

Research on Audiovisual Perception in Stairway Spaces of Mountain City Parks Based on Real-Scene EEG Monitoring

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Abstract : Stairway spaces are a crucial component of the pathway systems and vertical transportation networks in mountain city parks. These spaces are closely integrated with the undulating terrain of mountain environments, resulting in continuously changing spatial conditions that can significantly influence participants' behavioral characteristics, thereby affecting their perception. EEG signals, which have been proven to reflect various non-attentive physiological activities in the brain, are widely used in studies related to stress recovery effects and emotional perception. Existing research predominantly examines the impact of spatial characteristics and landscape elements of trails and greenways in plain cities on participants' perception, utilizing EEG signals in laboratory-simulated environments. These studies have preliminarily revealed the relationship between spatial environments and perception preferences. However, on-site ergonomics research in mountain environments remains relatively underdeveloped. To address this gap, the Stairway spaces in Pipashan Park, Chongqing, were selected as the research object. Wearable hydrogel EEG devices were employed to monitor participants' EEG data in real environments, and a Generalized Linear Mixed Model (GLMM) was constructed to explore differences in participants' perception under different paths and modes of movement, as well as the impact of visual and auditory environmental elements within each path on their perception. The model analysis results indicate significant differences in EEG data across different paths and movement modes. Additionally, typical mountainous spatial characteristics, such as openness, green view index, and elevation difference, are identified as key factors influencing participants' EEG data. Higher levels of natural sound and green view index were shown to effectively alleviate participants' stress perception in mountain stairway spaces. The findings reveal the intrinsic connections between environment, behavior, and perception in stairway spaces of mountain city parks, providing a theoretical basis for optimizing the design of stairway spaces in mountain cities.

Keywords : audio-visual perception, EEG monitoring, mountain city park, real environment, stairway space

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