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**The language of graphics**

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## CHAPTER 6

# Conclusions

In this thesis we have proposed a framework for parsing the syntactic structure of simple as well as complex information graphics (Chapter 2). In addition, this framework includes an examination of graphic interpretation (Chapter 3) and classification (Chapter 4), and can be used to analyze existing graphic theories (section 5.2). We have applied this framework to all example figures in the thesis, providing standardized analyses in the figure captions. The terminology of the proposed framework is summarized in the Glossary at the very end of this thesis.

We now briefly return to the aims and claims that we discussed in Chapter 1. These concerned the proposal of a *syntactic* approach, which is intended to be *comprehensive* and *unifying*, and which may apply in different *cultural contexts*.

### A SYNTACTIC FRAMEWORK

We have offered a proposal for the syntactic decomposition of graphic representations that can be applied *recursively*. We gave an example of a nesting of four levels of decomposition, when describing the syntactic structure of figure 2-03. Different types of nested syntactic structures were discussed in subsection 2.5.4. We have proposed the notion of different *syntactic roles* that graphic objects may play within a syntactic structure - these syntactic roles were discussed in section 2.5.3. The notion of *meaningful space* was introduced, and distinctions were made between *integral metric spaces*, *composite metric spaces*, and *distorted metric spaces*. We have compared our approach to the related approaches that were proposed by Richards (1984) and Horn (1998), which are both more limited in their set of syntactic structures that they describe, and which neither discuss recursive nesting, nor the possible structures of metric spaces.

Coming up with a set of basic syntactic structures, from which composite syntactic structures can be constructed, did involve certain choices that had to be made. An example of such a choice is our approach to 'partitioned graphic spaces', which was discussed at the beginning of subsection 2.5.2.

### A COMPREHENSIVE FRAMEWORK

The example figures that were analyzed cover a wide range of different types of graphics (see the Figure Index towards the end of this thesis for an overview). We have not yet come across an example of a graphic representation that could not be analyzed in terms of the proposed framework. This does not, of course, mean that we will not find such an example in the future.

### A UNIFYING FRAMEWORK

So far it seems that nobody has mapped out in detail how the various terminologies of different graphic theories can be related to each other. We have taken up this challenge in the 'term comparison tables' and in the literature discussion at the end of most (sub-) sections, using the proposed framework as a 'common denominator' for the numerous concepts that have been proposed in the literature. In section 5.2, we have provided a brief overview of how many existing approaches to graphic theory can be 'translated' into the concepts of this framework. By 'translating' them into the terms of this framework, any two of the existing graphic theories can be compared to each other. One of the conclusions of this exercise is that many approaches offer subsets of the same superset of relevant concepts (the superset that we have tried to present here), but that many authors have used terms in different, sometimes opposite ways, in order to describe these concepts. In the end, it is of course not the terms that are important, but the concepts that are involved.

### CULTURE DEPENDENCE

I have claimed in Chapter 1 that the framework proposed in this thesis is concerned with possible 'universal' principles of graphic representation, not only applicable to a broad spectrum of different types of graphic representations, but probably also extending across different cultures. We have done no research to confirm these claims, so most things we say in this regard will be based on speculation. The principles that were discussed in this thesis seem to be applicable to various non-Western graphic representations, such as Egyptian hieroglyphs (discussed in subsection 3.1.4) and graphic representations used by American Indians (discussed by Tversky 1995, 2001). Most of the proposed types of object-to-object relations are based on Gestalt principles of human perception, which also seem to hold across different

cultures. Maps in all cultures make similar uses of integral metric spaces, point locators, surface locators, and labels. Examples from various cultures are known concerning phenomena of metaphor, metonymy and rebus. An example of culture dependence in graphic structures is *directionality*, which is discussed by Tversky (1995, 2001), and in subsection 3.1.5 of this thesis.

#### WHAT IS IT ALL GOOD FOR?

The primary value of this work lies in the theoretical domain of the systematic analysis of various aspects of graphic representation. We have shown in this thesis that the proposed framework can be successfully applied to the analysis of a broad range of example graphics, as well as to the analysis and comparison of a large number of existing graphic theories. In addition, we hope that the development of the proposed concepts can form a basis for more practical work with graphic representations. Possible practical applications might include the analysis of design problems with specific graphics. Prescription of 'rules of good design' was not an aim of this thesis. Nevertheless, the thesis does provide a language that may be useful when discussing the phenomena that are involved in good and bad design. The proposed concepts concerning the composition and decomposition of syntactic structures could be used to generate and discuss different design alternatives for a given graphic representation problem.

Another possible area of application is in document analysis and data mining research that aims at information retrieval through automatic parsing of graphic representations. Parsing requires a syntactic framework. Research in computer science is developing in both directions, concerning automatic parsing as well as automatic generation. Continuing the work presented here, the proposed framework could be integrated into a computer-based design tool for generating graphic representations, possibly in combination with existing systems for static or interactive visualizations. Such software has the potential to serve as a cognitive tool, allowing people to create and explore different visual representations of the information that they are working with. These are exciting challenges for future research.

