Immersive Analytics
with WebVR and Google Cardboard

Peter W. S. Butcher
University of Chester, UK
p.butcher@chester.ac.uk

Jonathan C. Roberts
Bangor University, UK
j.c.roberts@bangor.ac.uk

Panagiotis D. Ritsos
University of Chester, UK
p.ritsos@chester.ac.uk

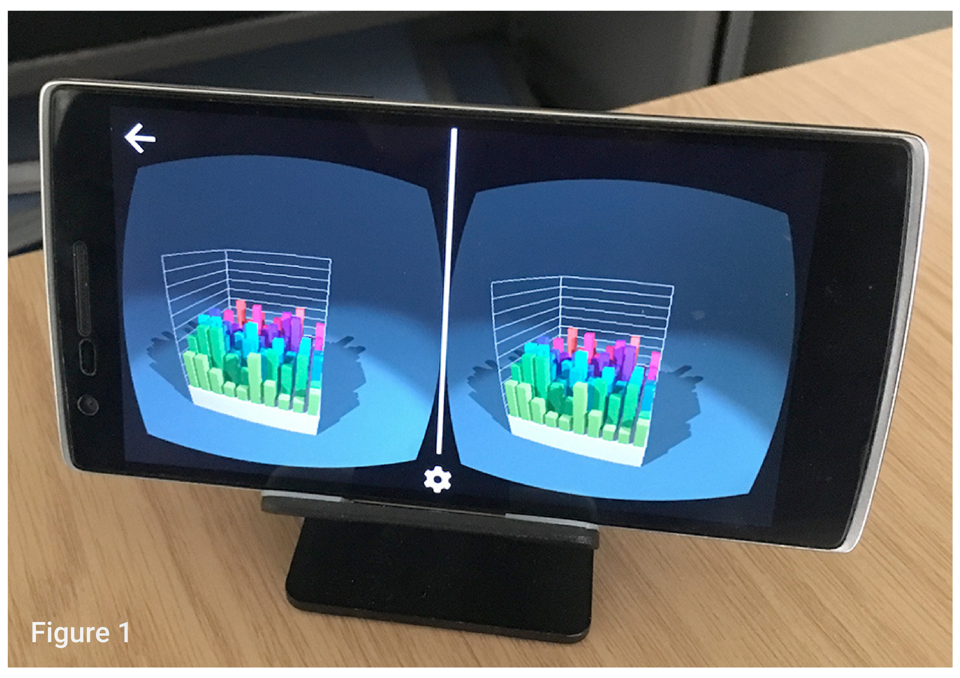
Figure 1

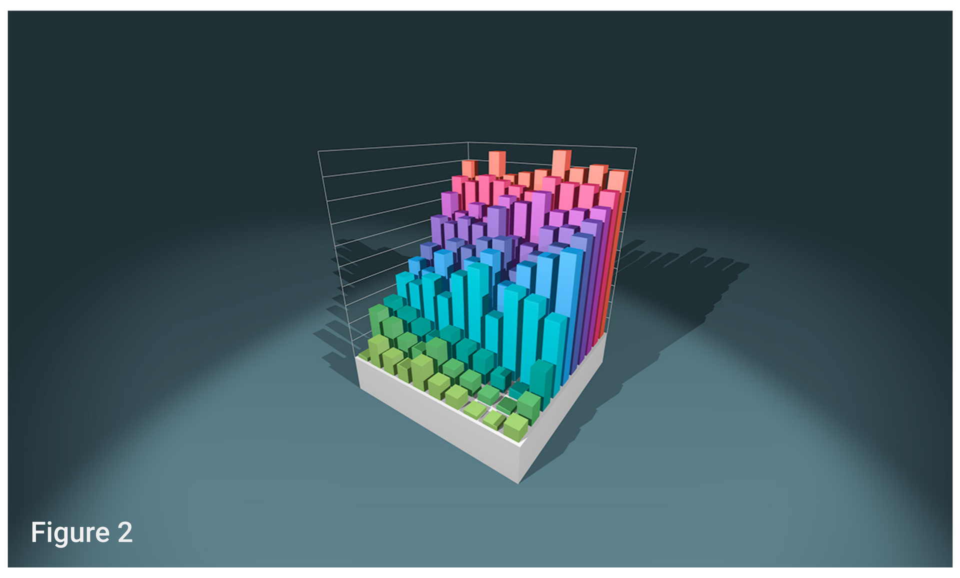
Figure 2

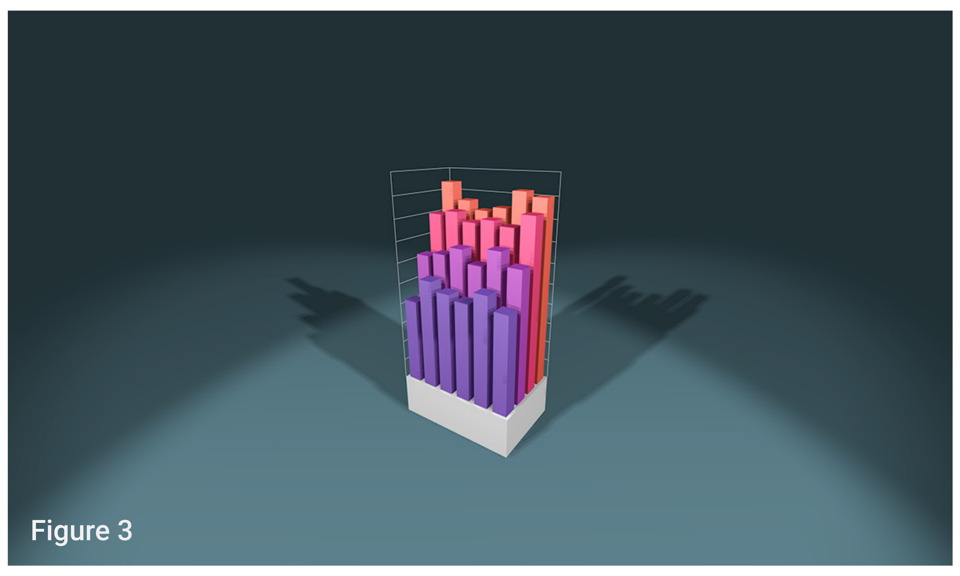
Figure 3

Immersive Analytics (IA) is an emerging research domain that builds upon paradigms such as virtual and mixed reality (VR/MR) [1], and investigates the use of novel display and interface technologies in analytical reasoning and decision making [2].

In this work we create a virtual representation to appear as if it were a physical visualization (based on [3], see Figure 2). To achieve this we use emerging standards-based web technologies for VR.

We present our WebVR-based platform for immersive analytics, using a smartphone and Google Cardboard (Figures 1 & 4) with a view to extend it to other similar platforms such as Samsung Gear VR, Oculus Rift and HTC Vive.

We focus on web technologies as we believe that the recent emergence of cutting edge VR APIs for the web offers exciting possibilities for data visualization.

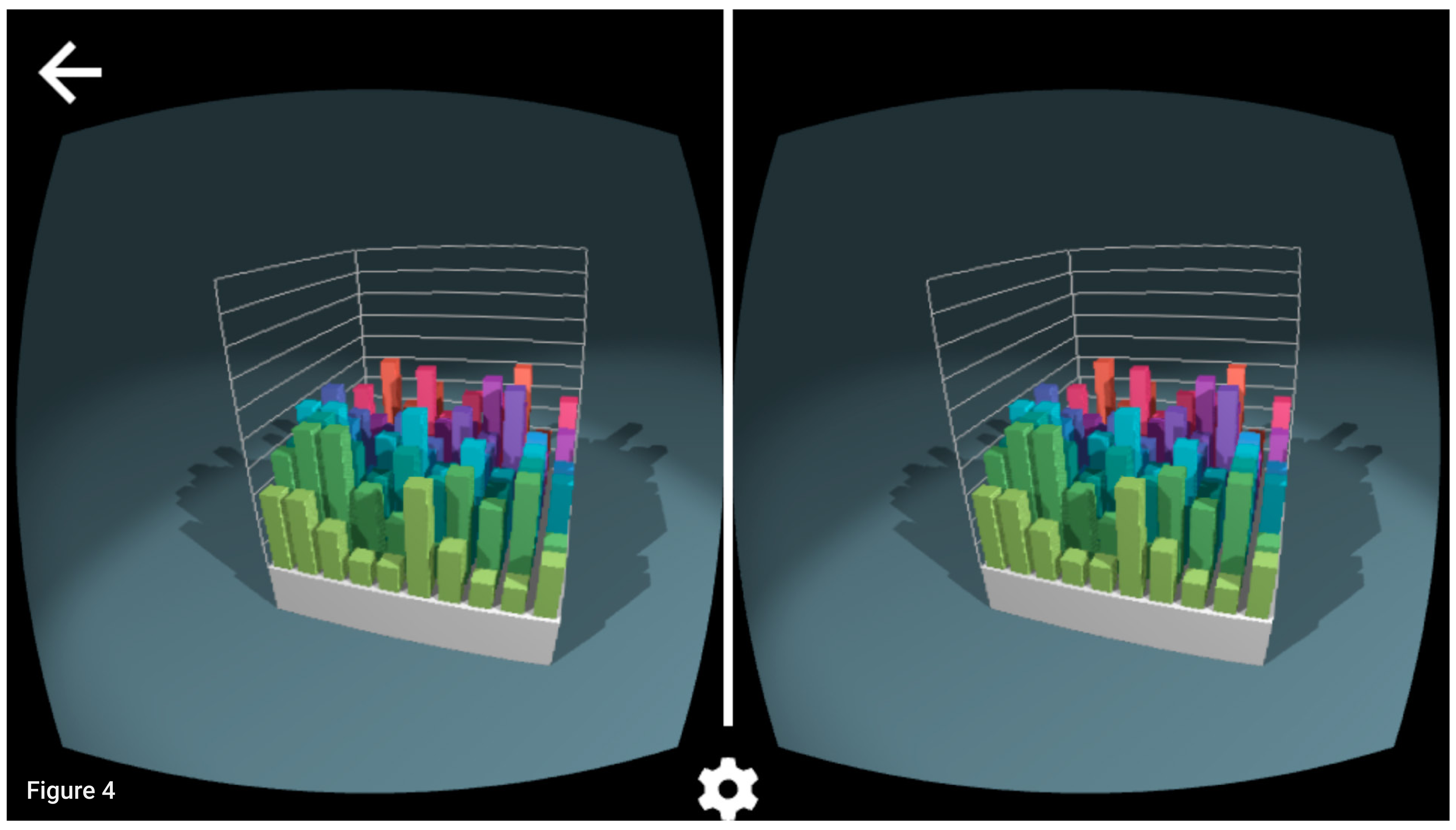
Figure 4

Our Prototype

The prototype uses the WebVR Polyfill [4], a JavaScript implementation of the WebVR specification, and Three.js [5]. It also employs head tracking with 3 DOF.

Currently, we load different datasets in JSON format (Figures 2 & 6) which can be filtered (Figures 2 & 3) by reducing the dimensions of the base, grid and axes.

We deliberately chose to confine the interaction, as with most HMD systems users can feel nauseous. Consequently, at this point we only rotate the visualization around the Y axis, rather than allowing the user to manipulate the object in all orientations.

Figures 1-6 exhibit the IA prototype running in different modes. Figures 1 and 4 demonstrate the application running with medium quality effects (antialiasing and shadows). Maximum quality effects cause mild frame loss on medium-high end smartphones. Figures 2, 3, 5 & 6 demonstrate various levels of rendering quality.

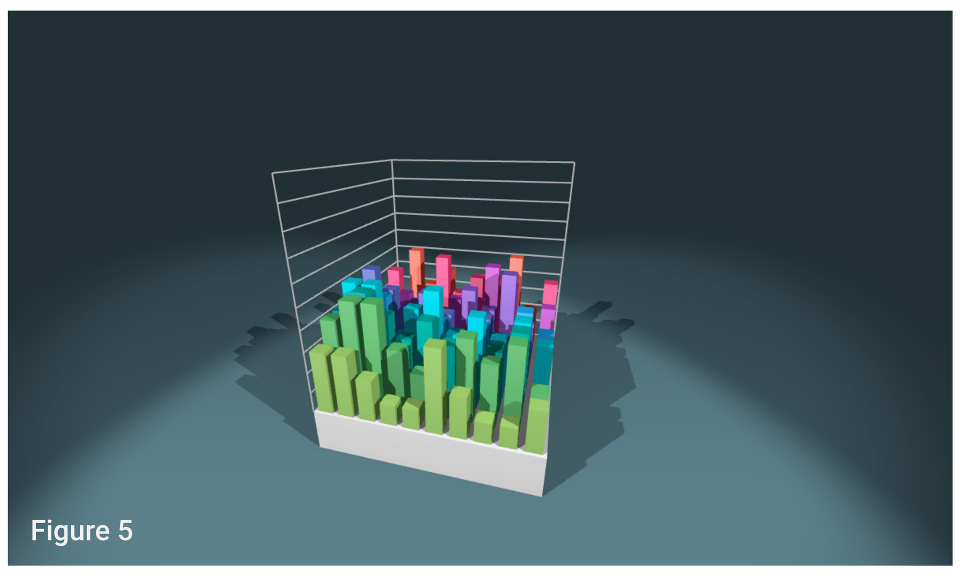
Figure 5

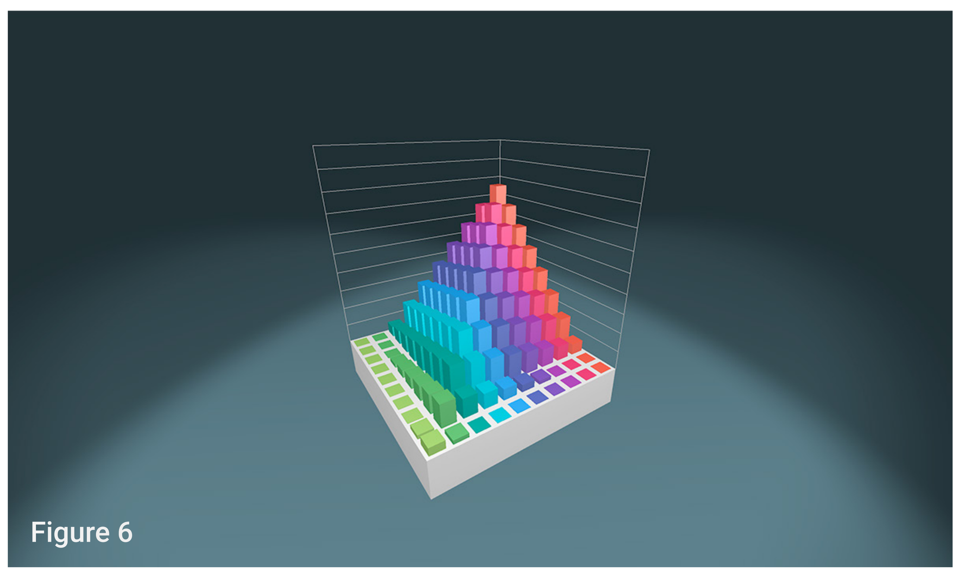
Figure 6

[1] - J. C. Roberts, P. D. Ritsos, S. K. Badam, D. Brodbeck, J. Kennedy, and N. Elmqvist, “Visualization Beyond the Desktop - The Next Big Thing”, Computer Graphics & Applications, IEEE, vol.34, no.6, pp.26-34, November 2014
[2] - T. Chandler, M. Cordeil, T. Czauderna, T. Dwyer, J. Glowacki, C. Goncu, M. Klapperstueck, K. Klein, K. Marriott, F. Schreiber, and E. Wilson, “Immersive analytics,” in Proc. BDVA’15, 2015, pp. 1–8.
[3] - Y. Jansen, P. Dragicevic, and J.-D. Fekete, “Evaluating the efficiency of physical visualizations,” in Proc. CHI’13. New York, NY, USA: ACM, 2013, pp. 2593–2602.
[4] - WebVR (https://webvr.info)
[5] - Three.js (https://threejs.org)

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