

Scientific abstract: *Integrated visual analysis and modelling for environmental and urban systems, in respect to interior space layout and functionality.*

The objective of the proposed research is to develop an integrated visual analysis and modeling for environmental and urban systems referring to interior space layout and functionality: integrating an advanced *Spatial Openness Index* (SOI) model within a realistic geovisualized Geographical Information Systems (GIS) environment, and assessment against subjective residents' evaluation. This interdisciplinary research effort focus is mainly on the Architecture Design discipline, but will incorporate consultancy from experts in three different disciplines: Geoinformatics, Computer Sciences and Environment–Behavior Studies. The proposed research will include three components:

1. Elaborateness of the visibility model for measuring the SOI and indicating perceived density, openness to the view, visual exposure and the impact of internal space layout and functionality.
2. Establishing a realistic and reliable urban 3D GIS database, and integrating and modifying the elaborated visibility analysis, SOI tool, into the functionality of the GIS environment, mainly spatial-analysis and geovisualization capabilities.
3. Assessment of the SOI visual and statistical measures against subjective measures of spatial openness and density as perceived by residents living in high-density environments.

Density measurements are used around the world as a common planning and design tool. Measurements of objective density do not predict the subjective response of inhabitants. Although researchers paid a fair amount of attention to the subjective aspects of high density, the commonly used measurements still lack the ability to transfer existing knowledge to quantified tools that planners and architects can use in order to accurately assess the impact of densification on residents. The suggested research aims at helping to bridge this gap. The SOI is a visibility analysis model. Past research showed that SOI measurements in different spatial configurations were correlated with the comparative perceived density, thus, the objective measurements indicated a subjective response. Still, the model in its current position is a theoretical one. The hypotheses that motivated the development of the SOI model have yet to be assessed against real environment configurations, and to actual evaluation of residents. Additional modules of the model, i.e. *Visual Openness* to a view and *Visual Exposure*, referring to the internal space layout and its functionality (privacy), that are also major aspects influencing quality of the human environment may elucidate the contribution of this analysis. The proposed research will compare the rankings obtained by the model with real-life ones of residents living in a high-density neighborhoods, and will assess the ability of the SOI to predict these measures in built-up environments. GIS have been successfully applied for many years in a wide number of professional contexts. Three-dimensional GIS (3D GIS) is currently used for projects requiring geovisualisation and geospatial analysis, such as environmental studies and urban planning. The development of an objective metric that can measure density and corresponding visual attributes in the urban environment, which also responds to space layout and functionality, and at the same time will present planners with a complete qualitative and visual comprehension of the subjective response of residents who live in a specific layout of built-up environment is of great importance for future urban research and development.