Poster: Choosel – Web-based Visualization Construction and Coordination for Information Visualization Novices

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ABSTRACT

Since information visualization has become increasingly vital to experts, it is now important to enable information visualization novices to consume, construct, and coordinate visualizations as well. Choosel is a web-based environment that aims at facilitating flexible visual data exploration for information visualization novices. It supports the iterative construction of multiple coordinated views during the visual data analysis process. A preliminary user study with 8 participants indicated that multiple windows, enhanced drag and drop interaction, and highlighting of items and sets, in particular, support novices in the visual data exploration process in a useful and intuitive way.

KEYWORDS: information visualization, novices, visualization construction, visualization coordination, multiple coordinated views, end user development, customization

1   INTRODUCTION

The vision of information visualization (InfoVis) for the masses implies that any user should be able to analyze data sets of interest easily. Cutting-edge services such as ManyEyes [7] allow users to upload and visualize data on the web, and facilitate the sharing and discussing of visualizations. However, constructing visualizations remains challenging for information visualization novices – those who are not familiar with information visualization and visual data analysis beyond the graphics encountered in everyday life. They especially struggle with creating visual mappings, and their mental model of visualization specification differs from the technology centric steps that are required by many current tools [1].

Based on our findings from an exploratory user study, we devised a set of cognitive support requirements and tool guidelines that aim at supporting InfoVis novices in visualization construction and coordination [1]. We then developed Choosel, a web-based visual data exploration environment that implements several of those guidelines. It supports the iterative construction of multiple coordinated views during the visual data analysis process. In this poster paper, we briefly describe Choosel and a preliminary user study that we have conducted.

2   RELATED WORK

Visualization tools have made several advancements in supporting visualization construction by InfoVis novices. For example, ManyEyes allows users to visualize data on the web, and supports collaboration on visualizations [7]. Polaris/Tableau uses the dragging and dropping of data attributes to facilitate the creation of visual mappings [6]. However, these tools have focused on constructing single visualizations, whereas Choosel is designed to support the construction of multiple coordinated views during data analysis.

There are several approaches to visualization coordination. North and Shneiderman devised a taxonomy of multiple window coordination techniques [3]. One user interface approach to visualization coordination is Snap-Together Visualization, which is based on relational schemata [4]. However, information visualization novices are likely to have difficulties understanding relational schemata, which might amplify the user interface problems reported for this approach [4].

Another approach to creating multiple coordinated views is implemented in Improvise. It uses a separate editor to allow the user to construct and coordinate visualizations using a combination of a coordination model with a visual abstraction and data processing language without restarting the application [8, 9]. However, the different specification formalisms in Improvise are challenging for users to understand and compose. Choosel aims at providing cognitive support for information visualization novices in coordinating multiple visualizations. The goal is to enable those users to coordinate and customize visualizations by themselves without requiring sophisticated technical knowledge.

Visage employs drag-and-drop to allow the users to interact with the different elements in its information visualization workspace, for example allowing for adding elements to views using drag-and-drop [5]. Choosel uses a similar information-centric approach as Visage, but provides additional cognitive support, for example drop target highlighting, drop previews, and creating filtered views and synchronized selections using drag-and-drop.
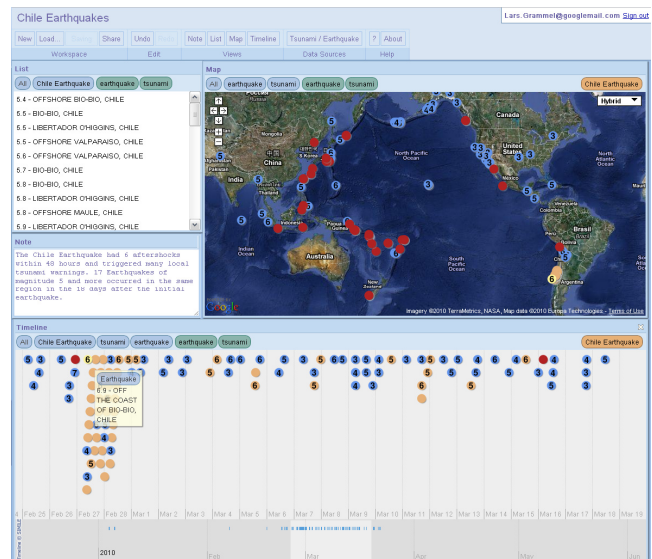

Fig. 1. Choosel – a web-based environment for flexible data exploration with multiple views (showing tsunami/earthquake data).

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3 CHOOSEL

Choosel is a web-based environment that uses multiple coordinated views to facilitate flexible data exploration (see Fig. 1). The main goal in developing this environment was to explore and evaluate cognitive support functionality that helps InfoVis novices coordinate multiple views. Choosel focuses on supporting iterative specification and on providing a tight integration of multiple coordinated views into the visual analytics process. These are two of the cognitive support feature categories that came out of the exploratory user study [1].

To support the iterative construction of multiple coordinated views, Choosel provides undo/redo, drag-and-drop of resources, windowing functionality and brushing in a web-based environment. In addition to those standard features, we explore several novel cognitive support concepts in Choosel. Drop target highlighting shows potential drop targets once a drag operation is started, which reduces the amount of visual search. Drop previews show the effect of a potential a drop operation when the user moves the mouse over a drop target without releasing the mouse button. This prevents the user from having to complete undesired drop operations to understand their results.

Choosel employs a set-based paradigm. Selections in views are resource sets, and each view can have several selections. The user can activate, deactivate, and change sets with familiar selection operations. All sets in a view are shown above the visualization, with input sets on the left and selection sets on the right. Users can create filtered views and synchronize selections between different views using the same drag-and-drop operations used for adding resources to views.

To tightly integrate this coordination of multiple views into the overall visual analysis process, Choosel also supports more general features such as the loading, saving and sharing of workspaces, the creation of notes, and the naming of resource sets. Our goal is to integrate visualization construction and coordination into the visual data analysis process, such that users do not recognize the difference and remain in their visual data analysis flow. The development of a more general visual analytics environment also allows for potential field evaluation and case studies in the future.

Choosel is currently used in two research projects: facilitating the exploration of biomedical ontology data[1], and facilitating the exploration of software engineering project data [2]. We also created visualizations of a spatiotemporal data set (earthquakes & tsunami warnings) with Choosel. The Choosel framework is freely available as open source software[2].

4 USABILITY EVALUATION OF CHOOSEL

Once an initial version of Choosel was implemented, it was important to identify usability issues and to study user interaction. In order to further improve it before conducting a formal comparative study, Choosel was evaluated in a user study with 8 InfoVis novices. At the beginning of each study session, the participants watched a 10 minute video tutorial that explained the main tool features. They then used the tool in a laboratory setting for 20 minutes on 6 tasks. After using the prototype, they filled out an evaluation questionnaire. The questionnaire asked the participants to rate different aspects of the prototype on 5-point Likert scales, and also contained open questions targeted at identifying strengths and weaknesses of the prototype.

The results of the usability evaluation indicate that the main concepts implemented in Choosel work well. The aggregated scores from the usability evaluation and our observations indicate that especially multiple windows, enhanced drag and drop interaction, and highlighting of items and sets support the visual data exploration process in a useful and intuitive way. However, as expected, several usability issues still impede the users' understanding of the tool. Using resource sets to create filtered views and synchronized selections is not always intuitive, and the views lack customizability.

5 FUTURE WORK

In addition to the usability improvements that were motivated by the usability evaluation, we are planning to extend Choosel in several ways. We are adding new visualizations including several types of charts, tag clouds, and more advanced graphs. Providing more visualizations will support a wider variety of sensemaking tasks on different types of data. We are also planning to support extended customizability of visualization. In particular, we want to enable the users to define how data is aggregated before displayed in a visualization. Finally, we are hoping to integrate automatic visualization capabilities into Choosel.

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