

Affective Relationship with the Environment in the Context of Fractal and Natural Aesthetics – Abstract for the general public

The research project aims to understand the processes underlying human biophilic preferences, which are the common human tendency to favor natural environments. Consequently, we are drawn to explanations related to the fractal geometry of nature and the timeless design principles of “natural order”, which were proposed by architect Christopher Alexander. We aim to verify these theories through experiments using advanced virtual and augmented reality technologies.

Studies in environmental psychology show that people prefer natural environments over artificial ones. This is evident both in verbal declarations and in neurophysiological reactions. Natural environments are more effective in restoring attention and supporting faster recovery of patients. The biophilia hypothesis, formulated by Edward O. Wilson, suggests that these preferences are (at least partially) innate. Although there are hypotheses regarding the basis of this preference, mainly related to our survival from an evolutionary perspective (e.g., the need for shelter while maintaining a decent view of the surroundings to effectively protect against predators), research on this topic mainly focuses on the effects of interaction with nature rather than the mechanism of this relationship.

Among the reasons often cited is the so-called fractal aesthetics of nature, meaning that the shapes of environments untouched by human intervention – rocks, plants, shorelines – can be understood through fractals, which are mathematical measures that allow distinguishing simple, underlying mechanisms in something that seems chaotic. Our understanding of what is fractal may not necessarily fully align with the mathematical definition, which is why we refer to the theory of natural order by architect Christopher Alexander. Based on observations of nature and contemporary research, he formulated 15 principles of good design strongly associated with fractal aesthetics. Our project aims to empirically verify these theories using advanced virtual and augmented reality technologies based on laser scans of locations and computer graphics for the most realistic experience of being in a given place while maintaining complete experimental control.

The project involves conducting five studies in which we will control the topological and visual parameters of the stimuli. Studies 1 and 2 will focus on creating three-dimensional environments with natural and abstract fractal aesthetics. Studies 3-5 will concern urban environments, where we will introduce elements of nature and fractal aesthetics to assess their impact on aesthetic evaluations. We will look at preference, perceived naturalness, and the emotional state induced by these places based on Russell's circumplex model of affect.

We intend to use the latest technologies, such as virtual and augmented reality goggles for realistic rendering of object scales, LiDAR laser scanners for three-dimensional digitalization of urban environments, which will be used in graphic programs like Blender, Octane, and Unreal Engine, granting us precise control over factors such as lighting, textures, and spatial properties.

The project includes the first attempt of its kind to verify Christopher Alexander's theory of natural order. The conclusions from this project have the potential to influence our understanding and application of natural design principles in both virtual and real environments, contributing to the creation of more friendly and aesthetically pleasing spaces.