' categories proposed by literature (Stern, 2000): Conservation, Transportation, Food, and Environmental Citizenship. The model showed an excellent fit ($CFI = 1.000$; $RMSEA = .000$ [$CI = .000 - .116$]; $SRMR = 0.031$; $\chi^2(4) = 3.412, p = .491$; explained variance = 26%) and almost all the hypotheses were confirmed: connection to nature and environmental attitudes are the only two constructs – among the ones used in the model – with a direct effect on EBs; connection to nature have also indirect effects, via perceived restorativeness and via environmental attitudes; environmental attitudes are influenced by perceived restorativeness but they do not significantly mediate the effect of restorativeness on EBs; social desirability has an indirect effect on EBs via connection to nature but it did not have a direct relationship with environmental attitude. All models with the different EBs categories as outcomes showed a good fit, however, while connection to nature is confirmed as a predictor of all the four categories of EBs, the environmental attitudes predicts only Environmental Citizenship. In sum, our model suggests that

connection to nature, besides being the strongest direct predictor of EBs, it is also an important predictor of perceived restorativeness and environmental attitudes. So, studies that have investigated the indirect effect of perceived restorativeness on EBs via environmental attitudes (Byrka et al., 2011; Collado & Corraliza, 2015; Hartig et al., 2007) without considering the role of the connection to nature could have overestimated the indirect effect.

SOMMARIO

Secondo alcuni studi le esperienze positive, gratificanti e rigeneranti di cui le persone fanno esperienza negli ambienti naturali sarebbero alla base della motivazione a preservare e proteggere la natura (Byrka, Hartig, & Kaiser, 2010; Collado & Corraliza, 2015; Hartig, Kaiser, & Strumse, 2007; Nisbet & Zelenski, 2011). L'esposizione agli ambienti naturali (e i benefici ottenuti) potrebbe influenzare la probabilità di mettere in atto comportamenti pro-ambientali (CPA) (Coldwell & Evans, 2017), ovvero quei comportamenti che danneggiano l'ambiente il meno possibile oppure che contribuiscono alla sua protezione (Hartig, Kaiser, & Bowler, 2001; Steg & Vlek, 2009). La ricerca in questo campo è relativamente recente e numerose questioni sono ancora aperte. Tra queste il presente elaborato intende affrontarne tre: la misurazione dei CPA, alcuni aspetti metodologici che riguardano gli effetti rigenerativi degli ambienti naturali e il ruolo di altri costrutti interrelati.

La mancanza di consenso riguardo a quale strumento di misurazione dei CPA utilizzare rende difficile il confronto tra gli studi e riflette una mancanza di consenso su quali comportamenti debbano essere effettivamente misurati. In particolare, gli psicologi spesso valutano i CPA senza considerarne l'influenza sul sistema ecologico.

Una grande quantità di studi sull'esperienze ed ambienti rigenerativi si basano sul presupposto che gli ambienti naturali sono più rigeneranti di quelli urbani. Tuttavia, gli studi che affrontano questo problema utilizzano una varietà di metodi di ricerca (riguardanti ad esempio il design della ricerca, gli strumenti di misurazione, i partecipanti, il tipo di esposizione agli ambienti) che rendono difficile confrontare i risultati e trarre conclusioni.

Infine, evidenze empiriche suggeriscono che l'effetto della restorativeness sui CPA non è diretto ma mediato dalle attitudini ambientali (Berto & Barbiero, 2017; Byrka et al., 2010; Hartig et al., 2007; Whitburn, Linklater, & Milfont, 2019). Inoltre, alcuni autori suggeriscono che la percezione delle qualità

rigenerative degli ambienti naturali dipende dalla connessione con la natura (ad es., Berto & Barbiero, 2017; Whitburn et al., 2019) che, a sua volta, rappresenta un prerequisito per i comportamenti di protezione della natura (ad es., Berto & Barbiero, 2017; Clayton, 2012; Mayer & Frantz, 2004). Infine, alcuni studi (ad es., Hartig et al., 2001; Milfont, 2009; Noppers, Keizer, Bolderdijk, & Steg, 2014) hanno suggerito che i CPA e i suoi antecedenti potrebbero essere influenzati dalla desiderabilità sociale (DS) (Paulhus, 1984). Tuttavia, non ci sono studi che abbiano indagato tutte queste variabili in un singolo modello.

Questa ricerca intende contribuire allo studio dell'associazione tra restorativeness e CPA superando i problemi descritti sopra.

Per prima cosa, la Pro-Environmental Behaviours Scale (PEBS; Markle, 2013) è, a nostra conoscenza, l'unica scala costruita sulla base dell'approccio impact-oriented e sulle evidenze empiriche fornite dalla comunità scientifica (Brower & Leon, 1999) e che misura le tre categorie di CPA proposte dalla letteratura (Stern, 2000). Per questo motivo, nel primo studio di questo progetto abbiamo adattato al contesto italiano la versione originale della PEBS (fase qualitativa) e ne abbiamo verificato le proprietà psicometriche (ad es., struttura fattoriale) (fase quantitativa). La versione originale è stata leggermente modificata seguendo le indicazioni ottenute da un focus group (n=17) e uno studio pilota (n=18). Su un campione di 765 adulti italiani (70% femmine, età media [DS] = 41.7 [12.2], 2 dati mancanti) i risultati hanno mostrato una struttura fattoriale a 4 fattori (conservazione, cittadinanza ambientale, cibo e trasporti) della versione italiana della PEBS, come nella versione originale (Markle, 2013), mantenendo 15 dei 19 item originali (CFI = .973; RMSEA = .037; WRMR = 1.047; $\chi(84)^2 = 170.63$, $p < .001$; explained variance = 42%). Le altre proprietà psicometriche erano almeno buone. Tali risultati suggeriscono che la versione italiana della PEBS è uno strumento valido e affidabile per misurare i principali CPA proposti dalla letteratura che hanno un elevato impatto sull'ambiente.

Il secondo studio di questo progetto attraverso una meta-analisi intende stimare quanto gli ambienti naturali sono percepiti più rigenerativi rispetto agli ambienti urbani. Inoltre, è stato indagato il ruolo di variabili moderatrici come il disegno di

ricerca, il tipo di ambiente naturale, i tipo di partecipanti, lo strumento di misura o il contesto in cui i dati sono stati esposti. I databases online PsycINFO, PsycARTICLES, Scopus, SpringerLINK, Web Of Science sono stati utilizzati per identificare tutti gli articoli peer-review sulla restorativeness pubblicati fino ad oggi ($k = 167$). La bibliografia degli articoli selezionati è stata esaminata per individuare ulteriori studi. Solo 22 studi hanno soddisfatto i criteri di inclusione (esposizione diretta all'ambiente, confronto tra un ambiente esterno con elementi naturali e uno senza elementi naturali e restorativeness misurata con strumenti self-report) e sono stati inclusi nella meta-analisi. I risultati mostrano che gli ambienti naturali sono percepiti come più rigenerativi degli ambienti urbani (*d di Cohen* [I.C.] = 1.99 [1.38 - 2.61]). È stata trovata una significativa eterogeneità tra studi ($Q_{(19)} = 503.16, p < .001$) e la variabilità tra studi era molto alta ($I^2 = 97\%$). Tuttavia, le analisi univariate dei moderatori non erano significative. Altre differenze metodologiche (ad es., condizioni di luce) potrebbero spiegare la variabilità. In conclusione, possiamo dire che la variabilità tra studi probabilmente è maggiormente legata a differenze individuali (ad es., età, connessione con la natura e attitudini ambientali) che a differenze metodologiche.

Infine, nel terzo studio abbiamo indagato la relazione tra restorativeness percepita, attitudini ambientali, connessione con la natura e desiderabilità sociale. Il primo obiettivo dello studio è quello di proporre un modello integrato di antecedenti di CPA. Il secondo obiettivo è verificare se il modello proposto è valido per le diverse categorie di CPA proposte dalla letteratura (Stern, 2000): conservazione, cittadinanza ambientale, cibo e trasporti. Il modello aveva ottimi indici di bontà (CFI = 1.000; RMSEA = .000 [CI = .000 - .116]; SRMR = 0.031; $\chi(4) = 3.412, p = .491$; varianza spiegata = 26%) e quasi tutte le ipotesi sono state confermate: la connessione con la natura e le attitudini ambientali sono gli unici due costrutti – tra quelli inclusi nel modello – con un effetto diretto sui CPA; la connessione con la natura ha anche un effetto indiretto attraverso la restorativeness percepita e le attitudini ambientali; le attitudini ambientali sono influenzate dalla restorativeness ma non mediano l'effetto di quest'ultima sui CPA; la desiderabilità sociale ha un effetto indiretto sui CPA attraverso la connessione con la natura ma non hanno un' influenza sulle attitudini ambientali. Tutti i modelli con le diverse categorie di

CPA come outcomes avevano buoni indici di bontà, tuttavia mentre la connessione con la natura è stata confermata come predittore di tutte le categorie di CPA, le attitudini ambientali predicono solo la cittadinanza ambientale. In sintesi, il nostro modello suggerisce che la connessione con la natura, oltre ad essere il predittore più forte dei CPA, è anche un importante predittore della restorativeness percepita e delle attitudini ambientali. Di conseguenza, gli studi che hanno indagato l'effetto indiretto della restorativeness percepita sui CPA attraverso le attitudini ambientali (Byrka et al., 2011; Collado & Corraliza, 2015; Hartig et al., 2007) senza considerare il ruolo della connessione con la natura potrebbero avere sovrastimato l'effetto indiretto.

References

- Berto, R., & Barbiero, G. (2017). How the psychological benefits associated with exposure to nature can affect pro-environmental behavior. *Annals of Cognitive Science, 1*, 16-20. Retrieved from <https://scholarlypages.org/Articles/cognitive-science/acs-1-004.pdf>
- Brower, M., & Leon, W. (1999). *The consumer's guide to effective environmental choices: Practical advice from the union of concerned scientists*. New York, NY: Three Rivers Press.
- Byrka, K., Hartig, T., & Kaiser, F. G. (2010). Environmental Attitude as a Mediator of the Relationship between Psychological Restoration in Nature and Self-Reported Ecological Behavior. *Psychological Reports, 107*(3), 847–859. doi: 10.2466/07.PR0.107.6.847-859
- Clayton, S.D. (2012). Environment and Identity. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 208-228). Oxford, England: Oxford Library of Psychology. doi: 10.1093/oxfordhb/9780199733026.013.0010
- Coldwell, D. F., & Evans, K. L. (2017). Contrasting effects of visiting urban green-space and the countryside on biodiversity knowledge and conservation support. *PLOS ONE, 12*(3), e0174376. doi: 10.1371/journal.pone.0174376
- Collado, S., & Corraliza, J. A. (2015). Children's Restorative Experiences and Self-Reported Environmental Behaviors. *Environment and Behavior, 47*(1), 38–56. doi:10.1177/0013916513492417
- Hartig, T., Kaiser, F. G., & Bowler, P. A. (2001). Psychological Restoration in Nature as a Positive Motivation for Ecological Behavior. *Environment and Behavior, 33*(4), 590–607. doi:10.1177/00139160121973142
- Hartig, T., Kaiser, F. G., & Strumse, E. (2007). Psychological restoration in nature as a source of motivation for ecological behaviour. *Environmental Conservation, 34*(04). doi:10.1017/S0376892907004250
- Markle, G. L. (2013). Pro-Environmental Behavior: Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology, 41*(6), 905–914. doi:10.1007/s10745-013-9614-8

- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503–515. doi: 10.1016/j.jenvp.2004.10.001
- Milfont, T. L. (2009). The effects of social desirability on self-reported environmental attitudes and ecological behaviour. *The Environmentalist*, 29(3), 263–269. doi:10.1007/s10669-008-9192-2
- Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating Nearby Nature: Affective Forecasting Errors Obscure the Happy Path to Sustainability. *Psychological Science*, 22(9), 1101–1106. doi:10.1177/0956797611418527
- Noppers, E. H., Keizer, K., Bolderdijk, J. W., & Steg, L. (2014). The adoption of sustainable innovations: Driven by symbolic and environmental motives. *Global Environmental Change*, 25, 52–62. doi: 10.1016/j.gloenvcha.2014.01.012
- Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, 46(3), 598–609. doi:10.1037/0022-3514.46.3.598
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. doi: 10.1016/j.jenvp.2008.10.004
- Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56(3), 407–424. doi:10.1111/0022-4537.00175
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, 51(7), 787–810. doi:10.1177/0013916517751009

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INTRODUZIONE

La psicologia ambientale inizia a emergere come disciplina indipendente verso la metà del secolo scorso (Clayton & Saunders, 2012) quando etologi e psicologi iniziano a rivolgere l'attenzione verso gli aspetti fisico-spaziali in cui si svolge il comportamento. Negli anni '60 cominciano ad emergere i primi movimenti ambientalisti in seguito alla presa di coscienza della limitatezza delle risorse ambientali e della degradazione ambientale causata dall'aumento della popolazione. È in questo contesto che l'American Psychological Association (APA) costituisce la prima task force sull'ambiente, che in seguito diventerà la divisione 34 che tutt'oggi si occupa di psicologia ambientale e popolazione. I principali argomenti di studio (ad es., Craik, 1973; Wohlwill, 1983) in queste prime fasi della psicologia ambientale sono: la percezione dell'ambiente fisico, l'uso dell'ambiente come spazio sociale, l'utilizzo delle risorse ambientali, ed emozioni e attitudini elicitate dall'ambiente (Clayton & Saunders 2012). Fin dalle origini dunque si riconosce la bidirezionalità del rapporto tra individuo e ambiente e che nell'esperienza (percezione) psicologica dell'ambiente confluiscono aspetti fisici e sociali. Inoltre, fin dall'inizio gli psicologi ambientali sono ben consapevoli (e preoccupati) del collegamento tra il comportamento umano e i cambiamenti ambientali (Gifford, 2008). Nel corso degli anni si è assistito a un progressivo spostamento dell'interesse degli psicologi ambientali dall'ambiente fisico alla relazione tra in individuo e ambiente (Clayton & Saunders, 2012).

Oggi la psicologia ambientale viene definita come la disciplina che si occupa di esaminare le transazioni tra l'individuo ed il suo ambiente socio-fisico, sia esso naturale, costruito artificialmente o persino virtuale (Gifford, 2014). Si può distinguere tra una psicologia ambientale con focus sull'ambiente costruito, con maggiori legami con le scienze della progettazione, e una psicologia ambientale con focus sull'ambiente naturale, che condivide maggiormente temi che sono di interesse anche per geografi ed ecologi (Bonnes, 1994). Considerando questo secondo ambito, la maggior parte degli studi oggi si può dividere in due linee di

ricerca: la prima intende studiare l'impatto delle attività umane sull'equilibrio del nostro ecosistema; la seconda indaga la relazione individuo-ambiente nella direzione opposta, ovvero ha come principale oggetto di ricerca l'impatto dell'ambiente fisico sulle persone e in particolare sul loro benessere (Bonnes & Bonaiuto, 2002; Gifford, 2014).

1.1 L'influenza degli esseri umani sull'ambiente naturale

Vi sono numerose evidenze empiriche che evidenziano come la più grave minaccia a lungo termine che il mondo sta affrontando sono proprio le azioni umane che producono cambiamenti irreversibili e dannosi alle condizioni ambientali che sostengono la vita sulla terra (APA, 2009; Gifford, 2008; Gifford & Nilsson, 2014; ; Intergovernmental Panel on Climate Change (IPCC), 2013; Koger & Scott 2007; Mobley, Vagias, & DeWard, 2010; Steg & Vlek, 2009). Poiché questa minaccia è causata dalla crescita della popolazione umana, dal consumo eccessivo e dalla mancanza di conservazione delle risorse del pianeta, nonché dall'industrializzazione non regolarizzata, gli psicologi ambientali hanno un ruolo vitale nell'aiutare la società a sfuggire al disastro ecologico e ad adottare un livello sostenibile di impatto sull'ambiente (Oskamp, 2000). Ad esempio, numerosi studi empirici hanno evidenziato come una delle maggior cause dell'accelerazione dei cambiamenti climatici osservata negli ultimi 50 anni sono le attività umane come la combustione di carburanti fossili per la produzione di energia, il consumo di risorse primarie e la produzione di cibo (APA, 2009; Clayton & Brook, 2005; Stern, 2011; Swim et al., 2011). Le attività di consumo sia a livello industriale (trasformazione di materiali ed energia) che a livello domestico (trasporto privato, riscaldamento degli edifici, dispositivi elettronici) hanno determinato un incremento delle emissioni dei gas serra (APA, 2009). L'attuale sistema di produzione del cibo non solo contribuisce all'emissione di gas serra e interferisce con l'abilità dell'atmosfera di assorbire tali gas (ad es., IPCC, 2014), ma è anche è una delle principali cause di degradazione dell'ambiente (per una review vedere Willett et al., 2019).

Comprendere perché le persone si comportano in modo sostenibile o meno e come promuovere Comportamenti Pro-Ambientali (CPA) sono gli argomenti principali

della *conservational psychology*, una branca della psicologia ambientale nata a cavallo del 20° e 21° secolo. I Comportamenti Pro-Ambientali (CPA) vengono definiti come comportamenti che danneggiano l'ambiente il meno possibile oppure che contribuiscono alla sua protezione (Hartig, Kaiser, & Bowler, 2001; Steg & Vlek, 2009) oppure comportamenti che alterano la struttura o l'equilibrio dell'ecosistema o della biosfera (Stern, 2000). Tuttavia, è non è sempre facile definire in assoluto cosa è pro-ambientale e cosa no. Infatti, alcuni comportamenti che oggi vengono definiti pro-ambientali potrebbero essere considerati dannosi in futuro. In più, l'impatto di un comportamento sull'ambiente deve essere considerato in termini relativi e non assoluti. Infatti, tutti i comportamenti umani hanno un impatto sull'ambiente ma alcuni più di altri. Ad esempio, durante il processo di respirazione l'uomo emette diossido di carbonio, così come un viaggio in treno o in macchina. Tuttavia, camminare produce meno diossido di carbonio di un viaggio in treno che a sua volta ne produce meno di un viaggio in macchina. Ma anche quest'ultimo può essere considerato un CPA rispetto a prendere un jet privato. Inoltre, le definizioni proposte in precedenza per i CPA seguono un approccio impact-oriented. Tuttavia, vi è un secondo approccio, detto intention-oriented che definisce i CPA come comportamenti intrapresi con l'intenzione di cambiare a beneficio dell'ambiente (Stern, 2000), indipendentemente dal reale impatto sull'ecosistema.

Tutto ciò ha portato ad una certa disomogeneità riguardo ai comportamenti presi in esame, e ha fatto sì che un certo numero di ricerche indagassero comportamenti con un minimo o nullo impatto sull'ambiente, e che, al contrario, comportamenti quotidiani che invece hanno un elevato impatto, come ad esempio l'utilizzo dell'automobile o il tipo riscaldamento nelle abitazioni (Gardner & Stern, 2008), venissero raramente indagati nelle ricerche di psicologia ambientale (Stern, 2011). Infatti, come verrà approfondito nel primo capitolo di questo elaborato, nelle ricerche di psicologia ambientale vi è la tendenza a misurare comportamenti di convenienza (Schultz & Kaiser, 2012) e di conseguenza di utilizzare questionari creati ad hoc. Inoltre, i diversi approcci teorici e di conseguenza i diversi strumenti di misurazione utilizzati hanno portato a risultati contrastanti o inconsistenti, tanto che ad oggi è difficile trarre delle conclusioni generali su quali

siano i principali predittori dei CPA, nonostante le ricerche siano iniziate più di 50 anni fa (Levine & Strube, 2012; Markle, 2013).

Manca quindi un consenso su quali comportamenti debbano essere indagati e, conseguentemente, su quali siano gli strumenti più adeguati a misurarli. Alcuni autori hanno suggerito che se gli psicologi intendono contribuire scientificamente al dibattito su come promuovere i CPA (e di conseguenza su come salvaguardare l'ecosistema) dovrebbero focalizzarsi su singole azioni che abbiano un elevato impatto ambientale e che possano essere “facilmente” modificate (Schultz & Kaiser, 2012; Swim et al., 2011). Ovvero, in altre parole gli strumenti dovrebbero essere costruiti seguendo l'approccio impact-oriented con l'obiettivo di misurare comportamenti che hanno un impatto significativo sull'ecosistema indipendentemente dalla motivazione alla base di tali comportamenti. Infatti, alcune persone scelgono di andare in bicicletta o a piedi al lavoro o a scuola, oppure di mangiare frutta e verdura biologiche, per motivi di salute, così come scelgono di incrementare l'efficienza energetica delle loro case per motivi economici senza pensare alle conseguenze sull'ambiente delle loro scelte. Tuttavia, tali scelte hanno un impatto significativo e di conseguenza è di questi comportamenti che la ricerca psicologica dovrebbe occuparsi, con lo scopo di capire come possano essere aumentati. Solo conoscendo i meccanismi psicologici che portano ad aumentare i CPA con un elevato impatto sull'ambiente si potranno pianificare programmi con significative conseguenze in termini di ecosostenibilità.

In sintesi, diversamente dall'elevato impegno da parte degli psicologi ambientali nell'identificare i predittori dei CPA, scarso interesse è stato rivolto allo sviluppo di adeguati strumenti di misura dei CPA (Markle, 2013). Solo tre scale recenti (Armel, Yan, Todd, & Robinson, 2011; Markle, 2013; Tabi, 2013) sono state sviluppate con l'esplicito obiettivo di misurare comportamenti che secondo la comunità scientifica hanno un significativo impatto sull'ambiente. Tra queste lo strumento più completo per la misurazione dei CPA è la scala sviluppata da Markle (2013) in quanto indaga entrambe le categorie di comportamenti proposte dalla letteratura (comportamenti nella sfera pubblica e quelli nella sfera privata).

Tuttavia, nessuno studio ha verificato in modo approfondito valida e affidabilità della scala da un punto di vista psicometrico. Per questo motivo, l'obiettivo del primo studio di progetto di ricerca (capitolo 1) è stato quello di effettuare una validazione completa della scala (validità interna, validità test-retest, validità di costrutto, validità di criterio e validità concorrente) dopo averla adattata al contesto italiano (fase qualitativa).

1.2 L'influenza dell'ambiente naturale sugli esseri umani

Numerosi studi empirici provenienti da diverse aree di ricerca (ad es., psicologia ambientale, psicologia della salute, psicologia delle organizzazioni, psicologia dello sport) hanno dimostrato che l'esposizione ad ambienti naturali può influenzare il benessere delle persone (ad es., Berto, 2014; Bodin & Hartig, 2003; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Hartig et al., 2011; Mitchell, 2013; Mitchell & Popham, 2008).

In psicologia ambientale la natura viene considerata come l'ambiente rigenerativo per eccellenza (per una review vedere Berto, 2014; McMahan & Estes, 2015; Ohly et al., 2016). Gli ambienti rigenerativi (*restorative environments*) vengono definiti come gli ambienti che promuovono (non solo permettono) il recupero delle risorse (biologiche, cognitive, psicologiche, sociali) (*psychological restoration*) in un individuo (Hartig, 2004) e sono un importante campo di ricerca della psicologia ambientale (Staats, 2012). Negli ultimi 30 anni le ricerche empiriche si sono basate su due principali teorie proposte per spiegare perché gli esseri umani traggono benefici dagli ambienti naturali: l'Attention Restoration Theory (ART, Kaplan & Kaplan, 1989; Kaplan, 1995) e la Stress Recovery Theory (SRT, Ulrich, 1983; Ulrich et al., 1991).

La SRT (o teoria psico-evolutiva) si focalizza sulla immediata e inconscia risposta emotiva elicitata dall'ambiente (Korpela, Klemetilä, & Hietanen, 2002).

Ulrich (1983) suggerisce che specifiche caratteristiche ambientali come la vegetazione o gli elementi acquatici determinano rapide risposte emotive (precognitive) positive. Tali risposte aiutano l'individuo ad essere più attratto dall'ambiente, allentano il senso di stress che la persona sta provando in quel

momento e aumentano il senso di rigenerazione mentale (Staats, 2012). Secondo questo approccio, mentre la scena viene visualizzata, gli effetti negativi vengono sostituiti da quelli positivi, l'interesse della persona viene mantenuto e l'eccitazione fisiologica diminuisce. La teoria di Ulrich è detta anche psico-evolutiva e sostiene che le persone sarebbero biologicamente predisposte per acquisire rapidamente e mantenere un interesse per le caratteristiche ambientali che sono state significative per la sopravvivenza dei nostri antenati (Ulrich, 1983). Una recente meta-analisi ha fornito prove empiriche a favore della teoria di Ulrich evidenziando che l'esposizione alla natura è positivamente correlata con emozioni positive ($r = .31$) e negativamente correlata con emozioni negative ($r = -.12$) (McMahan & Estes, 2015).

L'ART, al contrario della teoria di Ulrich, si focalizza sulla capacità degli ambienti di rigenerare le risorse cognitive e in particolare quelle attentive (Kaplan & Kaplan, 1989). Questa teoria si poggia sulla classica definizione di attenzione proposta da William James (1892), il quale la definisce come una risorsa limitata e passibile di esaurimento, con conseguenze debilitanti per le prestazioni cognitive e comportamentali degli individui. La teoria di Kaplan e Kaplan assume che la capacità di mantenere l'attenzione volontaria diminuisce con l'utilizzo in quanto richiede uno sforzo volto ad inibire le distrazioni (Kaplan & Kaplan, 1989; Kaplan, 1995). Al contrario, entrare in una situazione che non richiede un'attenzione volontaria permette a una persona affaticata di bloccare il meccanismo inibitorio, liberare risorse mentali e di conseguenza rigenerare l'attenzione (Staats, 2012). Secondo questa teoria, il processo di restorativeness necessita di cinque qualità o caratteristiche dello scambio individuo-ambiente:

1. fascino (*fascination*): si riferisce alla capacità dell'ambiente di attrarre l'attenzione involontaria dell'individuo;
2. essere via (*being away*): si riferisce alla capacità dell'ambiente di trasportare l'individuo in un altro posto/luogo/dimensione;
3. coerenza (*coherence*): si riferisce alla qualità dell'esperienza (se l'ambiente è percepito in modo strutturato)
4. scopo (*scope*): si riferisce a quella qualità offerta dall'ambiente di rendere possibile l'esplorazione;

5. compatibilità (*compatibility*): si riferisce alla corrispondenza tra le caratteristiche della persona e quelle dell'ambiente.

La *restorativeness* di un ambiente fisico, ovvero la sua potenzialità di rigenerare le abilità cognitive, può essere indagata direttamente, attraverso misure fisiologiche (ad es., Chen, He, & Yu, 2016; Tang et al., 2017) e test di attenzione e/o memoria (Berto, 2005; Lin, Tsai, Sullivan, Chang, & Chang, 2014). Una recente meta-analisi (Ohly et al., 2016) ha fornito prove empiriche a favore della ART confermando un effetto positivo sui processi attentivi in seguito all'esposizione ad ambienti naturali.

Tuttavia, la maggior parte delle ricerche utilizza questionari self-report (ad es., Hartig et al., 2001; Korpela, 2013; Tyrväinen et al., 2014) che indagano la *restorativeness* percepita (Hartig, Korpela, Evans, & Gärling, 1997; Pasini, Berto, Brondino, Hall, & Ortner, 2014), ovvero il potenziale rigenerativo di un'ambiente che le persone percepiscono quando sono esposti o pensano ad un ambiente fisico (Staats, 2012). Alle persone viene chiesto di valutare le qualità rigenerative di un ambiente basandosi sull'assunto che le abilità meta-cognitive delle persone sono abbastanza sviluppate da permettere alle persone di comprendere i loro processi cognitivi e di conseguenza di stimare quanto siano influenzati da diversi tipi di ambiente (Pearson & Craig, 2014). Nel secondo capitolo del presente elaborato verrà verificato empiricamente tale assunto attraverso una meta-analisi che intende sintetizzare la letteratura e indagare se e quanto (in media) la natura viene percepita più rigenerativa rispetto agli ambienti urbani. Infatti, nonostante numerose ricerche empiriche individuano la natura come l'ambiente maggiormente rigenerativo, le sostanziali differenze metodologiche tra gli studi non permettono un facile confronto tra i risultati e di conseguenza di trarre conclusioni. Per questo motivo, dopo aver verificato l'effect size medio, ovvero la differenza media tra ambienti naturali e urbani in termini di *restorativeness* percepita, attraverso analisi di moderazione, verrà indagato se tale differenza riportata dagli studi dipende almeno in parte dal metodo utilizzato. Infatti, è stato visto che gli effetti dell'esposizione ad ambienti naturali sul funzionamento affettivo e cognitivo delle persone variano a seconda del tipo di esposizione (reale o virtuale), al tipo di strumento utilizzato per misurare i benefici di tale

esposizione, e all'età dei partecipanti (per maggiori dettagli vedere McMahan & Estes, 2015; Ohly et al., 2016).

1.3 Relazione reciproca (circolarità) tra benessere individuale e ambientale

Ad oggi nei programmi di promozione dei CPA domina l'approccio che incoraggia le persone a impegnarsi per ottenere benefici dal punto di vista collettivo (per le future generazioni) o per la natura (Evans et al., 2013; Schultz, 2001). Tali programmi fanno appello all'altruismo delle persone che si è dimostrato essere un efficace fattore per promuovere i CPA; tuttavia questi programmi allo stesso tempo hanno dimostrato di avere dei limiti. Infatti, è stato visto che le persone altruistiche rispondono in modo efficace a tali programmi ma nello stesso tempo si comportano in modo pro-ambientale anche quando percepiscono che tali comportamenti portano a benefici personali. Al contrario, tali programmi non hanno effetto sulle persone "egoistiche" che sono interessate solo ai benefici personali (De Dominicis, Schultz, & Bonaiuto, 2017). Recentemente si è sviluppato quindi un nuovo approccio che sottolinea il ruolo dell'interesse personale come fattore per promuovere i CPA (Griskevicius, Tybur, & Van den Bergh, 2010). Tale approccio è stato criticato (Bolderdijk, Steg, Geller, Lehman, & Postmes, 2013) ma sembra avere un elevato potenziale per diffondere un cambiamento diffuso dei comportamenti delle persone (De Dominicis et al., 2017). Di solito tali programmi sottolineano i vantaggi personali in termini economici (i CPA permettono di risparmiare soldi) oppure di approvazione sociale. Tuttavia, nella maggior parte dei casi, non prendono in considerazione la salute e/o il benessere delle persone che sono tra le motivazioni più potenti alla base dei comportamenti delle persone. Quindi, mettendo in luce la relazione reciproca (circolarità) tra benessere personale e benessere ambientale è possibile "trasformare" i CPA, da comportamenti altruistici (ovvero costosi dal punto di vista personale ma benefici dal punto di vista collettivo), in comportamenti "egoistici", ovvero comportamenti messi in atto per il proprio benessere personale.

Questo cambio di prospettiva potrebbe essere favorito dallo sviluppo di una recente linea di ricerca che mette insieme due dei principali argomenti di studio

della psicologia ambientale attuale: i CPA e gli ambienti rigenerativi. Infatti, secondo alcuni studi le esperienze positive, gratificanti e rigeneranti di cui le persone fanno esperienza negli ambienti naturali sarebbero alla base della motivazione a preservare e proteggere la natura (Byrka, Hartig, & Kaiser, 2010; Collado & Corraliza, 2015; Hartig, Kaiser, & Strumse, 2007; Nisbet & Zelenski, 2011). L'esposizione ad ambienti naturali (e i benefici ottenuti) potrebbe influenzare la probabilità di mettere in atto CPA (Coldwell & Evans, 2017). In particolare, diversi studi suggeriscono che più le persone riconoscono (percepiscono) che gli ambienti naturali possono influenzare in modo significativo il loro benessere più diventano sensibili ai problemi ambientali e sviluppano preoccupazioni riguardo alla salute del nostro pianeta che li spingono a comportarsi in maniera ecosostenibile (ad es., Byrka et al., 2010; Collado & Corraliza, 2015; Hartig et al., 2001; Whitburn, Linklater, & Milfont, 2019). In termini di promozione dei CPA, tali studi suggeriscono che accrescendo la consapevolezza delle persone sul fatto che il loro benessere può essere favorito da una natura ricca e rigogliosa si potrebbe ottenere un incremento dell'impegno a proteggere la natura.

Tuttavia, essendo una linea di ricerca che si è sviluppata solamente negli ultimi 20 anni vi sono ancora numerosi aspetti critici da superare o questioni da approfondire. Ad esempio la relazione tra benefici (percepiti o reali) ottenuti con l'esposizione alla natura e l'incremento dei CPA non sarebbe diretta ma potrebbe essere mediata da altri fattori personali come ad esempio le attitudini ambientali o la connessione con la natura (Byrka et al., 2010; Nisbet & Zelenski, 2011; Whitburn et al., 2019), che a loro volta potrebbero influenzarsi a vicenda (Mayer & Frantz, 2004). Inoltre, nonostante l'impatto della desiderabilità sociale (tendenza inconscia a fornire un'immagine positiva di se stessi) nelle ricerche che indagano i CPA (e i suoi predittori) attraverso questionari self-report sembra essere minimo, ulteriori ricerche sono necessarie (Vesely & Klöckner, 2018). Infine, la maggior parte di questi ricerche ha indagato i CPA utilizzando misure generali, ovvero strumenti che indagano insieme diversi tipi di comportamenti senza considerare che gli antecedenti potrebbero essere diversi a seconda del comportamento indagato (ad es., Bamberg & Möser, 2007; Lee, Kim, Kim, &

Choi, 2014). Per questi motivi nel terzo capitolo dell'elaborato verranno indagate la *restorativeness* percepita, la connessione con la natura, le attitudini ambientali e la desiderabilità sociale, tutti costrutti predittori di CPA ma che tuttavia non sono mai state indagate contemporaneamente in un unico studio. Inoltre, verrà verificato se il modello proposto è valido per le diverse categorie di CPA misurate dal PEBS.

References

- American Psychological Association (APA). (2009). Task force on the interface between psychology and global climate change. Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. Retrieved from <https://www.apa.org/science/about/publications/climate-changebooklet.pdf>.
- Armel, K. C., Yan, K., Todd, A., & Robinson, T. N. (2011). The Stanford Climate Change Behavior Survey (SCCBS): Assessing greenhouse gas emissions-related behaviors in individuals and populations. *Climatic Change*, *109*(3–4), 671–694. doi: 10.1007/s10584-011-0031-y
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14–25. doi:10.1016/j.jenvp.2006.12.002
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology*, *25*(3), 249–259. doi:10.1016/j.jenvp.2005.07.001
- Berto, R. (2014). The Role of Nature in Coping with Psycho-Physiological Stress: A Literature Review on Restorativeness. *Behavioral Sciences*, *4*(4), 394–409. doi:10.3390/bs4040394
- Bodin, M., & Hartig, T. (2003). Does the outdoor environment matter for psychological restoration gained through running? *Psychology of Sport and Exercise*, *4*(2), 141–153. doi:10.1016/S1469-0292(01)00038-3
- Bolderdijk, J. W., Steg, L., Geller, E. S., Lehman, P. K., & Postmes, T. (2013). Comparing the effectiveness of monetary versus moral motives in environmental campaigning. *Nature Climate Change*, *3*(4), 413–416. doi:10.1038/nclimate1767
- Bonnes, M. (1994). Psicologia Ambientale. In Enciclopedia Treccani. Roma: Istituto dell'Enciclopedia Italiana.
- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, *10*(1), 456. doi:10.1186/1471-2458-10-456

- Byrka, K., Hartig, T., & Kaiser, F. G. (2010). Environmental Attitude as a Mediator of the Relationship between Psychological Restoration in Nature and Self-Reported Ecological Behavior. *Psychological Reports, 107*(3), 847–859. doi:10.2466/07.PR0.107.6.847-859
- Chen, Z., He, Y., & Yu, Y. (2016). Enhanced functional connectivity properties of human brains during in-situ nature experience. *PeerJ, 4*, e2210. doi:10.7717/peerj.2210
- Clayton, S., & Brook, A. (2005). Can Psychology Help Save the World? A Model for Conservation Psychology. *Analyses of Social Issues and Public Policy, 5*(1), 87–102. doi:10.1111/j.1530-2415.2005.00057.x
- Clayton, S.D. (2012). Environment and identity. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 208- 228). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0010
- Coldwell, D. F., & Evans, K. L. (2017). Contrasting effects of visiting urban green-space and the countryside on biodiversity knowledge and conservation support. *PLOS ONE, 12*(3). doi:10.1371/journal.pone.0174376
- Collado, S., & Corraliza, J. A. (2015). Children’s Restorative Experiences and Self-Reported Environmental Behaviors. *Environment and Behavior, 47*(1), 38–56. doi:10.1177/0013916513492417
- Craik, K. H. (1973). Environmental Psychology. *Annual Review of Psychology, 24*(1), 403–422. doi:10.1146/annurev.ps.24.020173.002155
- De Dominicis, S., Schultz, P. W., & Bonaiuto, M. (2017). Protecting the Environment for Self-interested Reasons: Altruism Is Not the Only Pathway to Sustainability. *Frontiers in Psychology, 8*. doi:10.3389/fpsyg.2017.01065
- Evans, L., Maio, G. R., Corner, A., Hodgetts, C. J., Ahmed, S., & Hahn, U. (2013). Self-interest and pro-environmental behaviour. *Nature Climate Change, 3*(2), 122–125. doi:10.1038/nclimate1662
- Gardner, G. T., & Stern, P. C. (2008). The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change. *Environment: Science and Policy for Sustainable Development, 50*(5), 12–25. doi:10.3200/ENVT.50.5.12-25
- Gifford, R. (2008). Psychology’s essential role in alleviating the impacts of climate change. *Canadian Psychology/Psychologie Canadienne, 49*(4), 273–280. doi:10.1037/a0013234

- Gifford, R. (2014). Environmental Psychology Matters. *Annual Review of Psychology*, 65(1), 541–579. doi:10.1146/annurev-psych-010213-115048
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, 49(3), 141-157. doi:10.1002/ijop.12034
- Griskevicius, V., Tybur, J. M., & Van den Bergh, B. (2010). Going green to be seen: Status, reputation, and conspicuous conservation. *Journal of Personality and Social Psychology*, 98(3), 392–404. doi:10.1037/a0017346
- Hartig, T. (2004). Restorative Environments. In *Encyclopedia of Applied Psychology* (pp. 273–279). doi:10.1016/B0-12-657410-3/00821-7
- Hartig, T., Kaiser, F. G., & Bowler, P. A. (2001). Psychological Restoration in Nature as a Positive Motivation for Ecological Behavior. *Environment and Behavior*, 33(4), 590–607. doi:10.1177/00139160121973142
- Hartig, T., Kaiser, F. G., & Strumse, E. (2007). Psychological restoration in nature as a source of motivation for ecological behaviour. *Environmental Conservation*, 34(04). doi:10.1017/S0376892907004250
- Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research*, 14(4), 175–194. doi:10.1080/02815739708730435
- Hartig, T., van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., ... Waaseth, G. (2011). Health Benefits of Nature Experience: Psychological, Social and Cultural Processes. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, & J. Schipperijn (Eds.), *Forests, Trees and Human Health* (pp. 127–168). doi: 10.1007/978-90-481-9806-1_5
- Intergovernmental Panel on Climate Change (IPCC). (2013). Climate change 2013: The physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change. Retrieved from http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf
- Intergovernmental Panel on Climate Change (IPCC). (2014). Climate change 2014: Synthesis report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved from

https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

- James, W. (1892). *Principles of psychology: Briefer course*. New York: Holt.
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. CUP Archive.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182. doi:10.1016/0272-4944(95)90001-2
- Koger, S., & Scott, B. (2007). Psychology and environmental sustainability: A call for integration. *Teaching of Psychology, 34*(1), 10– 18. doi: 10.1080/00986280709336642
- Korpela, K. M. (2013). Perceived restorativeness of urban and natural scenes — photographic illustrations. *Journal of Architectural and Planning Research, 30*(1), 23–38. Retrieved date 23 May 2017 from www.jstor.org/stable/43030991
- Korpela, K. M., Klemettilä, T., & Hietanen, J. K. (2002). Evidence for Rapid Affective Evaluation of Environmental Scenes. *Environment and Behavior, 34*(5), 634–650. doi: 10.1177/0013916502034005004
- Levine, D. S., & Strube, M. J. (2012). Environmental Attitudes, Knowledge, Intentions and Behaviors Among College Students. *The Journal of Social Psychology, 152*(3), 308–326. doi: 10.1080/00224545.2011.604363
- Lin, Y.-H., Tsai, C.-C., Sullivan, W. C., Chang, P.-J., & Chang, C.-Y. (2014). Does awareness effect the restorative function and perception of street trees? *Frontiers in Psychology, 5*. doi: 10.3389/fpsyg.2014.00906
- Markle, G. L. (2013). Pro-Environmental Behavior: Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology, 41*(6), 905–914. doi: 10.1007/s10745-013-9614-8
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503–515. doi: 10.1016/j.jenvp.2004.10.001
- McMahan, E. A., & Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *The Journal of Positive Psychology, 10*(6), 507–519. doi: 10.1080/17439760.2014.994224

- Mitchell, R. (2013). Is physical activity in natural environments better for mental health than physical activity in other environments? *Social Science & Medicine*, *91*, 130–134. doi: 10.1016/j.socscimed.2012.04.012
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. *Lancet*, *372*(9650), 1655–1660. doi: 10.1016/S0140-6736(08)61689-X
- Mobley, C., Vagias, W. M., & DeWard, S. L. (2010). Exploring Additional Determinants of Environmentally Responsible Behavior: The Influence of Environmental Literature and Environmental Attitudes. *Environment and Behavior*, *42*(4), 420–447. doi: 10.1177/0013916508325002
- Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating Nearby Nature: Affective Forecasting Errors Obscure the Happy Path to Sustainability. *Psychological Science*, *22*(9), 1101– doi: /10.1177/0956797611418527
- Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. *Journal of Toxicology and Environmental Health, Part B*, *19*(7), 305–343. doi: 10.1080/10937404.2016.1196155
- Oskamp, S. (2000). Psychology of Promoting Environmentalism: Psychological Contributions to Achieving an Ecologically Sustainable Future for Humanity. *Journal of Social Issues*, *56*(3), 373–390. doi: 10.1111/0022-4537.00173
- Pasini, M., Berto, R., Brondino, M., Hall, R., & Ortner, C. (2014). How to Measure the Restorative Quality of Environments: The PRS-11. *Procedia - Social and Behavioral Sciences*, *159*, 293–297. doi: 10.1016/j.sbspro.2014.12.375
- Pearson, D. G., & Craig, T. (2014). The great outdoors? Exploring the mental health benefits of natural environments. *Frontiers in Psychology*, *5*. doi: 10.3389/fpsyg.2014.01178
- Schultz, P.W. (2001). The structure of environmental concern: concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*(4), 327–339. doi: 10.1006/jevps.2001.0227
- Schultz, P. W., & Kaiser, F. G. (2012). *Promoting Pro-Environmental Behavior*. doi: 10.1093/oxfordhb/9780199733026.013.0029

- Staats, H. (2012). Restorative Environments. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 537-553). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0024
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317. doi: 10.1016/j.jenvp.2008.10.004
- Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues, 56*(3), 407–424. doi: 10.1111/0022-4537.00175
- Stern, P. C. (2011). Contributions of psychology to limiting climate change. *American Psychologist, 66*(4), 303–314. doi: 10.1037/a0023235
- Swim, J. K., Stern, P. C., Doherty, T. J., Clayton, S., Reser, J. P., Weber, E. U., ... Howard, G. S. (2011). Psychology's contributions to understanding and addressing global climate change. *American Psychologist, 66*(4), 241–250. doi: 10.1037/a0023220
- Tabi, A. (2013). Does pro-environmental behaviour affect carbon emissions? *Energy Policy, 63*, 972–981. doi: 10.1016/j.enpol.2013.08.049
- Tang, I.-C., Tsai, Y.-P., Lin, Y.-J., Chen, J.-H., Hsieh, C.-H., Hung, S.-H., ... Chang, C.-Y. (2017). Using functional Magnetic Resonance Imaging (fMRI) to analyze brain region activity when viewing landscapes. *Landscape and Urban Planning, 162*, 137–144. doi: 10.1016/j.landurbplan.2017.02.007
- Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., Tsunetsugu, Y., & Kagawa, T. (2014). The influence of urban green environments on stress relief measures: A field experiment. *Journal of Environmental Psychology, 38*, 1–9. doi: 10.1016/j.jenvp.2013.12.005
- Ulrich, R. S. (1983). Aesthetic and Affective Response to Natural Environment. In I. Altman & J. F. Wohlwill (Eds.), *Behavior and the Natural Environment* (pp. 85–125). doi: 10.1007/978-1-4613-3539-9_4
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201–230. doi: 10.1016/S0272-4944(05)80184-7

- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, *51*(7), 787–810. doi: 10.1177/0013916517751009
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. doi: 10.1016/S0140-6736(18)31788-4
- Wohlwill, J. F. (1983). The Concept of Nature. In I. Altman & J. F. Wohlwill (Eds.), *Behavior and the Natural Environment* (pp. 5–37). doi: 10.1007/978-1-4613-3539-9_2

CHAPTER 1

Adaptation and psychometric properties of the Italian version of the Pro-Environmental Behaviours Scale (PEBS)

Menardo, E., Brondino, M., & Pasini, M. (2019). Adaptation and psychometric properties of the Italian version of the Pro-Environmental Behaviours Scale (PEBS). *Environment, Development and Sustainability*. doi: 10.1007/s10668-019-00520-3

1. Introduction

Ecological behaviours (EBs) are among the most discussed subjects in environmental psychology and are a central topic of conservational psychology (Schultz & Kaiser, 2012). Literature has used different terms to refer to EBs as pro-environmental behaviours, environmentally significant behaviours or sustainability. All these terms refer to behaviours that harm the (natural) environment as little as possible or that contribute to its protection (Hartig, Kaiser, & Bowler, 2001; Steg & Vlek, 2009) or as behaviour that “changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself” (Stern, 2000, pp. 408). Many studies (APA, 2009; Gifford, 2008; Gifford & Nilsson, 2014; Intergovernmental Panel on Climate Change (IPCC), 2013; Koger & Scott 2007; Mobley, Vagias, & DeWard, 2010; Steg & Vlek 2009; Willett et al., 2019) have highlighted that human behaviour is one of the primary causes of environmental problems. Human activities (e.g. fossil fuel combustion, consumption of resources, household operation, and food production) are a significant cause of acceleration of climate change (APA, 2009; Clayton & Brook, 2005; Swim et al., 2011; Stern, 2011; Willett et al., 2019). Data have shown that fossil fuel combustion is the principal

source of energy (Gardner & Stern, 2008; U.S. Energy Information Administration, 2011). Private transportation consumes most of the energy (39%), followed by space heating and air conditioning (25%). About a half of US carbon emissions derive from household and everyday individual activities (21%) and from transportation (33%) (Gardner & Stern, 2008).

Moreover, different studies have shown that the current global food system is one of the major causes of environmental degradation (for a review see Willett et al., 2019). Food production contributes to freshwater consumption (Wada, van Beek, & Bierkens, 2011), land-system change (e.g. Brower & Leon, 1999; Foley et al., 2005), greenhouse emissions (e.g. IPCC, 2014), and interference with the ability of the atmosphere to absorb greenhouse gas (e.g., Millennium Ecosystems Assessment, 2005). In summary, strong evidence shows that human activities, such as personal and public transport, heating and cooling buildings, household appliances and electronic devices, and food habits, have a great impact on environmental degradation. Consequently, psychology can play a crucial role (APA, 2009; Stern, 2011) by improving the understanding of the reciprocal influence between people and the natural environment (Clayton & Saunders 2012).

With the increasing awareness of environmental challenges, like pollution or climate (Clayton & Saunders, 2012), it becomes important to understand why people behave in environmentally sustainable ways or not (Chawla & Derr, 2012) and how to promote sustainable behaviours. These are the main topics of conservational psychology, which emerged around the turn of the Twentieth and Twenty-first centuries (Clayton & Brook, 2005; Saunders, 2003). Its main goal is to understand the factors (individual and contextual) that motivate people to perform EBs, like choosing public transport instead of a private vehicle, reducing meat consumption, or improving the energy efficiency of one's own house.

1.1. Predictors of ecological behaviours

Empirical research on the predictors of EBs began in the early 1970s and continued (Markle, 2013) following two main approaches: person-oriented and focused on contextual factors (Schultz & Kaiser, 2012). The first approach

emphasizes the role of individual factors that promote EBs (Giuliani & Scopelliti, 2009), like environmental attitudes (e.g. Bamberg & Moser, 2007; Hartig, Kaiser, & Strumse, 2007; De Dominicis, Schultz, & Bonaiuto, 2017), connection to nature (Gosling & Williams, 2010; Mayer & Frantz, 2004; Swim et al., 2011), and personality characteristics (e.g. Brick & Lewis, 2016; Fraj & Martinez, 2006).

Personality factors have been studied in environmental psychology because they are stable and early personal characteristics that could influence later environmental values, attitudes, and behaviours (Stern, 2000). EBs have been found correlated with, or predicted by, openness (Brick & Lewis, 2016; Hirsch & Dolderman, 2007; Hilbig, Zettler, Moshagen, & Heydasch, 2013; Markowitz, Goldberg, Ashton, & Lee, 2012), agreeableness (Fraj & Martinez, 2006; Hirsh & Dolderman, 2007; Milfont & Sibley, 2012; Poškus & Žukauskiene, 2017), conscientiousness (Brick & Lewis, 2016; Fraj & Martinez, 2006; Milfont & Sibley, 2012), extraversion (Fraj & Martinez, 2006; Hilbig et al., 2013). However, according to theory (Stern, 2000), the influence of personality factors on EBs seems to be mediated by other personal variables, like environmental attitudes (Brick & Lewis, 2016; Markowitz et al., 2012) and connection to nature (Markowitz et al., 2012). The term “environmental attitudes” is used to indicate personal evaluations of specific environmental activities or issues (Schultz & Kaiser, 2012) or a general worldview about the environment (Mobley et al., 2010). Even though they are one of the most studied predictors of EBs (Schultz & Kaiser, 2012), results are inconsistent (Levine & Strube, 2012; Mobley et al., 2010). Some studies showed a medium-size correlation (Pearson’s r range from .46 to .52) between attitudes and EBs (Davis, Le, Coy, 2011; Levine and Strube 2012; Markle, 2013). However, the direct relationship between attitudes and EBs may be less strong (Steg & Vlek, 2009) and completely mediated by intention to perform behaviours. Indeed, in other studies, attitudes emerged as an independent predictor of intention to perform EBs (Bamberg & Moser, 2007; Levine & Strube, 2012) without direct significant correlation with EBs (Bamberg & Moser, 2007). In other words, environmental attitude could influence intention that, in turn, promotes the acting of the EBs.

Connection to nature refers to an individual's sense of emotional connection to the natural environment (Mayer & Frantz, 2004) and is based on the biophilia concept (Wilson, 1984), the idea that love for nature is genetically determined (Staats, 2012). This concept suggests that humans develop an innate tendency to focus on life and on living beings and to affiliate with nature (Berto, Barbiero, Barbiero, & Senes, 2018). A strong feeling of being part of the natural world may be a requirement for action to protect them (Clayton, 2012; Mayer & Frantz, 2004). This hypothesis is supported by empirical data: connection to nature strongly correlates with environmental concerns (Bruni & Schultz, 2010; Dutcher, Finley, Luloff, & Johnson, 2007) and EBs (Gosling & Williams, 2010; Dutcher et al., 2007; Whitburn, Linklater, & Milfont, 2019).

Many studies suggest that individual factors and psychological barrier (resistance to change) (Swim et al., 2011) can influence the probability to perform EBs. At the same time, however, the context-oriented approach underlines the role of contextual factors (Kollmuss & Agyeman, 2002; Schultz & Kaiser, 2012; Steg & Vlek, 2009). There is increasing evidence that EBs also depend on the physical characteristics of the environment (Steg & Vlek, 2009), like availability of public transport (Joireman, Posey, Truelove, & Parks, 2009), walkability areas (Werner, Brown, & Gallimore, 2010), or recycling programmes (Folz, 1991). Contextual factors can influence human behaviour directly, for instance people can choose to travel using public transport instead of private vehicle only if a public service is available or consistent with personal factors (Steg & Vlek, 2009; Swim et al., 2011).

This means that the effect of contextual factors can be mediated by personal factors, for instance the use of a public service may result in more positive attitudes towards it, which, in turn, can lead to a higher use of public transportation. At the same time, the effect of personal factors can be moderated by contextual factors, for instance a better public service may induce people not to use a private vehicle only for those individuals with a high level of environmental concern (Steg & Vlek, 2009). This moderation effect could explain why, as revealed by a recent meta-analysis (Maki, Burns, Ha, & Rothman, 2016), economic/political interventions (e.g. financial incentives for "green energy")

have only minimal power to change behaviour (Swim et al., 2011). As highlighted by Gifford (2011), there are psychological barriers that prevent EBs even if there are not contextual barriers (e.g. lack of public transportation). Gifford suggested seven psychological barriers linked to cognition (e.g. ignorance, optimism bias), ideologies (e.g. worldviews), comparisons with others (e.g. social norms), costs (e.g. financial investments, conflicting values, and goals), discrediting (e.g. perceived programme inadequacy), perceived risks (e.g. financial, social, temporal), and limited behaviours (people could do more).

1.2. The problem of measuring EBs

As said above, there is evidence that EBs are driven by personal and contextual factors, which can produce reciprocal effects. However, despite many studies on this, results are inconsistent, making it difficult to give a general framework and draw conclusions about the main predictors of EBs (Markle, 2013). For example, looking at personality factors, differences in results emerged, showing that EBs correlate sometimes with agreeableness and conscientiousness (Milfont, 2012), sometimes with extraversion and openness (Markowitz et al., 2012), and in other studies only with agreeableness (Poškus & Žukauskiene, 2017). These results seem conflicting, but arguably they could result from different theoretical approaches and consequently from the different EBs' measures used (Levine & Strube, 2012; Markle, 2013). Indeed, two main approaches have been used to study EBs: intention-oriented and impact-oriented. In the first approach, the focus is on motivation to protect the environment and the target behaviours are those based on the person's intention to contribute to environmental sustainability, whereas in the second approach, the focus is on the impact on the environment, independently from a motivation to perform the behaviours, and target behaviours are those that have an impact on environmental sustainability (Schultz & Kaiser, 2012; Stern, 2000). However, EBs are defined as behaviours that harm and alter environmental balance (Hartig et al., 2001; Steg & Vlek, 2009; Stern, 1997) and the main purpose of conservational psychology is understanding "how to encourage conservation of the natural world" (Saunders, 2003, pp. 138). So, if psychologists want to significantly contribute to the scientific debate on how to

promote EBs, they should focus on single actions with a large potential effect on environmental issues that can be “easily” changed (Schultz & Kaiser, 2012; Swim et al., 2011).

However, environmental psychology articles show a tendency to assess behaviours of convenience (Schultz & Kaiser, 2012; Stern & Oskamp, 1987), to construct ad hoc questionnaires (e.g., Jagers, Martinsson, & Matti, 2016; Markowitz et al., 2012; Milfont & Sibley, 2012; Seebauer, Fleiß, & Schweighart, 2017; Takahashi & Selfa, 2015), or to choose only selected items from other scales (e.g., Corral-Verdugo, Tapia-Fonllem, & Ortiz-Valdez, 2015; Levine & Strube, 2012; Prati, Albanesi, & Pietrantonio, 2017). The result is that some important behaviours that have the largest effect on household carbon emissions, like private vehicle use and space cooling and the use of air conditioners (Gardner & Stern, 2008), have only rarely been studied by psychologists (Stern, 2011). As shown in Table 1, different studies have used different instruments to assess the same EBs. The lack of consistency of instruments makes it difficult to compare the studies and reflects a lack of consensus regarding which behaviours should be measured. Stern (2000) proposed three categories of EBs: environmental activism, nonactivist behaviours in the public sphere, and private-sphere environmentalism. The first two categories include active involvement in environmental groups and support of environmental policies, respectively, and represent two different behaviours of environmental citizenship (Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Takahashi & Selfa, 2015). The last category includes consumer activities in the private sphere with direct environmental consequences, like household waste, energy efficiency and consumption, transportation, and “green” consumerism, that is “purchasing practices that consider the environmental impact of production processes” (Stern, 2000, pp. 410).

Table 1

Example of Behaviours of each Stern's Categories of Behaviours Investigated by Different Authors

Stern's category	Example of behaviours	Environmental Citizenship
Environmental activism	<ul style="list-style-type: none"> ▪ being a member of an environmental organization (Dono et al., 2010; Kaiser, 1998; Markle, 2013; Schultz et al., 2005; Stern et al., 1999; Zafeiroudi et al., 2014) ▪ to donate money to an environmental organization (Kaiser, 1998; Markle, 2013; Schultz et al., 2005; Stern et al., 1999; Takahashi et al., 2015) ▪ to sign a petition in support of protecting environment (Dono et al., 2010; Stern et al., 1999) ▪ to talk with other about environmental issues (Kaiser, 1998; Markle, 2013; Schultz et al., 2005) ▪ to watch tv program or read book about environmental issue (Dono et al., 2010; Markle, 2013; Zafeiroudi et al., 2014) 	
Nonactivist behaviours in the public sphere	<ul style="list-style-type: none"> ▪ to support a candidate in political election who support environmental issue (Dono et al., 2010; Schultz et al., 2005; Stern et al., 1999; Zafeiroudi et al., 2014) ▪ to write a letter or call your government official to support strong environmental protection (Dono et al., 2010; Schultz et al., 2005; Stern et al., 1999) 	
Private-sphere environmentalism	<ul style="list-style-type: none"> ▪ use of energy efficient devices (Armel et al., 2011; Cleveland et al., 2005; Jagers et al., 2016; Kaiser, 1998; Milfont, 2012) ▪ use of renewable sources (e.g., solar panels) (Kaiser, 1998; Milfont, 2012; Mobley et al., 2010) ▪ cooling and air conditioning habits (Armel et al., 2011; Cleveland et al., 2005; Jagers et al., 2016; Kaiser, 1998; Markle, 2013) ▪ turn off the light when leaving a room/house (Armel et al., 2011; Cleveland et al., 2005; Iwata, 2004; Jagers et al., 2016; Markle, 2013; Milfont, 2012; Seebauer et al., 2017) ▪ turn off equipment (tv, computer) when not in use (Armel et al., 2011; Markle, 2013; Milfont, 2012; Mobley et al., 2010; Seebauer et al., 2017) ▪ hot water consumption (Cleveland et al., 2005; Iwata, 2004; Markle, 2013; Milfont, 2012) 	Household Conservation

<ul style="list-style-type: none"> ▪ speed of driving (Armel et al., 2011; Kaiser, 1998; Saleem et al., 2018) ▪ fuel efficiency (Armel et al., 2011; Kaiser, 1998; Markle, 2013; Saleem et al., 2018) ▪ to choose environmentally friendly ways of travelling, like walking/cycling (Cleveland et al., 2005; Jagers et al., 2016; Kaiser, 1998; Markle, 2013; Markowitz et al., 2012; Schultz et al., 2005; Seebauer et al., 2017; Tabi, 2013) ▪ use of the public transport (Cleveland et al., 2005; Jagers et al., 2016; Kaiser, 1998; Markle, 2013; Markowitz et al., 2012; Mobley et al., 2010; Seebauer et al., 2017; Tabi, 2013) 	Transportation
<ul style="list-style-type: none"> ▪ quantity of specific food (e.g., meat, vegetables, milk) consumed (Armel et al., 2011; Jagers et al., 2016; Markle, 2013) ▪ to buy organic or local fruits and vegetables (Armel et al., 2011; Jagers et al., 2016; Markle, 2013; Markowitz et al., 2012; Mobley et al., 2010; Stern et al., 1999; Tabi, 2013) ▪ avoidance of vegetables treated with chemicals or pesticides (Dono et al., 2010; Iwata, 2004) 	Food consumption
<ul style="list-style-type: none"> ▪ household trash production per week (Armel et al., 2011; Takahashi et al., 2015) ▪ reuse of materials (Iwata, 2004; Jagers et al., 2016; Schultz et al., 2005) ▪ to buy products made from recycled materials (Armel et al., 2011; Mobley et al., 2010; Stern et al., 1999; Takahashi et al., 2015) ▪ to recycle paper/glass/plastic materials (Armel et al., 2011; Jagers et al., 2016; Kaiser, 1998; Mobley et al., 2010; Poškus et al., 2017; Schultz et al., 2005; Tabi, 2013; Takahashi et al., 2015) ▪ to buy products with recycled packaging (Armel et al., 2011; Cleveland et al., 2005; Dono et al., 2010; Kaiser, 1998; Schultz et al., 2005; Zafeiroudi et al., 2014) 	Recycling

The General Ecological Behaviour Scale (Kaiser, 1998; Kaiser & Wilson, 2004), the most widespread and used scale to assess EBs (e.g., Corral-Verdugo et al., 2015; De Dominicis et al., 2017; Otto, Kaiser, & Arnold, 2014; Scannell & Gifford, 2010; Vesely & Klockner, 2018) covers all Stern's categories. The scale showed good psychometrics properties (Kaiser, 1998; Kaiser & Wilson, 2004). However, it is a long instrument (50 items) and some items assess behaviours that do not have a significant impact on the environment (Markle, 2013), for instance

“After meals, I dispose of leftovers in the toilet”, or “I requested an estimate on having solar power installed”.

Conversely, three scales (Armel, Yan, Todd, & Robinson, 2011; Markle, 2013; Tabi, 2013) have been developed with the explicit aim of measuring behaviours that, according to the environmental scientific community (e.g., Brower & Leon, 1999; IPCC, 2007), have a significant influence on the environment. The scale of Armel and colleagues (2011) is a very long instrument with 97 very specific items (e.g., “For the following questions, for each food or drink listed, how often on average you have eaten, drank, or used the amount specified during the past month: skim or low-fat milk, whole milk, yogurt/ricotta, other cheese, ice-cream/sorbet/frozen yogurt, banana, egg, chicken with skin, chicken without skin, beef as sandwich, beef as main dish, etc.”). However, the scale assesses only one of the three EBs’ categories proposed by Stern (2000), the private-sphere environmentalism.

Tabi’s questionnaire (2013) is a very short instrument (8 items) but some items are too general, for instance “Has cut down their energy consumption (e.g., turning down air conditioning or heating, not leaving appliances on stand-by, buying energy saving light bulbs, buying energy efficient appliances, etc.)”. Moreover, Tabi’s instrument also assesses only consumer behaviours in the private sphere and does not consider Environmental Citizenship.

The Pro-Environmental Behaviours Scale (PEBS; Markle, 2013) is, to our knowledge, the only scale based on an impact-oriented approach and on empirical evidence recognized by the environmental scientific community (Brower & Leon 1999) to cover the three categories of EBs proposed by Stern (2000). Exploratory factor analyses (Markle, 2013) suggest four dimensions: Conservation, Transportation, Food, and Environmental Citizenship. The first three are expressions of private sphere environmentalism and include items regarding the three main human activities that influence climate change: household consumption, transportation, and food consumption (Brower & Leon, 1999; Gardner & Stern, 2008). The fourth, Environmental Citizenship, combines environmental activism and nonactivist behaviours in the public sphere. PEBS

showed good psychometric properties (reliability and construct validity) (Markle, 2013) and it seems to solve the problem of coherence among EBs measures.

In summary, in contrast to the great attention paid by environmental psychologists to identifying the predictors of EBs, there has been little interest in the theoretical development of adequate measurement tools of EBs (Markle, 2013). The availability of a valid and reliable impact-oriented instrument could help psychology to play a more effective role in the interdisciplinary debate on environmental sustainability. For example, by investigating the influence of personal factors (i.e., motivation, value, education, personality traits, etc.) on behaviours, psychologists could significantly contribute to the global effort on environmental protection.

For this reason, the aim of this paper is to adapt to the Italian context the original PEBS (Markle, 2013) that is, the only instrument that covers all principal categories of EBs and that was explicitly built to investigate human behaviours with a significant impact on the environment. We translated and adapted the scale to the Italian context, following a qualitative approach, and we verified its psychometrics properties.

The first aim was to verify the factorial structure proposed by Markle (2013) and the measurement invariance of the proposed factor-model across gender, educational level, and geographical provenance. The second aim was to provide evidence of the reliability and validity of the scale. In particular, we investigated internal coherence, criterion validity, divergent and convergent validity, and test-retest validity. To demonstrate criterion validity, we expected a positive correlation between the scale and recycling behaviour, an EBs behaviour not included in the PEBS. To verify divergent and convergent validity, environmental attitude, connection to nature, and personality factors were used. We expected PEBS to correlate with all these measures but with different magnitude. In particular, given that attitude and connection to nature are constructs more similar to PEBS than personality, we hypothesized that they would have higher correlations with PEBS than personality traits. Moreover, we hypothesized a different pattern of correlation between the PEBS dimensions and other investigated constructs.

2. Material and Methods

2.1 Participants and Procedure

765 Italian adults (70% female, mean [SD] age = 41.7 [12.2], range 18-82, 2 missing) who were recruited online were included in the analysis after the exclusion of participants who did not complete the survey ($n = 123$) or had at least one missing response ($n = 128$), potential simulators ($n = 39$), and multivariate outliers ($n = 5$). Data were collected in two waves, from July to October 2017 and from March to May 2019, with an online survey published on social media and promoted among the authors' personal contacts. Before completing the scale, the participants were asked to declare that they were of legal age and lived in Italy, and to provide informed consent. Participants completed the Italian PEBS, a social desirability scale, and demographic questions in that order. In the first wave, after the PEBS, they also completed the questions about recycling behaviour.

Informed consent was obtained for all participants, and no type of incentive was given. Table 2 shows characteristics of the participants.

Table 2

Characteristics of participants

	Participants ($n = 765$)
Gender (%)	
F – M	539 (70) – 226 (30)
Age (%) ^a	
< 33	262 (34)
34 – 49	248 (33)
> 50	253 (33)
M (SD)	41.7 (14.3)
Educational level (%) ^b	
High School or lower	306 (40)
University degree	314 (41)

Post-university	139 (19)
Place of residence (%) ^b	
North west Italy	440 (58)
North east Italy	129 (17)
Center Italy	74 (10)
South Italy	116 (15)

Note. ^a Two missing data; ^b Six missing data.

An independent sample of 104 Italian students of the University of Verona (75% female, mean [SD] age = 23.0 [7.1], range from 18 to 52) was used to verify test-retest reliability and convergent/divergent validity of the Italian PEBS. In a classroom they completed the Italian version of PEBS adapted by the authors, the New Ecological Paradigm Scale (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000), the Connectedness to Nature Scale (CNS; Mayer & Frantz, 2004) and the Italian-Ten Items Personality Inventory (I-TIPI; Chiorri, Bracco, Piccinno, Modafferi, & Battini, 2015). After about one month, participants completed again the Italian version of PEBS.

2.2 Instruments

2.2.1 Ecological Behaviours (EBs)

To measure EBs the Pro-Environmental Behaviours Scale (PEBS; Markle, 2013) was used. It contains 19 items each measuring four different dimensions of EBs: Conservation, Environmental Citizenship, Food, and Transportation. The first dimension comprises seven items assessing consumption of water and lighting: time spent in shower, turning off the light or using standby mode for electronic devices, and the use of washing machines, dishwashers or air-conditioning. Environmental Citizenship comprises six items assessing: being a member of an environmental organization or donating to them, talking with others or watching tv programs/movies about environmental issues, the consumption of organic fruits, and the fuel efficacy of the principal motor vehicle used (miles per gallon). Food comprises three items assessing the reduction in consumption of meat (pork, poultry, and beef) during the last year. Transportation comprises three items assessing using public or share transport (e.g., car-pooling), and ecological

alternatives transport (cycling or walking). The original version shows a satisfactory internal consistency for the scale (Cronbach's alpha = .76) and sub-scale (Cronbach's alpha ranging from .62 to .74).

Development of Italian Version

The first step to develop the Italian adaptation of the PEBS was the authors' translation of the original scale into Italian that was then checked by experts in the sector. Item 13 ("Please answer the following question based on the vehicle you drive most often: approximately how many miles per gallon does the vehicle get?") was adapted to the Italian and European context by changing "miles per gallon" to "kilometers per litre" and by changing the answer appropriately (e.g., "24 miles or less" to "10 km or less"). 17 Italian students (82% female, mean [SD] age = 33.0 [12.0]) participated in a focus group conducted by the researchers in a classroom of the University of Verona. After the participants completed the scale by themselves, a discussion was held with them on the appropriateness and comprehensibility of the terms used, the adequacy for the Italian context, the clarity of the topic (what sort of behaviour each item intended to investigate), and possible problems with the options provided. Some people reported difficulties in responding to item 7 ("At which temperature do you wash most of your clothes?"). Following the suggestions received, we added temperature degrees in the pre-existing options. Moreover, some people did not know the meaning of the term "car-pooling", so we added an explanation and an example of the term in item 17. ("During the past year how often have you car-pooled (sharing vehicle with other people, e.g., blablacar?"). Finally, we added "I do not know" as a response option for items 7 and 13. In item 13, we also added the option "I do not have a motor vehicle".

Based on focus group results, a second Italian version of the PEBS was generated, and then used for the pilot study. The data were collected online using participants from the general population recruited through personal contact by the first authors. 18 Italian adults (73% female, mean [SD] age = 36.0 [14.0]) completed the scale by themselves and then they answered questions about appropriateness, comprehensibility, adequacy, and clarity of the items and answer options. Data analysis suggested that some household devices, like televisions or washing

machines, are not widespread in Italian houses. Consequently, we added the answer options “I do not have a television” and “I do not have a washing machine” for item 4 (“How often do you turn off the TV when leaving a room?”) and item 7, respectively. The final 19 items of the Italian PEBS are listed in Appendix A.

2.2.2 Recycling behaviour

An ad hoc item (How many paper, cardboard, and plastic do you recycle?) was created to investigate recycling behaviour. The item was based on a 4-point Likert scale ranging from 1 (Nothing) to 4 (Everything possible).

2.2.3 Environmental attitudes

Environmental attitudes were measured with the New Ecological Paradigm scale (NEP, Dunlap et al., 2000), composed of 15 items based on a 5-point Likert scale, ranging from strongly disagree (0) to strongly agree (5). The scale showed good psychometric properties (Dunlap et al., 2000) and is the most widely used scale to assess environmental attitudes.

2.2.4 Connection to nature

Connection to nature was measured with the Connectedness to Nature Scale (CNS, Mayer & Frantz, 2004), composed of 14 items based on a 5-points Likert scale, ranging from never (0) to always (5). The scale showed good psychometric properties (Mayer & Frantz, 2004).

2.2.5 Personality

Personality was investigated with the Italian-Ten Items Personality Inventory (I-TIPI; Chiorri et al., 2015) that assesses each of the Big Five personality factors (Extraversion, Agreeableness, Emotional Stability, Conscientiousness, and Openness) through two items (one of them reverse) based on a 7-point Likert scale. The scale showed good psychometric properties (Chiorri et al., 2015).

2.2.6 Social Desirability

The short form of the Balanced Inventory of Desirable Responding-6 (BIDR-6) (Bobbio & Manganelli, 2011; Paulhus, 1991), assessing socially desirable responding, was used to identify potential simulators. The scale comprises 16 items, based on 6-point Likert scale, and showed good psychometrics properties. Individuals with a higher score than the cut-off (95th percentile of the normative group) were considered simulators (Bobbio & Manganelli, 2011).

2.3 Data Analysis

First, we checked the pattern of missing data using the Missing Completely At Random (MCAR) test (Little & Rubin, 1987). If the test has a statistically nonsignificant result, MCAR can be inferred and the deletion of missing data (if less than 5% for each variable) is a good alternative to estimation of missing data (Tabachnick & Fidell, 2013). Second, we checked for the presence of potential simulators and after excluding them we ran preliminary analyses following Tabachnick and Fidell's suggestion (2013). We checked for normal univariate and multivariate (Mardia's Test) distribution and for the presence of univariate and multivariate outliers.

The 4-factors structure of the original English version was checked through confirmatory factor analysis (CFA) using R package Lavaan (Rosseel, 2012). We used the robust version of the maximum likelihood weight-least-square estimator (WLSMV), that is specifically designed for categorical observed data and does not assume normally distributed variables (Brown, 2006; Li, 2016). To assign the metric, we chose the first factor loading for each latent variable. The goodness of fit was evaluated using chi-square statistic (χ^2), the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA) with associated 95% confidence intervals (CIs), and the Weighted Root-Mean-Square Residual (WRMR) (Byrne, 2008; Jackson, Gillaspay, & Purc-Stephenson, 2009; Schermelleh-Engel Moosbrugger, & Müller, 2003; Yu, 2002). For the interpretation of the indices we followed guidelines from the literature for categorical data (DiStefano, Liu, Jiang, and Shi, 2018; Schreiber, Nora, Stage,

Barlow, & King, 2006; Yu, 2002) that suggests a good fit with values close to .95 for CFI, smaller than .06 for RMSEA, and smaller than 1.00 for WRMR. To improve the fit of the model, we looked for modification indices (MIs) for each specified model. We modified, one at a time, only the parameters with a MIs index higher than 10 (Byrne, Shavelson, & Muthen. 1989; Sorbom & Joreskog, 1982).

We also checked all alternatives nested models obtained collapsing the four factors into one, two or three factors. In this case, we used Δ CFI and Δ RMSEA to compare the alternatives models with the 4-factors model. A Δ CFI value > 0.01 and a Δ RMSEA value $> .015$ indicate a deterioration of fit model (Cheung & Rensvold, 2002).

Multigroup CFA (R package “semTools”; Jorgensen, 2016) was used to investigate measurement invariance. We sequentially tested the invariance of the model constraining a higher number of parameters to be invariant across gender (female, male), educational level (high school or lower, university degree, post-university education), and place of residence (North-east of Italy, North-west, Centre and South Italy) subgroups. Following literature guidelines (Vandenberg & Lance, 2000), we tested configural (equal pattern of factor loading), metric (equal factor loading), and scalar (equal intercepts) invariance in this order. For each invariance test we evaluated the goodness of fit with the same indices used for CFA. Comparisons between invariance tests were done using the fit indices used for comparison of alternatives models.

Despite Cronbach’s alpha coefficient being the most popular internal coherence measure, many authors (e.g., Dunn, Baguley, & Brunsten, 2014; Zinbarg, Yovel, Revelle, & McDonald, 2006) disapprove of its usage and encourage the use of other measures of reliability, especially with multidimensional scales (Raykov, 1998; Raykov & Shrout, 2002; Zinbarg et al., 2006). Since the PEBS is a multidimensional scale, we used ω coefficient for categorical items calculated with Green and Yang’s formula (2009) implemented in R package “semTools” (Jorgensen, 2016). Non-parametric correlation (Spearman’s *rho*) was used to investigate test-rest validity, criterion validity, and convergent/divergent validity.

Data Availability. The datasets analysed during the current study are available in the Mendeley Data repository (doi: 10.17632/wxtbwjnfnd.2).

3. Results

3.1 Preliminary Analyses

Analysis of missing data revealed that no item had more than 5% of missing and MCAR Little' Test (Little & Rubin, 1987) was not significant ($\chi_{(895)}^2 = 896.57, p = .479$), so we could exclude participants with missing values ($n = 49$). Thirty-nine participants exceeded the cut-off of BIDR-6, so were excluded because they were potential simulators, and five participants were excluded because of being multivariate outliers. No univariate outliers were found. The data of the final samples ($n = 765$) were not normally distributed. Several items had skewness and/or kurtosis higher than ± 1 and calculated Mardia's Index (415) was higher than critical value (399), suggesting that the data were not multivariate normality distributed.

3.2 Confirmatory Factor Analysis, measurement invariance, criterion validity, and internal coherence

The original 4-factors model had a reasonably good fit (CFI = .953; RMSEA = .037; WRMR = 0.93; $\chi_{(146)}^2 = 197.24, p < .01$; explained variance = 37%) but items 7, 13, and 17 did not have a significant factor loading. Following MIs, first we moved item 13 (Please answer the following question based on the vehicle you drive most often: approximately how many kilometers per litre does the vehicle get?) from Environmental Citizenship dimension to Transportation dimension (model 2) and, second, we moved item 12 (During the past year have you increased the amount of organically grown fruits and vegetables you consume?) from Environmental Citizenship dimension to Food dimension (model 3). Items 1 (How often do you turn off the lights when leaving a room?), 4 (How often do you turn off the TV when leaving a room?), 7 (At which temperature do you wash most of your clothes?) and 17 (During the past year how often have you car-pooled?) had a factor loading very low ($< .25$) and MIs not suggested movement

between dimensions. So, we excluded them one by one, starting by item with the lower factor loading in the last computed model: item 7 (model 4), item 17 (model 5), item 4 (model 6), and item 1 (model 7) respectively. Model 7 (15 items) was the model with the best fit and the most explained variance (CFI = .973; RMSEA = .037; WRMR = 1.047; $\chi_{(84)}^2 = 170.63$, $p < .001$; explained variance = 42%) (see table 3). Factor loading and inter-factor correlation are reported in the path diagram in Figure 1.

Table 3

Confirmatory Factor Analysis (n = 765) of six 4-factors models

	CFI	RMSEA	WRMR	$\chi^2(df)$
Model 1	.942	.042 [.036-.048]	1.241	340.87 ₍₁₄₆₎ ***
Model 2	.951	.038 [.032-.044]	1.174	307.91 ₍₁₄₆₎ ***
Model 3	.954	.037 [.031-.043]	1.159	300.98 ₍₁₄₆₎ ***
Model 4	.960	.037 [.030-.043]	1.128	262.23 ₍₁₂₉₎ ***
Model 5	.961	.039 [.032-.045]	1.129	241.01 ₍₁₁₃₎ ***
Model 6	.970	.036 [.028-.043]	1.063	194.44 ₍₉₈₎ ***
Model 7	.973	.037 [.028-.045]	1.047	170.63 ₍₈₄₎ ***

Note. *** $p < .01$

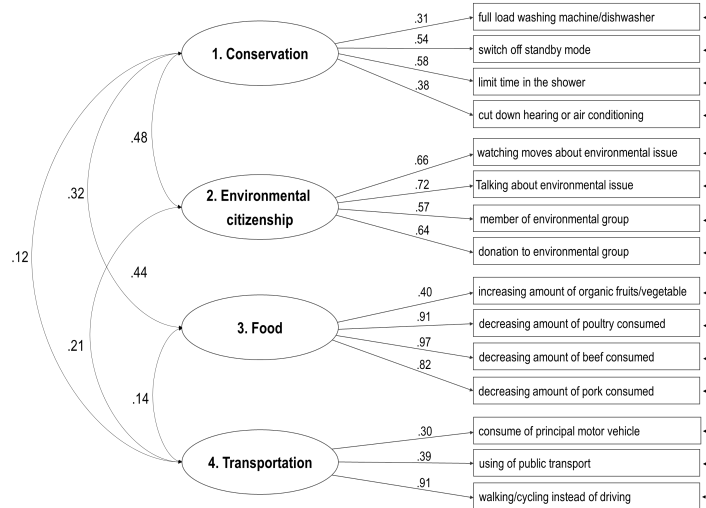


Figure 1. Confirmatory factor model of the 4-factor model of the 15-Items Italian Version of Pro-Environmental Behaviour Scale

The internal coherence of the total scale was reasonably good ($\omega = .71$).

After having established the items to maintain and the best model, we verified all the possible alternative models by combining the factors. Below we report only those that can be justified from a theoretical point of view. The final 4-factors model resulted better than all alternatives models. Between them, the 1-factor model had the worst fit (CFI = .838; RMSEA = .087; WRMR = 2.107; $\chi_{(90)}^2 = 610.49$, $p < .001$; Δ CFI = .135; Δ RMSEA = .050), followed by the 2-factors models, for instance the model with two Stern's category, Environmental Citizenship and private-sphere environmentalism (Conservation, Food, and Transportation together) (CFI = .889; RMSEA = .073; WRMR = 1.794; $\chi_{(89)}^2 = 446.86$, $p < .001$; Δ CFI = .084; Δ RMSEA = .036). The 3-factors model that joined the two consumption activities, household and transportation ((Conservation + Transportation) & Environmental Citizenship & Food) had a good fit (CFI = .943; RMSEA = .053; WRMR = 1.363; $\chi_{(87)}^2 = 270.90$, $p < .001$) but the comparison with the 4-factors model's fit indices suggested a deterioration of fit model (Δ CFI = .030; Δ RMSEA = .016).

Before the invariance test we verified if the model had a good fit in each of the sub-groups. The 4-factor model showed an acceptable fit for all sub-groups. Table 4 show the results of the configural, metric, and scalar invariance tests across gender, educational level, and place of residence. In all invariance tests fit indices and comparison indices are good, except WRMR that in all tests was higher than cut-off indicated by literature (DiStefano et al., 2018) and we did not need to release some parameters (partial invariance). Consequently, the 4-factor model can be considered full invariant across gender (explained variance = 43.3% for male and 40.8% for female), educational level (39.0% for high school or lower, 42.2% for university degree, and 40.4% per post-university), and place of residence (39.9% for North-east, 43.8% for North-west 43.8% for Centre and South) sub-groups.

Internal coherence of the scale was good in all sub-groups (range .69-.80), except in High school or lower education level sub-groups that was sufficient ($\omega = .60$).

Table 4.

Gender, educational level, and geographical provenience measurement invariance: Fit indices for the multigroup 4-factor model of the 15-Item Italian Version of Pro-Environmental Behaviour Scale

Invariance	CFI	RMSEA	WRMR	χ^2 (df)	vs	Δ CFI	Δ RMSEA
Gender							
Configural	.978	.033 [.022-.042]	1.231	239.1 ₍₁₇₀₎ ***	-	-	-
Metric	.978	.031 [.021-.040]	1.284	245.7 ₍₁₇₉₎ ***	Configural	.000	-.002
Scalar	.979	.030 [.020-.039]	1.274	248.2 ₍₁₈₄₎ ***	Metric	.001	-.001
Educational level							
Configural	.966	.040 [.030-.049]	1.520	357.8 ₍₂₅₅₎ ***	-	-	-
Metric	.971	.036 [.025-.045]	1.582	363.2 ₍₂₇₄₎ ***	Configural	.004	-.004
Scalar	.961	.041 [.031-.050]	1.652	400.0 ₍₂₈₂₎ ***	Metric	-.010	.005
Geographical provenience							
Configural	.982	.034 [.022-.044]	1.445	327.5 ₍₂₅₅₎ ***	-	-	-
Metric	.987	.028 [.014-.039]	1.485	328.2 ₍₂₇₄₎ *	Configural	.005	-.006
Scalar	.983	.031 [.019-.041]	1.532	352.8 ₍₂₈₄₎ **	Metric	-.004	.003

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

3.3 Test-retest reliability and convergent/divergent validity

Test-retest correlations were “good” or better (Spearman’s coefficient ranging from .61 to .73) (Table 5).

PEBS score showed a statistically significant positive correlation between with NEP ($r = .26$; $p < .01$) and CNS ($r = .36$; $p < .01$). Moreover, also Environmental Citizenship and Food dimensions were statistically significant positive correlated with NEP ($r = .34$; $p < .01$ and $r = .20$; $p < .05$, respectively) and CNS score ($r = .46$; $p < .01$ and $r = .25$; $p < .05$, respectively). As regard personality traits, PEBS score showed positive correlations with Agreeableness ($r = .19$; $p < .05$) and Openness ($r = .23$; $p < .01$), as well as Conservation dimension ($r = .22$; $p < .05$ for Agreeableness and $r = .21$; $p < .05$ for Openness) (Table 5).

Table 5.

Pearson Correlation Coefficients between Scores in the Four Factors of the 15 Item Italian Version of Pro-Environmental Behaviour Scale at time 1 and Score in time 2, in the New Ecological Paradigm Scale (NEP), in the Connectedness to Nature Scale (CNS), and in the Five Personality Factor of the Italian-Ten Items Personality Inventory (I-TIPI) Obtained by 103 participants

	PEBS (Time 1)				PEBS Total
	Conservation	Environmental Citizenship	Food	Transportation	
Test-Retest reliability					
Conservation (Time 2)	.661**				
Environmental Citizenship (Time 2)		.731**			
Food (Time 2)			.607**		
Transportation (Time 2)				.677**	
PEBS Total Score (Time 2)					.673**
Convergent/Divergent validity					
NEP	.069	.343**	.201	-.016	.254**
CNS ^a	.170	.458**	.248**	-.023	.361**
I-TIPI: Extroversion	.073	.019	.041	-.035	.057
I-TIPI: Agreeableness	.215*	.167	.082	.153	.193*
I-TIPI: Conscientiousness ^a	-.111	-.131	-.053	.124	-.106
I-TIPI: Emotional Stability	-.127	-.159	-.060	.025	-.147
I-TIPI: Openness	.212*	.278**	.110	-.039	.361**

Note. * $p < .05$; ** $p < .01$. ^a $n = 103$.

4. Discussion

The aim of this study was the adaptation of the Pro-Environmental Behaviours Scale (Markle, 2013) to the Italian context and the study of its psychometrics properties in a sample of Italian adults. In the first translation phase from English language to Italian, the scale was only slightly modified (e.g., units of measurement), trying to maintain the Italian version to be as close as possible to the original one. However, some answer options were added, to adapt to the Italian context. For instance, not every Italian adult owns a television or a motor vehicle, (this is becoming an increasingly frequent choice for a green life style in

Italy), or some people are not aware about their consumption, and we needed to adjust response options accordingly.

The second step was a confirmatory factor analysis, to verify whether the 4-factors structure proposed by Markle (2013) worked in the Italian context as well. The results confirmed the 4-factors structure (Conservation, Environmental Citizenship, Food, and Transportation), the same as the original scale, after removing 4 of the 19 original items. Nevertheless, two items, specifically the items concerning the increased consumption of organic fruits/vegetable and vehicle fuel efficiency, were moved from the Environmental Citizenship dimension to Food and Transportation dimensions, respectively. These locations have been hypothesized by Markle but were not confirmed by her results (2013).

The removed items concerned switching off the light and the television when leaving a room, the water temperature used for washing machines, and the use of shared vehicles. It seems that these activities reflect behaviours which do not allow distinguishing the different kind of EBs, at least in the Italian context. The poor performance of the items may have been partly related to cross-cultural differences due to different environmental engagement (Milfont, 2012) or to resources required for the investigated behaviours. For example, in Italy only a few cities have a public sharing car service and the habit of sharing cars among people is not as widespread as it is in the United States of America.

The four factors were significantly interrelated, but the Transportation dimension showed low correlation with Environmental Citizenship and Food dimensions. Transportation is highly related to contextual factors, for instance the availability of public transport (Joireman et al., 2009), and the presence of pedestrian streets and cycle paths (Werner et al., 2010), and this could be a reason for this lack of relationship with the other two factors. Conversely, we suggest that Environmental Citizenship behaviours and eating habits (and also conservation behaviours) are more linked to individual characteristics. Indeed, we found that both were correlated with connectdness to nature (CNS) and Environmental Citizenship also with Openess and environmental attitude (NEP scale). On the

other hand, Transportation did not correlate with any of the investigated individual characteristics.

Our results confirm the presence of different kind of behaviours as stated by Stern (2000). However, they suggest that private sphere personal environmental behaviours could be divided into three categories: (household) conservational behaviours, transportation and food consumption. The first two represent two forms of consumption activities (APA, 2009) and the 3-factors model that joined them also had a good fit. Consequently, for a more parsimonious model, household Conservation and Transportation could form a single category. The results of the measurement (configural) invariance suggest that the 4-factor structure of Italian PEBS is equivalent across independent groups and, thus, allow valid model comparison across sub-groups. Moreover, metric and scalar invariance suggest that items are perceived in the same way and the same meaning is attributed to the behaviour measured independently of gender, educational level, and geographical provenience. That is, Italian PEBS measures the same construct (EBs) in people with different socio-demographic characteristics.

Criterion validity of the Italian PEBS is supported by the positive correlation between the scale's score and recycling behaviours, included by Stern (2000) in private sphere personal environmental behaviours. Significant correlation between recycling and only some PEBS dimensions (Conservation and Environmental Citizenship dimensions) supports the presence of a different kind of EBs. Moreover, these results suggest that to behave in an ecological way is not a global behavioural tendency or life-style based. Quite the opposite, people who recycle or try to conserve natural resources (e.g., water) might not use an ecological transport or might not have a sustainable diet. In the light of this consideration, it is plausible to hypothesize a fundamental role of contextual factors in determining EBs, instead of personal value and motivation that probably could push people to behave ecologically in all areas of their lives.

The scale and each dimension showed a sufficient test-retest validity confirming Markle's study (2013).

Convergent and divergent validity's hypotheses were confirmed. First, as expected, Italian PEBS scores and some of its dimensions significantly correlated with NEP and CNS score. Moreover, PEBS scores generally showed higher correlation with CNS and NEP than with personality traits. These findings confirm the literature (Gosling & Williams, 2010; Poškus & Žukauskiene, 2017; Whitburn et al., 2019) and support the validity of the scale. Indeed, moderate correlations suggest that the tools measure similar but different constructs, whereas low correlations suggest different constructs. Second, we found different patterns of correlations between Italian PEBS dimensions and personality factors. Only Conservation and Environmental citizenship showed positive correlations with personality traits. In particular, both significantly correlated with Openness and Conservation correlated also with Agreeableness. These results confirm the literature (Brick & Lewis, 2016; Hirsh & Dolderman, 2007; Hilbig et al., 2013; Fraj & Martinez, 2006; Markowitz et al., 2012; Milfont & Sibley, 2012; Poškus & Zukauskiene, 2017). and support the hypothesis that “adaptive” and “socially desirable” personality factors are the ones that consistently correlated with EBs (Poškus & Žukauskiene, 2017). Moreover they suggest that investigating the different EBs' category separately could be more appropriate because they could have different predictors (e.g., Lee, Kim, Kim, & Choi, 2014).

4.1. Limitations and practical implications

This study has some limits that could be overcome in future studies. Most of the participants were women (70%) who lived in North Italy (75%) with at least a University degree (60%). Even though the analysis suggested that the scale is invariant across gender, educational level, and geographical provenance, future studies with a more heterogeneous sample are necessary. Moreover, in this study data were collected through an online survey that presents some issues (Wright, 2005) linked to sampling, for example self-selection bias (Stanton, 1998; Thompson, Surface, Martin, & Sanders, 2003) or the impossibility to control for the presence of non-independent data. Replication using both an online and offline setting would provide reliable and valid conclusions. Moreover, we think that further studies should investigate the possibility of improving the scale by adding

items assessing other EBs that have a relevant impact on the environment, like recycling (Schultz & Kaiser, 2012).

Finally, given that the scale was created with the specific aim of assessing behaviours that have a significant impact on the environment, further studies should explore the relationship between PEBS score and the ecological footprint. The last is a widespread measure used to assess an individual's environmental impact (Bleys, Defloor, Van Ootegem, & Verhofstadt, 2018), in particular the human consumption of natural resources (in term of land area) compared to the Earth's ability to regenerate them (Wackernagel & Rees, 2004).

In conclusion, the main novel contribution of this study is the adaptation to the Italian context of a valid and reliable tool that assesses principal EBs, proposed by the conservational psychology literature (Stern, 2000) and investigate behaviours that have a great impact on the environment, according to the scientific community (Brower & Leon, 1999; Gardner & Stern, 2008). The psychometric properties are particularly good, and the four dimensions identified explain a large part of the variance of the latent construct. Consequently, it could be a useful tool to respond to the necessity of psychological reasearch to focus on high-impact EBs (Stern, 2011). The scale could be useful for researchers who intend to investigate EBs antecedents to produce more targeted and efficacious programs. Indeed, knowing the different antecedents of principal categories of high-impact EBs, we could plan programs with greater and significant consequences for environmental balance. Moreover, since the factor structure of the scale found in the US context was replicated, we suggest that the PEBS could be used in cross-cultural studies to understand similarities and differences between cultures.

References

- American Psychological Association (APA). (2009). *Task force on the interface between psychology and global climate change. Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges*. Retrieved from <https://www.apa.org/science/about/publications/climate-change-booklet.pdf>
- Armel, K. C., Yan, K., Todd, A., & Robinson, T. N. (2011). The Stanford Climate Change Behavior Survey (SCCBS): Assessing greenhouse gas emissions-related behaviors in individuals and populations. *Climatic Change*, *109*(3–4), 671–694. doi: 10.1007/s10584-011-0031-y
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14–25. doi: 10.1016/j.jenvp.2006.12.002
- Berto, R., Barbiero, G., Barbiero, P., & Senes, G. (2018). An Individual's Connection to Nature Can Affect Perceived Restorativeness of Natural Environments. Some Observations about Biophilia. *Behavioral Sciences*, *8*(3), 34. doi: 10.3390/bs8030034
- Bleys, B., Defloor, B., Van Ootegem, L., & Verhofstadt, E. (2018). The Environmental Impact of Individual Behavior: Self-Assessment Versus the Ecological Footprint. *Environment and Behavior*, *50*(2), 187–212. doi: 10.1177/0013916517693046
- Brick, C., & Lewis, G. J. (2016). Unearthing the “Green” Personality: Core Traits Predict Environmentally Friendly Behavior. *Environment and Behavior*, *48*(5), 635–658. doi: 10.1177/0013916514554695
- Brower, M., & Leon, W. (1999). *The consumer's guide to effective environmental choices: Practical advice from the union of concerned scientists*. New York, NY: Three Rivers Press.
- Brown, T. (2006). *Confirmatory factor analysis for applied research*. New York, NY: Guilford.
- Bruni, C. M., & Schultz, P. W. (2010). Implicit beliefs about self and nature: Evidence from an IAT game. *Journal of Environmental Psychology*, *30*(1), 95–102. doi: 10.1016/j.jenvp.2009.10.004

- Byrne, B. (2008). Testing for multigroup equivalence of a measuring instrument: A walk through the process. *Psicothema* 20(4), 872-882. Retrived from <https://www.redalyc.org/pdf/727/72720455.pdf>
- Byrne, B., Shavelson, R., & Muthen, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement in variance. *Psychological Bulletin*, 105(3), 456-466. Retrived from http://www.statmodel.com/bmuthen/articles/Article_027.pdf
- Chawla, L., & Derr, V. (2012). The Development of conservation behaviours in childhood and youth. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 629-660). Oxford, England: Oxford Library of Psychology. doi: 10.1093/oxfordhb/9780199733026.013.0028
- Cheung, G., & Rensvold, R. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling A Multidisciplinary Journal*, 9(2), 233–255. doi: 10.1207/S15328007SEM0902_5
- Chiorri, C., Bracco, F., Piccinno, T., Modafferi, C., & Battini, V. (2015). Psychometric properties of a revised version of the ten item personality inventory. *European Journal of Psychological Assessment*, 31(2), 109–119. doi: 10.1027/1015-5759/a000215
- Clayton, S.D. (2012). Environment and Identity. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 208-228). Oxford, England: Oxford Library of Psychology. doi: 10.1093/oxfordhb/9780199733026.013.0010
- Clayton, S.D., & Brook, A. (2005). Can psychology help save the world? A model for conservation psychology. *Analyses of Social Issues and Public Policy*, 5(1), 87–102. doi: 10.1111/j.1530-2415.2005.00057.x
- Clayton, S.D., & Saunders, C. (2012). Introduction: Environmental and conservation psychology. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 23-29). Oxford, England: Oxford Library of Psychology. doi: 10.1093/oxfordhb/9780199733026.013.0001
- Cleveland, M., Kalamas, M., & Laroche, M. (2005). Shades of green: linking environmental locus of control and pro-environmental behaviours. *Journal of Consumer Marketing*, 22(4), 198–212. doi: 10.1108/07363760510605317

- Corral-Verdugo, V., Tapia-Fonllem, C., & Ortiz-Valdez, A. (2015). On the relationship between character strengths and sustainable behaviour. *Environment and Behavior*, 47(8), 877–901. doi: 10.1177/0013916514530718
- Davis, J., Le, B., & Coy, A. (2011). Building a model of commitment to the natural environment to predict ecological behaviour and willingness to sacrifice. *Journal of Environmental Psychology* (31), 257-265. doi:10.1016/j.jenvp.2011.01.004
- De Dominicis, S., Schultz, P. W., & Bonaiuto, M. (2017). Protecting the Environment for Self-interested Reasons: Altruism Is Not the Only Pathway to Sustainability. *Frontiers in Psychology*, 8. doi: 10.3389/fpsyg.2017.01065
- DiStefano, C., Liu, J., Jiang, N., & Shi, D. (2018). Examination of the Weighted Root Mean Square Residual: Evidence for Trustworthiness? *Structural Equation Modeling: A Multidisciplinary Journal*, 25(3), 453– doi: 10.1080/10705511.2017.1390394
- Dono, J., Webb, J., & Richardson, B. (2010). The relationship between environmental activism, pro-environmental behaviour and social identity. *Journal of Environmental Psychology*, 30(2), 178–186. doi: 10.1016/j.jenvp.2009.11.006
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues*, 56(3), 425–442. doi: 10.1111/0022-4537.00176
- Dunn, T. J., Baguley, T., & Brunsten, V. (2014). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology*, 105(3), 399–412. doi: 10.1111/bjop.12046
- Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity With Nature as a Measure of Environmental Values. *Environment and Behavior*, 39(4), 474–493. doi: 10.1177/0013916506298794
- Foley, J. A. (2005). Global Consequences of Land Use. *Science*, 309(5734), 570–574. doi: 10.1126/science.1111772
- Folz, D. H. (1991). Recycling Program Design, Management, and Participation: A National Survey of Municipal Experience. *Public Administration Review*, 51(3), 222. doi: 10.2307/976946

- Fraj, E., & Martinez, E. (2006). Influence of personality on ecological consumer behaviour. *Journal of Consumer Behaviour*, 5(3), 167–181. doi: 10.1002/cb.169
- Gardner, G. T., & Stern, P. C. (2008). The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change. *Environment: Science and Policy for Sustainable Development*, 50(5), 12–25. doi: 10.3200/ENVT.50.5.12-25
- Gifford, R. (2008). Psychology's essential role in alleviating the impacts of climate change. *Canadian Psychology/Psychologie Canadienne*, 49(4), 273–280. doi: 10.1037/a0013234
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist* 66 (4), 290-302. doi: 10.1037/a0023566
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, 49(3), 141-157. doi: 10.1002/ijop.12034
- Giuliani, M. V., & Scopelliti, M. (2009). Empirical research in environmental psychology: Past, present, and future. *Journal of Environmental Psychology*, 29(3), 375–386. doi: 10.1016/j.jenvp.2008.11.008
- Gosling, E., & Williams, K. J. H. (2010). Connectedness to nature, place attachment and conservation behaviour: Testing connectedness theory among farmers. *Journal of Environmental Psychology*, 30(3), 298–304. doi: 10.1016/j.jenvp.2010.01.005
- Green, S. B., & Yang, Y. (2009). Reliability of Summed Item Scores Using Structural Equation Modeling: An Alternative to Coefficient Alpha. *Psychometrika*, 74(1), 155–167. doi: 10.1007/s11336-008-9099-3
- Hartig, T., Kaiser, F. G., & Bowler, P. A. (2001). Psychological Restoration in Nature as a Positive Motivation for Ecological Behavior. *Environment and Behavior*, 33(4), 590–607. doi: 10.1177/00139160121973142
- Hartig, T., Kaiser, F. G., & Strumse, E. (2007). Psychological restoration in nature as a source of motivation for ecological behaviour. *Environmental Conservation*, 34(04). doi: 10.1017/S0376892907004250
- Hilbig, B. E., Zettler, I., Moshagen, M., & Heydasch, T. (2013). Tracing the Path from Personality - via Cooperativeness - to Conservation: Honesty-Humility and

- ecological behaviour. *European Journal of Personality*, 27(4), 319–327. doi: 10.1002/per.1856
- Hirsh, J. B., & Dolderman, D. (2007). Personality predictors of Consumerism and Environmentalism: A preliminary study. *Personality and Individual Differences*, 43(6), 1583–1593. doi: 10.1016/j.paid.2007.04.015
- Intergovernmental Panel on Climate Change (IPCC) (2007). *Climate change 2007: Synthesis report*. Retrived from https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf.
- Intergovernmental Panel on Climate Change (IPCC) (2013). *Climate change 2013: The physical science basis*. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change. Retrived from http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf.
- Intergovernmental Panel on Climate Change (IPCC) (2014). *Climate change 2014: synthesis report*. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Retrived from https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf.
- Iwata, O. (2004). Some psychological correlates of environmentally responsible behavior. *Social Behavior and Personality: An International Journal*, 32(8), 703–714. doi: 10.2224/sbp.2004.32.8.703
- Jackson, D. L., Gillaspay, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods*, 14(1), 6–23. doi: 10.1037/a0014694
- Jagers, S. C., Martinsson, J., & Matti, S. (2016). The Environmental Psychology of the Ecological Citizen: Comparing Competing Models of Pro-Environmental Behavior*: The Environmental Psychology of the Ecological Citizen. *Social Science Quarterly*, 97(5), 1005–1022. doi: 10.1111/ssqu.12313
- Joireman, J., Posey, D. C., Truelove, H. B., & Parks, C. D. (2009). The environmentalist who cried drought: Reactions to repeated warnings about depleting resources under conditions of uncertainty. *Journal of Environmental Psychology*, 29(2), 181–192. doi: 10.1016/j.jenvp.2008.10.003

- Kaiser, F. G. (1998). A General Measure of Ecological Behavior1. *Journal of Applied Social Psychology, 28*(5), 395–422. doi: 10.1111/j.1559-1816.1998.tb01712.x
- Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior: The specific composition of a general performance. *Personality and Individual Differences, 36*(7), 1531–1544. doi: 10.1016/j.paid.2003.06.003
- Koger, S. M., & Scott, B. A. (2007). Psychology and Environmental Sustainability: A Call for Integration. *Teaching of Psychology, 34*(1), 10–18. doi: 10.1080/00986280709336642
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260. doi: 10.1080/13504620220145401
- Lee, Y., Kim, S., Kim, M., & Choi, J. (2014). Antecedents and interrelationships of three types of pro-environmental behavior. *Journal of Business Research, 67*(10), 2097–2105. doi: 10.1016/j.jbusres.2014.04.018
- Levine, D. S., & Strube, M. J. (2012). Environmental Attitudes, Knowledge, Intentions and Behaviors Among College Students. *The Journal of Social Psychology, 152*(3), 308–326. doi: 10.1080/00224545.2011.604363
- Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods, 48*(3), 936–949. doi: 10.3758/s13428-015-0619-7
- Little, R., & Rubin, D. (1987). *Statistical analysis with missing data*. New York, NY: Wiley.
- Maki, A., Burns, R. J., Ha, L., & Rothman, A. J. (2016). Paying people to protect the environment: A meta-analysis of financial incentive interventions to promote proenvironmental behaviors. *Journal of Environmental Psychology, 47*, 242–255. doi: 10.1016/j.jenvp.2016.07.006
- Markle, G. L. (2013). Pro-Environmental Behavior: Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology, 41*(6), 905–914. doi: 10.1007/s10745-013-9614-8
- Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the “Pro-Environmental Individual”: A Personality Perspective: Personality and Pro-

- Environmental Action. *Journal of Personality*, 80(1), 81–111. doi: 10.1111/j.1467-6494.2011.00721.x
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503–515. doi: 10.1016/j.jenvp.2004.10.001
- Milfont, T. L. (2012). *Cultural Differences in Environmental Engagement*. doi: 10.1093/oxfordhb/9780199733026.013.0011
- Milfont, T. L., & Sibley, C. G. (2012). The big five personality traits and environmental engagement: Associations at the individual and societal level. *Journal of Environmental Psychology*, 32(2), 187–195. doi: 10.1016/j.jenvp.2011.12.006
- Millennium Ecosystems Assessment (2005). *Ecosystems and human well-being: Current state and trends: Findings of the condition and trends working group of the Millennium Ecosystem Assessment* (Vol. 2). Washington, DC: Island Press.
- Mobley, C., Vagias, W. M., & DeWard, S. L. (2010). Exploring Additional Determinants of Environmentally Responsible Behavior: The Influence of Environmental Literature and Environmental Attitudes. *Environment and Behavior*, 42(4), 420–447. doi: 10.1177/0013916508325002
- Otto, S., Kaiser, F. G., & Arnold, O. (2014). The Critical Challenge of Climate Change for Psychology: Preventing Rebound and Promoting More Individual Irrationality. *European Psychologist*, 19(2), 96–106. doi: 10.1027/1016-9040/a000182
- Paulhus, D. (1991) Measurement and control of response bias. In J. Robinson, J., Shaver, P., & Wrightsman L. (Eds.), *Measures of Personality and Social Psychological Attitudes* (Vol. 1) (pp. 17-59). San Diego, CA: Academic Press.
- Poškus, M. S., & Žukauskienė, R. (2017). Predicting adolescents' recycling behavior among different big five personality types. *Journal of Environmental Psychology*, 54, 57–64. doi: 10.1016/j.jenvp.2017.10.003
- Prati, G., Albanesi, C., & Pietrantoni, L. (2017). Social Well-Being and Pro-Environmental Behavior: A Cross-Lagged Panel Design. *Human Ecology Review*, 23(1), 123–139. doi: 10.22459/HER.23.01.2017.07
- Raykov, T. (1998). Coefficient Alpha and Composite Reliability With Interrelated Nonhomogeneous Items. *Applied Psychological Measurement*, 22(4), 375–385. doi: 10.1177/014662169802200407

- Raykov, T., & Shrout, P. E. (2002). Reliability of Scales With General Structure: Point and Interval Estimation Using a Structural Equation Modeling Approach. *Structural Equation Modeling: A Multidisciplinary Journal*, 9(2), 195–212. doi: 10.1207/S15328007SEM0902_3
- Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software* (48)2, 1-36. doi: 10.18637/jss.v048.i02
- Saleem, M. A., Eagle, L., & Low, D. (2018). Climate change behaviors related to purchase and use of personal cars: Development and validation of eco-socially conscious consumer behavior scale. *Transportation Research Part D: Transport and Environment*, 59, 68–85. doi: 10.1016/j.trd.2017.12.023
- Saunders, C. (2003). The emerging field of conservation psychology. *Human Ecology Review* 10(2), 137-149. Retrieved from <http://www.jstor.org/stable/24706965>
- Scannell, L., & Gifford, R. (2010). The relations between natural and civic place attachment and pro-environmental behavior. *Journal of Environmental Psychology*, 30(3), 289–297. doi: 10.1016/j.jenvp.2010.01.010
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Test of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research* 8(2), 23-74. Retrived from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.509.4258&rep=rep1&type=pdf>
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting Structural Equation Modeling and Confirmatory Factor Analysis Results: A Review. *The Journal of Educational Research*, 99(6), 323–338. doi: 10.3200/JOER.99.6.323-338
- Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their Relationship to Environmental Concern and Conservation Behavior. *Journal of Cross-Cultural Psychology*, 36(4), 457–475. doi: 10.1177/0022022105275962
- Schultz, P. W., & Kaiser, F. G. (2012). *Promoting Pro-Environmental Behavior*. doi: 10.1093/oxfordhb/9780199733026.013.0029
- Seebauer, S., Fleiß, J., & Schweighart, M. (2017). A Household Is Not a Person: Consistency of Pro-Environmental Behavior in Adult Couples and the Accuracy of

- Proxy-Reports. *Environment and Behavior*, 49(6), 603–637. doi: 10.1177/0013916516663796
- Sorbom, D., & Joreskog, K. (1982). The use of structural equation models in evaluation research. In Fornell, C. (Ed.), *A second generation of multivariate analysis: Vol. 2. Measurement and evaluation* (pp. 381-418). New York, NY: Praeger.
- Staats, H. (2012). Restorative Environments. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 537-553). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0024
- Stanton, J. (1998) An empirical assessment of data collection using the Internet. *Personnel Psychology* 51(3), 709-725. doi: 10.1111/j.1744-6570.1998.tb00259.x
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. doi: 10.1016/j.jenvp.2008.10.004
- Stern, P. (1997). Toward a working definition of consumption for environmental research and policy. In Stern, P., Dietz, T., Ruttan, V., Socolow, R., & Sweeney, J. (Eds.), *Environmentally significant consumption: Research directions* (pp. 12-35). Washington, DC: National Academy Press.
- Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56(3), 407–424. doi: 10.1111/0022-4537.00175
- Stern, P. C. (2011). Contributions of psychology to limiting climate change. *American Psychologist*, 66(4), 303–314. doi: 10.1037/a0023235
- Stern, P., & Oskamp, S. (1987). Managing scarce environmental resources. In Altman, I., & Stokols, D. (Eds.), *Handbook of Environmental Psychology* (pp. 1043-1088). New York, NY: Wiley.
- Stern, P., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Research in Human Ecology* 6(2), 81-97. Retrived from http://www.humanecologyreview.org/Human%20Ecology/HER_6,2,1999.pdf?q=human-synergetics#page=87
- Swim, J. K., Stern, P. C., Doherty, T. J., Clayton, S., Reser, J. P., Weber, E. U., ... Howard, G. S. (2011). Psychology's contributions to understanding and addressing

- global climate change. *American Psychologist*, 66(4), 241–250. doi: 10.1037/a0023220
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6. ed., internat. ed). Boston, Mass: Pearson.
- Tabi, A. (2013). Does pro-environmental behaviour affect carbon emissions? *Energy Policy*, 63, 972–981. <https://doi.org/10.1016/j.enpol.2013.08.049>
- Takahashi, B., & Selfa, T. (2015). Predictors of Pro-Environmental Behavior in Rural American Communities. *Environment and Behavior*, 47(8), 856–876. doi: 10.1177/0013916514521208
- Thompson, L. F., Surface, E. A., Martin, D. L., & Sanders, M. G. (2003). From paper to pixels: moving personnel surveys to the web. *Personnel Psychology*, 56(1), 197–227. doi: 10.1111/j.1744-6570.2003.tb00149.x
- U.S. Energy Information Administration (2011). *Annual energy review 2011*. Retrived from <https://www.eia.gov/totalenergy/data/annual/pdf/aer.pdf> (2017)
- Vandenberg, R. J., & Lance, C. E. (2000). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, 3(1), 4–70. doi: 10.1177/109442810031002
- Vesely, S., & Klockner, C. (2018). Global social norms and environmental behaviour. *Environment and Behavior* 50(3), 247-272. doi: 10.1177/0013916517702190
- Wackernagel, M., & Rees, W. (2004). *Our ecological footprint: Reducing human impact on the earth*. Gabriola Island, BC: New Society Publishers.
- Wada, Y., van Beek, L. P. H., & Bierkens, M. F. P. (2011). Modelling global water stress of the recent past: On the relative importance of trends in water demand and climate variability. *Hydrology and Earth System Sciences*, 15(12), 3785–3808. doi: 10.5194/hess-15-3785-2011
- Werner, C. M., Brown, B. B., & Gallimore, J. (2010). Light rail use is more likely on “walkable” blocks: Further support for using micro-level environmental audit measures. *Journal of Environmental Psychology*, 30(2), 206–214. doi: 10.1016/j.jenvp.2009.11.003
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature,

- the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, 51(7), 787–810. doi: 10.1177/0013916517751009
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. doi: 10.1016/S0140-6736(18)31788-4
- Wilson, E. O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.
- Wright, K. B. (2006). Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services. *Journal of Computer-Mediated Communication*, 10(3), 00–00. doi: 10.1111/j.1083-6101.2005.tb00259.x
- Yu, C.-Y. (2002). *Evaluation of model fit indices for latent variable models with categorical and continuous outcomes*. (Doctoral dissertation). Retrived from <https://www.statmodel.com/download/Yudissertation.pdf>.
- Zafeiroudi, A., & Hatzigeorgiadis, A. (2014). Validation of the Greek Version of the Responsible Environmental Behavior Scale and Relationships with Participation in Outdoor Activities. *International Journal of Sport Management, Recreation and Tourism*, 13, 20–37. doi: 10.5199/ijsmart-1791-874X-13b
- Zinbarg, R. E., Yovel, I., Revelle, W., & McDonald, R. P. (2006). Estimating Generalizability to a Latent Variable Common to All of a Scale's Indicators: A Comparison of Estimators for ω_h . *Applied Psychological Measurement*, 30(2), 121–144. doi: 10.1177/0146621605278814

CHAPTER 2

Restorativeness in natural and urban environments: A meta-analysis

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1. Introduction

Restorative environments, that is environments that facilitate the recovery of resources (biological, cognitive, psychological, and social) in an individual (Hartig, 2004), have become an important research field in environmental psychology (Staats, 2012). An increasing number of studies from different areas (e.g., environmental psychology, consumer psychology, health psychology, organizational psychology, sports psychology) indicate that exposure to natural environments can influence people's wellbeing (e.g., Berto, 2014; Bodin & Hartig, 2003; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Hartig, Mitchell, de Vries, & Frumkin, 2014; Mitchell, 2013; Mitchell & Popham, 2008). In the last 30 years, empirical research has been driven by two main theories proposed to explain why human beings benefit from exposure to certain types of environments: the Stress Recovery Theory (SRT, Ulrich, 1983; Ulrich et al., 1991) and the Attention Restoration Theory (ART, Kaplan & Kaplan, 1989; Kaplan, 1995). The SRT (or psycho-evolutionary theory) focuses on the immediate and unconscious emotional response elicited by an environment (Korpela, Klemettilä, & Hietanen, 2002). It suggests that contact with nature can promote mild to moderate feelings of interest, calm, and pleasantness (Hartig et al., 2011) and, consequently, allow recovery from a stress condition (Ulrich, 1979). The empirical support to Ulrich's theory was recently strengthened by a meta-analysis

(McMahan & Estes, 2015) of the effect of contact with natural environments on positive and negative affect. As expected, exposure to nature was positively correlated with positive emotions ($r = .31$) and negatively correlated with negative emotions ($r = -.12$) (McMahan & Estes, 2015).

ART focuses on cognitive responses and suggests that contact with nature allows people to restore resources consumed in facilitating directed (voluntary) attention and, consequently, to recover from a situation of cognitive fatigue (Kaplan, 1995). This theory assumes that the ability to direct voluntary attention decreases with use, as it requires an effort to inhibit distractions.

Being in a situation that does not require voluntary attention reduces the effect of the inhibitory mechanism thus freeing mental resources (Staats, 2012). According to the literature (e.g., Kaplan, 1995; Korpela & Hartig, 1996; Pasini, Berto, Brondino, Hall, & Ortner, 2014), a number of characteristics of an environment have been shown to promote the quality of restoration in individuals. These are:

- *Fascination*, a term that refers to the way an environment might attract the involuntary attention of an individual;
- *being away*, that refers to the extent to which an environment causes a person to feel freed from everyday cares and obligations;
- *extent*, a quality that comprise two elements: (1) *coherence* that refers to whether an environment is perceived as structured or not, and (2) *scope* that refers to the way an environment affords opportunities for exploration;
- *compatibility* that refers to the correspondence between the expectations of a person and the observed qualities of the environment.

The restorativeness of an environment, or its ability to restore cognitive resources, can be investigated not only directly, through physiological (e.g., Chen, He, & Yu, 2016; Tang et al., 2017) or behavioral measures (e.g., Berto, 2005; Lin, Tsai, Sullivan, Chang, & Chang, 2014), but also indirectly, through self-report measures. The latter assess the perceived restorativeness of an environment (e.g., Berto, 2014; Hartig, Korpela, Evans, & Gärling, 1997; Pasini et al., 2014). That is the estimation of the restorative potential of the environments (Staats, 2012). Whereby people are asked to evaluate the five restorative qualities of given

environments, based on the assumption that the meta-cognitive abilities of individuals allow them to understand their cognitive processes and to estimate how they are influenced by different environments (Pearson & Craig, 2014).

A recent systematic review (Ohly et al., 2016), focusing on ART confirmed the positive effect of exposure to natural environments on attention performance.

However, ART and SRT theories are not mutually exclusive, and both are based on the concept of biophilia (Wilson, 1984). Human beings, it is argued, would have developed an innate tendency to focus on living things and thus to affiliate with nature (Berto, Barbiero, Barbiero, & Senes, 2018). The natural environment would exhibit characteristics (e.g., vegetation, water, caves) or qualities (e.g., spatial configuration such as smooth ground texture or trees that help define the depth of the scene) which, during evolution, proved to be favorable for survival and which could explain why humans obtain affective and cognitive benefits from natural environments (Berto, 2014; Kaplan & Kaplan, 1989; Wilson, 1984). For example, the spatial configuration of a forest or savannah can make these natural environments favorable for survival because immediate information is available to judge where one can explore safely and what might occur in particular context (Kaplan & Kaplan, 1989).

In sum, many empirical studies suggest that nature is the most potent restorative environment with respect to both affective and cognitive domains. However, as highlighted in some reviews and meta-analysis (Berto, 2014; Hartig et al., 2014; McMahan & Estes, 2015; Ohly et al., 2016) there is substantial diversity across studies, in terms of method and study design, that makes it difficult to compare studies and draw conclusions.

For example, the effect of environmental exposure on positive emotion seems to be stronger in real environments than laboratory simulations, whereas no difference was found between manicured and wild nature (McMahan & Estes, 2015). Moreover, the observed difference in people's emotions and cognitive ability after exposure to different environments (nature vs urban) could be biased by the measurement instruments used. Indeed, the estimated effect of exposure to nature on mood and cognitive ability is higher in studies using Positive and

Negative Affect Schedule (PANAS) or the Trail Making Test (TMT), versus Zuckerman Inventory of Personal Reactions (ZIPERS) or Sustained Attention to Response Test (SART) (for details see: McMahan & Estes, 2015; Ohly et al., 2016).

Some studies suggested that “water” environments (i.e., lake, seaside, river) and wild nature are perceived as more restorative than “no water” (i.e., mountains, forest) environment or urban nature, respectively (e.g., Carrus et al., 2015; Laumann, Gärling, & Stormark, 2001; McAllister, Bhullar, & Schutte, 2017; Tang et al., 2017; Tyrväinen et al., 2014).

Given that perceived restorativeness is a concept now widely used in the literature (Staats, 2012), we suggest that a meta-analysis to summarize this literature could be useful. Moreover, through moderator analysis it should be possible to investigate if methodological differences could explain the variability in findings across studies.

2. Overview of the meta-analysis

The main aim of this study was to estimate the effect size and direction of the difference between the perceived restorativeness in natural and urban environments. Based on the literature (e.g., Berto, 2014; Hartig, Korpela, Evans, & Gärling, 1997), we expected that exposure to natural environments was associated with a greater perception of restorative quality than exposure to urban environments. Since meta-analysis also allows for the study of moderator variables that could explain the variability between studies, the second objective of this study was to test whether differences in research design or method can explain the differences in effect size observed between studies. Such information could be useful for highlighting possible systematic bias due to the methods used in estimating the effect of exposure to nature on people's cognitive resources.

Specifically, in this study we considered the following potential moderator variables:

1. *Research design.* Studies investigating the perceived restorativeness of environments have been conducted using both between-

subject (e.g., Korpela, 2013; Wilkie & Clouston, 2015) and within-subject designs (e.g., Stigsdotter, Corazon, Sidenius, Kristiansen, & Grahn, 2017; Tyrväinen et al., 2014). Given that within-subject studies tend to have higher effect sizes, we first checked whether research design is responsible for the variability between studies of the estimated effect size.

2. *Exposure to test environments.* Most of the research was conducted in the laboratory using photos (e.g., Wilkie & Stavridou, 2013), videos (e.g., Wang, Rodiek, Wu, Chen, & Li, 2016), or virtual reality devices (e.g., Schutte, Bhullar, Stilinović, & Richardson, 2017) based on the implicit assumption that exposure to simulated environments produces the same effects as exposure to real environments (de Kort, Meijnders, Sponselee, & IJsselsteijn, 2006; Valtchanov, Barton, & Ellard, 2010; Valtchanov & Ellard, 2010). However, some psychologists have shown that the technical characteristics of the simulated environments, such as the dynamic (or static) characteristics of the stimulus (Heft & Nasar, 2000; Kroh & Gimblett, 1992), critically influence the perception of the environments. For moderation analysis this variable has been coded in two levels: in laboratory and in situ.

3. *Environment.* The type of natural and urban environments investigated varies across studies (e.g., forest, mountains, lake, park, boulevard). Furthermore, some studies have suggested that even a few urban/built elements in a natural setting could be enough to decrease the potential power of the natural environment to restore people's resources (e.g., Beil & Hanes, 2013; Hauru, Lehvävirta, Korpela, & Kotze, 2012; Pals, Steg, Dontje, Siero, & van der Zee, 2014). So, we classified natural environments into three categories, wild nature, urban nature (i.e., nature with a built element), and mixed (wild and urban nature), to verify if the type of environment moderates a difference between nature and urban restorativeness.

4. *Measuring instruments.* The most used self-report questionnaire for investigating the cognitive qualities of environments (i.e., perceived restorativeness) is the Perceived Restorativeness Scale (Hartig et al., 1997)

or variants of it. Other questionnaires that have been used are the Restorativeness Outcome Scale (ROS) (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008; Takayama et al., 2014; Tyrväinen et al., 2014), the Restorativeness State Scale (RSS) (Van den Berg, Jorgensen, & Wilson, 2014), Environmental Restoration Perception (EPRA) (Martínez-Soto, Gonzales-Santos, Barrios, & Lena, 2014), and the Restorative Components Scale (RCS) (Laumann et al., 2001; Stevens, 2014). When the total score of a scale was not available (e.g., Chen et al., 2016), the fascination dimension was used for meta-analysis purposes. Fascination is a central element in Kaplan's theory (Kaplan & Kaplan, 1989) because it links to the attentional system. In particular, it refers to the form of attention that does not require effort (involuntary attention) and, consequently it allows a fatigued attentional system to be restored (Kaplan, 1995). For moderation analyses this variable has been codified in three levels: Perceived Restorativeness Scale (PRS), fascination, and other.

5. *Participants.* One of the main sources of variation between psychological studies is the type of participants that are used in surveys (Arnett, 2008; Henrich, Heine, & Norenzayan, 2010). Moreover, the extensive use of university students, has often been criticized (e.g., Hanel & Vione, 2016). For this reason we wanted to include the type of participants (student or general adults) used as a possible influence on the calculated effect sizes.

3. Method

3.1 Literature analysis and inclusion criteria

Studies for inclusion in the analysis were selected using two different research strategies. Peer-reviewed articles were searched in different databases (PsycINFO, PsycARTICLES, SpringerLINK, Web of Science) using combinations of the following keywords: restoration, restorativ*, "restorative qualit*", "perceived restorativeness scale", "restorative outcome*", "environment* psychology". Then, the references list of the selected studies was examined to identify further studies. A total of 168 studies were selected.

First, we excluded studies that did not report primary data (e.g., theoretical papers, or meta-analytic studies) and instrument validation papers ($n = 23$). To be included in this meta-analysis, the remaining studies had to meet the following inclusion criteria:

- The restorativeness was investigated following direct visual exposure to real or simulated environments (photographs, video or virtual reality). Studies that required the participants to evaluate an environment after imagining it (e.g., Korpela & Hartig, 1996; Korpela et al., 2008) or to evaluate personal experience (e.g., Kelz, Evans, & Röderer, 2015) were excluded.
- The restorativeness was investigated in at least two outdoor environments, one with natural elements (wild nature, city parks or avenues) and one without natural elements (roads, buildings). Studies that required to the participants to evaluate an indoor environment, such as home interiors (e.g., Meagher, 2016), offices (e.g., Evensen, Raanaas, Hagerhall, Johansson, & Patil, 2015), or an undefined place, such as the participants' "favorite place" (e.g., Ratcliffe & Korpela, 2016), were excluded.
- The restorativeness was investigated through a self-report questionnaire. Studies that investigated the effect of exposure to nature on memory (e.g., Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009) attention (e.g., Berto, 2005), other cognitive tests (e.g., Newman & Brucks, 2016), or on emotional resources (e.g., Lee et al., 2011; Ulrich, 1979) alone were excluded.

22 peer-reviewed studies met the inclusion criteria (Table 1). Most of them are within-subject research designs (60%) conducted in the laboratory (76%) with students (67%) using the Perceived Restorativeness Scale (67%).

Table 1.

Characteristics and estimated effect size (Cohen's d) for each of the 22 selected studies

First Author	Year	N	Research Design	Exp.	Instrument	Participants	Environment	Cohen's d
Berto	2007	20	between	lab.	PRS	adults	wild	2.76
Berto	2008	40	within	lab.	PRS	students	wild	6.68
Bodin	2003	12	within	situ	Fascination	adults	urban	3.03
Chen	2016	32	between	situ	Fascination	students	urban	1.14
Franek	2013	70	within	situ	Fascination	students	urban	3.53
Hernandez	2005	76	between	lab.	PRS	students	urban	0.60
Herzog	2003	144	within	lab.	Fascination	students	wild	0.49
Hietanen	2007	33	within	lab.	PRS	students	urban	3.00
Hietanen	2004	20	within	lab.	PRS	adults	wild	2.71
Korpela	2013	81	within	lab.	PRS	students	mixed	3.39
Lee	2015	150	between	lab.	PRS	students	urban	0.41
Martinez-Soto	2014	96	within	lab.	Other	students	wild	4.15
Schutte	2017	26	between	lab.	PRS	students	wild	1.73
Stevens	2014	69	within	lab.	Other	adults	wild	1.86
Stigsdotter	2017	46	within	situ	PRS	students	wild	2.26
Takayama	2014	45	within	situ	Other	students	wild	0.89
Tang	2017	31	within	lab.	PRS	adults	wild	4.36
Tyrvaainen	2014	77	within	situ	Other	adults	urban	1.07
Van den berg	2014	50	between	lab.	Other	students	wild	0.46
Wang	2016	40	between	lab.	PRS	students	urban	4.15
Wilkie	2013	113	between	lab.	PRS	students	mixed	7.46
Wilkie	2015	100	between	lab.	PRS	students	wild	0.40

Note. Exp = exposition; Lab =Laboratory; PRS = Perceived Restorative Scale

3.2 Data Analysis

To estimate effect size of the difference between restorativeness perceived in natural or urban environments we used *Cohen's d* (1988). In almost all cases the latter, were calculated using the descriptive statistics and the following formulas:

$$Cohen's d = \frac{\bar{\chi}_1 - \bar{\chi}_2}{s}, s = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2}}; \text{ where: } \bar{\chi} = \text{mean}, s = \text{standard}$$

deviation; n = sample size (Dunst, Hamby, & Trivette, 2004). We used the same *Cohen's d* formula for between-subject and within-subject studies because we did not have information about the correlation between the perceived restorativeness

of natural and urban environments required in the formula for within-subject designs (Dunst et al., 2004). However, through personal communication we retrieved some, but not all, correlational data (R. Berto, personal communication, October 18, 2017; T. Hartig, personal communication, October 25, 2017; K.M. Korpela, personal communication, November 2, 2017; J. Martínez-Soto, personal communication, October 27, 2017; N. Takayama, personal communication, October 26, 2017). Data suggested low or zero correlation between perceived restorativeness scores in natural and urban environment (range = .00 - .31). Consequently, the use of the between-subject formula was an appropriate alternative (Dunst et al., 2004). In two cases (Chen et al., 2016; Lee, Williams, Sargent, Williams, & Johnson, 2015) the descriptive statistics were not available and, therefore, the *Cohen's d* was calculated starting from the student t-statistic using the following formula: $Cohen's\ d = t \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$.

When information regarding the sample size of groups compared (in the case of between-subject studies) was not available, we assigned equal numbers to the groups by dividing the participants in half.

The software *r* (metafor package, version 2.0-0) was used for all analyzes. A random-effects model (estimation method: Restricted Maximum-Likelihood (RML)) was used to estimate the medium effect size. In random effects models, each study is weighted by the inverse of its variance, which includes both the variance between subjects and the variance within subjects (Borenstein, Hedges, Rothstein, & Higgins, 2009). This model was chosen instead of a fixed factor model because the studies included in the meta-analysis were conducted independently and using different methods in different populations, so we did not expect a common effect size. Heterogeneity was investigated through the Cochran's heterogeneity statistic (Q) which tests the null hypothesis according to which the effect sizes of the individual studies are similar enough to share a common effect size (Cochran, 1954). A significant value for Q means heterogeneity between the effects. Because of the limited power of Q in identifying heterogeneity in the meta-analysis (Higgins, Thompson, Deeks, & Altman, 2003), p values < .10 are considered significant. The level of

heterogeneity was investigated using the I^2 statistic, which measures the proportion of total variance due to the variability between studies (i.e., the heterogeneity that is explained by the random effect). High values (75-100) correspond to high levels of heterogeneity, medium values (50-74) correspond to moderate heterogeneity, low values (1-49) correspond to low heterogeneity, and zero indicates absence of heterogeneity (Higgins et al., 2003). To verify the presence of abnormal studies we checked the distribution of effect size (funnel plot) and the influence of individual studies on heterogeneity (Q statistic) and on the general model (Cook's distance).

Meta-analysis results can be influenced by bias due to publication process (e.g., scientific studies without significant results are not published). This phenomenon is commonly called "publication bias" (Rosenthal, 1995; Rothstein, Sutton, & Borenstein, 2005) and can be controlled through different strategies (Borenstein et al., 2009). We used the trim and fill approach of Duval and Tweedie (2000), a non-parametric method that estimates the number of studies missing from the meta-analysis by suppressing the studies that generate patterns of asymmetry and generating new data based on the initial sample to obtain a symmetrical effect size distribution.

Univariate moderation analyses were conducted to verify whether methodological differences between studies moderate the effect size estimated. In other words, we investigated whether the difference in restorativeness between environments changes depending, for example, on the instrument used or on the type of exposure. In particular, using univariate mixed effects models, we investigated the potential moderation effect of each of the variables coded: research design (between-subject or within-subject), location (laboratory or in situ), environment (wild nature or urban nature), instrument (PRS, fascination, or other tools), and participants (students or general adults). In addition to the indices previously described for the random effects model, the R^2 statistic that quantifies the amount of heterogeneity explained by the moderator variables is also reported.

4. Results

The effect sizes calculated for the individual studies included in the meta-analysis are listed in Table 1. All the estimated effect sizes were in the expected direction (median = 2.43) and had a normal distribution (asymmetry = 0.98, kurtosis = 0.72).

The random effects model ($k = 22$, $n = 1677$) estimated a medium effect size very large (*Cohen's d* [C.I.] = 2.46 [1.61 - 3.31], S.E. = .41). The studies were heterogeneous ($Q(21) = 731.97$, $p < .001$) and the proportion of total variance due to the variability between studies was very high (I^2 [C.I.] = 98.49% [97.42 – 99.29]). Trim and fill test was not significant suggesting no publication bias. Two studies, Wilkie and Stavridou (2013) and Berto (2008) had an effect size very far from the medium effect size estimated and from the confidence intervals (± 1.96 S.E.), *Cohen's d* = 7.46 and *Cohen's d* = 6.68, respectively. Moreover, both had high Cook's distance values indicating a huge influence on the medium effect size estimated. Wilkie's study had also a large influence on the studies' heterogeneity. For this reason, a second random model was run after exclusion of the Wilkie (2013) and Berto (2008) studies.

The effect size estimated by this second model was still large (*Cohen's d* [C.I.] = 1.99 [1.38 - 2.61], S.E. = .29), though lower but more accurate than those estimated by first random model (Figure 1). The heterogeneity of the studies was still very high ($Q(19) = 503.19$, $p < .001$; I^2 [C.I.] = 96.97% [94.61 – 98.62]) and Trim and fill approach was not significant.

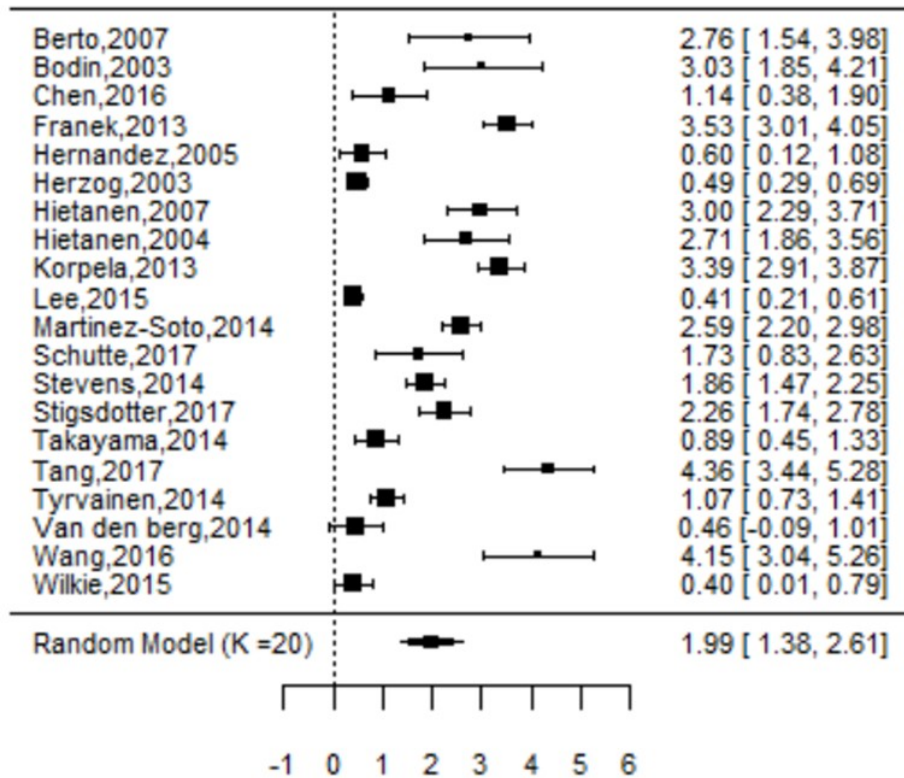


Figure 1. Forest plot: *Cohen's d* computed for each studies and medium effect size computed by the random effect model ($k = 20$) (in brackets confidence interval of *Cohen's d*).

Univariate mixed effect models were run to verify if moderator variable could explain the high heterogeneity. As shown in Table 2, only research design and the kind of participants involved explained a small amount of heterogeneity (13% and 3%, respectively) but their influence was not significant. None of the other moderators considered explained the different effect sizes found in single studies. Even so, the differences in effect sizes were in the expected direction: (1) in within-subject studies the difference between nature and urban environment was higher (*Cohen's d* = 2.39) than in between studies (*Cohen's d* = 1.36); (2) studies conducted in laboratory (*Cohen's d* = 2.32) than in situ (*Cohen's d* = 1.97); (3) studies comparing urban environment to urban nature (*Cohen's d* = 2.06) than to wild nature (*Cohen's d* = 1.82). The “mixed” category for type of environment was excluded in the moderation analysis because only one study (Korpela, 2013) fell into this category.

Table 2

Results of univariate mixed effect model

	Test of moderator		Model Results		
	$Q_M(F_{(1,18)})$	<i>p</i> value	R ² (%)	<i>Cohen's d</i>	95% C.I.
Research design	3.32	.085	13.40		
Between				1.36	0.44 – 2.29
Within				2.39	1.65 – 3.13
Exposition	0.01	.940	0.00		
Laboratory				2.32	1.43 – 3.21
In situ				1.97	0.57 – 3.37
Environment	0.14 ^a	.7118	0.00		
Wild nature				1.82	0.98 – 2.67
Urban nature				2.05	1.06 – 3.05
Instrument	0.84 ^b	.449	0.00		
PRS				2.29	1.44 – 3.13
Fascination				2.01	0.61 – 3.40
Other				1.38	0.16 – 2.60
Participant	1.68	.211	3.15		
Student				1.76	1.04 – 2.47
General adults				2.58	1.45 – 3.71

Note. PRS = Perceived Restorativeness Scale; ^a Df = 1,17. Mixed environments were excluded from this analysis because represented by only one study (Korpela, 2013). ^b Df = 2,18

5. Discussion and conclusion

The aim of this study was to conduct a meta-analysis on studies comparing perceived restorativeness resulting from direct exposure to natural or urban environments (simulated or real). In particular, this meta-analysis sought to estimate how much nature is perceived as more restorative than urban environments. Results pointed to nature being perceived as more restorative than urban environments, confirming from an empirical point of view what is typically now considered a given in environmental psychology (Gifford, 2014; Staats, 2012). The relevant indicator was the magnitude of the estimated medium effect size, which was particularly large (*Cohen's d* = 1.99) compared to those that are usually observed in psychology (Brand & Bradley, 2016). These results suggest that self-report questionnaires reliably discriminate between natural and urban environments with respect to perceived restorativeness. Moreover, moderator analysis indicated: (1) no real difference between instruments used in the literature

and (2) no difference between global scales or Fascination sub-scale supporting the use of Fascination items alone when other sub-scales were not available.

However, although this meta-analysis suggests that nature is perceived to be much more restorative than urban environments, its real benefits on people's cognitive resources may not be substantially greater than those offered by urban environments.

Indeed, if as claimed by the ART (Kaplan & Kaplan, 1989), the recovery of cognitive resources is the result of an interaction between direct attention and intrinsic properties of the environments, this recovery should occur regardless of what is perceived (Pearson & Craig, 2014). Environments can be assessed as more restorative even if cognitive performance is not influenced by the quality of the environment (Evensen et al., 2015). Consequently, measuring the perceived restorativeness without directly measuring the effects on cognitive functions could lead to misleading results (Pearson & Craig, 2014).

The second aim of this study was to investigate whether methodological differences could explain variability across studies.

First, moderation analyses highlighted that, as expected, research design partly explained the variability between studies, with higher effect sizes observed in within-subject studies than those observed in between-subject studies. This depended on the better inter-individual variability control in the first kind of research design than in the second. Indeed, obtaining two different measurements from the same subject makes it possible to exclude the influence of between subject differences on the construct under investigation. So, people's personal characteristics (i.e., age, gender, educational level, or personality) could play a significant role in determining the perceived restorativeness of certain environments. For example, age does not seem to influence the perception of the restorative qualities of the environments (Berto, 2007), however natural and urban environments could have different restorative potential in relation to the stage of life (Scopelliti & Giuliani, 2004). McMahan found higher correlation between positive mood and nature exposure in older people (McMahan & Estes, 2015). There seemed not to be any studies that have verified the effect of gender or

educational level on the perception of restorativeness. There were gaps in the demographic details across the studies we used for analysis and so it was not possible to check the extent of moderating effects of these variables. Future studies that are able to take these variables into account identify their possible effects on the perception of restorativeness perceived in a given environment. Personality characteristics could also play a role in determining the perceived restorativeness of environments. For example, it has been suggested that neuroticism influences the perceived restorativeness of home environments (Meagher, 2016). Furthermore, people with high neuroticism scores might obtain greater benefits following exposure to urban environments than people who score lower on neuroticism (Newman & Brucks, 2016). It has also been suggested that the ability to perceive the restorative potential of an environment depends on the level of affinity with natural elements. Empirical evidence shows that a high degree of perceived naturalness (Carrus et al., 2013; Hartig et al., 1997; Hipp, Gulwadi, Alves, & Sequeira, 2016), and connection with nature (Berto et al., 2018) could increase the perceived restorativeness of the environment.

Our results also highlight that nature is perceived as more restorative than urban environments regardless of the context of exposure (in the laboratory or in situ), the kind of natural environment being considered (wild or urban nature), the measurement instrument being used, or the kinds of people making the judgements. Consequently, these findings suggest that reproduced (virtual) environments are valid representations of real environments, confirming the implicit assumption that exposure to simulated environments produces the same effects as exposure to real environments (Stamps, 1990; Valtchanov et al., 2010; Valtchanov & Ellard, 2010). Moreover, students can be considered a good representative sample of the general population when the aim is to investigate the perception of restorativeness in different environments.

We found that all of the measurement instruments used to assess the perceived restorativeness of environments had the same ability to detect differences between environments. As a result, after appropriately transforming scales, plausible comparisons can be made between studies using different tools.

Finally, these findings suggest that urban nature could be a valid substitute for wild nature when planning restorative environments (McMahan & Estes, 2015). However, even if the presence of human-alteration (e.g., street, buildings, etc.) seems not to influence perception of the restorative qualities of an environment, other environmental characteristics could influence it. Indeed, the literature reports different restorative potential in respect of level of greenery (Beil & Hanes, 2013; de Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Hauru et al., 2012; Pals et al., 2014), biodiversity (Carrus et al., 2015; Hartig et al., 2014; Marselle, Irvine, Lorenzo-Arribas, & Warber, 2016), and percentage (de Vries et al., 2003; White, Pahl, Ashbullby, Herbert, & Depledge, 2013; White et al., 2010) and kinds of water surface (Wilkie & Stavridou, 2013). High levels of greenery (e.g., Beil & Hanes, 2013; Hauru et al., 2012) or the presence of a water surface (e.g., river, lake, sea) (e.g., Tang et al., 2017; White et al., 2013; White et al., 2010) increases the perceived restorativeness of the environment. Urban environments with water elements could have the same restorative potential as nature without water (White et al., 2010). Conversely, environments with unpleasant water elements could be less restorative than environments without water (Wilkie & Stavridou, 2013). Moreover, empirical evidence suggested that the characteristics of light (e.g., brightness, evenness, extensiveness, colour quality, glare) influence the perception of restorativeness qualities (e.g., Nikunen & Korpela, 2009; Nikunen, Puolakka, Rantakallio, Korpela, & Halonen, 2014). For example, natural light (fire, sunset) enhance fascination of an environment (Kaplan & Kaplan, 1989), brightness promotes its exploration (scope), and color quality facilitates relaxation and feelings of being away (Nikunen et al., 2014).

In sum, the critical aspect in determining levels of perceived restorativeness is probably not the presence of human-alteration (e.g., street, buildings, etc.) but particular (objective or subjective) features of the environment. So, investigation of different kinds of urban natural environments and on elements that discriminate each other are needed.

The principal limitation of this study is linked to the computation of effect sizes. We considered within-subject studies as between-subject studies because we did not have relevant correlational data from some studies. This approach is

conservative (e.g., Elbourne et al., 2002) and consequently effect size of within studies could be underestimated. So, it is plausible to hypothesise that in within-subject studies, compared to between-subject studies, the difference between the perceived levels of restorativeness across nature and urban environments is potentially higher.

Second, we included only peer-reviewed studies and we did not include articles from the so-called grey literature. However, we controlled for the presence of publication bias and the result was negative.

In conclusion, this meta-analysis supports the view that nature environments are perceived as much more restorative than urban environments, independently of mode of presentation, participants making the judgements, and the instruments used to assess the judgements. Consequently, we suggest that researchers should shift the focus from the comparison between nature and urban environments or between real and simulated environments and from the development of measurement tools to the identification of environmental or individual variables that influence the perception of restorativeness.

References

- Arnett, J. J. (2008). The neglected 95%: Why American psychology needs to become less American. *American Psychologist*, *63*(7), 602–614. doi: 10.1037/0003-066X.63.7.602
- Beil, K., & Hanes, D. (2013). The Influence of Urban Natural and Built Environments on Physiological and Psychological Measures of Stress— A Pilot Study. *International Journal of Environmental Research and Public Health*, *10*(4), 1250–1267. doi: 10.3390/ijerph10041250
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology*, *25*(3), 249–259. doi: 10.1016/j.jenvp.2005.07.001
- Berto, R. (2007). Assessing the restorative value of the environment: A study on the elderly in comparison with young adults and adolescents. *International journal of psychology*, *42*(5), 331-341. doi: 10.1080/00207590601000590
- Berto, R. (2014). The Role of Nature in Coping with Psycho-Physiological Stress: A Literature Review on Restorativeness. *Behavioral Sciences*, *4*(4), 394–409. doi: 10.3390/bs4040394
- Berto, R., Barbiero, G., Barbiero, P., & Senes, G. (2018). An Individual's Connection to Nature Can Affect Perceived Restorativeness of Natural Environments. Some Observations about Biophilia. *Behavioral Sciences*, *8*(3), 34. doi: 10.3390/bs8030034
- Berto, R., Massaccesi, S., & Pasini, M. (2008). Do eye movements measured across high and low fascination photographs differ? Addressing Kaplan's fascination hypothesis. *Journal of Environmental Psychology*, *28*(2), 185-191. doi: 10.1016/j.jenvp.2007.11.004
- Bodin, M., & Hartig, T. (2003). Does the outdoor environment matter for psychological restoration gained through running? *Psychology of Sport and Exercise*, *4*(2), 141–153. doi: 10.1016/S1469-0292(01)00038-3
- Borenstein, M., Hedges, L. V., Rothstein, H. R., & Higgins, J. P. T. (A c. di). (2009). *Introduction to meta-analysis*. Chichester, England: John Wiley & Sons

- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, *10*(1), 456. doi: 10.1186/1471-2458-10-456
- Brand, A., & Bradley, M. T. (2016). The Precision of Effect Size Estimation From Published Psychological Research: Surveying Confidence Intervals. *Psychological Reports*, *118*(1), 154–170. doi: 10.1177/0033294115625265
- Carrus, G., Laforteza, R., Colangelo, G., Dentamaro, I., Scopelliti, M., & Sanesi, G. (2013). Relations between naturalness and perceived restorativeness of different urban green spaces. *Psychology*, *4*(3), 227–244. doi: 10.1174/217119713807749869
- Carrus, G., Scopelliti, M., Laforteza, R., Colangelo, G., Ferrini, F., Salbitano, F., ... Sanesi, G. (2015). Go greener, feel better? The positive effects of biodiversity on the well-being of individuals visiting urban and peri-urban green areas. *Landscape and Urban Planning*, *134*, 221–228. doi: 10.1016/j.landurbplan.2014.10.022
- Chen, Z., He, Y., & Yu, Y. (2016). Enhanced functional connectivity properties of human brains during in-situ nature experience. *PeerJ*, *4*, e2210. doi: 10.7717/peerj.2210
- Cochran, W. G. (1954). The Combination of Estimates from Different Experiments. *Biometrics*, *10*(1), 101. <https://doi.org/10.2307/3001666>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). Hillsdale, N.J: Lawrence Erlbaum Associates
- de Kort, Y. A. W., Meijnders, A. L., Sponselee, A. A. G., & IJsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology*, *26*(4), 309–320. doi: 10.1016/j.jenvp.2006.09.001
- de Vries, S., Verheij, R. A., Groenewegen, P. P., & Spreeuwenberg, P. (2003). Natural Environments—Healthy Environments? An Exploratory Analysis of the Relationship between Greenspace and Health. *Environment and Planning A: Economy and Space*, *35*(10), 1717–1731. doi: 10.1068/a35111
- Dunst, C. J., Hamby, D. W., & Trivette, C. M. (2004). Guidelines for Calculating Effect Sizes for Practice-Based Research Syntheses. *Centerscope*, *3*(1), 10.
- Duval, S., & Tweedie, R. (2000). Trim and Fill: A Simple Funnel-Plot–Based Method of Testing and Adjusting for Publication Bias in Meta-Analysis. *Biometrics*, *56*(2), 455–463. doi: 10.1111/j.0006-341X.2000.00455.x

- Elbourne, D. R., Altman, D. G., Higgins, J. P., Curtin, F., Worthington, H. V., & Vail, A. (2002). Meta-analyses involving cross-over trials: methodological issues. *International Journal of Epidemiology*, *31*, 140–149. doi: 10.1093/ije/31.1.140
- Evensen, K. H., Raanaas, R. K., Hagerhall, C. M., Johansson, M., & Patil, G. G. (2015). Restorative Elements at the Computer Workstation: A Comparison of Live Plants and Inanimate Objects With and Without Window View. *Environment and Behavior*, *47*(3), 288–303. doi: 10.1177/0013916513499584
- Franěk, M. (2013). Environmental factors influencing pedestrian walking speed. *Perceptual and motor skills*, *116*(3), 992–1019. doi: 10.2466/06.50.PMS.116.3.992-1019
- Gifford, R. (2014). Environmental Psychology Matters. *Annual Review of Psychology*, *65*(1), 541–579. doi: 10.1146/annurev-psych-010213-115048
- Hanel, P. H. P., & Vione, K. C. (2016). Do Student Samples Provide an Accurate Estimate of the General Public? *PLOS ONE*, *11*(12), e0168354. doi: 10.1371/journal.pone.0168354
- Hartig, T. (2004). Restorative Environments. In C. Spielberger (Ed.), *Encyclopedia of Applied Psychology* (pp. 273–279). Amsterdam, the Netherlands: Elsevier. doi: 10.1016/B0-12-657410-3/00821-7
- Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research*, *14*(4), 175–194. doi: 10.1080/02815739708730435
- Hartig, T., Mitchell, R., de Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health*, *35*, 207–228. doi: 10.1146/annurev-publhealth-032013-182443
- Hartig, T., van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, R., ... Waaseth, G. (2011). Health Benefits of Nature Experience: Psychological, Social and Cultural Processes. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. de Vries, K. Seeland, & J. Schipperijn (Eds.), *Forests, Trees and Human Health* (pp. 127–168). Dordrecht: Springer Netherlands. doi: 10.1007/978-90-481-9806-1_5
- Hauru, K., Lehvävirta, S., Korpela, K., & Kotze, D. J. (2012). Closure of view to the urban matrix has positive effects on perceived restorativeness in urban forests in

- Helsinki, Finland. *Landscape and Urban Planning*, 107(4), 361–369. doi: 10.1016/j.landurbplan.2012.07.002
- Heft, H., & Nasar, J. L. (2000). Evaluating Environmental Scenes Using Dynamic Versus Static Displays. *Environment and Behavior*, 32(3), 301–322. doi: 10.1177/0013916500323001
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33(2–3), 61–83. doi: 10.1017/S0140525X0999152X
- Hernández, B., & Hidalgo, M. C. (2005). Effect of urban vegetation on psychological restorativeness. *Psychological reports*, 96(3_suppl), 1025-1028. doi: 10.2466/pr0.96.3c.1025-1028
- Herzog, T. R., Maguire, P., & Nebel, M. B. (2003). Assessing the restorative components of environments. *Journal of Environmental Psychology*, 23(2), 159-170. doi:10.1016/S0272-4944(02)00113-5
- Hietanen, J. K., & Korpela, K. M. (2004). Do both negative and positive environmental scenes elicit rapid affective processing? *Environment and behavior*, 36(4), 558-577. doi: 10.1177/0013916503261391
- Hietanen, J. K., Klemetilä, T., Kettunen, J. E., & Korpela, K. M. (2007). What is a nice smile like that doing in a place like this? Automatic affective responses to environments influence the recognition of facial expressions. *Psychological Research*, 71(5), 539-552. doi: 10.1007/s00426-006-0064-4
- Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, 327(7414), 557–560. doi: doi.org/10.1136/bmj.327.7414.557
- Hipp, J. A., Gulwadi, G. B., Alves, S., & Sequeira, S. (2016). The Relationship Between Perceived Greenness and Perceived Restorativeness of University Campuses and Student-Reported Quality of Life. *Environment and Behavior*, 48(10), 1292–1308. doi: 10.1177/0013916515598200
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. CUP Archive
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 169–182. doi: 10.1016/0272-4944(95)90001-2

- Kelz, C., Evans, G. W., & Röderer, K. (2015). The Restorative Effects of Redesigning the Schoolyard: A Multi-Methodological, Quasi-Experimental Study in Rural Austrian Middle Schools. *Environment and Behavior*, *47*(2), 119–139. doi: 10.1177/0013916513510528
- Korpela, K., & Hartig, T. (1996). Restorative Qualities Of Favorite Places. *Journal of Environmental Psychology*, *16*(3), 221–233. doi: 10.1006/jevp.1996.0018
- Korpela, K. M. (2013). Perceived restorativeness of urban and natural scenes — photographic illustrations. *Journal of Architectural and Planning Research*, *30*(1), 23–38. Retrieved date 23 May 2017 from www.jstor.org/stable/43030991
- Korpela, K. M., Klemettilä, T., & Hietanen, J. K. (2002). Evidence for Rapid Affective Evaluation of Environmental Scenes. *Environment and Behavior*, *34*(5), 634–650. doi: 10.1177/0013916502034005004
- Korpela, K. M., Ylén, M., Tyrväinen, L., & Silvennoinen, H. (2008). Determinants of restorative experiences in everyday favorite places. *Health & Place*, *14*(4), 636–652. doi: 10.1016/j.healthplace.2007.10.008
- Kroh, D. P., & Gimblett, R. H. (1992). Comparing live experience with pictures in articulating landscape preference. *Landscape Research*, *17*(2), 58–69. doi: 10.1080/01426399208706362
- Laumann, K., Gärling, T., & Stormark, K. M. (2001). Rating scale measures of restorative components of environments. *Journal of Environmental Psychology*, *21*(1), 31–44. doi: 10.1006/jevp.2000.0179
- Lee, J., Park, B.-J., Tsunetsugu, Y., Ohira, T., Kagawa, T., & Miyazaki, Y. (2011). Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health*, *125*(2), 93–100. doi: 10.1016/j.puhe.2010.09.005
- Lee, K. E., Williams, K. J. H., Sargent, L. D., Williams, N. S. G., & Johnson, K. A. (2015). 40-second green roof views sustain attention: The role of micro-breaks in attention restoration. *Journal of Environmental Psychology*, *42*, 182–189. doi: 10.1016/j.jenvp.2015.04.003
- Lin, Y.-H., Tsai, C.-C., Sullivan, W. C., Chang, P.-J., & Chang, C.-Y. (2014). Does awareness effect the restorative function and perception of street trees? *Frontiers in Psychology*, *5*. doi: 10.3389/fpsyg.2014.00906

- Marselle, M. R., Irvine, K. N., Lorenzo-Arribas, A., & Warber, S. L. (2016). Does perceived restorativeness mediate the effects of perceived biodiversity and perceived naturalness on emotional well-being following group walks in nature? *Journal of Environmental Psychology, 46*, 217–232. doi: 10.1016/j.jenvp.2016.04.008
- Martínez-Soto, J., Gonzales-Santos, L., Barrios, F. A., & Lena, M. E. M.-L. (2014). Affective and Restorative Valences for Three Environmental Categories. *Perceptual and Motor Skills, 119*(3), 901–923. doi: 10.2466/24.50.PMS.119c29z4
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why Is Nature Beneficial?: The Role of Connectedness to Nature. *Environment and Behavior, 41*(5), 607–643. doi: 10.1177/0013916508319745
- McAllister, E., Bhullar, N., & Schutte, N. S. (2017). Into the Woods or a Stroll in the Park: How Virtual Contact with Nature Impacts Positive and Negative Affect. *International Journal of Environmental Research and Public Health, 14*(7), 786. doi: 10.3390/ijerph14070786
- McMahan, E. A., & Estes, D. (2015). The effect of contact with natural environments on positive and negative affect: A meta-analysis. *The Journal of Positive Psychology, 10*(6), 507–519. doi: 10.1080/17439760.2014.994224
- Meagher, B. R. (2016). There's No Place Like a Neurotic's Home: Neuroticism Moderates the Prioritization of Restorative Properties in Home Environments. *Journal of Individual Differences, 37*(4), 260–267. doi: 10.1027/1614-0001/a000213
- Mitchell, R. (2013). Is physical activity in natural environments better for mental health than physical activity in other environments? *Social Science & Medicine, 91*, 130–134. doi: 10.1016/j.socscimed.2012.04.012
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *Lancet (London, England), 372*(9650), 1655–1660. doi: 10.1016/S0140-6736(08)61689-X
- Newman, K. P., & Brucks, M. (2016). When are natural and urban environments restorative? The impact of environmental compatibility on self-control restoration. *Journal of Consumer Psychology, 26*(4), 535–541. doi: doi.org/10.1016/j.jcps.2016.02.005

- Nikunen, H. J., & Korpela, K. M. (2009). Restorative Lighting Environments-Does the Focus of Light Have an Effect on Restorative Experiences? *Journal of Light & Visual Environment*, 33(1), 37–45. doi: 10.2150/jlve.33.37
- Nikunen, H., Puolakka, M., Rantakallio, A., Korpela, K., & Halonen, L. (2014). Perceived restorativeness and walkway lighting in near-home environments. *Lighting Research & Technology*, 46(3), 308–328. doi: 10.1177/1477153512468745
- Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. *Journal of Toxicology and Environmental Health, Part B*, 19(7), 305–343. doi: 10.1080/10937404.2016.1196155
- Pals, R., Steg, L., Dontje, J., Siero, F. W., & van der Zee, K. I. (2014). Physical features, coherence and positive outcomes of person–environment interactions: A virtual reality study. *Journal of Environmental Psychology*, 40, 108–116. doi: 10.1016/j.jenvp.2014.05.004
- Pasini, M., Berto, R., Brondino, M., Hall, R., & Ortner, C. (2014). How to Measure the Restorative Quality of Environments: The PRS-11. *Procedia - Social and Behavioral Sciences*, 159, 293–297. doi: 10.1016/j.sbspro.2014.12.375
- Pearson, D. G., & Craig, T. (2014). The great outdoors? Exploring the mental health benefits of natural environments. *Frontiers in Psychology*, 5. doi: 10.3389/fpsyg.2014.01178
- Ratcliffe, E., & Korpela, K. M. (2016). Memory and place attachment as predictors of imagined restorative perceptions of favourite places. *Journal of Environmental Psychology*, 48, 120-130. doi: 10.1016/j.jenvp.2016.09.005
- Rosenthal, R. (1995). Writing meta-analytic reviews. *Psychological Bulletin*, 118(2), 183–192. doi: 10.1037/0033-2909.118.2.183
- Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). *Publication bias in meta-analysis*. Chichester, England: Wiley
- Schutte, N. S., Bhullar, N., Stilinović, E. J., & Richardson, K. (2017). The Impact of Virtual Environments on Restorativeness and Affect. *Ecopsychology*, 9(1), 1–7. doi: 10.1089/eco.2016.0042

- Scopelliti, M., & Giuliani, M. V. (2004). Choosing restorative environments across the lifespan: A matter of place experience. *Journal of Environmental Psychology*, 24(4), 423–437. doi: 10.1016/j.jenvp.2004.11.002
- Staats, H. (2012). *Restorative Environments*. Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0024
- Stamps, A. E. (1990). Use of Photographs to Simulate Environments: A Meta-Analysis. *Perceptual and Motor Skills*, 71, 907–913. doi: 10.2466/pms.1990.71.3.907
- Stevens, P. (2014). Affective priming of perceived environmental restorativeness: affect and perceived restorativeness. *International Journal of Psychology*, 49(1), 51–55. doi: 10.1002/ijop.12016
- Stigsdotter, U. K., Corazon, S. S., Sidenius, U., Kristiansen, J., & Grahn, P. (2017). It is not all bad for the grey city – A crossover study on physiological and psychological restoration in a forest and an urban environment. *Health & Place*, 46, 145–154. doi: 10.1016/j.healthplace.2017.05.007
- Takayama, N., Korpela, K., Lee, J., Morikawa, T., Tsunetsugu, Y., Park, B.-J., ... Kagawa, T. (2014). Emotional, Restorative and Vitalizing Effects of Forest and Urban Environments at Four Sites in Japan. *International Journal of Environmental Research and Public Health*, 11(7), 7207–7230. doi: 10.3390/ijerph110707207
- Tang, I.-C., Tsai, Y.-P., Lin, Y.-J., Chen, J.-H., Hsieh, C.-H., Hung, S.-H., ... Chang, C.-Y. (2017). Using functional Magnetic Resonance Imaging (fMRI) to analyze brain region activity when viewing landscapes. *Landscape and Urban Planning*, 162, 137–144. doi: 10.1016/j.landurbplan.2017.02.007
- Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., Tsunetsugu, Y., & Kagawa, T. (2014). The influence of urban green environments on stress relief measures: A field experiment. *Journal of Environmental Psychology*, 38, 1–9. doi: 10.1016/j.jenvp.2013.12.005
- Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape Research*, 4(1), 17–23. doi: 10.1080/01426397908705892
- Ulrich, R. S. (1983). Aesthetic and Affective Response to Natural Environment. In I. Altman & J. F. Wohlwill (Eds.), *Behavior and the Natural Environment* (pp. 85–125). Boston, MA: Springer US. doi: 10.1007/978-1-4613-3539-9_4

- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201–230. doi: 10.1016/S0272-4944(05)80184-7
- Valtchanov, D., Barton, K. R., & Ellard, C. (2010). Restorative Effects of Virtual Nature Settings. *Cyberpsychology, Behavior, and Social Networking, 13*(5), 503–512. doi: 10.1089/cyber.2009.0308
- Valtchanov, D., & Ellard, C. (2010). Physiological and affective responses to immersion in virtual reality: Effects of nature and urban settings. *Journal of Cyber Therapy and Rehabilitation, 3*(4), 359–373. doi: 10.1089/cyber.2009.0308
- Van den Berg, A. E., Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning, 127*, 173–181. doi: 10.1016/j.landurbplan.2014.04.012
- Wang, X., Rodiek, S., Wu, C., Chen, Y., & Li, Y. (2016). Stress recovery and restorative effects of viewing different urban park scenes in Shanghai, China. *Urban Forestry & Urban Greening, 15*, 112–122. doi: 10.1016/j.ufug.2015.12.003
- White, M. P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology, 35*, 40–51. doi: 10.1016/j.jenvp.2013.04.002
- White, M., Smith, A., Humphryes, K., Pahl, S., Snelling, D., & Depledge, M. (2010). Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology, 30*(4), 482–493. doi: 10.1016/j.jenvp.2010.04.004
- Wilkie, S., & Clouston, L. (2015). Environment preference and environment type congruence: Effects on perceived restoration potential and restoration outcomes. *Urban Forestry & Urban Greening, 14*(2), 368–376. doi: 10.1016/j.ufug.2015.03.002
- Wilkie, S., & Stavridou, A. (2013). Influence of environmental preference and environment type congruence on judgments of restoration potential. *Urban Forestry & Urban Greening, 12*(2), 163–170. doi: 10.1016/j.ufug.2013.01.004
- Wilson, E. O. (1984). *Biophilia*. Harvard, MA: Harvard University Press

CHAPTER 3

An integrative model of Ecological Behaviours' antecedents

1. Introduction

An increasing body of empirical research showed that a significant cause of environmental degradation are humans' behaviours (e.g., personal and public transport, heating and cooling buildings, household appliances and electronic devices, food habits, recycling). This means that psychology can play a crucial role in the efforts concerning environmental issues (APA 2009; Stern, 2011). In the early stage (Craik, 1973; Wohlwill, 1970), environmental psychology studies focused on risks perception, perception of space and its use in everyday behaviours, emotions and attitudes elicited by environment, and resources and attributes of physical environment (Clayton & Saunders, 2012). However, over time, that focus has shifted from physical environment to sustainable development (Bonnes & Bonaiuto 2002), focusing on how to improve the relationship between natural environment and humans (Gifford, 2014), and on understand the physical (context-oriented approach) and individuals factors (person-oriented approach) that motivate people to perform Ecological Behaviours (EBs) (Clayton & Brook 2005; Saunders, 2003). Context-oriented approach showed that contextual barriers (physical environment) as the unavailability of public transport (Joireman, Posey, Truelove, & Parks, 2009), walkability areas (Werner, Brown, & Gallimore, 2010), or recycling programs (Folz, 1991) impede EBs (Steg & Vlek, 2009). However, the role of contextual factors is often mediated by personal factors. For example, a better public service may induce people not to use a private vehicle only for those individuals with a high level of environmental concern (Steg & Vlek, 2009). Moreover, economic/political interventions (e.g., financial incentives for "green energy", free tickets for public transport, cash prize for recycling or energy conservation) have only minimal power to change people behaviour (Gifford,

2011; Maki, Burns, Ha, & Rothman, 2016). Indeed, an external motivation, as economics incentives, to engage in the behaviours is usually less efficient because is limited to a specific action (Schultz & Kaiser, 2012). For example, to incentivize people to recycle paper has no effect on glass or plastic recycling (Schultz & Kaiser, 2012). The person-oriented approach emphasizes the role of individual factors that promote EBs (Giuliani & Scopelliti, 2009), like environmental attitudes (e.g., Bamberg & Möser, 2007; De Dominicis, Schultz, & Bonaiuto, 2017; Hartig, Kaiser, & Strumse, 2007), connection to nature (Gosling & Williams, 2010; Mayer & Frantz, 2004; Swim et al., 2011), moral norms and values (e.g., Bamberg & Möser, 2007; Hansla, Gamble, Juliusson, & Gärling, 2008), personality characteristics (e.g., Brick & Lewis, 2016; Fraj & Martinez, 2006). In the last 30 years the environmental psychology adopted the Theory of Planned Behaviours (TPB) developed by Ajzen (1991) to explain why people adopt (or not adopt) healthy behaviours. The theory claims that behaviours depend on intentions that in turn are influenced by attitudes, social norms, and perceived behavioural control (Ajzen, 1991). A meta-analysis furnished empirical support to the applicability of the TPB for EBs showing that they are strongly predicted by intentions that, in turn, are determined by attitudes, social norms, and perceived behavioural control (Bamberg & Möser, 2007).

These approaches focus on individual or contextual factors without considering that the experiences in natural environment (and the perception of the environment's qualities and psychophysiological benefit) of the individual could also influence the choice to implement or not EBs. A relatively new research field suggests that exposure to natural environments could be associated with a greater probability of implementing EBs (Coldwell & Evans, 2017; Whitburn, Linklater, & Milfont, 2019). The positive, rewarding, and restorative experiences that people experience in such environments would be the basis of the motivation to preserve and protect nature (Byrka, Hartig, & Kaiser, 2010; Hartig et al., 2007; Nisbet & Zelenski, 2011). In particular, some studies suggest that the probability to behave in an ecological way depends on the restorative potential that people perceive in natural environments (Byrka et al., 2010; Hartig et al., 2007). Such researches are based on one of the two main theories proposed to explain why human beings

benefit from natural environments: the Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989; Kaplan, 1995). According to Kaplan (1995), contact with nature allows people to free (and therefore regenerate) voluntary attentional resources and thus make it possible to recover from a situation of cognitive fatigue.

In particular, empirical evidences suggest that the effect of perceived restorativeness on EBs is not a direct effect but is mediated by environmental attitudes (Berto & Barbiero, 2017). That is, people who perceived the natural environment as restorative develop positive attitudes toward nature, and these positive attitudes, in turn, works as a motivator for EBs (Byrka et al., 2010; Collado & Corraliza, 2015; Hartig et al., 2007; Whitburn, et al., 2019).

Environmental attitudes are one of the most studied predictors of EBs (Schultz & Kaiser 2012). Empirical data support the hypothesis that a personal concern about ecological issues may be a prerequisite to promote actions protecting the natural world. Indeed, different studies showed that environmental attitudes are a significant direct predictor of EBs (e.g., Brick & Lewis, 2016; Hartig et al., 2007; Pavalache-Ilie & Cazan, 2018; Whitburn et al., 2019).

The term “attitudes” is usually used to reflect beliefs or concerns about specific environmental activities or issues (Schultz & Kaiser 2012). Environmental attitudes are usually assessed using the “New Environmental Paradigm (NEP)” scale (Dunlap, Van Liere, Mertig, & Jones, 2000) that was built to measure a general worldview about the environment (Mobley, Vagias, & DeWard, 2010) that determine individuals’ beliefs concerning their relationship to the natural world (Mayer & Frantz, 2004). However, according to several authors (e.g., Collado & Corraliza, 2015; Mayer & Frantz, 2004; Whitburn et al., 2019), the scale measures only the cognitive dimension of environmental attitudes, neglecting an important dimension that is the affective one. The affective dimension of environmental attitudes is the feeling of being a part of the natural environment, and the emotional aspects of this relationship (Mayer & Frantz, 2004; Schultz, 2002). This dimension includes the construct of connection to nature that refers to an individual’s sense of emotional connection to the natural

environment (Mayer & Frantz, 2004) and is based on the idea that love for nature is genetically determined (biophilic hypothesis) (Staats, 2012). Some authors (e.g., Berto & Barbiero, 2017; Clayton, 2012; Mayer & Frantz, 2004) suggest that a strong feeling of being part of the natural world may be a requirement for action to protect them. Empirical data support this hypothesis showing a strong correlation between connection to nature and EBs (Dutcher, Finley, Luloff, & Johnson, 2007; Gosling & Williams, 2010; Whitburn et al., 2019). People who have a greater connection with nature spend more time in natural environments and experience more positive emotions that in turn promote EBs (Mayer & Frantz, 2004; Nisbet & Zelenski, 2011). These studies refer to the stress recovery theory (SRT) (Ulrich et al., 1991) that presuppose that contact with nature elicits positive emotions and allows individuals to recover from a situation of stress (or negative mood) (Ulrich et al., 1991).

1.1 Positive experience in nature, environmental attitudes, and connection to nature

In sum, perceived restorativeness of natural environment, environmental attitudes, and connection to nature seems to be three different but interrelated antecedent of EBs. Despite this, only recently some authors tried to study all these constructs in the same model.

Environmental attitudes, on one side, are correlated to connection to nature (e.g., Mayer & Frantz, 2004; Nisbet, Zelenski, & Murphy, 2009) and, on the other side, they mediate the effect of perceived restorativeness (Byrka et al., 2010; Collado & Corraliza, 2015; Hartig et al., 2007; Whitburn et al., 2019) and emotional effect of nature exposure (Coelho, Pereira, Cruz, Simões, & Barata, 2017) on EBs.

The role of connection to nature is less clear. Indeed, some studies suggested that connection to nature determines the ability to perceive a natural environment as restorative (Berto & Barbiero, 2017; Whitburn et al., 2019). That is, people with a strong emotional feeling with nature perceive it as more restorative. However, there are also evidence that the relationship works in the opposite way (restorative experience enhances connection to nature) (Nisbet & Zelenski, 2011), supporting the hypothesis that connection to nature is a context-dependent emotional

response (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Nisbet & Zelenski, 2011; Weinstein, Przybylski, & Ryan, 2009). Moreover, people who are fascinated by natural world, who effortlessly focus their attention on natural stimuli, could develop a greater feeling of belonging to natural world, and so a strong tendency to love and protect nature (Kaplan, 1995). Finally, in a recent study (Wyles et al., 2019) a series of structural equation analyses provided evidence for a bidirectional association between connection to nature and restoration.

Only study investigated restorativeness, environmental attitudes and connection to nature in the same model, that is Whitburn and colleagues (2019). They found an indirect effect of the connection to nature on EBs through restorativeness and attitudes. However, in this study authors did not investigate perceived restorativeness but the use of nature for restorative purposes, affective restoration, and the direct relationship between connection to nature and environmental attitudes.

1.2 Social Desirability

EBs are considered as socially appropriate behaviours (Vesely & Klöckner, 2018). For this reason, social desirability (SD) (Paulhus, 1984) is sometimes called in support to understand the misreporting of EBs (e.g., Chao & Lam, 2011; Hartig, Kaiser, & Bowler, 2001). Moreover, some studies suggested that also motivation to perform EBs (Noppers, Keizer, Bolderdijk, & Steg, 2014) and environmental attitudes (Milfont, 2009) or consciousness self-report measures (Stocké & Hunkler, 2007) could be bias by SD. Even if the impact of SD on environmental researches often appears to be small (e.g., Milfont, 2009; Panno, Carrus, Maricchiolo, & Mannetti, 2015) more researches are needed (Vesely & Klöckner, 2018). One open issue concerns the relationship between SD, EBs and its antecedents. For example, Milfont (2009) found that SD have a direct impact on environmental attitudes but not on EBs. Hartig, Kaiser, and Bowler (2001) found that SD has a direct effect on EBs, independently of perceived restorativeness. No study has investigated all these variables in a single model.

1.3 The present study: aim and hypothesis

In this study we investigated the perceived restorativeness of a virtual natural environment, the environmental attitudes, the connection to nature, and the social desirability, as predictors of EBs. The use of the virtual reality in restorativeness studies is becoming more and more frequent, and a recent meta-analysis (Menardo, Brondino, Hall, & Pasini, 2019a) found no moderation effect of the kind of exposure to the physical environment, in exploring the effect of natural vs built restorative effect, suggesting that virtual environments are valid representations of real environments, also confirming the implicit assumption that exposure to simulated environments produces the same effects as exposure to real environments (Stamps, 1990; Valtchanov, Barton, & Ellard, 2010; Valtchanov & Ellard, 2010). The novelty of the proposed research is that these predictors have never been investigated together in a single model. The first aim of this study is to cover this lack by proposing an integrated model of antecedents of EBs. Based on the previous studies, we tested the following hypotheses:

- (H1) connection to nature predicts perceived restorativeness;
- (H2) perceived restorativeness has an indirect effect on EBs, through the mediation of environmental attitudes;
- (H3) connection to nature and environmental attitudes have a direct effect on EBs;
- (H4) connection to nature predicts environmental attitudes;
- (H5) social desirability has an indirect effect on EBs, fully mediated by environmental attitude and connection to nature, independently of perceived restorativeness's effect.

The explored theoretical model is shown in figure 1.

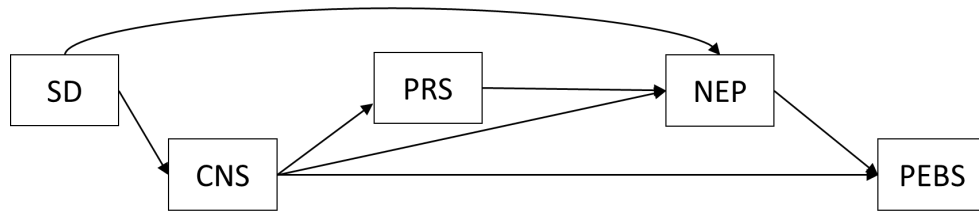


Figure 1. Path of the theoretical model investigated. SD = Social Desirability; CNS = Connection to nature; PRS = Perceived Restorativeness Scale; NEP = New Ecological Paradigm Scale; PEBS = Pro-Environmental behaviours Scale.

To explore the relationship between connection to nature and perceived restorativeness we tested two alternatives models:

- perceived restorativeness predicts connection to nature;
- perceived restorativeness and connection to nature are correlated.

Moreover, the second aim of this study is to verify if the proposed model is valid for different EBs. Indeed, literature about effect of perceived restorativeness and connection to nature on EBs usually uses general measures of EBs (e.g., Byrka et al., 2010; Collado & Corraliza, 2015; Dutcher, et al., 2007; Hartig et al., 2007; Whitburn et al., 2019), without considering that different EBs could have different antecedents (Bamberg & Möser, 2007; Dietz, Stern, & Guagnano, 1998; Lee, Kim, Kim, & Choi, 2014; Menardo, Brondino, & Pasini, 2019b; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). We investigated four EBs: Conservation, Transportation, Food and Environmental Citizenship. These four aspects of EBs cover the three categories proposed by Stern (2000): environmental activism, nonactivist behaviours in the public sphere, and private-sphere environmentalism. Conservation, Transportation, and Food are expressions of private sphere environmentalism (Stern, 2000) and regard the three main human activities that influence climate change: household consumption, transportation, and food consumption (Brower & Leon, 1999; Gardner & Stern, 2008). The fourth, Environmental Citizenship, combines environmental activism and nonactivist behaviours in the public sphere (Stern, 2000), and include active involvement in environmental groups (environmental activism) and support of environmental

policies (nonactivist behaviours in the public sphere) (Stern, et al., 1999; Takahashi & Selfa, 2015).

2. Method

2.1 Participant and Procedure

146 undergraduate students (82% female, mean (ds) age = 22.35 (12.62), range = 18 – 55) of a university in the north east of Italy participated to the study. We used a three-wave research design, collecting data in three different moments from October 2018 to March 2019. 187 students (out of 400 contacted ones, 47%) agreed to take part in the experiment and completed the first data collection. 152 out of this original sample of 187 students (81%) participated to the second data collection and finally a total number of 146 students (78% of the initial group of participants) participated to the third data collection.

The first data were collected in a classroom where participants completed the New Ecological Paradigm (NEP) Scale (Dunlap et al., 2000), the Connectedness to Nature Scale (CNS) (Mayer & Frantz, 2004), and the Balanced Inventory of Desirable Responding-6 Short Form (BIDR-6 Short Form) (Bobbio & Manganelli, 2011). Then, participants were invited individually to the laboratory. They first saw a 5-minutes 360-degree video wearing a virtual reality head-set (Oculus Rift). The video was filmed with a Samsung 360-degree panoramic camera in a semi-manicure wood of north of Italy. The landscape included undergrowth, bushes, trees (chestnut, ash, elder) and a stream (see figure 2). After exposure they completed the Perceived Restorativeness Scale (PRS) (Pasini, Berto, Brondino, Hall, & Ortner, 2014). Third, after about one month, participants received an e-mail with a link to complete the Italian Pro-Environmental Behaviours Scale (I-PEBS) (Menardo et al., 2019b).

Before each data collection informed consensus was required to participate to the current data collection and to be contacted for the following.



Figure 2. An image of the environment in which participants were immersed using virtual reality.

2.2 Instrument and measures

2.2.1 Perceived restorativeness

The Perceived Restorativeness Scale (PRS) (Pasini et al., 2014) comprises 11 items assessing the individual perception of restorative qualities (i.e., fascination, being-away, coherence, and scope) of an environment. After exposure to the natural environment, participants were asked to indicate how much each item described their feeling on a 11-point Likert scale from 0 (Not at all) to 10 (Very Much). An example of item is “To get away from things that usually demand my attention I like to go to places like this”. The scale showed excellent internal reliability (McDonald $\omega = .95$).

2.2.2 Environmental attitude

Environmental attitudes were measured by the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). The scale is composed of 15 items, based on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), measuring

endorsement of an ecological worldview. An example of item is: “Humans have the right to modify the natural environment to suit their needs”. Internal reliability was acceptable (Cronbach $\alpha = .62$).

2.2.3 Connection to nature

Connection to nature was assessed using the Italian translation (Berto, Barbiero, Barbiero, & Senes, 2018) of the Connectedness to Nature Scale (CNS, Mayer & Frantz 2004). The scale is composed of 14 items based on a 5-points Likert scale, ranging from 1 (never) to 5 (always). An example of item is: “I often feel a sense of oneness with the natural world around me”. The scale showed good internal reliability (Cronbach $\alpha = .89$).

2.2.4 Ecological behaviours (EBs)

To measure EBs the Italian Pro-Environmental Behaviours Scale (I-PEBS; Menardo et al., 2019b) was used. The scale is a 15-items scale assessing the principal EBs’ category (Conservation, Environmental Citizenship, Food, and Transportation) proposed by the literature as having a great impact on the environment (Brower & Leon 1999; Markle, 2013). An example of item is: “During the past year how often have you walked or cycled instead of driving?”. The original and Italian version of the scale showed an excellent 4-factor structure and internal validity (Markle, 2013; Menardo et al., 2019b) and a good internal reliability (original version’s Cronbach $\alpha = .76$; Italian version McDonald $\omega = .71$)

2.2.5 Social desirability

Social Desirability was measure by the Balanced Inventory of Desirable Responding-6 (BIDR-6) Short Form. The 16-items scale uses a 6-point Likert scale, ranging to 1 (completely disagree) to 6 (completely agree) to assess unconscious tendency to socially desirable responses (Bobbio & Manganelli, 2011; Paulhus, 1991). An example of item is: “My first impressions of people usually turn out to be right” This scale has shown good psychometric proprieties

(internal consistency and factor structure) (Bobbio & Manganeli, 2011) (Cronbach $\alpha = .69$).

2.2.6 Virtual reality

Oculus Rift is composed of two lenses that project images onto two OLED screens (1080 × 1200 resolution) completely covering the view of users. Users are totally immersed in the virtual environment with a peripheral view similar of real life (110° of visual angle). It is also equipped with headphones that produce a 3D sound effect and a gyroscope that follows the movements of the head on the 4 axes of view (from top to bottom, from right to left), so users can look around during the experience.

2.3 Data analysis

First, we checked the pattern of missing data using missing completely at random (MCAR) Little's test (Little & Rubin, 1987). If the test has a statistically nonsignificant result, MCAR can be inferred and the estimation of missing data (if less than 5% for each variable) can be done (Tabachnick & Fidell, 2013). Second, we checked for univariate and multivariate (Mardia's Test) normal distribution and for the presence of univariate and multivariate outliers.

After preliminary analysis we checked the models through path analyses (PAs) using R package Lavaan (Rosseel, 2012), applying the maximum likelihood (ML) estimator. The goodness of fit was evaluated using chi-square statistic (χ^2), the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA) with associated 95% confidence intervals (CIs), and the Standardized Root-Mean-Square Residual (SRMR) (Byrne, 2008; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Yu, 2002). Values close to .95 for CFI, smaller than .05 for RMSEA, and smaller than .08 for SRMR, suggest a reasonable fit (Byrne, 2011).

Then, we checked for the alternatives models to test the different possible pattern of relationships proposed by the literature between CNS and perceived restorativeness: perceived restorativeness as an antecedent of connection to nature,

with a positive effect (Model 2), vs reciprocal influence (correlation) between the two constructs (Model 3). To compare the alternative nested models, we used Δ CFI and Akaike's information criterion (AIC). A Δ CFI value > 0.01 indicates a deterioration of model fit (Cheung & Rensvold, 2002). A lower value of AIC indicates a better fitting model) (Schermelleh-Engel et al., 2003; Sterba & Pek, 2012).

The reported models are the final models after a stepwise removal strategy of the least significant paths until only significant paths remained (and modification indices suggested no modification).

3. Results

Analysis of missing data revealed that no item had more than 5% of missing and MCAR Little' Test (Little & Rubin, 1987) was not significant ($\chi_{(1348)}^2 = 1375.9, p = .291$). Data was normally distributed: skewness and kurtosis lower than ± 1 (see Table 1) and calculated Mardia's Index (34) was lower than critical value (35) suggesting multivariate normality. Consequently, missing data were estimated using the Expectation Maximization (EM) method.

No univariate or multivariate outliers were found.

Table 1

Descriptive statistics of the measures

	N	Mean	SD	Skewness	Kurtosis
Connection to nature (CNS)	146	3.65	0.63	-.26	-.48
Environmental attitudes (NEP)	146	3.83	0.36	-.40	.02
Perceived restorativeness (PRS)	146	8.34	1.62	-.81	.60
Social Desirability (SD)	146	57.66	9.30	-.25	.01
Ecological Behaviours (EBs)	146	48.89	7.80	-.16	-.70
Conservation	146	12.23	2.18	.14	.51

Environmental Citizenship	146	12.30	2.87	-.14	-.39
Food	146	12.15	3.67	.37	-.35
Transportation	146	12.21	2.73	-.70	.24

Model 1 showed a excellent fit (CFI = 1.000; RMSEA = .000 [CI = .000 - .116]; SRMR = 0.031; $\chi_{(4)}^2 = 3.412$, $p = .491$; explained variance = 26%) (see Table 2), supporting the hypothesis that connection to nature influence the perceived restorativeness.

Examination of the other associations showed that connection to nature ($\beta = .39$; SE = .07; $p < .001$) and environmental attitudes ($\beta = .22$; SE = .07; $p = .003$) are the only two variables with a direct effect on EBs. Connection to nature also showed an indirect effect on EBs via environmental attitudes ($\beta_{\text{indirect}} = .06$; SE = .03; $p = .023$). The double mediation effect (CNS \rightarrow PRS \rightarrow NEP) found by Whitburn and colleagues (2019) was not confirmed ($\beta_{\text{indirect}} = .01$; SE = .01; $p = .126$).

Environmental attitudes are influenced by perceived restorativeness ($\beta = .17$; SE = .08; $p = .002$) but they did not significantly mediate the effect of restorativeness on EBs ($\beta_{\text{indirect}} = .04$; SE = .02; $p = .089$).

Social desirability had an indirect effect on EBs via connection to nature ($\beta_{\text{indirect}} = .11$; SE = .04; $p = .003$) but it did not show a direct relationship with environmental attitude (so, its effect on EBs is not mediated by attitudes).

Alternatives models showed also a good fit but Δ CFI value higher that .01 (.16 for model 2 and .21 for model 3) and a lower AIC suggested a deterioration of fit compare to model 1 (Table 2). Figure 3 shows the best model.

Table 2

Fit indices of the three models

χ^2 (p)	df	CFI	RMSEA	SRMR	AIC	R ²
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[C.I.]							
Model 1	3.412 (.491)	4	1.000	.000	.031	2959	.256
				[.000-.116]			
Model 2	5.374 (.251)	4	0.984	.048	.046	2961	.252
				[.000-.142]			
Model 3	5.747 (.219)	4	0.979	.055	.048	2962	.252
				[.000-.146]			

Note. Model 1 (CNS → PRS); Model 2 (PRS → CNS); Model 3 (CNS ↔ PRS). CNS = Connection to Nature Scale; PRS = Perceived Restorativeness Scale

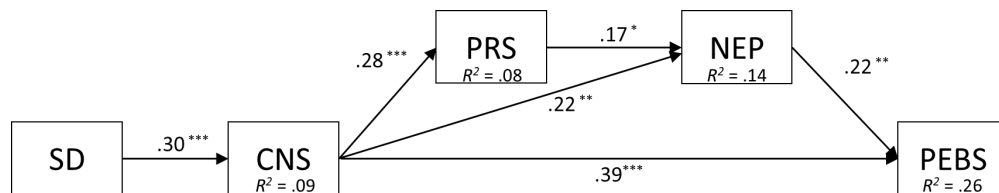


Figure 3. Path of model 1. SD = Social Desirability; CNS = Connection to nature; PRS = Perceived Restorativeness Scale; NEP = New Ecological Paradigm Scale; PEBS = Pro-Environmental behaviours Scale. * $p < .05$; ** $p < .01$; *** $p < .001$.

To explore why the mediational role of environmental attitudes in the association between perceived restorativeness and EBs was not confirmed by our data, we run a fourth unplanned model without any direct association between connection to nature and attitudes. The aim was to replicate Whitburn's model (2019). The model did not show acceptable fit to the data (CFI = 0.871; RMSEA = .121 [CI = .057 - .191]; SRMR = 0.079; $\chi^2_{(5)} = 15.750$, $p = .008$; explained variance = 22%) but the indirect effect of restorativeness on EBs via attitudes was significant ($\beta_{\text{indirect}} = .06$; SE = .03; $p = .028$). Modification index suggested to add the effect of connection to nature on environmental attitudes to the model.

All models with the different EBs categories as outcomes showed a good fit, however only for Environmental Citizenship (CFI = 0.984; RMSEA = .043 [CI =

.000 - .138]; SRMR = 0.041; $\chi_{(4)}^2 = 5.069$, $p = .280$; explained variance = 16%) connection to nature ($\beta = .26$; SE = .08; $p = .001$) and environmental attitudes ($\beta = .23$; SE = .08; $p = .004$) were both confirmed as predictors. In addition, the indirect effect of connection to nature via environmental attitudes ($\beta_{\text{indirect}} = .07$; SE = .03; $p = .025$) were confirmed only for Environmental Citizenship. Instead, Food (CFI = 1.000; RMSEA = .000 [CI = .000 - .099]; SRMR = 0.027; $\chi_{(4)}^2 = 2.418$, $p = .659$; explained variance = 13%), Conservation (CFI = 0.996; RMSEA = .021 [CI = .000 - .128]; SRMR = 0.038; $\chi_{(4)}^2 = 4.250$, $p = .373$; explained variance = 10%) and Transportation behaviours (CFI = 0.992; RMSEA = .027 [CI = .000 - .131]; SRMR = 0.037; $\chi_{(4)}^2 = 4.431$, $p = .351$; explained variance = 09%) were predict only by connection to nature (β range = .24 - .29; $p < .05$).

As regard social desirability, for all EBs category its indirect effect via connection to nature was confirmed (β_{indirect} range= .07 - .09; $p < .05$).

4. Discussion

The aim of this study was to investigate reciprocal influence between EBs' antecedents and to propose an integrated model that could explain EBs variability in the population. The model (the pattern of relationships among the considered constructs) was build based on the results of the previous studies (e.g., Barbiero, 2014; Berto & Barbiero, 2017; Berto et al., 2018; Byrka et al., 2010; Hartig et al., 2007; Milfont, 2009; Vesely & Klöckner, 2018; Whitburn et al., 2019) and almost all of our hypothesis were confirmed.

First, connection to nature predicts perceived restorativeness and environmental attitudes. These results support the idea that connection to nature is a genetically determined emotional feeling (e.g., Staats 2012) that affects the consequent relationship with natural word. It could determine the ability of an individual to perceive restorative potential of an environment (Berto & Barbiero, 2017) and also influence attitudes toward environmental issues, and so determine an ecological worldview (Barbiero, 2014; Mayer & Frantz, 2004). So, people with a strong emotional feeling with nature are more fascinated by natural stimuli and perceive the nature as a world where they could refuge from everyday problems. That is, they feel more restored when they are exposed to natural environment.

Moreover, they develop a stronger attitude toward environmental issues and this, in turn, increase their commitment to protect natural world.

As expected, the model suggests that perceived restorativeness has not a direct effect on EBs, in accordance with theories that suggest that behaviours are motivated by intentions, (personal and social) norms, and knowledge (Berto & Barbiero, 2017). However, our results have not confirmed the mediational role of the environmental attitudes reported by literature (Byrka et al., 2011; Collado & Corraliza, 2015; Hartig et al., 2007; Whitburn et al., 2019). This difference could be linked to the different method used. Indeed, to investigate the perceived restorativeness we exposed participant to nature using virtual reality whereas previous studies used images (Byrka et al., 2010; Hartig et al., 2007) or real nature (Whitburn et al., 2019). However, we suppose that the difference is because we modelled also the relationship between connection to nature and environmental attitude. Indeed, eliminating this relationship from the model, our data would also have confirmed the indirect effect of perceived restorativeness on EBs via environmental attitudes. This result agrees with Mayer and Frantz (2004) that showed that the relationship between environmental attitudes and EBs disappears when connection to nature is introduced as controlling variable.

Whitburn and colleagues (2019), besides the mediational role of the environmental attitudes, found also a double indirect effect from connection to nature to EBs, through perceived restorativeness and environmental attitudes. Our data did not confirm this double indirect effect and, again, we suppose that the difference is linked to the direct association between connection to nature and attitudes modelled in our model and not in those of Whitburn. Indeed, we found a significant direct effect of connection to nature on environmental attitudes ($\beta = .29$; $SE = .08$; $p < .001$) and a non-significant indirect effect via perceived restorativeness ($\beta_{\text{indirect}} = .05$; $SE = .03$; $p = .073$). However, in the model without the direct association between connection to nature and environmental attitudes the indirect association via perceived restorativeness was significant ($\beta_{\text{indirect}} = .07$; $SE = .03$; $p = .021$).

At the same time, our model suggests that the reported effect of connection to nature on EBs could be biased by social desirability. Indeed, we found that connection to nature is the only EBs' antecedent, among those investigated, that was influenced by social desirability. People with a greater tendency to give socially desirable answers and to describe oneself as conforming to social norms reported also a greater emotional feeling toward nature. To our knowledge, only Mayer and Frantz (2004) have previously investigated this relationship and they found no correlation between the two measures. Further investigations are needed to go deeper into this issue, to clarify the relationship between social desirability and connection to nature. Moreover, social desirability did not show a direct effect on EBs but, as hypothesized, an indirect effect, via connection to nature emerged. These results suggest, in accordance to previous studies (e.g., Milfont, 2009), that social desirability has not a direct influence on people's response to self-reported measure of EBs. However, it could lead to a misreporting of EBs' antecedents that, in turn, bias the investigation of relationship between variables.

The important role of connection to nature is also confirmed by the analysis on the single EBs' category. Indeed, CN is the only predictor that showed a significant effect on all kind of ecological behaviours (β range = .24 - .29), suggesting that a strong sense of belonging to natural world create a general predisposition/motivation to act sustainable behaviours. This result supports the hypothesis that emotional connection with natural environment is a prerequisite for increasing EBs (Mayer & Frantz, 2004).

On the contrary, environmental attitudes showed a significant direct effect only on environmental citizenship, which is an expression of the public sphere environmentalism (activism and nonactivist behaviours). As argued by Stern (2000) an important characteristics of public sphere behaviours is their link with awareness about ecological issue. So, it is not surprising that they are predicted by environmental concern. Instead, the lack of association between private sphere behaviours and environmental attitudes could be due to the impact-oriented approach used to assess EBs. Indeed, I-PEBS, assesses those behaviours that have an impact on environmental sustainability, independently from motivation to perform them (Schultz & Kaiser, 2012; Stern, 2000). Conservation,

Transportation, and Food, that are expression of the private sphere environmentalism, have a direct environmental impact, whereas the impact of public sphere behaviours is indirect through public policies (Stern, 2000). So, people with higher Conservation, Transportation, and Food scores could behave in an ecological way not because they are worried about ecological issue but for other reasons. For example, people could eat organically fruits and vegetables or biking instead of driving for health reasons or to reduce home heating or hot water consumption for economic causes.

In addition, the lack of the direct effect of environmental attitudes on EBs agrees with studies that suggest an indirect path through intentions (Kaiser & Gutscher, 2003; Kaiser, Hubner, & Bogner, 2005; Levine & Strube, 2012) in accordance with the Theory of Planned Behaviour (TPB, Ajzen, 1991). Empirical support to TPB was given by a meta-analytic structural equation modelling (MASEM) conducted on 10-years of researches (Bamberg & Möser, 2007). The MASEM showed that attitudes (with social norm and perceived behavioural control) are one of the stronger predictors of intentions that, in turn, predicts EBs (Bamberg & Möser, 2007). The inclusion of intentions in the model maybe could increment its predictive power

4.1. Limitation and Future directions

The main limitation of this study is the sampling methodology, which has been carried out using a convenience sample composed by undergraduate students. However, we were interested to the reciprocal influence between variables and not to the absolute level of the variables, so this should not be a problem. Instead, the higher percentage of female (82%) could have influenced our results. Indeed, women generally report more environmental attitude and behaviours (for a review see Gifford & Nilsson, 2014), whereas no gender differences were reported in the connection to nature levels (Mayer & Frantz, 2004). Future researches should use samples from general population, more balanced with regard to socio-demographics characteristics. A larger sample could also allow to include demographic characteristics into the model. Indeed, in his literature review,

Gifford (2014) highlighted the role of personal factors (i.e., childhood experience, educational level, gender, age) as predictors of EBs.

Moreover, future researches should try to insert the proposed model in the Theory of Planned Behaviour (TPB) of Ajzen (1991). A study using a MASEM suggested that intentions alone explained 27% of the EBs (Bamberg & Möser, 2007). So, it is probably a crucial predictor of EBs, even if it is not the only one. Moreover, the constructs planned in the TPB (environmental attitudes, social norms, perceived behavioural control) explain “only” the 50% of the intentions. Consequently, other variables could be included in the model to increase its predictive power. In particular, our results suggest an important relationship between connection to nature and environmental attitudes. So, we suggest that the love for nature could be added in the model proposed by TPB. To our knowledge no study has investigated the relationship between connection to nature and TPB constructs. Based on our results, we suggest that connection to nature could be a direct predictor of environmental attitudes, subjective norms, and intentions.

As regard perceived restorativeness, our study suggested a less important role than those reported by previous studies (Byrka et al., 2010; Hartig et al., 2007; Nisbet & Zelenski, 2011). Indeed, we did not find the hypothesized indirect effect on EBs via environmental attitudes, leading to think that it does not influence the probability to act EBs. However, our results confirm that perceived restorativeness significantly influences environmental attitudes. So, it could be included in the TPB’s model hypothesizing a double indirect effect on EBs through attitudes and intentions (perceived restorativeness → attitudes → intentions → EBs).

Finally, given that the correlation between self-report and objective measure (e.g., ecological footprint) of EBs is small (Bleys, Defloor, Van Ootegem, & Verhofstadt, 2018; Kormos & Gifford, 2014), future studies should verify if the proposed model is able to predict also objective individuals’ impact on environment (ecological footprint).

5. Conclusion

In sum, our model suggests that connection to nature, besides being the strongest direct predictor of EBs, it is also an important predictor of perceived restorativeness and environmental attitudes. So, studies that have investigated the indirect effect of perceived restorativeness on EBs via environmental attitudes (Byrka et al., 2011; Collado & Corraliza 2015; Hartig et al., 2007) without considering the role of the connection to nature could have overestimated the indirect effect. Our results suggest that the role of restorativeness could be less important than those reported by previous studies. As regard the relationship between connection to nature and perceived restorativeness, the model suggests a causal pattern: a greater feeling of belonging to natural world increases the ability to perceive its restorative potential.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. doi: 10.1016/0749-5978(91)90020-T
- American Psychological Association (APA). (2009). Task force on the interface between psychology and global climate change. Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges. Retrived from <https://www.apa.org/science/about/publications/climate-change-booklet.pdf>.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14–25. doi: 10.1016/j.jenvp.2006.12.002
- Barbiero, G. (2014). Affective Ecology for Sustainability. *Visions for Sustainability*, (1). doi: 10.7401/visions.01.03
- Berto, R., & Barbiero, G. (2017). How the psychological benefits associated with exposure to nature can affect pro-environmental behavior. *Annals of Cognitive Science*, 1, 16-20. Retrived from <https://scholarlypages.org/Articles/cognitive-science/acs-1-004.pdf>
- Berto, R., Barbiero, G., Barbiero, P., & Senes, G. (2018). An Individual's Connection to Nature Can Affect Perceived Restorativeness of Natural Environments. Some Observations about Biophilia. *Behavioral Sciences*, 8(3), 34. doi: 10.3390/bs8030034
- Bleys, B., Defloor, B., Van Ootegem, L., & Verhofstadt, E. (2018). The Environmental Impact of Individual Behavior: Self-Assessment Versus the Ecological Footprint. *Environment and Behavior*, 50(2), 187–212. doi: 10.1177/0013916517693046
- Bobbio, A., & Manganelli, A. M. (2011). Measuring social desirability responding. A short version of Paulhus' BIDR 6. *Testing, Psychometrics Methodology in Applied Psychology*, 18(2), 117-135. Retrived from <http://www.tpmmap.org/tpmap/wp-content/uploads/2014/11/18.2.4.pdf>
- Bonnes, R., & Bonaiuto, M. (2002). Environmental psychology: From spatial-physical environment to sustainable. In Bechtel, R., & Churchman, A. (Eds.), *Handbook of environmental psychology* (pp. 28-55). New York, NY: Wiley.

- Brick, C., & Lewis, G. J. (2016). Unearthing the “Green” Personality: Core Traits Predict Environmentally Friendly Behavior. *Environment and Behavior*, 48(5), 635–658. doi: 10.1177/0013916514554695
- Brower, M., & Leon, W. (1999). *The Consumer’s Guide to Effective Environmental Choices: Practical Advice from the Union of Concerned Scientists*. New York, NY: Three Rivers Press.
- Byrka, K., Hartig, T., & Kaiser, F. G. (2010). Environmental Attitude as a Mediator of the Relationship between Psychological Restoration in Nature and Self-Reported Ecological Behavior. *Psychological Reports*, 107(3), 847–859. doi: 10.2466/07.PR0.107.6.847-859
- Byrne, B. M. (2008). Testing for multigroup equivalence of a measuring instrument: A walk through the process. *Psicothema*, 20(4), 872-882. Retrieved from <https://www.redalyc.org/pdf/727/72720455.pdf>
- Byrne, B. M. (2011). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. Mahwah, New York: Erlbaum.
- Chao, Y.-L., & Lam, S.-P. (2011). Measuring Responsible Environmental Behavior: Self-Reported and Other-Reported Measures and Their Differences in Testing a Behavioral Model. *Environment and Behavior*, 43(1), 53–71. doi: 10.1177/0013916509350849
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating Goodness-of-Fit Indexes for Testing Measurement Invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, 9(2), 233–255. doi: 10.1207/S15328007SEM0902_5
- Clayton, S.D. (2012). Environment and identity. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 208- 228). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0010
- Clayton, S., & Brook, A. (2005). Can psychology help save the world? A model for conservation psychology. *Analyses of Social Issues and Public Policy*, 5(1), 87-102. doi: 10.1111/j.1530-2415.2005.00057.x
- Clayton, S. D., & Saunders, C. D. (2012). Introduction: Environmental and Conservation Psychology. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 24- 29). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0001

- Coelho, F., Pereira, M. C., Cruz, L., Simões, P., & Barata, E. (2017). Affect and the adoption of pro-environmental behaviour: A structural model. *Journal of Environmental Psychology, 54*, 127–138. doi: 10.1016/j.jenvp.2017.10.008
- Coldwell, D. F., & Evans, K. L. (2017). Contrasting effects of visiting urban green-space and the countryside on biodiversity knowledge and conservation support. *PLOS ONE, 12*(3). doi: 10.1371/journal.pone.0174376
- Collado, S., & Corraliza, J. A. (2015). Children's Restorative Experiences and Self-Reported Environmental Behaviors. *Environment and Behavior, 47*(1), 38–56. doi: 10.1177/0013916513492417
- Craik, K. H. (1973). Environmental Psychology. *Annual Review of Psychology, 24*(1), 403–422. doi: 10.1146/annurev.ps.24.020173.002155
- De Dominicis, S., Schultz, P. W., & Bonaiuto, M. (2017). Protecting the Environment for Self-interested Reasons: Altruism Is Not the Only Pathway to Sustainability. *Frontiers in Psychology, 8*. doi: 10.3389/fpsyg.2017.01065
- Dietz, T., Stern, P. C., & Guagnano, G. A. (1998). Social Structural and Social Psychological Bases of Environmental Concern. *Environment and Behavior, 30*(4), 450–471. doi: 10.1177/001391659803000402
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues, 56*(3), 425–442. doi: 10.1111/0022-4537.00176
- Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity With Nature as a Measure of Environmental Values. *Environment and Behavior, 39*(4), 474–493. doi: 10.1177/0013916506298794
- Folz, D. H. (1991). Recycling Program Design, Management, and Participation: A National Survey of Municipal Experience. *Public Administration Review, 51*(3), 222. doi: 10.2307/976946
- Fraj, E., & Martinez, E. (2006). Influence of personality on ecological consumer behaviour. *Journal of Consumer Behaviour, 5*(3), 167–181. doi: 10.1002/cb.169
- Gardner, G. T., & Stern, P. C. (2008). The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change. *Environment: Science and Policy for Sustainable Development, 50*(5), 12–25. doi: 10.3200/ENV50.5.12-25

- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66(4), 290–302. doi: 10.1037/a0023566
- Gifford, R. (2014). Environmental psychology matters. *Annual Review of Psychology*, 65, 541–79. doi: 10.1146/annurev-psych-010213-115048
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review: personal and social factors that influence pro-environmental behaviour. *International Journal of Psychology*, 49(3), 141–157. doi: 10.1002/ijop.12034
- Giuliani, M. V., & Scopelliti, M. (2009). Empirical research in environmental psychology: Past, present, and future. *Journal of Environmental Psychology*, 29(3), 375–386. doi: 10.1016/j.jenvp.2008.11.008
- Gosling, E., & Williams, K. J. H. (2010). Connectedness to nature, place attachment and conservation behaviour: Testing connectedness theory among farmers. *Journal of Environmental Psychology*, 30(3), 298–304. doi: 10.1016/j.jenvp.2010.01.005
- Hansla, A., Gamble, A., Juliusson, A., & Gärling, T. (2008). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, 28(1), 1–9. doi: 10.1016/j.jenvp.2007.08.004
- Hartig, T., Kaiser, F. G., & Bowler, P. A. (2001). Psychological Restoration in Nature as a Positive Motivation for Ecological Behavior. *Environment and Behavior*, 33(4), 590–607. doi: 10.1177/00139160121973142
- Hartig, T., Kaiser, F. G., & Strumse, E. (2007). Psychological restoration in nature as a source of motivation for ecological behaviour. *Environmental Conservation*, 34(04). doi: 10.1017/S0376892907004250
- Joireman, J., Posey, D. C., Truelove, H. B., & Parks, C. D. (2009). The environmentalist who cried drought: Reactions to repeated warnings about depleting resources under conditions of uncertainty. *Journal of Environmental Psychology*, 29(2), 181–192. doi: 10.1016/j.jenvp.2008.10.003
- Kaiser, F. G., & Gutscher, H. (2003). The Proposition of a General Version of the Theory of Planned Behavior: Predicting Ecological Behavior1. *Journal of Applied Social Psychology*, 33(3), 586–603. doi: 10.1111/j.1559-1816.2003.tb01914.x

- Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior With the Value-Belief-Norm Model in Explaining Conservation Behavior. *Journal of Applied Social Psychology, 35*(10), 2150–2170. doi: 10.1111/j.1559-1816.2005.tb02213.x
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. CUP Archive.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182. doi: 10.1016/0272-4944(95)90001-2
- Kormos, C., & Gifford, R. (2014). The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology, 40*, 359–371. doi: 10.1016/j.jenvp.2014.09.003
- Lee, Y., Kim, S., Kim, M., & Choi, J. (2014). Antecedents and interrelationships of three types of pro-environmental behavior. *Journal of Business Research, 67*(10), 2097–2105. doi: 10.1016/j.jbusres.2014.04.018
- Levine, D. S., & Strube, M. J. (2012). Environmental Attitudes, Knowledge, Intentions and Behaviors Among College Students. *The Journal of Social Psychology, 152*(3), 308–326. doi: 10.1080/00224545.2011.604363
- Maki, A., Burns, R. J., Ha, L., & Rothman, A. J. (2016). Paying people to protect the environment: A meta-analysis of financial incentive interventions to promote proenvironmental behaviors. *Journal of Environmental Psychology, 47*, 242–255. doi: 10.1016/j.jenvp.2016.07.006
- Markle, G. L. (2013). Pro-Environmental Behavior: Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology, 41*(6), 905–914. doi: 10.1007/s10745-013-9614-8
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503–515. doi: 10.1016/j.jenvp.2004.10.001
- Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why Is Nature Beneficial? The Role of Connectedness to Nature. *Environment and Behavior, 41*(5), 607–643. doi: 10.1177/0013916508319745

- Menardo, E., Brondino, M., Hall, R., & Pasini, M. (2019a). Restorativeness in Natural and Urban Environments: A Meta-Analysis. *Psychological Reports*. doi: 10.1177/0033294119884063
- Menardo, E., Brondino, M., & Pasini, M. (2019b). Adaptation and psychometric properties of the Italian version of the Pro-Environmental Behaviours Scale (PEBS). *Environment, Development and Sustainability*. doi: 10.1007/s10668-019-00520-3
- Milfont, T. L. (2009). The effects of social desirability on self-reported environmental attitudes and ecological behaviour. *The Environmentalist*, 29(3), 263–269. doi: 10.1007/s10669-008-9192-2
- Mobley, C., Vagias, W. M., & DeWard, S. L. (2010). Exploring Additional Determinants of Environmentally Responsible Behavior: The Influence of Environmental Literature and Environmental Attitudes. *Environment and Behavior*, 42(4), 420–447. doi: 10.1177/0013916508325002
- Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating Nearby Nature: Affective Forecasting Errors Obscure the Happy Path to Sustainability. *Psychological Science*, 22(9), 1101–1106. doi: 10.1177/0956797611418527
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. *Environment and Behavior*, 41(5), 715–740. doi: 10.1177/0013916508318748
- Noppers, E. H., Keizer, K., Bolderdijk, J. W., & Steg, L. (2014). The adoption of sustainable innovations: Driven by symbolic and environmental motives. *Global Environmental Change*, 25, 52–62. doi: 10.1016/j.gloenvcha.2014.01.012
- Panno, A., Carrus, G., Maricchiolo, F., & Mannetti, L. (2015). Cognitive reappraisal and pro-environmental behavior: The role of global climate change perception: Cognitive reappraisal and climate change perception. *European Journal of Social Psychology*, 45(7), 858–867. doi: 10.1002/ejsp.2162
- Pasini, M., Berto, R., Brondino, M., Hall, R., & Ortner, C. (2014). How to Measure the Restorative Quality of Environments: The PRS-11. *Procedia - Social and Behavioral Sciences*, 159, 293–297. doi: 10.1016/j.sbspro.2014.12.375

- Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, 46(3), 598–609. doi: 10.1037/0022-3514.46.3.598
- Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of social psychological attitudes, Vol. 1. Measures of personality and social psychological attitudes* (pp. 17-59). San Diego, CA, US: Academic Press. doi: 10.1016/B978-0-12-590241-0.50006-X
- Pavalache-Ilie, M., & Cazan, A.-M. (2018). Personality correlates of pro-environmental attitudes. *International Journal of Environmental Health Research*, 28(1), 71–78. doi: 10.1080/09603123.2018.1429576
- Rosseel, Y. (2012). **lavaan**: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, 48(2). doi: 10.18637/jss.v048.i02
- Saunders, C. (2003). The Emerging Field of Conservation Psychology. *Human Ecology Review*, 10(2), 137-149. Retrieved from <http://www.jstor.org/stable/24706965>
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of psychological research online*, 8(2), 23-74. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.509.4258&rep=rep1&type=pdf>
- Schultz, P. W. (2002). Inclusion with Nature: The Psychology Of Human-Nature Relations. In P. Schmuck & W. P. Schultz (Eds.), *Psychology of Sustainable Development* (pp. 61–78). doi: 10.1007/978-1-4615-0995-0_4
- Schultz, P. W., & Kaiser, F. G. (2012). *Promoting Pro-Environmental Behavior*. doi: 10.1093/oxfordhb/9780199733026.013.0029
- Staats, H. (2012). Restorative Environments. In Clayton, S.D. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology* (pp. 537-553). Oxford, England: Oxford University Press. doi: 10.1093/oxfordhb/9780199733026.013.0024
- Stamps, A. E. (1990). Use of Photographs to Simulate Environments: A Meta-Analysis. *Perceptual and Motor Skills*, 71, 907–913.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. doi: 10.1016/j.jenvp.2008.10.004

- Sterba, S. K., & Pek, J. (2012). Individual influence on model selection. *Psychological Methods, 17*(4), 582–599. doi: 10.1037/a0029253
- Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues, 56*(3), 407–424. doi: 10.1111/0022-4537.00175
- Stern, P. C. (2011). Contributions of psychology to limiting climate change. *American Psychologist, 66*(4), 303–314. doi: 10.1037/a0023235
- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human ecology review, 81-97*. Retrived from http://www.humanecologyreview.org/Human%20Ecology/HER_6,2,1999.pdf?q=human-synergetics#page=87
- Stocké, V., & Hunkler, C. (2007). Measures of Desirability Beliefs and Their Validity as Indicators for Socially Desirable Responding. *Field Methods, 19*(3), 313–336. doi: 10.1177/1525822X07302102
- Swim, J. K., Stern, P. C., Doherty, T. J., Clayton, S., Reser, J. P., Weber, E. U., ... Howard, G. S. (2011). Psychology's contributions to understanding and addressing global climate change. *American Psychologist, 66*(4), 241–250. doi: 10.1037/a0023220
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6. ed., internat. ed). Boston, Mass.: Pearson.
- Takahashi, B., & Selfa, T. (2015). Predictors of Pro-Environmental Behavior in Rural American Communities. *Environment and Behavior, 47*(8), 856–876. doi: 10.1177/0013916514521208
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201–230. doi: 10.1016/S0272-4944(05)80184-7
- Valtchanov, D., Barton, K. R., & Ellard, C. (2010). Restorative Effects of Virtual Nature Settings. *Cyberpsychology, Behavior, and Social Networking, 13*(5), 503–512. doi: 10.1089/cyber.2009.0308
- Valtchanov, D., & Ellard, C. (2010). Physiological and affective responses to immersion in virtual reality: Effects of nature and urban settings. *Journal of Cyber Therapy and*

- Rehabilitation*, 3(4), 359–373. Retrived from
https://www.researchgate.net/profile/Deltcho_Valtchanov/publication/286055436_Physiological_and_affective_responses_to_immersion_in_virtual_reality_Effects_of_nature_and_urban_settings/links/5672f29708aee7a4274365a6.pdf
- Vesely, S., & Klöckner, C. A. (2018). Global Social Norms and Environmental Behavior. *Environment and Behavior*, 50(3), 247–272. doi: 10.1177/0013916517702190
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can Nature Make Us More Caring? Effects of Immersion in Nature on Intrinsic Aspirations and Generosity. *Personality and Social Psychology Bulletin*, 35(10), 1315–1329. doi: 10.1177/0146167209341649
- Werner, C. M., Brown, B. B., & Gallimore, J. (2010). Light rail use is more likely on “walkable” blocks: Further support for using micro-level environmental audit measures. *Journal of Environmental Psychology*, 30(2), 206–214. doi: 10.1016/j.jenvp.2009.11.003
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, 51(7), 787–810. doi: 10.1177/0013916517751009
- Wohlwill J.F. (1983) The Concept of Nature. In: Altman I., & Wohlwill J.F. (Eds.), Behavior and the Natural Environment. *Human Behavior and Environment (Advances in Theory and Research)*, 6. Boston, MA: Springer.
- Wyles, K. J., White, M. P., Hattam, C., Pahl, S., King, H., & Austen, M. (2019). Are Some Natural Environments More Psychologically Beneficial Than Others? The Importance of Type and Quality on Connectedness to Nature and Psychological Restoration. *Environment and Behavior*, 51(2), 111–143. doi: 10.1177/0013916517738312
- Yu, C.-Y. (2012). Evaluation of model fit indices for latent variable models with categorical and continuous outcomes. (Doctoral dissertation). Retrived from <https://www.statmodel.com/download/Yudissertation.pdf>.

CONCLUSIONI

In questo capitolo finale della dissertazione viene sottolineato il contributo che il progetto di ricerca ha apportato alla psicologia ambientale e in particolare (1) alla misurazione di due costrutti fondamentali nella psicologia ambientale (restorativeness e comportamenti pro-ambientali) e (2) allo studio della relazione tra i due costrutti. Inoltre, verranno analizzati i possibili sviluppi futuri. L'obiettivo generale del progetto era quello di studiare la relazione tra comportamenti pro-ambientali e restorativeness dopo aver verificato l'adeguatezza degli strumenti classicamente utilizzati per la misurazione di tali costrutti.

Nel primo studio (capitolo 1) per contribuire al dibattito su quali siano i comportamenti pro-ambientali da misurare, e di conseguenza quale sia lo strumento di misura più adeguato, è stata adattata al contesto italiano la Scala dei Comportamenti Pro-ambientali (Pro-Environmental Behavioural Scale, PEBS) sviluppata in lingua inglese da Markle (2013). Tale scala è stata scelta come strumento più adeguato alla misurazione dei comportamenti ecologici dopo avere effettuato una revisione degli strumenti presenti in letteratura e aver concluso che tale questionario fosse l'unico costruito con l'esplicito intento di misurare i comportamenti pro-ambientali con il maggior impatto sull'ecosistema e che, nello stesso tempo, fosse l'unico a coprire tutte le principali categorie di comportamenti pro-ambientali proposti dalla psicologia ambientale (conservazione, abitudini alimentari, trasporto e "cittadinanza" ambientale). Oltre all'adattamento in italiano in questo studio viene fatta per la prima volta una validazione completa della PEBS fornendo prove a favore della sua affidabilità (coerenza interna e validità test-retest) e validità (struttura fattoriale, validità di criterio, invarianza tra gruppi diversi di popolazione). Il questionario ha mostrato ottime proprietà psicometriche dimostrandosi uno strumento valido e affidabile in grado di spiegare ampiamente la variabilità del costrutto indagato. Di conseguenza, il nostro studio fornisce uno strumento che potrebbe rivelarsi estremamente utile nelle ricerche che studiano i

comportamenti pro-ambientali con l'obiettivo di incrementare la loro frequenza. Inoltre, le analisi sull'invarianza dello strumento hanno dimostrato che la versione italiana della PEBS misura il costrutto in maniera equivalente in persone con diverse caratteristiche sociodemografiche (genere, livello di educazione e provenienza geografica). Di conseguenza la scala può essere utilizzata anche per confrontare i comportamenti di misurazione di diversi sub-gruppi di popolazione, liberando gli studiosi dal rischio che le differenze ottenute non siano dovute a reali differenze tra sub-gruppi ma a bias sistematici relativi alla misurazione.

In sintesi, il primo studio contribuisce allo sviluppo di strumenti di misurazione dei comportamenti pro-ambientali in ambito italiano ma non solo. Infatti, visto che lo studio ha confermato le analisi preliminari effettuate sulla versione Americana (Markle, 2013), la PEBS potrebbe essere utile anche per studi cross-culturali o cross-nazionali per studiare le differenze e similitudini tra popoli e culture diverse. Futuri studi cross-nazionali sono necessari per fornire prove empiriche a favore di quest'ultimo punto.

Nel secondo studio (capitolo 2) viene confermato da un punto di vista empirico attraverso una meta-analisi ciò che ormai viene considerata una conoscenza acquisita della psicologia ambientale: gli ambienti naturali vengono percepiti come più rigenerativi rispetto agli ambienti urbani (Gifford, 2014). La magnitudo dell'effect size medio calcolato (d di Cohen = 1.99) suggerisce inoltre che i questionari self-report sono in grado di discriminare in modo efficace gli ambienti naturali da quelli urbani rispetto alla restorativeness percepita. Inoltre, le analisi di moderazione suggeriscono che la differenza tra ambienti emerge indipendentemente dal disegno di ricerca (entro o tra soggetti), dal tipo di esposizione (reale o virtuale), dal tipo di ambiente naturale (selvaggio o manipolato dall'uomo), dai partecipanti (studenti o popolazione generale) e dallo strumento self-report utilizzato. Di conseguenza, gli ambienti virtuali e la natura "urbana" possono essere considerati validi sostituti degli ambienti naturali e della natura selvaggia, rispettivamente. Gli studenti possono essere considerati un campione rappresentativo della popolazione (aspetto spesso criticato nelle ricerche in psicologia). Infine, i risultati suggeriscono che i diversi questionari self-report hanno la stessa capacità di discriminare gli ambienti. Quindi, dopo

adeguate trasformazioni dei punteggi è possibile fare confronti plausibili tra studi che hanno utilizzato diversi strumenti di misura. Tuttavia, rimane una significativa eterogeneità tra studi che non viene spiegata dalle differenze metodologiche tra studi e quindi dipende, probabilmente, da altre variabili che influenzano la percezione del potenziale rigenerativo. Tali risultati contribuiscono allo studio degli ambienti rigenerativi suggerendo agli psicologi ambientali di focalizzare gli studi futuri sull'identificazione di variabili individuali (ad es., genere, età, esperienze infantili) o ambientali (presenza o assenza di particolari elementi naturali) che influenzano la restorativeness percepita, piuttosto che sul confronto tra ambienti tipi di ambiente naturale o ambienti virtuali e reali.

I primi due studi del progetto di ricerca sono stati fondamentali per far sì che il terzo studio fosse costruito su forti e corrette impostazioni metodologiche. Infatti, il primo studio ha fornito un valido e affidabile strumento di misurazione dei comportamenti pro-ambientali che non era disponibile per il contesto italiano. Il secondo studio ha confermato l'adeguatezza degli strumenti self-report per studiare il potenziale rigenerativo degli ambienti naturali. Inoltre, ha garantito che l'utilizzo di studenti come campione e di ambienti virtuali per lo studio delle restorativeness non conducesse a bias sistematici dovuti al metodo di ricerca utilizzato.

L'obiettivo del terzo studio (capitolo 3) era quello di studiare la relazione tra comportamenti pro-ambientali e restorativeness. Il modello proposto ipotizza un potere predittivo della restorativeness tendendo in considerazione anche altri antecedenti dei comportamenti pro-ambientali che potenzialmente potrebbero influenzare tale relazione: attitudini ambientali, connessione con la natura e desiderabilità sociale. Diversi studi hanno mostrato un effetto indiretto della restorativeness sui comportamenti pro-ambientali attraverso le attitudini ambientali (ad es., Byrka, Hartig, & Kaiser, 2010), tuttavia non hanno studiato contemporaneamente la connessione con natura che secondo alcuni autori sarebbe a sua volta un predittore della restorativeness oltre che dei comportamenti pro-ambientali (ad es., Berto & Barbiero, 2017). Solo Whitburn e colleghi (2019) hanno proposto un modello predittivo di comportamenti pro-ambientali indagando restorativeness, attitudini ambientali e connessione con la natura senza però

considerare la relazione tra connessione con la natura e attitudini ambientali. Inoltre, nessuno degli studi precedenti ha verificato il ruolo della desiderabilità sociale. Tale studio intende quindi contribuire allo studio degli antecedenti dei comportamenti pro-ambientali indagando per la prima volta nello stesso studio quattro diversi antecedenti di comportamenti pro-ambientali: restorativeness, attitudini ambientali, connessione con la natura e desiderabilità sociale. Infatti, nonostante siano tutti stati identificati come predittori significativi di comportamenti pro-ambientali non erano mai stati indagati insieme.

Lo studio evidenzia l'importanza dell'utilizzo di modelli di predizione che tengano in considerazione la relazione tra diversi predittori. Infatti, inserendo nel modello anche la connessione con la natura e la sua relazione con le attitudini ambientali, il ruolo di moderatore di quest'ultime nella relazione tra restorativeness e comportamenti pro-ambientali riportato dagli studi precedenti sembra scomparire. Il ruolo della restorativeness potrebbe quindi essere meno importante di quello riportato dagli studi precedenti rispetto a quello della connessione con la natura, che risulta essere il predittore di comportamenti pro-ambientali più forte. Allo stesso tempo, la connessione con la natura è risultata essere l'unica variabile, tra quelle investigate, influenzata dalla desiderabilità sociale. La tendenza inconscia a fornire un'immagine positiva della propria persona spinge le persone a riferire un maggiore attaccamento alla natura. Quest'effetto potrebbe quindi aver influenzato la forte relazione riscontrata tra connessione con la natura e comportamenti pro-ambientali. Ulteriori studi sono necessari per approfondire tale relazione e per verificare se e come la desiderabilità sociale influenza indirettamente i comportamenti pro-ambientali. Lo studio suggerisce anche la necessità di indagare separatamente diversi tipi di comportamenti pro-ambientali in quando possono avere antecedenti diversi. Infatti, solo la connessione con la natura risulta predire tutti i comportamenti indagati dalla PEBS (conservazione, abitudini alimentari, trasporto e "cittadinanza" ambientale). Al contrario le attitudini ambientali predicono solo i comportamenti di "cittadinanza" ambientale (partecipare ad iniziative di gruppi ambientalisti e/o supportare economicamente tali gruppi). Tali risultati dovrebbero essere ripetuti in studi futuri con un campione della popolazione più

ampio e più eterogeneo. Inoltre, la mancanza di un effetto diretto delle attitudini ambientali sui CPA è in linea con gli studi che, basandosi sulla Teoria del Comportamento Pianificato (TCP) di Ajzen (1991), sottolineano come l'effetto delle attitudini sui comportamenti sia mediato dalle intenzioni (Kaiser, Hubner, & Bogner, 2005; Levine & Strube, 2012), principale predittore dei comportamenti (Bamberg & Möser, 2007). Nello stesso tempo, attraverso un'indagine meta-analitica è stato visto che le variabili considerate dalla TCP (attitudini, norme sociali e controllo comportamentale percepito) spiegano “solo” il 50% delle intenzioni. Altre variabili come ad esempio la connessione con la natura e la restorativeness percepita potrebbero essere incluse nel modello per aumentarne il suo potere predittivo. Di conseguenza, ulteriori studi dovrebbero verificare l'effetto delle variabili studiate in questo studio all'interno del modello proposto dalla TCP. In particolare, sulla base dei risultati presentati in questo elaborato, si ipotizza che la connessione con la natura sia un diretto predittore delle attitudini ambientali, norme soggettive e intenzioni. Mentre la restorativeness influenzerebbe direttamente le attitudini ambientali che a loro volta influenzerebbero le intenzioni.

Infine, studi futuri dovrebbero verificare se il modello proposto è utile per predire anche l'impatto reale delle persone sull'ambiente (impronta ecologica) e non solo i comportamenti self-reported.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. doi: 10.1016/0749-5978(91)90020-T
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14–25. doi: 10.1016/j.jenvp.2006.12.002
- Berto, R., & Barbiero, G. (2017). How the psychological benefits associated with exposure to nature can affect pro-environmental behavior. *Annals of Cognitive Science*, 1, 16-20. Retrieved from <https://scholarlypages.org/Articles/cognitive-science/acs-1-004.pdf>
- Byrka, K., Hartig, T., & Kaiser, F. G. (2010). Environmental Attitude as a Mediator of the Relationship between Psychological Restoration in Nature and Self-Reported Ecological Behavior. *Psychological Reports*, 107(3), 847–859. doi: 10.2466/07.PR0.107.6.847-859
- Gifford, R. (2014). Environmental Psychology Matters. *Annual Review of Psychology*, 65(1), 541–579. doi:10.1146/annurev-psych-010213-115048
- Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior With the Value-Belief-Norm Model in Explaining Conservation Behavior. *Journal of Applied Social Psychology*, 35(10), 2150–2170. doi: 10.1111/j.1559-1816.2005.tb02213.x
- Levine, D. S., & Strube, M. J. (2012). Environmental Attitudes, Knowledge, Intentions and Behaviors Among College Students. *The Journal of Social Psychology*, 152(3), 308–326. doi: 10.1080/00224545.2011.604363
- Markle, G. L. (2013). Pro-Environmental Behavior: Does It Matter How It's Measured? Development and Validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology*, 41(6), 905–914. doi:10.1007/s10745-013-9614-8
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to Urban Nature and Tree Planting Are Related to Pro-Environmental Behavior via Connection to Nature, the Use of Nature for Psychological Restoration, and Environmental Attitudes. *Environment and Behavior*, 51(7), 787–810. doi:10.1177/0013916517751009

APPENDIX A

Scala dei comportamenti Pro-Ambientali

Markle, 2013;

Adattamento italiano a cura di E. Menardo, M. Brondino & M. Pasini (2019)

Le seguenti domande riguardano diversi tipi di comportamenti pro-ambientali (ecologici) che le persone possono mettere in atto.

Per favore, legga attentamente ogni domanda e contrassegni la risposta che le sembra più vicina al suo comportamento.

1. Quanto spesso spegne la luce quando esce da una stanza? <i>[ESCLUSO]</i>				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
2. Quanto spesso spegne la modalità standby dei dispositivi e apparecchi elettronici?				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
3. Quanto spesso riduce l'uso del riscaldamento o dell'aria condizionata per limitare l'utilizzo dell'energia?				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
4. Quanto spesso spegne la televisione quando esce da una stanza? <i>[ESCLUSO]</i>				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
<input type="checkbox"/> Non possiedo la televisione				
5. Quanto spesso limita il suo tempo in doccia per conservare l'acqua?				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
6. Quanto spesso aspetta il pieno carico prima di usare la lavastoviglie o la lavatrice?				
<input type="checkbox"/> Mai	<input type="checkbox"/> Raramente	<input type="checkbox"/> Qualche volta	<input type="checkbox"/> Di solito	<input type="checkbox"/> Sempre
7. A quale temperatura lava la maggior parte dei vestiti? <i>[ESCLUSO]</i>				
<input type="checkbox"/> Calda (a partire da 60°)	<input type="checkbox"/> Tiepida (circa 30-40°)	<input type="checkbox"/> Meno di 30°	<input type="checkbox"/> Non lo so	<input type="checkbox"/> Non possiedo la lavatrice
8. Attualmente è membro di un gruppo ambientalista o di protezione della natura selvaggia?				
<input type="checkbox"/> No	<input type="checkbox"/> Sì			

9. Nell'ultimo anno ha fatto delle donazioni nei confronti di gruppi ambientalisti o di protezione della natura?

No Sì

10. Quanto spesso guarda programmi televisivi, film o video online su problemi ambientali?

Mai Raramente Qualche volta Spesso Continuamente

11. Quanto spesso parla con gli altri dei loro comportamenti pro-ambientali?

Mai Raramente Qualche volta Spesso Continuamente

12. Nell'ultimo anno ha aumentato il consumo di frutta e verdura biologici?

No Sì

13. Per favore, risponda alla seguente domanda sulla base del suo veicolo principale: approssimativamente quanti km per litro percorre il veicolo?

10 km o meno 11-12 km 13-14 km 15-16 km 17 km o più

Non conosco la risposta Non possiedo un veicolo a motore

14. Nell'ultimo anno ha ridotto il consumo di carne di manzo?

No Sì Non mangio carne di manzo

15. Nell'ultimo anno ha ridotto il consumo di carne di maiale?

No Sì Non mangio carne di maiale

16. Nell'ultimo anno ha ridotto il consumo di carne di pollo?

No Sì Non mangio carne di pollo

17. Nell'ultimo anno quanto spesso ha usato il car-pooled (condivisione del veicolo con altre persone, ad es., blablacar)? *[ESCLUSO]*

Mai Qualche volta Spesso

18. Nell'ultimo anno quanto spesso ha usato i trasporti pubblici?

Mai Qualche volta Spesso

19. Nell'ultimo anno quanto spesso è andato a piedi o ha usato la bicicletta invece che l'auto?

Mai Qualche volta Spesso

OSSERVAZIONI:
