Acquario: A Tangible Spatially-Aware Tool for Information Interaction and Visualization

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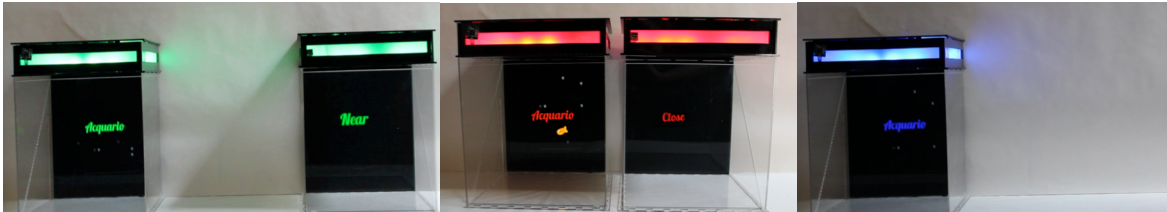{sapratte, teddy.seyed, frank.maurer}@ucalgary.ca

Figure 1. The Acquario interactive, spatially aware cubic display running a web-based demo application highlighting the proximity ranges of 'close' (b), 'near' (a) and 'far' (c).

ABSTRACT

Acquario is an interactive, spatially aware personal cubic display that can be used as an interaction tool for visualizations. Acquario uses the Pepper's ghost effect to transform a web-based visualization into a "holographic" visualization that can be interacted with using gestures, proximity or custom laser printed tangible objects with embedded NFC tags. The aim of Acquario is to enable proximity, tangible and gestural interactions for designers for keyboard and mouse based interactions, allowing users an innovative and "hands on" means.

CCS Concepts

• **Human-centered computing~Interactive systems and tools** • *Human-centered computing~Gestural input* • Human-centered computing~Ubiquitous and mobile computing design and evaluation methods

Keywords

Tangibles; spatial; gestures; information visualization;

1. INTRODUCTION

A significant amount of research has explored and continues to explore, novel and interesting ways to view and analyze datasets. Providing different means of exploration allows users to discover new and interesting insights from their data, which is only made possible with newer techniques of interaction [1]. More recent research focuses in information visualization are interaction techniques, as they allow users to "get their hands on the data" [1]. One interaction method with visualizations that has been explored in different contexts is proxemics. Similar to prior research, our research explores creating a tangible, spatial tool for interacting with information through gestures, tokens and proxemics. We introduce Acquario, which transforms web-based

visualization designs and allows users to manipulate and perform common information visualization tasks (e.g. comparison, selection, navigation) in a novel way.

2. ACQUARIO

The main goals of Acquario are (1) to provide designers of visualizations a means to enable proximity, tangible and gestural interactions, and (2) to allow users to explore visualizations in a manner that allows them to interact with data in a new way. The primary components of the system include a Samsung Galaxy Tab S2 8" tablet, a Spark Core development board, and laser-cut physical tokens with NFC tags. All components of *Acquario* are contained in a plexiglass cube (figure 1). The display of the tablet is reflected on a thin sheet of plexiglass inside the cube, at ~45° degree angle from the tablet's screen, creating the faux "hologram" that is projected onto the back surface of the cube. This technique (Pepper's ghost effect) makes digital information appear inside the cube, as seen in Figure 1.

Acquario detects when two cubes are within different proximic ranges. This can allow for individual versus collaborative information visualization. Proximity also allows users to interact with data in new ways; for example, compare data sets by bring them within a specified range. Acquario using NFC also recognizes tangible objects. When a user places a tangible object inside the cube from the left side, an event is triggered (e.g. query data). Additionally, depending on the design of a token, virtual information can be displayed on or around the token inside the cube.

3. CONCLUSION

In this work we present our early work on a tangible spatially aware tool, *Acquario*. Our research aim is to allow designers to explore data in a novel way using interaction techniques such as physical tokens, gestures and proxemics. In the next stages of this research, we will conduct further studies on usability and features that visualization designers could require from Acquario.

4. REFERENCES

[1] Sheelagh Carpendale. 2013. Innovations in visualization. In *Proceedings of Graphics Interface 2013* (GI '13). Canadian Information Processing Society, Toronto, Ont., Canada, Canada, 1-8.