

## Exploring Neural Responses to Urban Spaces in Older People Using Mobile EEG

**Authors :** Chris Neale, Jenny Roe, Peter Aspinall, Sara Tilley, Steve Cinderby, Panos Mavros, Richard Coyne, Neil Thin, Catharine Ward Thompson

**Abstract :** This research directly assesses older people's neural activation in response to walking through a changing urban environment, as measured by electroencephalography (EEG). As the global urban population is predicted to grow, there is a need to understand the role that the urban environment may play on the health of its older inhabitants. There is a large body of evidence suggesting green space has a beneficial restorative effect, but this effect remains largely understudied in both older people and by using a neuroimaging assessment. For this study, participants aged 65 years and over were required to walk between a busy urban built environment and a green urban environment, in a counterbalanced design, wearing an Emotiv EEG headset to record real-time neural responses to place. Here we report on the outputs for these responses derived from both the proprietary Affectiv Suite software, which creates emotional parameters with a real time value assigned to them, as well as the raw EEG output focusing on alpha and beta changes, associated with changes in relaxation and attention respectively. Each walk lasted around fifteen minutes and was undertaken at the natural walking pace of the participant. The two walking environments were compared using a form of high dimensional correlated component regression (CCR) on difference data between the urban busy and urban green spaces. For the Emotiv parameters, results showed that levels of 'engagement' increased in the urban green space (with a subsequent decrease in the urban busy built space) whereas levels of 'excitement' increased in the urban busy environment (with a subsequent decrease in the urban green space). In the raw data, low beta (13 - 19 Hz) increased in the urban busy space with a subsequent decrease shown in the green space, similar to the pattern shown with the 'excitement' result. Alpha activity (9 - 13 Hz) shows a correlation with low beta, but not with dependent change in the regression model. This suggests that alpha is acting as a suppressor variable. These results suggest that there are neural signatures associated with the experience of urban spaces which may reflect the age of the cohort or the spatiality of the settings themselves. These are shown both in the outputs of the proprietary software as well as the raw EEG output. Built busy urban spaces appear to induce neural activity associated with vigilance and low level stress, while this effect is ameliorated in the urban green space, potentially suggesting a beneficial effect on attentional capacity in urban green space in this participant group. The interaction between low beta and alpha requires further investigation, in particular the role of alpha in this relationship.

**Keywords :** ageing, EEG, green space, urban space

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