

# Web-based Interactive Visualization of Reconstructed Cognized and Functional Spaces: The case of U.S. Migration

Zhaoya Gong and Jean-Claude Thill

**Abstract**— Sound conceptualization of space is essential to the understanding of the processes that shape geographic phenomena. Cognized spaces often are at great variance with the physical space that supports human actions and other events. As a derivative, they are tightly connected to human cognition of the physical space or to the modalities of functional relationships between places embedded in the physical space. In his 1984 study of human migrations in the United States, David Plane set to elicit the space relevant to functional relationships of migration, after he noted that absolute physical distances usually provide an inferior measure of the relative functional distances that affect destination choices of US interstate migrants. He proposed to use doubly constrained spatial interaction models with observed state-to-state migration flows as input to calibrate and estimate the cognized distances between U.S. states. As a result, the functional ‘migration space’ within which migrations are made is reconstructed around migration origins and destinations. In the original work, visualization of the functional space was not automated nor was there any interactivity to explore the fundamental properties of the cognized space. Web-based geospatial visualization technology is proposed here to address the challenges of visualization and analytics of cognized and functional spaces through automation, interactivity, and the integration of multiple local views through spatial data fusion. Plane's methodology is implemented with ArcGIS Sever technology to construct local and global views of the cognized space that frames migration behaviors. Interactive exploration and analysis of space properties is conducted across time periods on the basis of multiple U.S. interstate migration data sets. The on-line visualization application can readily be applied to study other cognized and functional spaces, such as commuting sheds, trade spaces, and personnel activity spaces.

**Index Terms**—Cognized space, functional space, web-based GIS, interactive visualization, migration.

- *Zhaoya Gong, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, Charlotte, NC, USA, zgong1@uncc.edu*
- *Jean-Claude Thill, Department of Geography and Earth Sciences, University of North Carolina at Charlotte, Charlotte, NC, USA, Jean-Claude.Thill@uncc.edu*