

Outcome expectancy: A key factor to understanding childhood exposure to nature and children's pro-environmental behavior

Silvia Collado^{1*} and Gary W. Evans²

^{1*}Department of Psychology and Sociology, University of Zaragoza, Teruel, Spain.

Email: scollado@unizar.es

²Departments of Design & Environmental Analysis and of Human Development,

Cornell University, Ithaca, United States. Email: gwe1@cornell.edu

*Direct correspondence to Silvia Collado, Department of Psychology and Sociology, University of Zaragoza, Teruel Campus, Ciudad Escolar, 44003, Teruel, Spain; Phone: 0034 607364497; email scollado@unizar.es

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1 **1. Introduction**

2 Human behavior is largely responsible for the environmental issues we face
3 today (Cook et al., 2013), requiring a deeper understanding of the substance and
4 etiology of pro-environmental behaviors (Gifford, 2011; Otto, Kaiser, & Arnold, 2014;
5 Schultz & Kaiser, 2012). Pro-environmental behavior refers to actions that contribute to
6 the sustainability of nature (Schultz & Kaiser, 2012). Given that children will be the
7 ones grappling with future environmental challenges, and that most environmental
8 education programs are organized for youngsters, a better understanding of the factors
9 and processes leading children to behave in a more environmentally responsible manner
10 is relevant both for scientific and practical reasons.

11 One of the most widely documented correlates of pro-environmental behavior is
12 childhood experiences in natural environments (Chawla & Derr, 2012; Cheng &
13 Monroe, 2012; Evans, Otto, & Kaiser, 2018). Several ideas have been offered to explain
14 why experiences in nature at an early age could play a formative role in children's pro-
15 environmental behaviors. These explanations include an increase in connectedness with
16 nature (Cheng & Monroe, 2012; Otto & Pensini, 2017), enhanced appreciation of its
17 beauty and other positive characteristics (Müller, Kals, & Pansa, 2009), which, in turn,
18 promotes stronger place attachment (Hartig, Kaiser, & Bowler, 2001), enhanced
19 opportunities for self-directed exploration and learning (Chawla & Derr, 2012), renewal
20 of depleted attentional capabilities (i.e., psychological restoration) (Collado &
21 Corraliza, 2015; Hartig, Mitchell, De Vries, & Frumkin, 2014), and the development of
22 environmental ethics (Kahn, 2006). Nature experiences are also associated with more
23 positive environmental attitudes (Evans, Brauchle, Haq, Stecker, Wong, & Shapiro,
24 2007; Hartig, Kaiser, & Strumse, 2007). These have been defined as “concern for the
25 environment or caring about environmental issues” (Gifford & Sussman, 2012, p. 92)

26 and partially explain the relation between contact with nature and pro-environmental
27 behavior (Cheng & Monroe, 2012; Collado, Staats, & Corraliza, 2013; Hartig et al.,
28 2007; Wells & Lekies, 2006).

29 Despite the growing evidence supporting the link between contact with nature
30 and environmental attitudes and behavior, the degree of association is variable,
31 suggesting that other factors likely intercede with this relation. For example, Wells and
32 Lekies (2006) found that the type of experiences in nature as a child was associated with
33 adults' pro-environmental behaviors. Free play in nature (e.g., playing in the woods)
34 had a stronger link to adult pro-environmental behavior relative to compulsory
35 experiences in nature (e.g., planting trees). Similarly, children's previous frequency of
36 contact with nature moderates the relation between their current contact with nature and
37 pro-environmental attitudes and behavior, with current contact with nature being more
38 strongly associated with pro-environmental attitudes/behaviors when children's
39 frequency of past experiences in nature were low (Collado et al., 2015). Reasons for
40 heterogeneity in the strength of the contact with nature–pro-environmental attitudes and
41 behavior relations remain unclear. The primary aim of the present study is to examine
42 the possible moderating role of outcome expectancy in the variability in the strength of
43 the contact with nature–pro-environmental behavior relation.

44 Self-efficacy theory (Bandura, 1977) proposes that an individual's beliefs about
45 his/her capabilities of performing a behavior (i.e., self-efficacy) and the expectation that
46 an outcome will follow a given behavior (i.e., outcome expectancy) will affect the
47 probability of the individual to engage in the behavior that leads to the goal. Self-
48 efficacy (a construct similar to perceived behavioral control; Fishbein & Ajzen, 2010)
49 has been shown to predict the performance of different behaviors as well as to moderate
50 the relation between predictors of behavior and performance (Manstead, 2011).

51 Similarly, the capability of a behavior to accomplish a certain goal (i.e., outcome
52 expectancy) affects individuals' behavioral performance (Bandura, 1977). Yet,
53 compared to the extensive research work on how self-efficacy is related to pro-
54 environmental behavior (e.g., Homburg & Stolberg, 2006; Jugert, Greenaway, Barth,
55 Büchner, Eisentraut, & Fritsche, 2016; Tagkaloglou & Kasser, 2018), significantly less
56 attention has been paid to outcome expectancy. To reiterate, self-efficacy means the
57 extent to which the individual believes s/he is capable to perform a specific behavior-in
58 the present case pro-ecological behaviors, such as recycling glass. Outcome expectancy
59 refers to the belief that if one engages in the behavior (e.g. recycling), an outcome will
60 follow such behavior (e.g., my recycling will help the earth). Note that although these
61 two constructs are obviously related, as Bandura (1977) has shown through a decades
62 long research program, they are not the same and each independently contributes to the
63 probability of engaging in behavior.

64 The role of outcome expectancy in the development of cognitive explanations of
65 behavior has been studied in several behavioral domains. For instance, expectancy of
66 positive outcomes increased engagement in peer aggression (Pornari & Wood, 2010)
67 and elevated physical activity (Williams, Anderson, & Winett, 2005). Outcome
68 expectancy was also positively associated with academic performance (Zimmerman,
69 2000) and actions associated with better health (Gao, Xiang, Lee, & Harrison, 2014). In
70 addition to being instrumental in its influence on different behaviors, evidence shows
71 that outcome expectancy can have a moderating effect between a predictor of behavior
72 and actual engagement in the behavior (e.g., Steward, Wright, Hui, & Simmons, 2009).
73 Thus, the effect of different predictors on performance can be strengthened or weakened
74 by a person's beliefs of whether his/her actions can make a difference (Bandura, 1977,
75 Manstead, 2011; Fishbein & Azjen, 2010). The outcomes of individual efforts in pro-

76 environmental behavior are small and difficult to discern (Gifford, 2011). Indeed, as
77 several have noted this is one of the many characteristics of climate change that
78 contribute to general public antipathy towards this problem. Hence, the belief that
79 individual efforts will make a difference may be a relevant factor regulating people's
80 pro-environmental actions. In other words, the relation between a specific predictor of
81 behavior (e.g., behavioral intentions) and the performance of the behavior is
82 strengthened when the individual believes that his/her actions will lead to the desired
83 pro-environmental goal. Of particular interest to the current research, four studies with
84 adults have found interactions between outcome expectancy and predictors of pro-
85 environmental behavior. Landry, Gifford, Milfont, Weeks, and Arnocky (2018)
86 concluded that people with low relative to high outcome expectancy had a weaker
87 association between environmental concern and pro-environmental behavior. Similarly,
88 Staats, Jansen, and Thøgersen (2011) found that outcome expectancy strengthened the
89 relation between intention to use less pesticides and actual reductions in use. According
90 to Harland, Staats, and Wilke (2007), the relation between pro-environmental
91 behavioral intentions and performance was stronger for individuals high in outcome
92 expectancy. The predictive role of environmental concern on knowledge about
93 environmental issues and willingness to accept environmental protection regulations
94 was moderated by outcome expectancy (Ellen, Weiner, & Coob-Walgren, 1991). The
95 effect of environmental concern on perceived need for government involvement in
96 environmental protection was stronger for individuals with low outcome expectancy.

97 These findings suggest that an individual's beliefs that his/her behavior will (or
98 will not) lead to the desired outcome (i.e., outcome expectancy) is capable of
99 moderating relations between predictors of ecological behavior and such behaviors.

100 Building upon both the general outcome expectancy literature and specific findings on

126 Data were collected in four public primary schools in Madrid. Parents of
127 children in fourth, fifth and sixth grade received an informed consent letter from the
128 school. They were asked to report their educational level, their family socioeconomic
129 status and their children's contact with nature. Seventy-two percent of the parents
130 authorized their children to participate, six percent did not authorize them and the rest
131 did not reply. Child assent was also obtained. Questionnaires were completed
132 individually at school with assurance of child anonymity.

133 *2.3. Measures*

134 Data were collected via an Internet-based survey at school with a well-validated
135 game-format instrument developed for children as young as six years (Evans et al.,
136 2007). Items registering children's contact with nature (CN), environmental attitudes
137 (EA), pro-environmental behavior (EB) and outcome expectancy appeared on the
138 computer screen together with moveable animated cartoons indicating the direction and
139 intensity of children's responses. For CN and EB, participants indicated how frequently
140 they performed a series of actions.

141 For EA and outcome expectancy, children had to indicate whether they agreed
142 or disagreed with each sentence by clicking either the "agree" [green balloon] or
143 "disagree" [red balloon] button. Once the participant clicked on his/her selected option,
144 the [red/green] balloon expanded and two more options appeared: "a lot" (written in a
145 bigger font) or "a little" (written in a smaller font) thus yielding a scale ranging from 1
146 = disagree-a lot; 2 = disagree-a little; 3= agree- a little to 4 = agree- a lot. For further
147 details, see Evans et al. (2007).

148 *2.3.1. Contact with nature*

149 Children's CN was scored using four items used in prior work (Collado et al.,
150 2015; Gotch & Hall, 2004; Larson, Green, & Castleberry, 2011). Participants were

151 asked “How frequently in the past 12 months have you spent time in natural places such
152 as the country side, the beach, the mountains, etc?”; “2) “how frequently in the past 12
153 months have you visited places such as zoos or aquariums”; and asked to indicate: never
154 (1), between 1 and 5 times (2), between 6 and 10 times (3), and more than 10 times (4).
155 They were also asked 3) “Do you play in natural places after school time?” and 4) “Do
156 you play in natural places during the weekends?” Response format was 1 (never), 2
157 (sometimes), 3 (most of the times) and 4 (always). Internal consistency herein was good
158 ($\alpha = .79$), and comparable to prior work (Collado et al., 2015).

159 Because children’s independent mobility depends on parental permission,
160 parents were asked about their children’s CN as a partial check on the validity of the
161 child report data. The same items used for the children were attached to the parents’
162 consent letter, but referring to their child. For instance: “My child plays in natural
163 places after school time”. Internal consistency was good ($\alpha = .75$). The correlation
164 between parental responses and those of their children was $r = .65, p < .001$. In order to
165 minimize response bias in this cross sectional study, parental responses were used in the
166 subsequent analyses as a measure of children’s CN¹.

167 2.3.2. *Environmental attitudes*

168 We assessed EA with the New Environmental Paradigm (NEP). It is the most
169 widely-used instrument measuring people’s EA (Dunlap & Van Liere, 1978; Dunlap,
170 Van Liere, Mertig, & Jones, 2000; Hawcroft & Milfont, 2010). Previous studies have
171 shown that the NEP is positively correlated with EB (Collado et al., 2013; Olli,
172 Grendstad, & Wollebaek, 2001) and that children’s scores on the NEP increase after
173 exposure to nature (Evans et al., 2007; Manoli, Johnson, & Dunlap, 2007). The NEP,
174 adapted for use with children by Evans et al. (2007), was employed to measure

¹ The mediated moderation model (Figure 1A) was checked using children’s self-reported contact with nature as the independent variable instead of parental reports. The relations between the variables remained similar.

175 children's EA. It consists of eleven items (e.g., "Animals and people should be treated
176 equally") registering whether the respondent considers human impact on nature and
177 opinions about limits to growth. Internal consistency in the current sample was $\alpha = 0.82$.

178 *2.3.3. Environmental Behavior*

179 Children's self-reported EB was registered by 19 items related to daily
180 conservation habits, such as recycling paper, glass or plastic, reusing paper and saving
181 water (see Appendix A). For instance: "I recycle glass". The response format was: never
182 (1), sometimes (3), most of the times (3), or always (4). This measure is based on the
183 General Environmental Behavior (GEB) scale (Kaiser, 1998; Kaiser & Wilson, 2004)
184 and its adaptation for children (Collado, Evans, & Sorrel, 2017; Evans et al., 2007). The
185 internal consistency of the current sample was $\alpha = 0.80$. See Evans et al. (2007) for
186 additional data on the reliability and validity of the child NEP and EB scales,
187 respectively.

188 *2.3.4. Outcome expectancy*

189 As far as we know, there are no validated environmental outcome expectancy
190 instruments for children. We assessed outcome expectancy by four items that were as
191 specific as possible and that could be easily understood by children. These were: "When
192 I walk or cycle instead of travelling by car, I help to protect the animals and plants";
193 "When I switch off the light when leaving a room, I help to make animals and plants
194 that live in the wild happy"; "When turning off the tap while brushing my teeth, I help
195 to protect the places in nature where plants and animals live"; "When I recycle, I help to
196 protect plants and animals that live in the wild". Internal consistency was acceptable (α
197 = 0.70).

198 We conducted extensive pilot testing with a different sample of 60 children to
199 validate the outcome expectancy measure. Forty-two children filled in the

224 Our next step was to check the hypothesized CN*outcome expectancy
225 interaction (H1) by conducting a two-step regression analysis on EB. On step 1, we
226 entered CN and outcome expectancy. On step 2, we entered the CN*outcome
227 expectancy interaction term. More CN was associated with more EB ($\beta = .59, p < .001$)
228 but this association was moderated by outcome expectancy ($\beta = -.13, p < .001$). The
229 interactive model explained 25% of the variance of children's EB. To follow up on this
230 significant interaction, we conducted floodlight analyses (Joireman & Liu, 2014;
231 Landry et al., 2018; Spiller, Fitzsimons, Lynch, & McClelland, 2013). Deconstruction
232 of the interaction showed that the relation between CN and EB was significant for those
233 with expectancy scores less than or equal to 3.70. In other words, CN seems to have a
234 stronger effect on EB for children with low outcome expectancy than for those with
235 high outcome expectancy (Figure 2). Note this is the opposite interactive pattern than
236 expected in Hypothesis 1.

237 INSERT FIGURE 2 ABOUT HERE

238 We next explored whether EA could explain the interactive effect of CN and
239 outcome expectancy on EB (Hypothesis 2, Figure 1B). This mediated moderation was
240 analyzed with PROCESS program (Model 8) to estimate the confidence interval for the
241 indirect effect. The direct effect of CN on EB became non significant ($\beta = .10, p = .11$)
242 as did the interaction effect between CN and outcome expectancy ($\beta = -.02, p = .25$) on
243 EB with the inclusion of EA in the model. There is a direct effect of the interaction term
244 on EA ($\beta = -.15, p < .001$), and a direct main effect of EA on EB ($\beta = .45, p < .001$). The
245 CI for the indirect effect of CN*outcome expectancy on EB via EA was [.02, .05],
246 suggesting that the interactive effect of CN and outcome expectancy on children's EB is
247 mediated by EA. The model explained 44.52% of EB variance.

248 Last, we examined whether the above results could be influenced by SES. We
249 reran all of the above models with the addition of household income and parental
250 education. There were no changes in the outcomes (see Supplementary material).

251 **4. Discussion**

252 There is growing recognition of the relevance that childhood contact with nature
253 has for the development of pro-environmental attitudes and behaviors (Chawla & Derr,
254 2012; Evans, Otto, & Kaiser, 2018; Whitburn, Linklater, & Milfont, 2018). More
255 specifically, direct experience in nature increase people's frequency of conducting
256 environmentally friendly actions (Evans et al., 2018; Chawla & Derr, 2012; Hinds &
257 Sparks, 2008), and this effect is partially mediated by increased environmental attitudes
258 (Cheng & Monroe, 2012; Collado et al., 2013; Wells & Lekies, 2006).

259 Despite the accumulated evidence on the positive link between contact with
260 nature and pro-environmental behaviors, the strength of this relation varies according to
261 individual factors, such as previous experiences in nature (Collado et al., 2015) and type
262 of nature exposure (compulsory vs free play) (Wells & Lekies, 2006). However,
263 potential individual factors moderating the contact with nature-pro-environmental
264 behavior relation have received little systematic attention. To fill this gap in the
265 literature, we focus on outcome expectancy as one individual factor that may affect the
266 strength of the contact with nature-pro-environmental behavior relation. Previous
267 research with adults has found a moderating effect of outcome expectancy on the
268 relation between individual predictors of pro-environmental behavior and pro-
269 environmental behavior (e.g., Landry et al., 2018, Staats et al., 2011). This is in line
270 with research in other behavioral domains (e.g., Steward et al., 2009; Williams et al.,
271 2005), as well as with the propositions of social cognitive theorists (e.g., Witte & Allen,
272 2000). Building upon this prior work and theorizing, we examined whether children's

273 outcome expectancy would increase the strength of the relation between contact with
274 nature (as a predictor of pro-environmental behavior) and pro-environmental behavior
275 (H1) and explored whether this effect would be explained by environmental attitudes
276 (H2).

277 In line with previous studies (Chawla & Derr, 2012; Cheng & Monroe, 2012;
278 Collado et al., 2015; Evans et al., 2007; 2018), exposure to nature was positively
279 associated with pro-ecological behaviors among children. This association was
280 moderated by children's beliefs of whether their actions can contribute to protecting the
281 environment (i.e., outcome expectancy) but, contrary to what we expected (H1), the
282 moderating effect was negative. We can only speculate why this counterintuitive effect
283 may have occurred. One possible reason for the interaction pattern found in Figure 2
284 may be that when children already have a strong conviction that they are capable of
285 positively influencing environmental quality, factors such as more frequent or intensive
286 experiences in nature may be relatively superfluous given their already high degree of
287 outcome expectancy. This interpretation of the moderating pattern uncovered herein is
288 similar to one study on environmental outcome expectancy in adults. Ellen et al. (1991)
289 found that for individuals who reported high outcome expectancy, the effect of
290 environmental concern on demands for more government environmental regulation was
291 weaker than for those who did not think their actions could make a difference. Another
292 possible explanation for our findings is that children with higher environmental
293 outcome expectancy also have stronger pro-environmental attitudes. Collado and
294 colleagues (2015) found that contact with nature had a weaker association with pro-
295 environmental behavior for those children with stronger pro-environmental attitudes.

296 The present results and several others document that early childhood experiences
297 in nature predict more pro-ecological behaviors both in childhood (Cheng & Monroe,

298 2012) and later in adulthood (Evans et al., 2018; Hinds & Sparks, 2008; Ward
299 Thompson, Aspinall, & Montarzino, 2008). Nonetheless, as indicated earlier, the
300 strength of these associations is heterogeneous suggesting the operation of one or more
301 moderating factors. For the first time, we have empirically demonstrated that outcome
302 expectancy may alter the strength of the connection between childhood experiences in
303 nature and the development of pro-ecological behaviors.

304 In order to explore potential underlying reasons for the interaction of contact
305 with nature and outcome expectancy on children's pro-environmental behavior, a
306 mediated moderator analysis was conducted with environmental attitudes as a possible
307 mediator. In line with H2, we found that the interactive effect of contact with nature and
308 outcome expectancy was mediated by environmental attitudes. In other words, the
309 moderation effect appears to be produced through environmental attitudes. Contact with
310 nature is more strongly related to environmental attitudes for children whose outcome
311 expectancy is low. Environmental attitudes, in turn, were positively associated with
312 children's self-reported pro-environmental behavior. These results indicate that the
313 relation between contact with nature and environmental attitudes/behavior is stronger
314 for children low in outcome expectancy. It is noteworthy that this mediated moderation
315 model accounts for a greater proportion of pro-environmental behavior variance (>40%)
316 than most child pro-environmental behavior studies (Cheng & Monroe, 2012; Collado
317 et al., 2015; Evans et al., 2018).

318 Our findings have potentially important implications for the design of
319 environmental education programs. First, in light of the positive link between contact
320 with nature and pro-environmental behavior found in this study as well as in previous
321 ones (e.g., Chawla & Derr, 2012; Evans et al., 2018), we encourage environmental
322 educators to organize their programs outside in nature. This way children can benefit

323 from the formal instruction of the program as well as from the direct experience of
324 nature. Second, given our results and others with adults (Ellen et al., 1991; Harland et
325 al., 2007; Lam, 2006; Lam & Chen, 2006; Staats et al., 2011) on the saliency of
326 outcome expectancy for conducting pro-environmental behavior, environmental
327 educators should consider ways to enhance children's outcome expectancy for
328 protecting the environment. The severity of environmental problems can be
329 overwhelming, especially for children (Gifford, 2011; Sobel, 1996). Highlighting the
330 seriousness of environmental issues such as Global Climate Change might generate the
331 perception that nothing one person can do would matter (Evans, 2018; Gifford, 2011).
332 Considering that children's abstract thinking is still developing (Dumontheil, 2014;
333 Piaget, 1962), issues such as climate change or the extinction of species might be
334 difficult to link to specific individual actions. Given that outcome expectancy
335 contributes to children's pro-environmental behaviors, educators could emphasize how
336 performing small tasks locally is related to specific outcomes, both locally and globally.
337 For instance, children could be taught not only about how to recycle, which is related to
338 individual beliefs about one's capabilities to perform a target behavior of interest (i.e.,
339 self-efficacy), but also about what the results of recycling are, such as how many trees
340 are being saved by the amount of paper a child can recycle in a year. Feedback about
341 the patterns needed to accomplish given outcomes can be more influential in regulating
342 people's actions than reinforcement itself (Bandura, 1977). Furthermore, our findings
343 point out that frequent experiences in nature are especially relevant for children low in
344 outcome expectancy. In order to overcome children's feelings that their actions have no
345 repercussions for the health of the environment, initiatives that encourage children's
346 contact with nature should be promoted.

347 Some limitations should be considered when interpreting the findings. First, our
348 study is cross-sectional and results should not be interpreted causally. Other currently
349 unspecified factors could also be associated with the outcome expectancy by contact
350 with nature interaction on pro-environmental behaviors. For instance, how much and in
351 what manner children’s parents engage with nature might also prove impactful. It may
352 also be that other factors included in Bandura’s theory (1977), such as self-efficacy,
353 play a role in the contact with nature by outcome expectancy relation. Future studies
354 should look at the joint roles of self-efficacy and outcome expectancy in regulating
355 children’s pro-environmental behavior, as well as the mechanisms influencing both
356 constructs. Nevertheless, the fact that we found an interaction effect indicates that our
357 model is less subject to threats to internal validity than prior work on the direct link
358 between contact with nature and pro-environmental behavior. Any alternative causal
359 explanation for our results would have to explain the interaction as well as the main
360 effects. The plausibility of such alternative explanations is much lower (Cook &
361 Campbell, 1979). It is also worth noting that response bias was minimized in the present
362 study by using parental reports of their children’s frequency of contact with nature and
363 that the addition of parental education of household income as statistical controls did
364 not change any of the findings. The best way to address the internal validity weakness
365 of our study would be to conduct a true experiment with manipulation of exposure to
366 nature and of outcome expectancy.

367 A second limitation concerns the fact that we assessed self-reported rather than
368 actual pro-environmental behavior. It should also be noticed that some of the behaviors
369 included in the pro-environmental behavior scale (e.g., I separate waste) are likely to be
370 dependent on parental decisions. Future studies could consider the effect of parental
371 descriptive and injunctive norms on children’s pro-environmental behavior, especially

372 for those behaviors in which parents are usually more involved (e.g., means of transport
373 to school). The veracity of children's responses should also be evaluated by, for
374 instance, asking parents about the frequency of their children's pro-environmental
375 actions or by direct observation.

376 *4.1. Conclusion*

377 The present study extends knowledge about factors and processes linked to
378 children's pro-environmental behavior. We show outcome expectancy moderates the
379 well-documented link between children's exposure to natural environments and more
380 ecologically responsible behavior. Experiences in nature, while important, seem to
381 matter less for a child who already has a well developed sense of outcome expectancy
382 for environmental challenges. This highlights the necessity of considering outcome
383 expectancy when trying to explain differences in the benefits of exposure to nature for
384 people's engagement in pro-environmental behaviors. Our results also suggest the
385 practical importance of providing feedback about how individual actions help to achieve
386 local and global environmental goals. We encourage social scientists studying
387 ecological behavior to not only examine its correlates but to probe deeper into the
388 psychological processes underlying the etiology of pro-environmental behavior.

389 **5. References**

- 390 Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change.
391 *Psychological Review*, 84, 191-215. doi: 10.1037/0033-295X.84.2.191
- 392 Chawla, L., & Derr, V. (2012). The development of conservation behaviors in
393 childhood and youth. In S. Clayton (Ed.), *The Oxford handbook of environmental
394 and conservation psychology* (pp. 527-555). New York: Oxford University Press.

- 395 Cheng, J. C., & Monroe, M. C. (2012). Connection to nature: Children's affective
396 attitude toward nature. *Environment and Behavior*, *44*, 31-49. doi:
397 10.1177/0013916510385082
- 398 Collado, S., & Corraliza, J. A. (2015). Children's restorative experiences and self-
399 reported pro-environmental behaviors. *Environment and Behavior*, *47*, 38-56. doi:
400 10.1177/0013916513492417
- 401 Collado, S., Corraliza, J. A., Sorrel, M. A., & Evans, G. W. (2015). Spanish version of
402 the Children's Ecological Behavior (CEB) scale. *Psicothema*, *27*, 82-87. doi:
403 10.7334/psicothema2014.117
- 404 Collado, S., Corraliza, J. A., Staats, H., & Ruiz, M. A. (2015). Effect of frequency and
405 mode of contact with nature on children's self-reported ecological behaviors.
406 *Journal of Environmental Psychology*, *41*, 65-73. doi: 10.1016/j.jenvp.2014.11.001
- 407 Collado, S., Evans, G. W., & Sorrel, M. A. (2017). The role of parents and best friends
408 in children's pro-environmentalism: Differences according to age and gender.
409 *Journal of Environmental Psychology*, *54*, 27-37. doi: 10.1016/j.jenvp.2017.09.007
- 410 Collado, S., Staats, H., & Corraliza, J. A. (2013). Experiencing nature in children's
411 summer camps: Affective, cognitive and behavioral consequences. *Journal of*
412 *Environmental Psychology*, *33*, 37-44. doi: 10.1177/0013916513492417
- 413 Cook, T.D. & Campbell, D.T. (1979). *Quasi-experimentation: Design and analysis for*
414 *field settings*. Chicago: Rand McNally.
- 415 Cook, J., Nuccitelli, D., Green, S. A., Richardson, M., Winkler, B., Painting, R., &
416 Skuce, A. (2013). Quantifying the consensus on anthropogenic global warming
417 in the scientific literature. *Environmental Research Letters*, *8*, 1-7. doi:
418 10.1088/1748-9326/8/2/024024
- 419 Dumontheil, I. (2014). Development of abstract thinking during childhood and

420 adolescence: The role of rostralateral prefrontal cortex. *Developmental Cognitive*
421 *Neuroscience, 10*, 57-76. doi: 10.1016/j.dcn.2014.07.009

422 Dunlap, R. E., & Van Liere, K. (1978). The new ecological paradigm. *Journal of*
423 *Environmental Education, 9*, 10-19. doi: 10.3200/JOEE.40.1.3-18

424 Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring
425 endorsement of the new ecological paradigm: A revised NEP scale. *Journal of*
426 *Social Issues, 56*, 425-442. doi: 10.1111/0022-4537.00176

427 Ellen, P. S., Weiner, J. L., & Cobb-Walgren, C. (1991). The role of perceived consumer
428 effectiveness in motivating environmentally conscious behaviors. *Journal of Public*
429 *Policy & Marketing, 10*, 102-117.

430 Evans, G.W. (2018). Projected behavioral impacts of global climate change. *Annual*
431 *Review of Psychology*. In press. doi: 10.1146/annurev-psych-010418-103023.

432 Evans, G. W., Otto, S., & Kaiser, F. G. (2018). Childhood origins of young adult
433 environmental behavior. *Psychological Science, 29*, 679-687. doi:
434 10.1177/0956797617741894

435 Evans, G. W., Brauchle, G., Haq, A., Stecker, R., Wong, K., & Shapiro, E. (2007).
436 Young children's environmental attitudes and behaviors. *Environment and*
437 *Behavior, 39*, 635-659. doi: 10.1177/0956797617741894

438 Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned*
439 *action approach*. New York, NY: Psychology Press.

440 Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate
441 change mitigation and adaptation. *American Psychologist, 66*, 290-302. doi:
442 10.1037/a0023566.

- 443 Gifford, R., & Sussman, R. (2012). Environmental attitudes. In S. Clayton (Ed.), *The*
444 *Oxford handbook of environmental and conservation psychology* (pp. 92-114). New
445 York: Oxford University Press
- 446 Gotch, C., & Hall, T. (2004). Understanding nature-related behaviours among children
447 through a theory of reasoned action approach. *Environmental Education Research,*
448 *10*, 157-177. doi: 10.1080/13504620242000198159
- 449 Harland, P., Staats, H., & Wilke, H. A. M. (2007). Situational and personality factors as
450 direct or personal norm mediated predictors of pro-environmental behavior:
451 questions derived from norm-activation theory. *Basic and Applied Social*
452 *Psychology, 29*, 323-334. doi: 10.1080/01973530701665058
- 453 Hartig, T., Kaiser, F., & Bowler, P. (2001). Psychological restoration in nature as a
454 positive motivation for ecological behavior. *Environment and Behavior, 33*, 590-
455 607. doi: 10.1177/00139160121973142
- 456 Hartig, T., Kaiser, F., & Strumse, E. (2007). Psychological restoration in nature as a
457 source of motivation for ecological behaviour. *Environmental Conservation, 34*,
458 291-299. doi: 10.1017/S0376892907004250
- 459 Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual*
460 *Review of Public Health, 35*, 207-228. doi: 10.1146/annurev-publhealth-032013-
461 182443
- 462 Hawcroft, L. J., & Milfont, T. L. (2010). The use (and abuse) of the new environmental
463 paradigm scale over the last 30 years: A meta-analysis. *Journal of Environmental*
464 *Psychology, 30*, 143-158. doi: 10.1016/j.jenvp.2009.10.003
- 465 Hinds, J., & Sparks, P. (2008). Engaging with the natural environment: The role of
466 affective connection and identity. *Journal of Environmental Psychology, 28*, 109-
467 120. doi: 10.1016/j.jenvp.2007.11.001

468 Homburg, A., & Stolberg, A. (2006). Explaining pro-environmental behavior with a
469 cognitive theory of stress. *Journal of Environmental Psychology, 26*, 1-14. doi:
470 10.1016/j.jenvp.2006.03.003

471 Joireman, J., & Liu, R. L. (2014). Future-oriented women will pay to reduce global
472 warming: Mediation via political orientation, environmental values, and beliefs
473 in global warming. *Journal of Environmental Psychology, 40*, 391-400. doi:
474 10.1016/j.jenvp.2014.09.005

475 Jugert, P., Greenaway, K. H., Barth, M., Büchner, R., Eisentraut, S., & Fritsche, I.
476 (2016). Collective efficacy increases pro-environmental intentions through
477 increasing self-efficacy. *Journal of Environmental Psychology, 48*, 12-33. doi:
478 10.1016/j.jenvp.2016.08.003

479 Kaiser, F. G. (1998). A general measure of environmental behavior. *Journal of Applied*
480 *Social Psychology, 28*, 395-422. doi: 10.1111/j.1559-1816.1998.tb01712.x

481 Kaiser, F. G., & Wilson, M. (2004). Goal directed conservation behavior: The specific
482 composition of general performance. *Personality and Individual Differences, 36*,
483 1531-1544. doi: 10.1016/j.paid.2003.06.003

484 Kahn, P. H. (2006). Nature and moral development. In M. Killen & J. G. Smetana
485 (Eds.), *Handbook of moral development* (pp. 461-480). Mahwah, NJ: Lawrence
486 Erlbaum Associates.

487 Landry, N., Gifford, R., Milfont, T., Weeks, A., & Arnocky, S. (2018). Learned
488 helplessness moderated the relationship between environmental concern and
489 behavior. *Journal of Environmental Psychology, 55*, 18-22. doi:
490 10.1016/j.jenvp.2017.12.003

491 Lam, S. P. (2006). Predicting intention to save water: theory of planned behavior,
492 response efficacy, vulnerability, and perceived efficiency of alternative solutions.

493 *Journal of Applied Social Psychology*, 36, 2803-2824. doi:10.1111/j.0021-
494 9029.2006.00129.x

495 Lam, S. P., & Chen, J. K. (2006). What makes customers bring their bags or buy bags
496 from the shop? A survey of customers at a Taiwan Hypermarket. *Environment and*
497 *Behavior*, 38, 318-332. doi: 10.1177/0013916505278327

498 Larson, L. R., Green, G. T., & Castleberry, S. B. (2011). Construction and validations
499 of an instrument to measure environmental orientations in a diverse group of
500 children. *Environment and Behavior*, 43, 72-89. doi: 10.1177/0013916509345212

501 Manoli, C. C., Johnson, B., & Dunlap, R. E. (2007). Assessing children's environmental
502 worldviews: Modifying and validating the new ecological paradigm scale for the
503 use with children. *Journal of Environmental Education*, 38, 3-13. doi:
504 10.3200/JOEE.38.4.3-13

505 Manstead, A. S. (2011). The benefits of a critical stance: a reflection on past papers on
506 the theories of reasoned action and planned behavior. *British Journal of Social*
507 *Psychology*, 50, 366-373. doi: 10.1111/j.2044-8309.2011.02043.x.

508 Müller, M. M., Kals, E., & Pansa, R. (2009). Adolescents' emotional affinity toward
509 nature. *Journal of Developmental Processes*, 4, 59-69. doi: citeulike-article-
510 id:7694522

511 Olli, E., Grendstad, G., & Wollebaek, D. (2001). Correlates of environmental behaviors:
512 Bringing back social context. *Environment and Behavior*, 33, 181-208. doi:
513 10.1177/0013916501332002

514 Otto, S., Kaiser, F. G., & Arnold, O. (2014). The critical challenge of climate change for
515 psychology. Preventing rebound and promoting more individual irrationality.
516 *European Psychologist*, 19, 96-106. doi: 10.1027/1016-9040/a000182

517 Otto, S., & Pensini, P. (2017). Nature-based environmental education of children:
518 Environmental knowledge and connectedness to nature, together, are related to
519 ecological behavior. *Global Environmental Change*, 47, 88-94. doi:
520 10.1016/j.gloenvcha.2017.09.009

521 Piaget, J. (1962). *Play, dreams and imitation in childhood*. New York: Norton (Original
522 title: *La formation du Symbole chez L'enfant: Imitation, Jeu et Reve Image et*
523 *representation*).

524 Sobel, D. (1996). *Beyond ecophobia: Reclaiming the heart in nature education*. Great
525 Barrington, MA: The Orion Society.

526 Spiller, S. A., Fitzsimons, G. J., Lynch, J. G., & McClelland, G. H. (2013). Spotlights,
527 floodlights, and the magic number zero: Simple effects tests in moderated
528 regression. *Journal of Marketing Research*, L, 277-288. doi:
529 10.1509/jmr.12.0420

530 Staats, H., Jansen, L., & Thøgersen, J. (2011). Greening the greenhouse grower. A
531 behavioral analysis of a sector-initiated system to reduce the environmental load of
532 greenhouses. *Journal of Environmental Management*, 92, 2461-2469. doi:
533 10.1016/j.jenvman.2011.05.007

534 Schultz, P. W., & Kaiser, F. (2012). Promoting pro-environmental behavior. In S.
535 Clayton (Ed.), *The Oxford handbook of environmental and conservation*
536 *psychology* (pp. 556-580). New York: Oxford University Press.

537 Ward Thompson, C., Aspinall, P., & Montarzino, A. (2008). The childhood factor.
538 Adults' visits to green places and the significance of childhood experience.
539 *Environment and Behavior*, 40, 111-143. doi: 10.1177/0013916507300119

540 Wells, N., & Lekies, K. (2006). Nature and the life course: Pathways from childhood
541 nature experiences to adult environmentalism. *Children, Youth and Environments*,
542 *16*, 2-25.

543 Whitburn, J., Linklater, W. L., & Milfont, T. L. (2018). Exposure to Urban Nature and
544 Tree Planting Are Related to Pro-Environmental Behavior via Connection to
545 Nature, the Use of Nature for Psychological Restoration, and Environmental
546 Attitudes. *Environment and Behavior*. In press. doi:10.1177/0013916517751009

547 Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for
548 effective public health campaigns. *Health Education & Behavior*, *27*, 591-615.
549 doi: 10.1177/109019810002700506

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555 Appendix A

556 **Children's pro-environmental behaviours scale** (adapted from the Children's
557 Ecological Behaviors Scale; Evans et al., 2007). Response format: never (1), sometimes
558 (2), most of the times (3), always (4).

559

- 560 1. After one day of use, my sweaters or pants go into the laundry.
- 561 2. As the last person to leave the room, I switch off the lights.
- 562 3. I leave electrically powered appliances (TV, stereo, printer) on standby (standby
563 means background power is on so it turns on without warming up).
- 564 4. I ride a bicycle, take public transportation or walk to school.
- 565 5. If I am offered a plastic bag in a store, I take it. (*Reverse*)
- 566 6. I reuse the shopping bags.
- 567 7. I recycle used paper.
- 568 8. I keep gift wrapping paper for reuse.
- 569 9. For making notes, drawing, etc., I take paper that is already used on one side.
- 570 10. I put empty batteries in the garbage. (*Reverse*)
- 571 11. I turn off the water when I brush my teeth.
- 572 12. I read books, publications, and other materials about environmental problems.
- 573 13. I stand in front of the refrigerator with the door open trying to decide what I
574 want to eat. (*Reverse*)
- 575 14. I learn about environmental issues in the media (newspapers, magazines, TV, the
576 Internet).
- 577 15. After a picnic, I leave the place as clean as it was before.
- 578 16. I recycle glass bottles.

579 17. How often do you throw stuff on the ground when you don't see any trash cans?

580 (*Reverse*)

581 18. I place plastic waste in the recycling bin.

582 19. I separate waste.

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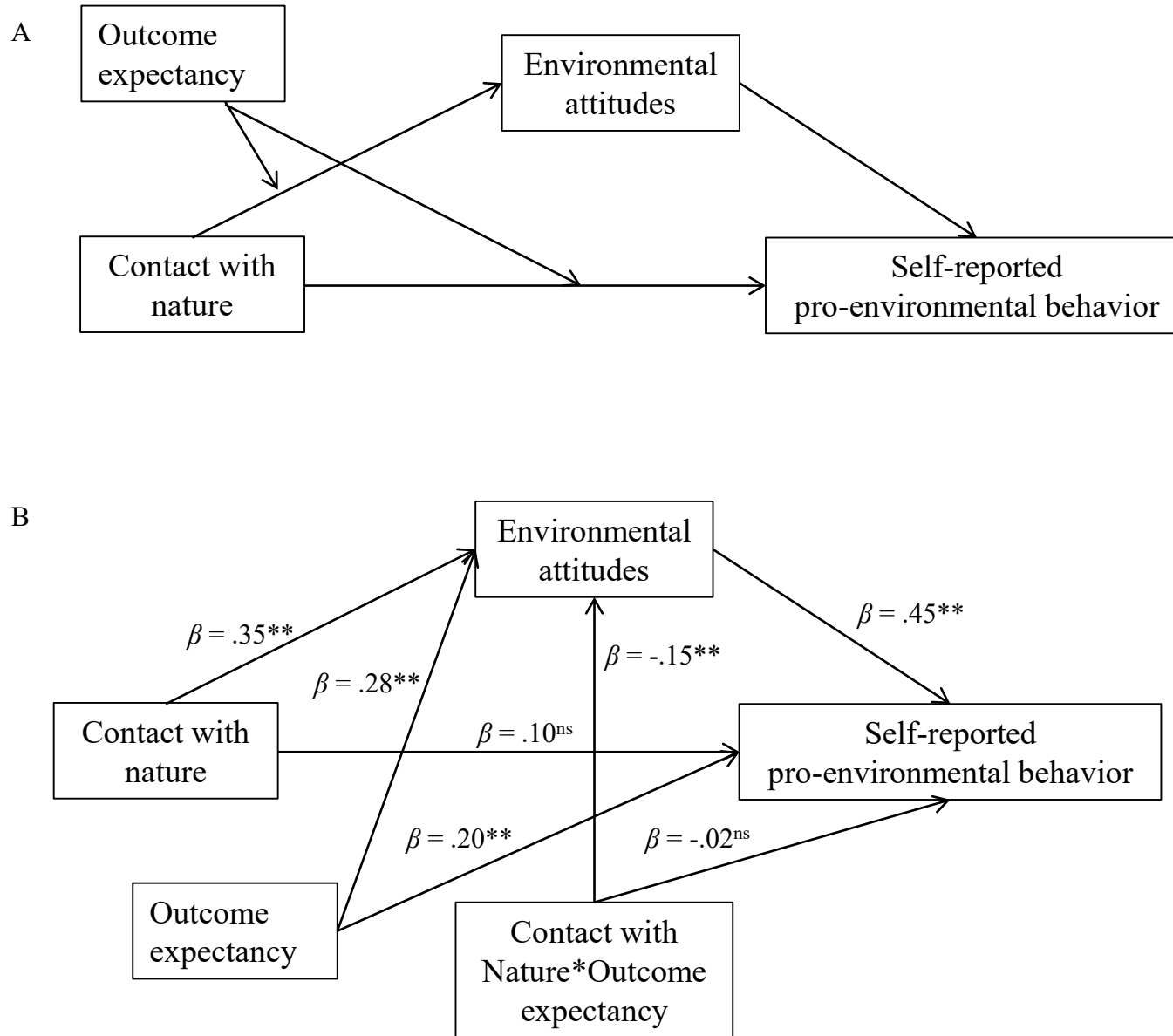


Figure 1. Hypothesized relation between the variables (A) and statistical diagram with regression weights for the moderated mediation model (B). $^{**}p < .01$, ns = non significant

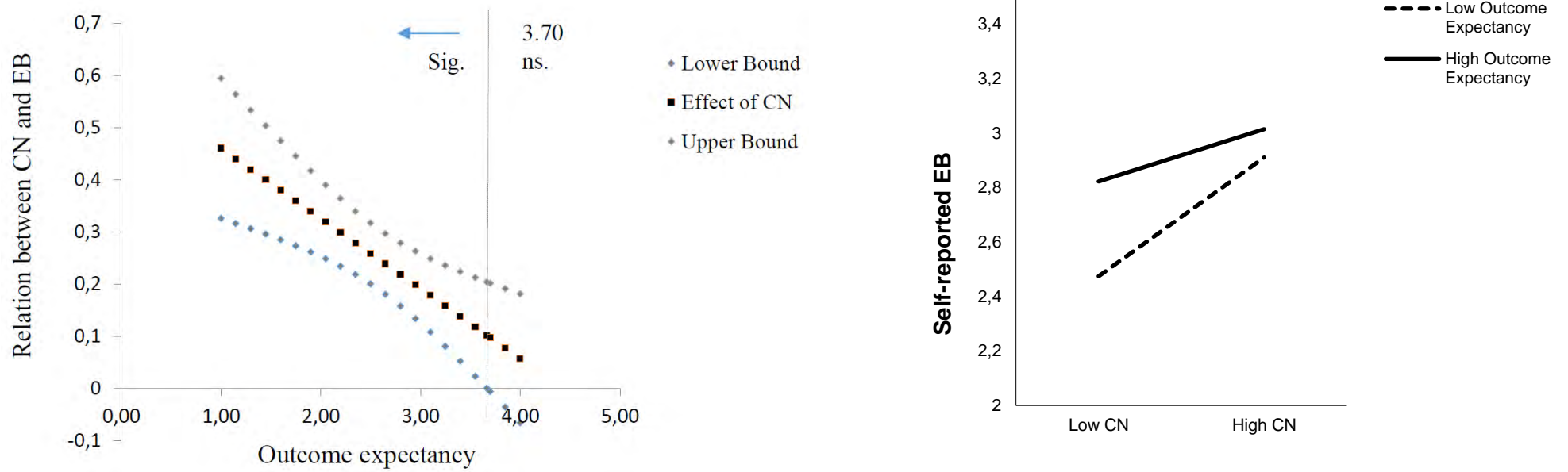


Figure 2. Johnson-Neyman confidence limits (left) and standardized moderation effect of Outcome Expectancy scores on the relation between frequency of contact with nature and self-reported pro-environmental behavior and (right). CN = Contact with nature; EB = pro-environmental behavior.