Research Statement

Information Visualization …

Visualization is generally divided into three areas:
Volume Visualization deals with volumetric data, like data from computer tomography (CT) or magnetic resonance imaging (MRI),
Flow Visualization visualizes measured and simulated flow data, like data from aircraft design, combustion simulation, etc., and
Information Visualization (InfoVis) is concerned with more abstract data, possibly without any spatial or otherwise intuitively understandable dimensions, like bank account data, health statistics, etc. In InfoVis the amount of data is usually reduced in order to communicate the main points more effectively i.e., by using metaphors, and preattentive methods. InfoVis needs to present the underlying data exactly, not less and not more. The combination of expressiveness and effectiveness is sometimes very hard and cannot be reached at the same time.

The main topic of my Ph.D. thesis is to develop a framework for InfoVis methods with the focus on the users' tasks, starting with the Visual Information Seeking Mantra by Shneiderman. [Shne96], based on findings from cognitive psychology.

… needs interdisciplinary approaches

To generate expressive and effective visualizations, the user and her tasks have to be taken into account. InfoVis should be highly interactive in order to support the exploration of the data by the user.

Since pictures are usually based on metaphors, they have to be seen in their social context in order to understand them. The user filters the visual signals, she perceives based on what makes sense to her. However, some visual representations seem to be better than others [Ware00].

Visualizations in general are external representations of thought. Like real objects, they act as external memory. These external representations facilitate cognitive tasks like problem solving, reasoning, and decision making. They provide information that can be perceived directly und used without being interpreted and formulated explicitly and can anchor cognitive behavior [Zhan99]. We never see everything of our environment at once. We perceive only these objects in detail, which are in the focus of our interest. Change blindness and its potential for visualization methods is one of these interesting phenomena [Rens02].

We all know the saying "A picture is worth ten thousand words". But do we know why this works? Cognitive Science and Computer Science together have some important questions to explain and therefore need to intensify their cooperation. A huge amount of questions and challenges emerge. For example: How does visual perception work? Perception and cognition versus sense and interpretation: How do they intertwine? How can we use the findings on perception and cognition to create expressive and effective visualizations? Is preattentiveness an adequate scale for the effectiveness of a visualization? Which interactions take place while using visualization as external representation of cognitive processes? Which requirements are to follow and constraints to accept in designing user interfaces?

These are some questions, which I plan to discuss in my Ph.D. Thesis.

Literature

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