

How Childhood Nature Exposure Can Influence Well-being and Connection to Nature in
Adulthood

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Abstract

Promotion of nature experiences in childhood may affect psychological well-being in adulthood. Nature provides numerous benefits that are increasingly documented in literature. Previous research has shown that an individual's connectedness to nature can promote well-being characteristics, and childhood nature experiences help to shape that connection in adulthood. In association with adult experiences and nature, childhood experiences with nature can possibly predict the extent to which they come to appreciate and benefit from natural environments. The current study examines the impact of exposure to nature on well-being, and the possible moderating effects of childhood nature experiences (CNE) and adult connection to nature (CN) upon this relationship. The study is a two-group experiment, in which participants were randomly assigned either to a control group (spending 10 minutes in an outdoor space with little green space) or a nature exposure group (like the control group but surrounded by nature). Contrary to hypotheses, there was no significant difference in well-being between a group who observed man-made environments versus a group who observed natural environments. CNE and CN also did not moderate the relationship between experimental condition and well-being scores. However, results did find a small, positive correlation between CNE and CN, as well as a main effect in which higher CN scores are associated with higher well-being scores. Further research needs to be done to properly measure and examine the relationship between adult connection to nature, positive childhood nature experiences, and how that affects overall well-being. Limitations and implications for future research are discussed.

How Childhood Nature Exposure Can Influence Well-being and Connection to Nature in Adulthood

Promotion of nature experiences in childhood may affect psychological well-being in adulthood. Nature provides numerous benefits that are increasingly documented in the literature. There is evidence that exposure to nature promotes positive emotions and self-esteem, reduces stress and depressive symptoms, increases positive mood, and perceived mental and physical health (Aerts et al., 2018). A widely accepted definition of nature is provided by the field of ecology, which describes the environment more broadly as the sum of all external conditions that surround a system, community, or object (Stavrianos, 2016). The environment is divided into two parts: “manmade” and “natural”. The “natural” environment includes natural ecosystems which are either existing or were created in nature and cannot be man-made.

The relationship between humans and nature has been explored through various perspectives. The biophilia hypothesis, therapeutic landscapes and place attachment are only a handful of ways in which the human-nature relationship has been examined (Cleary et al., 2020). According to Kellert (1993), contact with the natural environment is essential as it is just as important as having contact with other people as for healthy development (Stavrianos, 2016). The biophilia hypothesis proposes that contact with nature is an integral part of health: mentally, physically, and emotionally, and that all humans have an innate, evolutionarily based connection and need for natural environments. In addition, it has been found that humans have an innate interest in nature scenery due to a “hypothesized instinctual preference for green environments” (Craig et al., 2015, p. 1061). This growing body of research suggests that exposure to the natural environment is likely an important factor that contributes to the development of human feeling and functioning (McMahan & Estes, 2015).

Increasingly, children have been spending more time indoors and on electronics than spending time outside compared to past generations (Suchert et al, 2015). Historically, humans have spent most of their time outside and participated in primarily outdoor activities. As technology advances, society is gearing toward a more “technological” mindset. Research has documented the dangers that too much technology can create. For example, screen time is associated with “less psychological well-being and quality of life” (Suchert et al., 2015, p. 54). Nature tends to promote positive well-being, while technology has the potential to stunt it. Nature provides a way for children to engage in physical activity and avoid patterns of sedentary behavior. High levels of physical activity and low levels of sedentary behavior are positively associated with better mental health among children and adolescents (Sampasa-Kanyinga et al., 2020). Promotion of healthy behaviors is crucial in childhood, as initial symptoms of mental disorders usually occur in childhood and adolescence and carry on into adulthood (Suchert et al., 2015). Being that mental disorders frequently occur first in childhood, improving mental health among children is critical to preserving an individuals’ overall health through childhood into adulthood.

Whereas there is significant evidence for benefits of nature exposure in both childhood and adulthood (Suchert et al., 2015), there is relatively little literature that examines the relationship between childhood nature experiences and the influence on adult perception of nature, which in turn may have an influence on well-being in adulthood. The current study examines the impact of exposure to nature on well-being, and the possible moderating effects of childhood nature experiences and adult connection to nature upon this relationship.

Nature and Well-being

Numerous studies highlight the importance of nature for one's well-being and the impact it has on overall well-being. For example, environmental psychologists found that observing nature scenery remedies negative effects, including mental fatigue and stress, and increases overall cognitive performance (Craig et al., 2015). A study conducted by Olafsdottir et al. (2020), examined how recreational nature exposure affects mood and psychophysiological responses to stress. The researchers aimed to test if walking in nature promotes positive effects on mood and psychophysiological acute and chronic stress responses, compared with exercise and a virtual setting, which had participants watch a nature video on a television screen in a laboratory environment. Results of the study found that when the individuals were under more stress, those who walked in nature experienced the largest decrease in cortisol levels. This difference remained significant even after controlling for baseline differences, which indicates that walking in nature may reduce stress when experiencing higher chronic stress levels (Olafsdottir et al., 2020). In addition, it was found that participants in the nature group had significantly lower cortisol levels compared with the video group after the intervention. This finding suggests that physically being present in nature was most effective when under both high and low chronic stress as compared to a virtual condition. A study conducted by Richardson et al. (2020) examined how nature can bring calmness and increase well-being in adolescents via a 9-week intervention. Results found that the intervention helped residents manage their emotions, which in turn supported their mental health and promoted a general sense of wellbeing. The authors attribute this finding to attention restoration theory (ART), which proposes that natural environments help restore fatigued attention resources, which aids in concentration and focus.

Neill et al. (2019) investigated how contact with nature influences benefits for hedonic and self-transcendent emotions. Results show that short-term contact with nature improved both hedonic (e.g. happiness) and self-transcendent emotions (e.g. empathy), and that duration of contact did not have impact on said improvement. In addition, Bratman et al. (2021) reviewed the affective benefits of nature exposure with a focus on affect regulation, which allows an individual to regulate their emotions in relevance to their environment. They suggest that nature increases positive affect and subjective well-being through such regulation and that individuals may seek out natural environments to regulate their affective states (Bratman et al., 2021).

With rapid advances in technology, simulated virtual nature experiences have increasingly been a topic of interest, especially for individuals who have disabilities or mobility difficulties. Therefore, research about virtual reality (VR) nature has become an increasingly studied subject. White et al. (2019) conducted a literature review on how VR nature can affect mental, physical, and emotional well-being. The study concludes that although real-world nature is preferred, VR can act as an alternative if actual contact with nature is not possible and may offer some of the benefits of a natural environment (White et al., 2019).

Kondo et al. (2018) explored how stress has been measured in real-time exposure to outdoor environments via a systematic review of published literature. The use of real-time measurements may allow for evaluation of the differences in stress responses to environmental stimuli. The types of exposures evaluated in the literature review included nature viewing, outdoor walks, outdoor exercise, and gardening. A meta-analytic review of 43 studies was conducted, and results of the study found that spending time in outdoor environments, particularly those with green space (vegetated land), may reduce the experience of stress, and ultimately improve health. Research shows that spending time in outdoor environments can

increase an individual's understanding of their own stress and stressors, and could lead to interventions that reduce physical, emotional, and mental health issues.

Connectedness to Nature

The benefits of exposure to nature may not equally apply to everyone, however. Individual differences may matter when examining the effects that nature has on outcomes such as well-being and stress reduction. Nature connection refers to an "individuals' subjective sense of their relationship with nature and encompasses the affective, cognitive, and experiential aspects of that relationship" (Cleary et al., 2020, p.580). Previous research has found that nature appreciation was significantly related to well-being characteristics including life satisfaction and gratitude (Craig et al., 2015).

Cervinka et al. (2012) examined the relationship between various aspects of well-being and connectedness to nature (CN). In the study, indicators of well-being were found to be "robustly correlated with CN, particularly meaningfulness" (Cervinka et al., 2012, p. 384). In addition, individuals who scored high on CN scored high on vitality and on psychological well-being as well. The study's results suggest that CN should be encouraged for the promotion of mental health.

Cleary et al. (2020) examined the relationship between nature connection and both past (childhood) and present (adult) nature experiences. Results of the study found that "both past childhood nature experiences and duration of current nature experiences significantly predicted nature connection" (Cleary et al., 2020, p. 579). Wolsko et al. (2019) examined the relationship between nature-based physical recreation (i.e., outdoor activities such as hiking), CN and well-being. Through a series of five studies, it was concluded that there was a positive association between participation in nature-based physical recreation and well-being, supported by measures

of life satisfaction, depression, subjective vitality, and positive emotional experience. In addition, it was found that engaging in physical recreation in nature is positively associated with CN. The researchers conclude that certain recreational activities may be worthy of promotion in the public health field - to promote satisfaction, vitality, and well-being.

Childhood Nature Experiences

Cheng and Monroe, (2012) measured children's affective attitude towards nature. Results of the study found that learning, understanding, experiencing nature, and living close to nature may positively influence the development of children's affective attitude toward nature. In addition, the study also found that out of six variables, connection to nature was the strongest independent variable that predicted children's interest in participating in nature-based activities.

Childhood nature experiences may also have significant outcomes when relating to adult well-being and mental health. Exposure to nature can increase children's well-being and may have an impact on a child's development, with potential effects lasting into adulthood. A study conducted by Wells and Lekies (2006) found that individuals who had more natural exposure during their childhood are more likely to have pro-environmental attitudes and behaviors as adults. This suggests that children who often take part in healthy nature-based activities and have a greater appreciation for nature have better overall attitudes towards the environment later in life. In addition, the study suggested that experiences in nature before age 11 are associated with the development of influential positive adult attitudes (Wells & Lekies, 2006). However, it is possible that exposure to nature at different ages may have different effects upon one's relationship with nature as an adult.

Preuß et al. (2019) inspected the relationship between childhood nature exposure and adult mental health. Nature exposure was measured using mixed models to investigate

associations with both childhood and adulthood, while mental health was assessed using two subscales from “The Medical Outcome Study 36-item Short-Form Health Survey (SF-36). Low levels of childhood natural outdoor environment (NOE) exposure were associated with worse mental health in adulthood when compared to those who had high levels of childhood NOE exposure (Preuß et al., 2019). In addition, it was found that adults with low levels of childhood NOE exposure considered NOE exposure to be less important when compared to adults with high levels of childhood NOE exposure. The authors concluded that NOE exposure should be promoted to children for the development of a positive and nature appreciating attitude that can assist them into and throughout adulthood.

The Current Study

Overall, nature has a significant impact on physical, emotional, and mental well-being. An individual’s connectedness to nature can promote well-being characteristics, and childhood nature experiences help to shape that connection in adulthood. In association with adult experiences and nature, childhood experiences with nature can possibly predict the extent to which they come to appreciate and benefit from natural environments.

The current study examines the impact of exposure to nature on well-being, and the possible moderating effects of childhood nature experiences and adult connection to nature upon this relationship. The study is a two-group experiment, in which participants were randomly assigned either to a control group or a nature exposure group. The control group was put into an outdoor area surrounded by little green space, surrounded by mostly man-made buildings, with no access to technology for 10 minutes (See Appendix D). The experimental group sat in an outdoor environment which was surrounded by nature and will have no access to technology for 10 minutes (See Appendix E). Both groups had seating in the form of cloth folding chairs. The

purpose of the study is to replicate past findings on how CN moderates the effect of exposure to nature upon well-being (Craig et al., 2015) and how childhood nature experiences can contribute to adult outcomes. The current study also explores how the duration of nature exposure affects mental health. The study hypothesizes the following: Hypotheses 1 and 2 aim to extend previous literature, while Hypotheses 3 and 4 test what the previous literature lacks.

Hypothesis 1: There will be a higher level of well-being after the intervention in the experimental group versus the control group.

Hypothesis 2: There will be a positive correlation between participants' positive childhood nature experiences and their connection to nature as an adult.

Hypothesis 3: Positive childhood nature experiences (CNE) will moderate the effect of exposure to nature upon well-being, such that participants who felt more positive about their childhood nature experiences will benefit more from exposure to nature than those who spent less time in nature during childhood.

Hypothesis 4: Connectedness to Nature (CN) will moderate the effect of exposure to nature upon well-being, such that participants with high CN will benefit more from exposure to nature than those who score lower on CN.

Method

Participants

Seventy-six college students (58.6% female, 35.7% male, 4.3% non-binary), ranging from ages 18-35, provided data for the study. Most participants were between the ages of 18-22 ($M = 19.61$, $SD = 2.69$). However, due to invalid or incomplete responses, six subjects were dropped from the study, leaving seventy ($n=70$) participants for data analysis. Most participants were White/Caucasian (70%), followed by Latino/Hispanic (12.9%), and African American

(8.6%). Twenty-three of the seventy participants identified as Christian (32.9%), followed by Agnostic (15.9%), and “other” (14.3%). Ethics approval was obtained from SUNY New Paltz before research began. All subjects were recruited online from the SUNY New Paltz Psychology Department subject pool.

Procedure

Participants were invited to participate in the study via the SUNY New Paltz SONA system. The study is a two-group experiment, in which participants were randomly assigned either to a control group or a nature exposure group. Participants in both groups were asked to bring their laptop or phone to take the pre- and post-experiment surveys. Both groups took the CN and CNE surveys via Qualtrics (www.qualtrics.com) before the experimental manipulation.

Before observing their surroundings, participants were asked to return their phone or laptop either in their bag (away from them) or leave it with the instructor, who stayed close by. The study took place on two parts of the SUNY New Paltz campus during the transition from the fall season to the winter season. The control group instructed to sit in an outdoor area surrounded by little green space, which was surrounded by mostly man-made buildings, with no access to technology for a 10-minute time period. The experimental group sat in an outdoor environment which was surrounded by nature; these participants also had no access to technology for the 10-minute time period. Both groups had seating in the form of cloth folding chairs. The time period of 10 minutes was chosen based on previous research, as they used a similar amount of time in past studies (Neill et al., 2019). Both groups performed the same task, in which they were instructed to observe their surroundings (see Appendices D and E for instructions). Phones and laptops were returned after the manipulation was completed. After the experimental manipulation, participants took the PANAS-X measure via Qualtrics on their electronic device.

Measures

Participants took surveys distributed online via the survey site Qualtrics. Primary predictor and outcome measures are connectedness to nature, childhood nature exposure, and overall well-being. They completed both the connectedness to nature (CN) and childhood nature exposure (CNE) scales before the experiment and completed the PANAS-X after the intervention. Responses were measured using the following scales:

Connectedness to Nature (CN). CN is measured using the Connectedness to Nature scale, or CNS (Mayer & Frantz, 2004) to measure their perceived amount of connectedness to nature. The scale consists of 14 items that measure individuals' levels of feeling emotionally connected to the natural world (see Appendix A). Participants responded on a 5-point scale, where 1 = strongly disagree, and 5 = strongly agree. The reliability of the scale is $\alpha = .84$, which was taken from previous literature.

Childhood Nature Exposure (CNE). CNE was assessed using the child positive experiences in nature scale, which consists of 5 items, and it examines the direct and indirect relationships of outdoor recreation participation during childhood and adulthood (see Appendix B). The scale was developed for the current study due to unavailability of preexisting measures. Responses were measured on a Likert Scale ranging from 1 to 5, where 1 = strongly disagree and 5 = strongly agree. The reliability of the scale for the current study is $\alpha = .80$.

Well-being. The general positive subscale of the PANAS-X was used to measure participants' well-being (Watson & Clark, 1999). The scale consists of 10 items which describe general feelings of positive affect (see Appendix C). Participants responded using a 5-point Likert scale, where 1 = not at all, and 5 = extremely. The reliability of the scale for the current study is $\alpha = .85$.

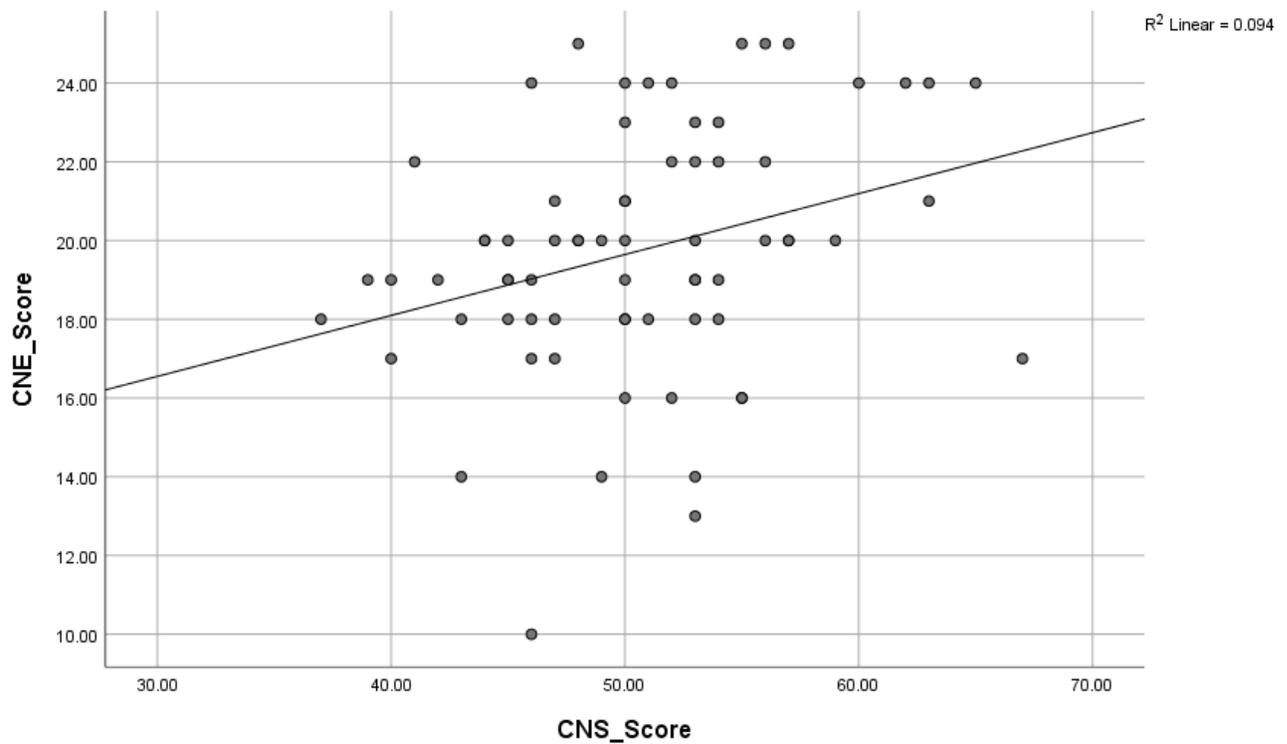
Results

An independent-samples t-test was conducted for Hypothesis 1. The 34 participants who were in the control group ($M = 31.03$, $SD = 7.31$), compared to the 36 participants in the experimental group ($M = 31.22$, $SD = 6.62$) showed no significant difference in overall well-being; $t(68) = -0.12$, $p = .486$. The effect size for this analysis ($d = 0.03$) was found to be trivial. These results suggest that there was little to no difference in well-being between those observing a man-made environment versus a natural environment. Hence, Hypothesis 1 was not supported.

For Hypothesis 2, a Pearson correlation coefficient was computed to assess the linear relationship between positive childhood nature experiences (CNE) and connection to nature (CN). There was a small positive correlation between the two variables, $r(68) = .31$, $p = .010$. A scatterplot summarizes the findings (Figure 1). Overall, there was a small, positive correlation between CNE and CN. Higher scores in positive childhood nature experiences were correlated with higher scores in overall connectedness to nature.

Figure 1

Scatterplot depicting the correlation between CNE and CN



A multiple linear regression was calculated to predict well-being based on positive childhood nature experiences and group for Hypothesis 3. Table 1 summarizes the descriptive statistics and analysis results. The multiple regression model was not significant, $F(3, 66) = 0.11$, $p = .953$, with an R^2 of .01. Contrary to Hypothesis 3, the analysis revealed that the interaction between CNE and experimental group did not significantly predict overall well-being, $B = .20$, $p = .712$. Therefore, the effect of viewing a natural or man-made environment upon well-being did not depend upon the participant's level of childhood nature experiences.

For Hypothesis 4, a multiple linear regression was calculated to predict well-being based on overall connection to nature and group. Table 2 summarizes the descriptive statistics and

analysis results. The multiple regression model was not significant, $F(3, 66) = 1.93$, $p = .134$, with an R^2 of .08. Contrary to Hypothesis 4, the analysis revealed that the interaction between CN and experimental group did not significantly predict overall well-being, $B = -.32$, $p = .233$. Therefore, the effect of viewing a natural or man-made environment upon well-being did not depend upon the participant's level of adult connection to nature. However, a main effect was found in which higher CN scores are associated with higher well-being scores (Table 2).

Table 1

Variable	B	SE	95% CI	β	t	p
Group	-3.76	10.81	[-25.34,17.82]	-.27	-.39	.729
CNE Score	.01	.39	[-.77,.79]	.01	.03	.980
Group*CNE	.20	.54	[-.88,1.28]	.30	.37	.712

Results of Multiple Linear Regression comparing CNE and Group

Note. CI = Confidence Interval for β . * $p < .05$.

Table 2

Variable	B	SE	95% CI	β	t	p
Group	16.47	13.43	[-10.35,43.29]	1.20	1.23	.224
CN Score	.43	.19	[.06,.81]	.39	2.32	.024
Group*CN	-.32	.26	[-.84,.21]	-1.18	-1.20	.233

Results of Multiple Linear Regression comparing CN and Group

Note. CI = Confidence Interval for β . * $p < .05$.

Discussion

The purpose of this study was to gain a better understanding of how childhood nature exposure can influence well-being and connection to nature in adulthood. Past research (e.g., Cleary et al., 2020) has established that an individual's connectedness to nature can promote well-being characteristics, and childhood nature experiences help to shape that connection in adulthood. In association with adult experiences and nature, childhood experiences with nature can possibly predict the extent to which they come to appreciate and benefit from natural environments.

Previous research has suggested an environment devoid of nature may have a negative effect on overall well-being, such as health or quality of life (Grinde & Patil, 2009). However, there were no significant findings on the difference of well-being between a group who observed man-made environments versus a group who observed natural environments. There are a few possibilities as to why there was no difference in well-being regarding the current study. The most prevalent being that the site in which the study was conducted did not have an exclusive "unnatural" environment for the control group to observe. There is a possibility that the environment that was selected was not "unnatural" enough to be considered a non-natural environment, and as a result, the two environments presented in the study did not differ enough in the amount of nature. Both environments that were used in the study contained some sort of nature (trees, grass, animals, etc.), due to the limitations of the study site. The campus this study took place on is abundant with greenery, and it was difficult to find a truly industrial man-made

section of the campus. It is possible that there was not enough differentiation between the two groups, leaving little variability in the effect that being in nature had on overall well-being. This may contribute to the lack of difference in well-being between the experimental groups as discussed in Hypothesis 1, as well as the lack of well-being based on potential moderating effects of CNE and CN in Hypothesis 3 and Hypothesis 4.

Another possible explanation for the lack of findings between the two groups is what defines a “natural” environment. Many scientists argue that nature is a multi-dimensional concept (e.g., van Kamp, 2003) and Keune et al. (2022) suggests individual definitions of nature are based off normative and dynamic worldviews that are context-specific and subjective. As a result, the definition of nature remains a debate in the modern-day. It is difficult to predict what the limit is regarding a “natural” versus “unnatural” environment, especially in urban areas, as often natural elements are accompanied by unnatural elements such as infrastructure. Relatedly, Mansor et al. (2012) explains the concept of “green infrastructure”, which is defined as “various types of greenery and open spaces linked by streets, and waterways that connect urban areas”. Experience in green infrastructure gives direct physical exposure and prompts psychological processes that benefit physical, cognitive and social well-being (Mansor et al., 2012). It remains difficult to measure such concepts, as there is little literature that suggests a particular ratio of green space to infrastructure necessary in order receive benefits from the natural environment, as well as the variance in what is experienced as “nature” from individual to individual. It is possible that participants in the current study received benefits of nature by simply being outdoors, which could explain the lack of difference in overall well-being scores between the two groups. Further studies should aim to more carefully define “natural” environments, to further understand the impact that partially natural environments can have on well-being.

However, there was a positive relationship found between positive childhood nature experiences (CNE) and adult connection to nature (CN). Although the correlation was small, it builds on previous literature that states positive experiences with nature as a child influences one's relationship with nature as an adult. Childhood nature experiences and exposure to pro-environmental social norms during childhood are related to adulthood development of connectedness with nature (Molinaro et al., 2020). Jensen & Olsen (2019) conducted a literature review which suggests that there is strong evidence that childhood nature experiences are correlated with pro-environmental behaviors and experiences in adulthood.

Limitations

Regarding the results of the study, it is important to recognize several limitations. Small sample size, the use of self-report data, inconsistent weather and temperature were all limitations that were present in the current study and may explain these findings. There are three potential limitations concerning the results of the study. The first limitation is that the sample size for this study was 70 participants, in which participant ages were mostly between 18-22 years old. This is a relatively narrow sample size, consisting of only an undergraduate population. A small sample size makes it more difficult to determine if the outcome of the study applies to the broader population. In this case, the use of an exclusive undergraduate sample limits the generalizability of the study. In addition, it is possible that most students in the sample spend time outside regularly as they walk around campus. There may have been more of an effect in a sample that consisted of people who are not exposed to the outdoors during the day – such as people who work in an office setting. An important goal for future studies is to incorporate a more diverse sample size that consists of greater variability in gender, ethnicity, age, socioeconomic status, and religion.

The second limitation of the study is the use of self-reporting data. The sole use of self-reports has a greater possibility of bias and inaccurate responses. However, Hypotheses 2 and 3 of the study depended on participants' abilities to recall retrospective childhood experiences, which can often result in recall bias. Recall bias overestimates the magnitude of the difference between cases, either through underreporting or overreporting true experiences (Raphael, 1987). In the case of this study, recall bias may play a role in regarding the emotional experiences in connection to nature during childhood. In addition, it was found that positive affect overestimation was associated with higher psychological well-being (Colombo et al., 2020). While acknowledging this, it is important to state that the absence of recall bias cannot be guaranteed, especially in the case of the current study. Future research may be able to rely on different measures of recording childhood experiences to ensure less likelihood of recall bias.

The final limitation of the study is the inconsistency of weather and temperature across the study times. The correlation between weather and well-being is well documented, and past findings state that day-to-day short-term weather variation impacts self-reported life satisfaction (Feddersen et al., 2014). Due to the current study being held on different days with differing weather patterns and temperatures, it can be difficult to determine if an individual was influenced from the weather that could have affected their overall well-being scores. Future research should aim to have a more controlled and consistent environment, with temperatures and weather patterns remaining relatively consistent.

Conclusion

Taken together, the findings indicate that there was no difference in well-being between the two groups, as well as no moderating effects of CNE or CN on the effect of the nature manipulation upon well-being. The ability to better define nature and the inclusion of adequate

environments is an important implication for future research. There was, however, a small positive correlation between CNE and adult CN, suggesting that childhood nature experiences do have an impact on adult connectedness to nature. In addition, there was a main effect in which higher CN scores are associated with higher well-being scores, suggesting that adult connectedness to nature can have an influence on well-being.

Appendix A

Connectedness to Nature Scale

Please answer each of these questions in terms of *the way you generally feel*. There are no right or wrong answers. Using the following scale, in the space provided next to each question simply state as honestly and candidly as you can what you are presently experiencing.

- | 1 | 2 | 3 | 4 | 5 |
|------------------------------|--|---------|---|----------------|
| Strongly disagree | | Neutral | | Strongly agree |
| <input type="checkbox"/> 1. | I often feel a sense of oneness with the natural world around me. | | | |
| <input type="checkbox"/> 2. | I think of the natural world as a community to which I belong. | | | |
| <input type="checkbox"/> 3. | I recognize and appreciate the intelligence of other living organisms. | | | |
| <input type="checkbox"/> 4. | I often feel disconnected from nature. | | | |
| <input type="checkbox"/> 5. | When I think of my life, I imagine myself to be part of a larger cyclical process of living. | | | |
| <input type="checkbox"/> 6. | I often feel a kinship with animals and plants. | | | |
| <input type="checkbox"/> 7. | I feel as though I belong to the Earth as equally as it belongs to me. | | | |
| <input type="checkbox"/> 8. | I have a deep understanding of how my actions affect the natural world. | | | |
| <input type="checkbox"/> 9. | I often feel part of the web of life. | | | |
| <input type="checkbox"/> 10. | I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'. | | | |
| <input type="checkbox"/> 11. | Like a tree can be part of a forest, I feel embedded within the broader natural world. | | | |
| <input type="checkbox"/> 12. | When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature. | | | |
| <input type="checkbox"/> 13. | I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees. | | | |
| <input type="checkbox"/> 14. | My personal welfare is independent of the welfare of the natural world. | | | |

Appendix B
 Childhood Positive Experiences in Nature Scale

Please select the response that best describes your experience during your childhood.

1. I enjoyed being in nature as a child.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. I sought out natural environments as a child.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3. I felt a deep connection to plants and animals as a child.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

4. When looking back at my childhood, I felt nature played an important role in my life.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. As a child, being in nature made me feel peaceful.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Appendix C

PANAS-X

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This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now (in the present moment).

Use the following scale to record your answers:

Not at all 1	a little 2	moderately 3	quite a bit 4	extremely 5
___ active	___ alert	___ attentive	___ enthusiastic	___ excited
___ inspired	___ interested	___ proud	___ strong	___ determined

Appendix D

Experiment Instructions – Control Condition

Before beginning, you will complete a short survey on your device of choice. Please answer as accurately as possible. Please place your device on silent mode to not disturb others. In addition, please leave your phone or laptop in the bin with the instructor, or in your bag (if you feel more comfortable) before beginning. Your device will be returned to you after the experiment is complete. As you sit outside, focus on your surroundings. Specifically, the man-made buildings that surround you. Think about how it makes you feel, or what you notice around you. This portion of the study will last 10 minutes. I will be located nearby at the check-in station. After the 10 minutes pass, I will return and you will fill out a second survey. The experiment will then be over. Thank you!

Appendix E

Experiment Instructions – Experimental Condition

Before beginning, you will complete a short survey on your device of choice. Please answer as accurately as possible. Please place your device on silent mode to not disturb others. In addition, please leave your phone or laptop in the bin with the instructor, or in your bag (if you feel more comfortable) before beginning. Your device will be returned to you after the experiment is complete. As you sit outside, focus on your surroundings. Specifically, the nature that surrounds you. Think about how it makes you feel, or what you notice around you. This portion of the study will last 10 minutes. I will be located nearby at the check-in station. After the 10 minutes pass, I will return and you will fill out a second survey. The experiment will then be over. Thank you!

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