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EFFECTS OF A PROTOCOL OF ENVIRONMENTAL PSYCHOLOGICAL RESTORATION WITH VIRTUAL REALITY ON INDICATORS OF DEMOTIVATION IN CHILDREN

Aimée Argüero-Fonseca[1]*, Joel Martínez-Soto[2], Diana P. Aguirre-Ojeda[1], Diana Pérez Pimienta[1], Davide M. Marchioro[3].

[1]Academic program of Psychology, Autonomous University of Nayarit, Mexico.
[2]Department of Psychology, University of Guanajuato, Mexico.
[3]Area of Psychology, Instituto Universitario Salesiano Venezia, Mestre, Italy.

***Correspondence author: -** Aimée Argüero-Fonseca
0000-0002-3864-5299. Email: aimee.arguero@uan.edu.mx

Abstract

For some children, lockdown due to the pandemic or crime can be demotivating, so accessing nature's restorative properties through virtual reality could improve their mental health. Environmental Psychological Restoration (EPR) with virtual reality (VR) protocols are designed to provide a simulated experience of natural environments that could promote psychological renewal and rejuvenation. The present work focuses on the restoration of demotivation in children, to document the effects of an EPR protocol with VR technology on indicators of demotivation such as valence affective and activation. Healthy children, between 8 and 11 years old, (ME=9.12; SD= .99; F= 12; M=12) from a private school in Tepic, Nayarit México. A homogeneous sample of 24 was taken, whose parents consented to participation. An experimental design of two groups and repeated measures was used. During each treatment, participants were tested at baseline (T1), exposed to a cognitive deficit induction test (n-back; T2), and subsequently, G1 was exposed to EPR-VR treatment, while G2 received no treatment (T3). Findings suggest a decline in demotivation after EPR-VR ($p < 0.05$). Exposure to nature, even virtual, may benefit children's motivation. Changes in motivation would have to be strengthened with continuous sessions. The findings are discussed in light of future developments in EPR-VR research.

Keywords: Environmental psychological restoration, Virtual reality, Demotivation, Children.

Introduction

Environmental psychological restoration is a theory in environmental psychology that suggests that spending time in nature can help restore mental and emotional well-being. According to this theory, exposure to natural environments can provide a sense of psychological renewal and rejuvenation that can help individuals recover from mental fatigue and stress (Kaplan & Kaplan, 1989; Ulrich, et al., 1991).

The concept of environmental psychological restoration is based on the idea that humans have an innate connection to nature, which has been shaped by our evolutionary history (Hartig et al., 1996). This connection is believed to provide a sense of calm and relaxation that can help reduce stress and anxiety (Berto, 2005; Argüero-Fonseca et al., 2021; Liu, et al., 2022).

Research has shown that spending time in natural environments can have a positive impact on mental health, including reducing symptoms of anxiety and depression. This effect has been observed even in urban environments with relatively small amounts of green space (Hartig et al.6, 1991; Kaplan, 1995; Martínez-Soto & González-Santos, 2020).

Environmental psychological restoration is often cited as a rationale for incorporating nature into urban design and planning. For example, urban parks and green spaces can provide a much-needed respite from the stresses of city life and improve the quality of life for residents (Liu et al., 2022; Martínez-Soto & González-Santos, 2020, Zhu et al., 2023). Environmental psychological restoration highlights the importance of connecting with nature for maintaining mental and emotional well-being (Punhakka, 2021).

The relationship between Environmental Psychological Restoration (EPR) and Virtual Reality (VR) lies in the potential of VR technology to provide a simulated experience of natural environments, which can promote psychological restoration (Maggio et al., 2020)

Studies have shown that exposure to nature, even in virtual environments, can reduce stress and increase feelings of relaxation and restoration. In fact, some research suggests that exposure to virtual nature may be as effective as exposure to real nature in promoting psychological restoration (Bolouki, 2022; Maggio et al., 2020; Argüero-Fonseca et al., 2021).

Environmental Psychological Restoration (EPR) with virtual reality (VR) is a promising approach to improving children's well-being by providing a simulated experience of natural environments (Reese & Merchant, 2023). EPR with VR can be especially beneficial for children who may have limited access to natural environments due to various reasons, such as living in urban areas or having physical disabilities (Argüero-Fonseca et al., 2021).

Research has shown that exposure to natural environments, even in virtual form, can have positive effects on children's cognitive, emotional, and behavioral development (Meidenbauer et al., 2019; Yeo et al., 2020). For example, exposure to natural scenes has been found to improve attention and reduce symptoms of attention deficit hyperactivity disorder (ADHD) in children. Similarly, exposure to virtual nature has been shown to reduce stress and anxiety in children (Browning et al., 2023).

EPR with VR can also be designed to promote physical activity and encourage exploration and curiosity in children. By providing interactive and immersive experiences, EPR with VR can motivate children to engage in physical activity and exploration, which can enhance their cognitive and social development (Zhang, 2021).

Moreover, EPR with VR can be tailored to individual needs and preferences, allowing children to choose the type of natural environment they want to explore and engage in activities that are of interest to them. This personalized approach can increase engagement and satisfaction with the experience, potentially leading to greater benefits for children's well-being (Zhang, 2021).

Overall, EPR with VR has the potential to be a powerful tool for promoting children's well-being by providing a simulated experience of natural environments. As VR technology continues to evolve, it may become an increasingly important tool for improving children's mental, emotional, and physical health (Ford et al., 2021).

Design

An experimental design of two groups and repeated measures was used. During each treatment, all participants were assessed on measures of valence affective and activation (T1), and exposed to a cognitive deficit induction test (n-back; T2) for 43 minutes and were assessed on measures of valence affective and activation again (T2), then, G1 was exposed to EPR-VR intervention with a duration of 15 minutes, while G2 received no treatment, finally, measurements of valence affective and activation were taken(T3). At last, the results were analyzed to determine the effects of the EPR with VR protocol on demotivation. (See figure 1)

Method

Participants

Healthy children, between 8 and 11 years old, (ME=9.12; SD= .99; F= 12; M=12) from a private school in Tepic, Nayarit México. A homogeneous sample of 24 was taken, whose parents consented to participation. Assignment to the experimental and control groups was randomized. The experimental protocol was approved by the State Bioethics Commission of the state of Nayarit (CEBN/05/2020).

Stimuli

Experimental treatment of demotivation induction

N-back test. A 43-min computerized version of the n-back continuous performance test with loads 0 to 3 was used. A review of the psychometric properties of the n-back test can be read in Gajewski et al. (2018). The advantages of using such versions contemplate (a) the possibility of parametric variation in task difficulty, (b) multimodal presentation, and (c) accurate measurement of performance characteristics (Jacola, et al. 2014).

Valencia and activation

Emotion dimensions were assessed using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994). SAM consists of a pictorial assessment that employs sequences of humanoid-like cartoons that are graded in terms of intensity representing three bipolar affective dimensions: valence, arousal, and dominance. In the SAM scale, each subscale is represented by five graphic figures, with four intermediate points so that a nine-point scale is configured.

Affective valence, pleasure, and hedonism (SAM-Val), ranges from a smiling figure (highest score, 9) to an unhappy one (lowest score, 1). Activation or arousal (SAM-Act) ranges from a wide-eyed figure (highest score, 9) to a very relaxed one (lowest score, 1). The reliability of the SAM in the Mexican population shows high internal consistency indices >.90 (Martínez Soto et al., 2014). Some research has questioned the relevance of the dominance dimension to explaining people's affective self-evaluations (Russell et al., 1981), and for this reason, this dimension is not taken into account in the present study.

Data analysis

Descriptive statistical analyses were performed to determine means and standard deviations. To evaluate the normality of the dependent variables, the Shapiro-Wilk test was used (considering that there were less than 50 observations). This test confirmed the absence of such a distribution, so the analyses were performed using nonparametric tests. Next, employing the Wilcoxon test, the intragroup scores were compared between the pretest and posttest. Additionally, through a set of Mann-Whitney U tests, intergroup pretests and posttests were compared. Finally, the effect size was calculated with Rosenthal's r. The accepted significance value was established. The accepted significance value was set at p<.05.

Figure 1. Experimental design of the EPR with VR protocol.

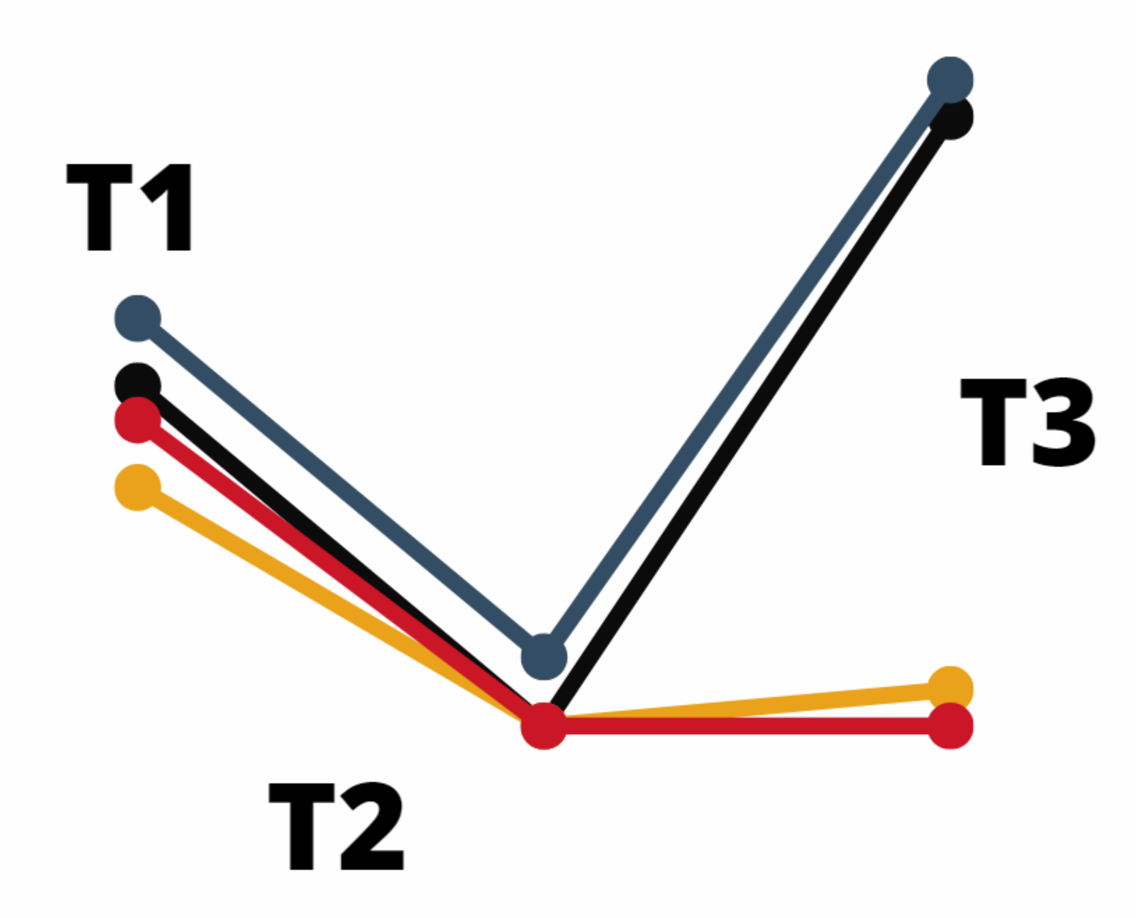
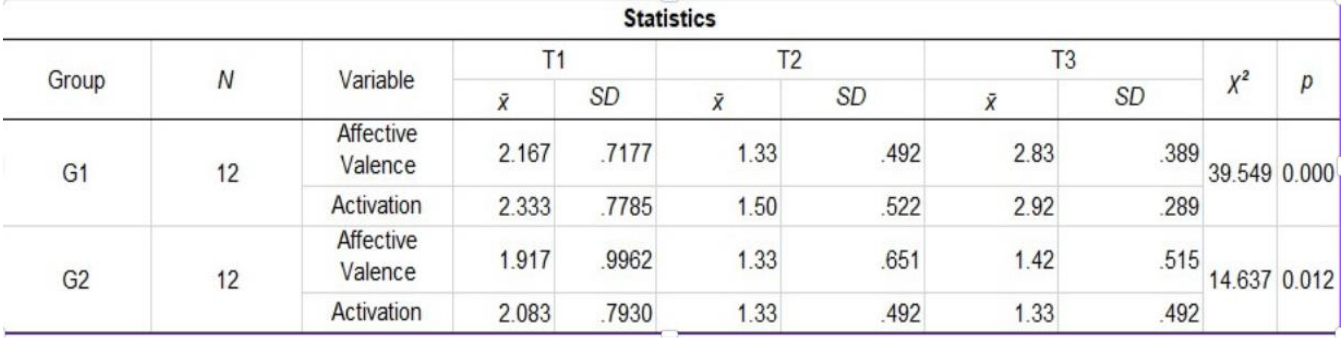


Figure 2. Differences between measurements of valence affective of G1 (Black) and G2(Yellow) and activation of G1 (Grey) and G2 (Red) .

Table 1. Descriptive and inferential data for measures related to Affective Valence and Activation

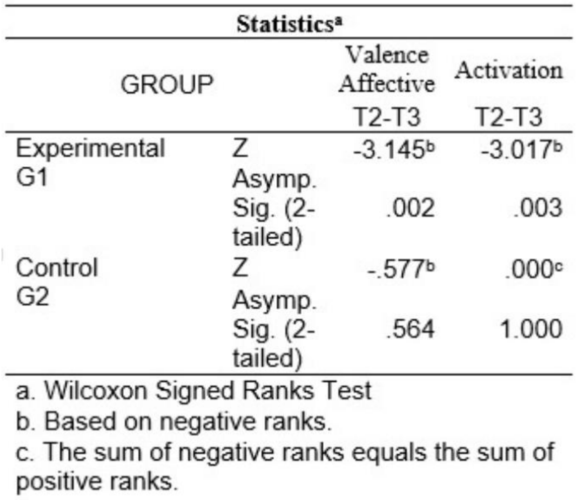


Statistics

Group	N	Variable	T1		T2		T3		χ^2	p
			$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		
G1	12	Affective Valence	2.167	.7177	1.33	.492	2.83	.389	39.549	0.000
		Activation	2.333	.7785	1.50	.522	2.92	.289		
G2	12	Affective Valence	1.917	.9962	1.33	.651	1.42	.515	14.637	0.012
		Activation	2.083	.7930	1.33	.492	1.33	.492		

Note: G1 = Experimental group; G2 = Control group.

Table 2. Differences between groups



Statistics^{a}

GROUP		Valence Affective T2-T3	Activation T2-T3
Experimental G1	Z	-3.145^{b}	-3.017^{b}
	Asymp. Sig. (2-tailed)	.002	.003
Control G2	Z	-.577^{b}	.000^{c}
	Asymp. Sig. (2-tailed)	.564	1.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. The sum of negative ranks equals the sum of positive ranks.

Note: G1 = Experimental group; G2 = Control group.

Results

Table 1 presents the means and standard deviations of both the experimental G1 and control G2. As can be seen, the nonparametric Mann-Whitney U independent measures test demonstrates the initial equivalence of the experimental group for the neutral group in terms of pretest measurements, indicating that these groups were comparable for the psychophysiological aspects of demotivation before starting the intervention (see table 1). The effectiveness of the protocol on affective valence and activation manipulation is observed in the post-test measurements (see figure 2).

Table 2 presents the results of both the experimental G1 and control G2. As can be seen, the effectiveness of the EPR with VR protocol is confirmed. Findings suggested a decline in demotivation after EPR-VR ($p < 0.05$) (see table 2).

Discussion

Exposure to nature, even virtual, may benefit children's motivation. Changes in motivation would have to be strengthened with continuous sessions (Jeong et al., 2021). The findings could have implications for interventions aimed at improving motivation and well-being in children, particularly those experiencing demotivation and for whom physical access to natural environments may be limited.

References

1. Argüero Fonseca, A., Martínez Soto, J.., Reynoso González, O. U. & Aguirre Ojeda, D. P. (2021). Technical-methodological validation of a virtual reality device for the exhibition of restorative environments. Educateconciencia, 29(30), 30–44. https://tecnocientifica.com.mx/educateconciencia/index.php/revistaeducate/article/view/406
2. Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. Journal of environmental psychology, 25(3), 249-259. https://doi.org/10.1016/j.jenvp.2005.07.001
3. Bolouki, A. (2022). The impact of virtual reality natural and built environments on affective responses: A systematic review and meta-analysis. International Journal of Environmental Health Research, 1-17. https://doi.org/10.1080/09603123.2022.2130881
4. Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. Journal of Behavior Therapy and Experimental Psychiatry, 25(1), 49–59.doi:10.1016/0005-7916(94)90063-9 Ford, T., John, A., & Gunnell, D. (2021). Mental health of children and young people during pandemic. bmj, 372. https://doi.org/10.1136/bmj.n614

5. Browning, M. H., Shin, S., Drong, G., McAnirlin, O., Gagnon, R. J., Ranganathan, S. & Heller, W. (2023). Daily exposure to virtual nature reduces symptoms of anxiety in college students. Scientific reports, 13(1), 1239. https://doi.org/10.1038/s41598-023-28070-9
6. Gajewski, P. D., Hanisch, E., Falkenstein, M., Thönes, S., & Wascher, E. (2018). What does the n-back task measure as we get older? relations between working-memory measures and other cognitive functions across the lifespan. Frontiers in psychology, 9.doi:10.3389/fpsyg.2018.02208
7. Hartig T, Mang M, & Evans, G. (1991) Restorative effects of natural-environment experiences. Environment and Behavior, 23, 3-26. https://doi.org/10.1177/0013916591231001
8. Hartig, T., Böök, A., Garvill, J., Olsson, T., & Gärling, T. (1996). Environmental influences on psychological restoration. Scandinavian journal of psychology, 37(4), 378-393. https://doi.org/10.1111/j.1467-9450.1996.tb00670.x
9. Howes, S., & Warwick, P. (2023). Creating equitable and sustainable opportunities for nature immersion to support restoration from stress within mental health nursing: A critical interpretive synthesis. International Journal of Mental Health Nursing. https://doi.org/10.1111/inm.13109
10. Jacola, L. M., Willard, V. W., Ashford, J. M., Ogg, R. J., Scoggins, M. A., Jones, M. M., Wu, S., & Conklin, H. M. (2014). Clinical utility of the n-back task in functional neuroimaging studies of working memory. Journal of Clinical and Experimental Neuropsychology, 36(8), 875–886. https://doi.org/10.1080/13803395.2014.953039
11. Jeong, H. S., Lee, J. H., Kim, H. E., & Kim, J. J. (2021). An appropriate number of treatment sessions in virtual reality-based individual cognitive behavioral therapy for social anxiety disorder. Journal of Clinical Medicine, 10(5), 915. https://doi.org/10.3390/jcm10050915
12. Kaplan S. (1995). The restorative benefits of nature - Toward an integrative framework. Journal of Environmental Psychology, 15, 169-182. https://doi.org/10.1016/0272-4944(95)90001-2
13. Kaplan, R., & Kaplan, S. (1989). The experience of nature: a psychological perspective. The Experience of Nature: A Psychological Perspective. https://books.google.com.mx/books?hl=es&lr=&id=7l80AAAAIAAJ&oi=fnd&pg=PR7&ots=TqO1SHs93f&sig=mfhkooUtj7uXh2LtSkX7hhreGHg
14. Liu, L., Qu, H., Ma, Y., Wang, K., & Qu, H. (2022). Restorative benefits of urban green space: Physiological, psychological restoration and eye movement analysis. Journal of Environmental Management, 301, 113930. https://doi.org/10.1016/j.jenvman.2021.113930
15. Maggio, M. G., Naro, A., La Rosa, G., Cambria, A., Lauria, P., Billeri, L., ... & Calabrò, R. S. (2020). Virtual reality based cognitive rehabilitation in minimally conscious state: a case report with EEG findings and systematic literature review. Brain Sciences, 10(7), 414. https://doi.org/10.3390/brainsci10070414
16. Martínez-Soto, J., & González-Santos, L. (2020). Affective psychological restoration through mediated exposure to the environment (Restauración psicológica afectiva a partir de la exposición mediada del ambiente). PsyEcology, 11(3), 289-318. https://doi.org/10.1080/21711976.2020.1730133
17. Martínez-Soto, J., Gonzales-Santos, L., Montero, M., & Barrios, F. (2014). Affective and restorative valences for three environmental categories. Perceptual and Motor Skills, 119, 901–923. https://doi.org/10.2466/24.50.PMS.119c29z4
18. Meidenbauer, K. L., Stenfors, C. U., Young, J., Layden, E. A., Schertz, K. E., Kardan, O., ... & Berman, M. G. (2019). The gradual development of the preference for natural environments. Journal of Environmental Psychology, 65, 101328. https://doi.org/10.1016/j.jenvp.2019.101328
19. Puhakka, R. (2021). University students' participation in outdoor recreation and the perceived well-being effects of nature. Journal of outdoor recreation and tourism, 36, 100425. https://doi.org/10.1016/j.jort.2021.100425
20. Reece, R., & Merchant, S. (2023). Exploring the impacts that virtual nature exposure can have on health and well-being and the mechanisms involved: a systematic review. The Open Review, 71. https://doi.org/10.47967/TOR2022COL/VOL8.06

21. Russell, J., Ward, L., & Pratt, G. (1981). Affective quality attributed to environments: a factor analysis study. Environment & Behavior, 13, 259-288. https://doi.org/10.1177/0013916581133001
22. 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. https://doi.org/10.1016/S0272-4944(05)80184-7
23. Yeo, N. L., White, M. P., Alcock, I., Garside, R., Dean, S. G., Smalley, A. J., & Gatersleben, B. (2020). What is the best way of delivering virtual nature for improving mood? An experimental comparison of high definition TV, 360 video, and computer generated virtual reality. Journal of environmental psychology, 72, 101500. https://doi.org/10.1016/j.jenvp.2020.101500
24. Zhang, Z., Kuzik, N., Adamo, K. B., Ogden, N., Goldfield, G. S., Okely, A. D. & Carson, V. (2021). Associations between the child care environment and Children’s in-care physical activity and sedentary time. Health Education & Behavior, 48(1), 42-53. https://doi.org/10.1177/1090198120972689
25. Zhu, X., Zhang, Y., Luo, Y. Y., & Zhao, W. (2023). Natural or artificial? Exploring perceived restoration potential of community parks in Winter city. Urban Forestry & Urban Greening, 79, 127808. https://doi.org/10.1016/j.ufug.2022.127808