3. Interacting with Visualizations

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In human-media interactions, visualizations occur in a large variety of forms. However, they remain but a single form of possible feedback towards a user. In this chapter it is argued that human-centered visualization is a fundamental part of human-media interaction and vice versa. To that end, the focus in this chapter lies first on the more general topic of interaction research, thus providing a solid literary ground for the rest of this chapter (Section 3.1). In Section 3.2 the focus shifts towards the question how a display technology influences the way(s) in which interaction with visualization takes place. This path is then broadened in Section 3.3 by focusing on approaches towards interacting multimodally with visualizations. To that end a chronological overview of developments in that field is given, thus providing an insight of trends and required steps in realizing multimodal interactions. Also, future work in this field is deducted from literature and those development trends. Fourthly, Section 3.4 describes the issues at hand for effectively applying visualizations in group-based collaborative and distributed environments. The aim in this chapter is to provide an overview of developments and the current state-of-the-art of approaches in which visualization supports the human-machine interaction process and vice versa. For that, this chapter is finalized with a short summary of issues to deal with while designing interaction for visualization. In addition current and future challenges in interacting with visualizations will be discussed.

3.1 Interaction

Typically, *"we"*—humans—interact extensively with one another on a daily basis. *"We"* are hardly aware of the enormous complexity of these human-human interactions. When reviewing the research field of interaction studies this complexity becomes painfully clear by the sheer number of research efforts on a seemingly even larger number of research topics, all concerning themselves with various aspects of interaction. When humans communicate with one another, each participant in the conversation uses a combination of various modalities to express himself. Apart from a speaker being able to send multimodal signals, the listener is able to receive and interpret those multiple input signals. Mehrabian [556] found that only 7 percent of human interaction in a dialogue setting is provided by verbal cues in contrast to 38 percent vocal cues and 55 percent facial expressions. In addition, Qvarfordt and Zhai [686] found that eye gaze