Automatic graph drawing deals with the task to create a well-readable layout for a given graph in a way that the graph's content and structure become visible. Using formal aesthetic criteria, the quality of such layouts can be evaluated with respect to an underlying application. A variety of methods that focus on obtaining suitable drawings with respect to a subset of these criteria has been proposed over the years.

The task to construct layouts for a finite set of graphs, instead of for a single graph, is a recently introduced problem within graph drawing. This so-called *Simultaneous Graph Drawing* focuses on two main aspects when creating a series of drawings, namely the readability of the individual layouts and the mental map preservation in the series of drawings. While the readability is similar to the already discussed aesthetic criteria, a typical way to maintain recognizability of information in different drawings is to make sure that common vertices and edges are layouted equally in all drawings.

In this thesis we study the simultaneous drawing problem from different angles. Forcing vertices or edges to be drawn equally in the set of drawings can imply unpleasing individual drawings, as this restriction may lead to non-planar drawings for planar graphs. Analyzing sets of planar graphs whether they allow a series of planar drawings is known as the *simultaneous embedding* problem. In the theoretical part of this thesis we examine different variations of this problem. The practical part reformulates aesthetic criteria for the concept of simultaneous drawing and shows how to adapt known drawing methods to be usable in this context. Finally, we discuss different visualization schemes for the constructed layouts and present a new visualization software for simultaneous graph drawing.