Chapter 6
How Visualisation and Interaction Can Optimize the Cognitive Processes Towards Big Data

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ABSTRACT

In recent decades, large amounts of data became essential parts of daily work and life such that the rise of big data movements was inevitable. However, is everybody able to see what the data really means? Is everybody able to extrapolate the right information from the jungle? Maybe yes, but most probably no if he or she is not an expert. In parallel, the spread of interactive devices, stationary and mobile, has the potential to improve and ease information retrieval processes. On top of both developments, human-computer interaction (HCI) and of visualization have a great impact on the cognitive process to understand and interpret big data. In this respect, a new method for gathering data via easy-to-use interfaces and intuitive visualization is presented. This chapter also presents an example of how interaction with the new devices enhances the cognitive processes of memorizing the information.

INTRODUCTION

Visual analytics is the study of transformation of data to visual representations. The goal is to create these representations in such a way that their interpretation is driven by effective and efficient cognitive processes that enable an easy understanding of the data itself. Today, visualization and visual analytics is more than just a collection of plots, graphs, and computer-generated 3D renderings. There are many visualization techniques for every form of data, including, but not limited to, texts, documents and corpora, tree graphs and networks, image collections and videos, time series, tabular and multivariate

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data, geographical data, scalar vector, and tensor fields, isosurfaces, numerical, geometrical, statistical and other mathematical models, historical events and provenance records, dynamic data streams, algorithms, programs, and computational logs, and a wide range of domain-specific data in disciplines such as engineering, biology, medicine and many others.

Visualization is easily perceived as a means for presenting beautiful computer generated images and animations to impress an audience. However, significant evidence obtained through perceptual studies and user evaluation confirms that proper visualization has enabled researchers and decision makers to be more efficient in gaining insights from data and therefore efficiently improving their cognitive system. It facilitates the formulation of new hypotheses, assists in decision-making, enables effectual communication of ideas, and facilitates dissemination of knowledge.

To gain insight into these data, to make sense of these data, and to gain new scientific knowledge out of it, we must proceed to work on and aim to define efficient and user-friendly solutions.

The importance of having proper visualisation solutions to improve and optimize the memorizing processes is continuously increasing, e.g. to optimize time and effort in cognitive learning processes and in gaining insights from geo-spatial, behavioral, commercial, scientific data.

Useful data is generated with the advent of new hardware technologies and with sensors embedded everywhere. Examples are CCTV cameras, social media, and systems where machines and users generate contents in various forms, such as, videos, images, text and geospatial data. This data represents a valuable source to identify trends in all sectors. Leveraging social media data presents many challenges: social media data has a large volume; it is a multimodal set of data, it is often ambiguous in its content, and is highly context- and user-dependent.

Moreover, Human Computer Interaction (HCI) transformed the way end users are interacting with information. New interaction paradigms, such as voice recognition, gesture based interactions and multi-touch interaction now enable a deeper interactive experience in memorizing information and in optimizing search for information.

Mobile platforms like smart phones and tablets have advanced significantly in the last 10 years. The incorporation of faster processors and mobile GPUs has greatly increased the impact and range of applications. The ubiquity of geo data and mapping applications for smart phones has familiarized a broad base of users with the navigation and interpretation of 2-D maps as well as 3-D maps that have been introduced on the major mobile platforms. This phenomenon is also increasing the familiarity of users with navigating in 3-D textured environments not only representing geographical spaces.

The following chapter describes the transformation of cognitive processes through different ways of interacting with data as well as it describes the importance that visualisation is gathering as a common taxonomy to optimize insights from disseminating and sharing data. Its structure is as follows:

1. The first part focuses on the Human Computer Interaction and Interactive Digital Media,
2. The second part focuses on Big Data and Interaction, and
3. The last part comprises of the description of the experiment and the authors conclusions.

The chapter is structured as follows:

1. A first part focuses on the Human Computer Interaction and Multi model user interfaces,
2. The second part on Interaction,
3. The last part comprises of the results from an experiment and the authors conclusions.