

SUPPORTING CREATIVITY IN THE CREATION OF DATA VISUALIZATIONS
WITHOUT PROGRAMMING USING AN OBJECT-ORIENTED APPROACH

by

Drew Skau

A dissertation submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in
Computing and Information Systems

Charlotte

2013

Approved by:

Dr. Robert Kosara

Dr. Zachary Wartell

Dr. Celine Latulipe

Christopher Beorkrem

Dr. Mary Lou Maher

ABSTRACT

DREW SKAU. Supporting Creativity in the Creation of Data Visualizations Without Programming Using An Object-Oriented Approach. (Under the direction of DR. ROBERT KOSARA)

Visualizations are typically created using a pipeline approach that relies on pre-defined algorithms to map data to visuals. This prevents creativity from entering the process of building data visualizations. My work explores a new model for creating visualizations that involves designing data visualizations with an object-oriented approach. This allows the creation of novel visualizations and visual structures. I plan to explore this space further using prototype tools developed using the model. Evaluation of the tools will focus around creativity support.

TABLE OF CONTENTS

LIST OF FIGURES	v
LIST OF TABLES	vi
CHAPTER 1: INTRODUCTION	1
1.0.1	2
CHAPTER 2: APPENDIX	3
REFERENCES	4

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Creating new types of visualization invariably requires programming. Tools like Tableau create visualizations based on data and user input, but are limited to a relatively narrow selection of visualization types. Many designers are trying their hands on visualization frameworks like D3.js [2], but are not familiar enough with the programming concepts involved to be very effective. At the same time, the theory of visual representation has not advanced much since the seminal work by Bertin [1] and Mackinlay [3]. I believe that both problems can be solved by a fresh look at the nature of visual representation in visualization.

I propose a new model for the representation of data in information visualization: visualization primitives. Like graphical primitives, visualization primitives are simple geometrical objects that can be combined into more complex ones. In addition to just the graphical component, however, visualization primitives also connect to data and, in turn, produce output data. By designing simple prototypes and applying data to them, users can quickly create many different visualizations in a very short time.

The goals of this work are as follows. On the theory side, I want to develop a new model of visual data representation. I believe that current models that are based on pipelines are too limited and do not adequately define the connection between visual appearance and data. On the practical side, I believe that this model will

translate into tools that will make it easier for non-technical users – such as designers, illustrators, and journalists – to create new visualizations from scratch. Designers are already accustomed to working with graphical objects, and manually change them to represent data. Using visualization primitives, they are now able to design prototypes that automatically and immediately represent the data.

I believe this approach will support creativity in visualization creation. The immediacy of the feedback promotes exploration of the visualization design space.

1.0.1

CHAPTER 2: APPENDIX

REFERENCES

- [1] J. Bertin. *Semiology of graphics*. University of Wisconsin Press, 1983.
- [2] M. Bostock, V. Ogievetsky, and J. Heer. D³ data-driven documents. *Visualization and Computer Graphics, IEEE Transactions on*, 17(12):2301–2309, 2011.
- [3] J. Mackinlay. Automating the design of graphical presentations of relational information. *ACM Transactions on Graphics (TOG)*, 5(2):110–141, 1986.