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3D Visualisations Should Not be Displayed Alone – Encouraging a Need for Multivocality in Visualisation

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Abstract

We believe that 3D visualisations should not be used alone; by coincidentally displaying alternative views the user can gain the best understanding of all situations. The different presentations signify manifold meanings and afford different tasks. Natural 3D worlds implicitly tell many stories. For instance, walking into a living room, seeing the TV, types of magazines, pictures on the wall, tells us much about the occupiers: their occupation, standards of living, taste in design, whether they have kids, and so on. How can we similarly create rich and diverse 3D visualisation presentations? How can we create visualisations that allow people to understand different stories from the data? In a multivariate 2D visualisation a developer may coordinate and link many views together to provide exploratory visualisation functionality. But how can this be achieved in 3D and in immersive visualisations? Different visualisation types, each have specific uses, and each has the potential to tell or evoke a different story. Through several use-cases, we discuss challenges of 3D visualisation, and present our argument for concurrent and coordinated visualisations of alternative styles, and encourage developers to consider using alternative representations with any 3D view, even if that view is displayed in a virtual, augmented or mixed reality setup.

CCS Concepts

• ***Human-centered computing*** → ***visualisation;*** • ***Computing methodologies*** → ***Computer graphics;***

1. Introduction

In this paper we lay the foundations of our hypothesis: that when a developer is displaying data in 3D they should also use other depiction methods alongside. They need to use different strategies that accompany each other to enable people to understand the richness of the data, see it from different viewpoints, and deeply understand complexities within it. A single data-visualisation can be used to tell different stories. People can observe, maximum or minimum values, averages, compare data points to known values, and so on, from one visualisation depiction. But when several visualisation depictions are used together, people can view the data from different perspectives. Alternative presentations allow people to understand different points of view, see the data in different ways, or fill gaps of knowledge or biases that one view may give.

In many cases, it may be possible to coordinate the user-manipulation of each of the views [Rob07]. Through methods such as linked brushing or linked navigation the user can then understand how the information in one view is displayed in another view. But sometimes it is not obvious how to create multiview solutions, or how to link the information from one view to another. For instance, tangible visualisations (printed on a 3D printer) can be used as a user-interface tool, but it may not be clear how to coincidentally display other information, or to 'link' the manipulation of these objects directly with information in other views.

Since the early days of visualisation research, developers have created three-dimensional visualisations. Users perceive 3D through depth perception [CV95, MPWL13] and understand data through visual cues; visualisation designers map values to attributes of 3D geometry (position, size, shape, colour and so on). Perhaps the data to be examined is multivariate, and maybe one or more of the dimensions are spatial, or it is possible that the developer wants to create an immersive data presentation. Whatever the reason, three-dimensional visualisations can enable users to become immersed in data. 3D Visualisations range from medical reconstructions, depictions of fluid flowing over wings, to three-

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