

Towards Quantifying Multiple View Layouts in Visualisation as Seen from Research Publications

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Abstract:

We present initial results of a quantitative analysis of how developers layout the visualisations in their multiple view systems. Many developers create multiple view systems and the technique is commonly used by the visualisation community. Each visualisation shows data in a different way, and often user interaction is coordinated between the views. But it is not always clear to know how many views a developer should use, or what would be the best layout. We extract images of visualisation tools, across TVCG journal, conference, posters and workshop papers 2012-2018 to analyse the quantity and layout of the views in these visualisation systems. Focusing on view juxtaposition, we code the layout of 491 images and analyse view topology in juxtaposed views. Our analysis acts as a starting point to help designers create better visualisations, acts as a taxonomy of visualisation layouts, and provides a quantitative analysis of how many views developers have used in their visualisation systems.

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Towards Quantifying Multiple View Layouts in Visualisation as Seen from Research Publications

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ABSTRACT

We present initial results of a quantitative analysis of how developers layout the visualisations in their multiple view systems. Many developers create multiple view systems and the technique is commonly used by the visualisation community. Each visualisation shows data in a different way, and often user interaction is coordinated between the views. But it is not always clear to know how many views a developer should use, or what would be the best layout. We extract images of visualisation tools, across TVCG journal, conference, posters and workshop papers 2012-2018 to analyse the quantity and layout of the views in these visualisation systems. Focusing on view juxtaposition, we code the layout of 491 images and analyse view topology in juxtaposed views. Our analysis acts as a starting point to help designers create better visualisations, acts as a taxonomy of visualisation layouts, and provides a quantitative analysis of how many views developers have used in their visualisation systems.

Keywords: Information visualization, multiple view layouts

1 INTRODUCTION

Multiple view systems are often used by visualisation developers. But it is not easy for a developer to know how to layout and position the views in their systems, or how many views they should use, or what design attributes work best. We believe that developers and learners should have guidelines and frameworks to help them make good design decisions. Subsequently, we are keen to develop theories for visualisation, and specifically develop guidelines on best practices of view layout. But to achieve these goals, researchers need to perform basic research to understand best practices of what we currently do. The results of this paper helps us move forward towards our goals.

We present initial results of a quantitative analysis of the quantity of views used in *multiple view* systems as reported in the visualisation literature. In this paper we focus on two questions: (Q1) how many views, and (Q2) what are their arrangements? To answer these questions, we (1) **prepare and extract images** from papers, (2) **code and classify each layout** through visual inspection and discussion, we considered each visualisation in turn, judging the topological makeup of each visualisation, coded them such that we can classify them, and recorded a sketch of their topology and (3) **analyse the results**. Our three-stage methodology is shown in Figure 1, and we use this process to structure the rest of the paper. First the related work in Section 2. Second, we describe how we collected the images for our analysis (Section 3). Third, present how we codify the layouts (Section 4) and fourth we present the results for each question (Q1 in Section 5 and Q2 in Section 6) and discuss how we organised the sketches on a tabletop. Finally we discuss the results and their application, and conclude.

We extract images from research publications that were published at the IEEE Visualisation conference between 2012 and 2018. This

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seven year period provides a convenient and reproducible set of images of modern visualisation tools that have been designed and presented by community experts. In particular, because these works have gone through peer review, we assume that the authors have spent careful thought over how they present their tools, and consequently they have been attentive to the selection of their views and the presentation of their multiple view systems. We considered many sources, including using a general Internet search for visualisation images, video sources such as Vimeo or YouTube, or other online image repositories. Adding these sources might give us a rich data set of different images and this is certainly a limitation of what we did here. But, they also bring challenges, where image searches change over time, results change per user or geographic location, which would make it more difficult for others to confirm our studies, and to add more images for future years.

In this work we concentrate on view juxtaposition, where each views sits alongside each other, and on the topology of each design layout (e.g., a 2-view system can have one view above another, or left/right of each other). This short-paper extends our poster paper, that was presented at the 2018 IEEE Visualisation conference, where we introduced our methodology and highlighted initial results [1]. The feedback and discussions with the community at this event was invaluable; consequently we extended our quantitative analysis, widened our input data to include 2018 papers and included statistics on single-view systems. There are many research questions that we have investigated in our broader research project, including the quality of views, layout organisation, symmetry and design attributes, to the type of visualisation used. With space limitations of this format, therefore we summarise our main findings and focus on two main questions: Q1 How many views are used in multiple view systems? and Q2 What layout arrangements are popular in multiple view systems?

(1) Prepare

- Select files
- Extract images
- Name images

(2) Code

- Judge the views
- Sketch topology
- Code view type

(3) Analyse

- Layout on tabletop
- Analyse topology



Figure 1: (1) We extracted 491 images from IEEE VIS 2012–2018 conference publication. (2) We coded the images by their topology (making sketches of the layout, totalling 22 sheets of paper); discussing cases to confirm their layouts. (3) We cut the 22 sheets of sketches into individual tiles, and organised them on a tabletop, to analyse and tally the quantities.

2 RELATED WORK

We acknowledge the huge amount of well-cited research that has been achieved in the area of multiple views. Twenty five papers from the conference on Coordinated and Multiple Views conferences (2003 to 2007), rules and principles for the use of multiple views [24], state of the art in Coordinated Multiple Views (CMV) [20], juxtaposition, superposition and explicit designs for multiple view sys-