General Introduction

Maps[1], in one form or another, were established and drawn very early on in history, in all epochs and all civilizations, as testified by the abundance of books and articles on this subject [JAC 92, KIS 80]. These documents showed property boundaries, helped military operations, as well as showing the way for travelers. Maps multiplied and became abundant in the scientific domain, in the overview of the general public, as well as in planning organizations. They have become an object of frequent use in various activities: mountain hikes, road trips, as well as finding a hotel or a restaurant. The arrival of the tools for free access to digital maps, of which Google Earth is certainly the most prominent example, further reinforces the importance of maps, either topographic or thematic, in the modern world. We live in a society of maps. Nevertheless, are the correct uses of a map, its creation and the possibilities it offers well known?

These questions are pertinent when we look at the maps published on paper (in magazines, books or atlases) or on screen (on the web). There we find carefully designed, highly complex maps, though illegible, as well as simple schematic documents, crudely and imprecisely drawn, possibly attractive but misleading. Everyone believes that he or she is capable of creating a map, as if using a computer is sufficient for obtaining an immediate response to a particular request. Maps are required "right away", as if "push button" maps existed and a map's validity was automatic. In reality, even before making a map, we need to know what the actual request is, whether the map is truly needed or whether a table would be more appropriate. Given the current proliferation of maps, their abundance and the dangers inherent in the variety of technological possibilities, it is important to

1 At this stage we will state that a map is "a simplified or conventional planar geometric representation of the whole or a part of the Earth's surface with a suitable degree of similarity to the original" [JOL 76]. This term will be explored further in Chapter 2.

carefully determine the necessary mapmaking route, in order to put cartography[2] into a more strict, rigorous setting and to produce a reliable document. This leads us to considering cartography and maps in a new light and to proposing a novel approach, after having identified new objectives.

The approach presented in this book utilizes cartographic reasoning, which puts mapmaking within a larger experimental scientific approach. A map is no longer a document produced in an isolated fashion, simply for illustration. It is a constructed image incorporated into a larger study, which at a given point of its development warrants the production of a map. It is therefore necessary to explain the context which justifies the map, to know its intended recipient in order to determine the theoretical and contextual elements on which the production of the map will hinge and based on which further choices will be made. The cartographic reasoning is meant to instruct us how to "dissect" a map request, in order to ascertain which questions to ask and what range of answers to offer. In fact, there is no unique answer for each request: "*the Map*" *does not exist*. Among others, there are solutions that produce maps more appropriate to a given purpose.

This reasoning provides a loose guide, which can incorporate changes, both conceptual and technical. Making a map by "clicking" a computer mouse may produce an image, whose quality or reliability cannot be certain: inaccurate data and improper processing do not produce correct maps. Wrong signs, inadequate representation modes will not yield accurate, meaningful information. Making a map based on cartographic reasoning allows us, however, to recreate an image whose elements can all be justified and explained and whose quality is assured. It produces a document which the recipients can use for deliberations, for asking and answering questions without worrying about the validity of the initial information. In order to achieve this, the map's author should be familiar with the readers' interests, objectives and capabilities.

From this point of view, a map is not a simple illustration accompanying a text because for most it is more pleasant to look at than a table. Depending on the context, it becomes a tool for deliberation or research, a "revealer" of hidden structures, or a supporting document, allowing partners to have concrete discussions. Nevertheless, we should not forget that regardless of its context, a map is always the result of at least a *minimum amount of research*: even for an illustration, we need to have some knowledge concerning the thematic phenomena represented and the locations in question. This presupposes a certain amount of

2 Here cartography is defined as "the set of scientific, artistic and technological studies and operations starting from the results of direct observations or the use of documentation with the aim of creating maps, plans and other modes of expression, as well as their usage" [JOL 76]. This term will also be clarified in Chapter 2.

preliminary study. It is based on this knowledge that a map can be established and can fulfill its multiple functions. Indeed, while preserving its initial function of locating observable spatial phenomena, the map also acquired the function of locating the characteristics which are invisible and which underlie these spatial phenomena both in structure and process. *The map becomes, therefore, a tool for discovery, and cartography becomes a discipline of localizing the invisible.*

This work on thematic cartography thus provides a guide to making a map, such that the map fits the requirements which originated its production, be it in the framework of a hypothesis in a study or the work of a consultant office. Although work conditions may differ, the basic principles are the same, and the guiding thread is identical, since a map is always produced via a succession of very particular stages.

An important point, which we will emphasize, is the dynamic component of cartography, which manifests itself throughout production stages that include all the transformations. We cannot proceed from the Earth to the map without transforming the elements present on the Earth and those depicted on the map. We will show that a map is the result of a series of transformations, each of which plays a specific role and requires a particular field of expertise. No longer can a map be designed by the two classical co-authors – the cartographer and the thematician. It needs the expertise of geomaticians, computer scientists, mathematicians and semioticians, which has its positives and negatives. On the one hand, because of the diversity of the domains which come into cartography, and the proliferation of experts or amateurs who consider themselves cartographers, a certain confusion is created, which considerably damages the final product, the map. On the other hand, the cartographic discipline is constantly expanding thanks to the contributions of the related disciplines and is gradually turning into what is currently called "geovisualization".

Irrespective of the name given to the discipline, a map must be useful and serve a purpose. It is no secret that a map is not always legible and reliable: being overloaded or badly drawn (lines too thick or too thin, for instance), it is not useful. A map should be of good quality and should present accurate information. Like any science, cartography must follow deontology rules. This is especially sensible today, when maps are circulated on the Web, mutually enriching each other, subject to their original quality.

In the three volumes of this book, the various transformations leading to the production of the map will be discussed sequentially.

Volume 1 contains the stages and the expertise necessary for the production of any thematic map. The content is standard, but as mentioned above, the approach is

different, the stress being on *the guiding role of cartographic reasoning*. Part 1, after a brief history of thematic cartography, identifies different transformations and shows the basis of cartographic reasoning, which relies on the scientific approach. Part 2 concerns the data, locations and attributes, and emphasizes their quality and the importance of the associated metadata. Part 3 addresses the physical production of the map, explores the sign systems, characterizes the representation modes and completes the process by giving the legend of the map.

Volume 2 is focused on the *known, though partially updated, transformations*: the consequences of the introduction of quantitative methods in cartography and the renewal of old methods by means of novel technologies.

Finally, Volume 3 concerns the *changes related to the recent revolutions in numerics, multimedia, the Internet and the Web*, that is to say, the advances due to the most recent technologies.