Chapter 3

Theoretical Foundations of Information Visualization

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The field of Information Visualization, being related to many other diverse disciplines (for example, engineering, graphics, statistical modeling) suffers from not being based on a clear underlying theory. The absence of a framework for Information Visualization makes the significance of achievements in this area difficult to describe, validate and defend. Drawing on theories within associated disciplines, three different approaches to theoretical foundations of Information Visualization are presented here: data-centric predictive theory, information theory, and scientific modeling. Definitions from linguistic theory are used to provide an over-arching framework for these three approaches.

1 Introduction

Information Visualization suffers from not being based on a clearly defined underlying theory, making the tools we produce difficult to validate and defend, and meaning that the worth of a new visualization method cannot be predicted in advance of implementation. There is much unease in the community as to the lack of theoretical basis for the many impressive and useful tools that are designed, implemented and evaluated by Information Visualization researchers.

The purpose of a theory is to provide a framework within which to explain phenomena. This framework can then be used to both evaluate and predict events, in this case, users' insight or understanding of visualization, and their use of it. An Information Visualization theory would enable us to evaluate visualizations with