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Effect of Natural and Urban Environments on the Perception of Thermal Pain – Experimental Research Using Virtual Environments

Authors : Anna Mucha, Ewa Wojtyna, Anita Pollak

Abstract : The environment in which an individual resides and observes may play a meaningful role in well-being and related constructs. Contact with nature may have a positive influence of natural environments on individuals, impacting mood and psychophysical sensations, such as pain relief. Conversely, urban settings, dominated by concrete elements, might lead to mood decline and heightened stress levels. Similarly, the situation may appear in the case of the perception of virtual environments. However, this is a topic that requires further exploration, especially in the context of relationships with pain. The aforementioned matters served as the basis for formulating and executing the outlined experimental research within the realm of environmental psychology, leveraging new technologies, notably virtual reality (VR), which is progressively gaining prominence in the domain of mental health. The primary objective was to investigate the impact of a simulated virtual environment, mirroring a natural setting abundant in greenery, on the perception of acute pain induced by thermal stimuli (high temperature) – encompassing intensity, unpleasantness, and pain tolerance. Comparative analyses were conducted between the virtual natural environment (intentionally constructed in the likeness of a therapeutic garden), virtual urban environment, and a control group devoid of virtual projections. Secondary objectives aimed to determine the mutual relationships among variables such as positive and negative emotions, preferences regarding virtual environments, sense of presence, and restorative experience in the context of the perception of presented virtual environments and induced thermal pain. The study encompassed 126 physically healthy Polish adults, distributing 42 individuals across each of the three comparative groups. Oculus Rift VR technology and the TSA-II neurosensory analyzer facilitated the experiment. Alongside demographic data, participants' subjective feelings concerning virtual reality and pain were evaluated using the Visual Analogue Scale (VAS), the original Restorative Experience in the Virtual World questionnaire (Doświadczenie Regeneracji w Wirtualnym Świecie), and an adapted Slater-Usoh-Steed (SUS) questionnaire. Results of statistical and psychometric analyses, such as Kruskal-Wallis tests, Wilcoxon tests, and contrast analyses, underscored the positive impact of the virtual natural environment on individual pain perception and mood. The virtual natural environment outperformed the virtual urban environment and the control group without virtual projection, particularly in subjective pain components like intensity and unpleasantness. Variables such as restorative experience, sense of presence and virtual environment preference also proved pivotal in pain perception and pain tolerance threshold alterations, contingent on specific conditions. This implies considerable application potential for virtual natural environments across diverse realms of psychology and related fields, among others as a supportive analgesic approach and a form of relaxation following psychotherapeutic sessions.

Keywords : environmental psychology, nature, acute pain, emotions, vitrual reality, virtual environments
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