HCI and Visualization - Thoughts on the Relationship and Future Development of Two Disciplines

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HCI and visualization are two closely related disciplines with several important overlapping topics. So far however they maintain distinct individual research traditions and agendas. We think these two traditions can be well characterized by differences with regard to their main focus, the applied methods and the main questions the regarding research tries to answer.

According to our perception v*isualization* traditionally is more concerned with rather static displays of available information, and focusing on ways to optimize the presentation of complex and multidimensional data set. The main emphasis in visualization typically lies on supporting the development of an understanding of data.

In contrast *human computer interaction* typically focuses much more on the dynamics and interaction between user and system, and the main goal is to support the user in achieving practical hands-on tasks.

Recently with the advent of so-called *visual analytics* researchers started to combine aspects of both worlds, especially enriching visualization with a more dynamic and interactive approach to data understanding. Visual analytics has been described as "the science of analytical reasoning facilitated by visual interactive interfaces" [Thomas & Cook 2005]. This interest in combining visualization and interaction approaches is driven by the increasing complexity and dimensionality of data which cannot be displayed in a single visualization but requires the active exploration and interaction of the user to reveal all its nuances.

In future we expect an even further integration of human computer interaction and visualization approaches to address the challenges of understanding ever more complex relations in ever increasing data pools. Furthermore we expect an increase of the integration and application of data mining and machine learning methods with visual analytics. Such approaches could be used to guide the users' attention to potentially interesting aspects of the available data, and allow integrating more information in the display as the processed data provides a concentration and compression of the multiple facets of available data.

In the context of the above describe developments we think the following research challenges are of key importance within HCI, visualization and visual analytics within the next years:

Integration of data mining and machine learning approaches with visualization, human computer interaction and visual analytics systems. We think that data mining and machine learning approaches could help to deal with the ever-increasing amount of data, and allows reducing the (visual) complexity of displayed data thereby making it easier to comprehend respectively allow to show additional features. For example, in prior work we used different methods to clustered tags within tag clouds according to their semantic relatedness, and could show that this could support fast perception and understanding of data structures [Schrammel et. al 2009].

Developing *new approaches for the visualization and understanding of large scale networked data*. The world is becoming ever more interconnected, and it has become impossible to understand phenomena in an isolated way. Therefore we think that analysis systems that support the understanding of networked data are of high importance for future research. New developments allowing to visualize the semantic structure of networks such as e.g. developed by NodeXL [Smith et. al 2009] or algorithms that allow optimize drawing and display of identified structures such as e.g. Euler diagrams [Rodgers 2004] have the potential to increase understanding of data based on improved data analysis, visualization and interaction concepts.

Exploring the possibilities of novel display hardware, and develop visualization systems that systematically capitalize the newly emerging possibilities for improving interaction and understanding. New hardware providing exiting possibilities (e.g. 3D-Screens, AR-Systems) is becoming available, and researchers only started to explore the possibilities for visualization and HCI.

Apply computer vision and vision theory to predict the usefulness of different visualizations, to allow to dynamically adapting visualization systems and parameters to the concrete circumstances of the visualization and the displayed data. Furthermore, learning from interactions of expert users with interactive visualization systems can capture knowledge which helps developing a deeper understanding of the involved perception processes and problem solving strategies, and to develop supporting mechanisms for novice users based on these findings.

References

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