



MULTIDIMENSIONAL DATA EXPLORATION WITH IMMERSIVE 3D USER INTERFACES

Wijayawardena A.S.K.^{1*} and Wimalaratne G.D.S.P.²

¹Department of Software Technology, Faculty of Information Technology,
University of Vocational Technology, Rathmalana, Sri Lanka

²Communication and Media Technologies,
University of Colombo School of Computing, Sri Lanka
asithask@gmail.com

Abstract

Multidimensional data visualization is crucial in disease surveillance and controlling outbreaks. To extract useful information, it requires to visually analyze complex multidimensional datasets such as patients' data including complex dimension hierarchies and measures. However, the available visualizations for disease surveillance are mostly based on 2D representations such as cartography, thematic maps, etc. Existing visualizations require high cognitive efforts to clearly understand these datasets. Therefore, it has become a challenge to get better insights into multidimensional datasets in controlling vector-borne disease outbreaks such as Dengue. In this context, 3D visualizations are mostly acknowledged for visualizing complex multidimensional datasets. Therefore, based on the concept of 3D metaphoric data visualization, this paper presents a novel 3D user interface metaphor to reduce the cognitive load on the brain and address the usability issues in large multidimensional data visualization in disease surveillance. This research involves the concept of a 3D carousel metaphor to implement drill-down and roll-up operations. Based on the Design Science Research methodology, it is attempted to address the design and investigation of artifacts and context. A pilot usability evaluation experiment has been carried out to measure the usability of the proposed 3D user interface metaphor over a synthetically generated dataset. A group of Public Health Inspectors (PHI) were selected via an open invitation as subjects for the evaluation. A prototype was given to the subjects to interactively perform pre-defined visual analysis tasks based on their routine work. Both qualitative and quantitative aspects were considered to measure statistical significance. According to the user feedback, it shows that the proposed metaphor has higher usability in visualizing complex multidimensional datasets. Therefore, it can be concluded that this research introduces a novel interactive 3D user interface metaphor to enhance the usability in visual analytics of complex multidimensional datasets in disease surveillance.

Keywords: Multidimensional Data Visualization, Visual Data Analytics, Metaphoric Data Visualization, 3D User Interface Metaphor