Chapter 2
Modern Cartography and GIS: What the Spatial Science Practitioner Should Know

Mulalu I. Mulalu
University of Botswana, Botswana

ABSTRACT

This paper presents the view that with the rapid change in technology, which necessitates the constant rethinking of the supporting conceptual frameworks, spatial science practitioners need to be well grounded in the basic technological concepts and research arguments in order to perform their varied tasks with knowledge based integrity. Cartography has now been placed in the public domain as well as in GIS. GIS in turn has introduced GIS Cartography and is also practiced in the public domain. In both cases, there are situations where people do cartography and GIS without understanding their basic concepts and principles. The paper seeks to shed light on the varied exemplification of the cartography and GIS disciplines with a bias in developing country contexts where there is still a piecewise treatment of these disciplines in education and work environments and a shortage of professional bodies and certification routines. By discussing basic concepts and conceptual frameworks, the practice environments, education and accreditation as well as professional certification, the paper highlights some of the basic requirements of spatial science practitioners. The paper is written from the Botswana context as an example of a developing country context, but most issues should relate to other developing country contexts too.

INTRODUCTION

Map production (the cartography) and map analysis (the GIS) should contribute significantly to facilitate planning and decision making and to carrying out successful implementations of varied human development and natural resources management activities. However, for these disciplines to function this way there is need for the varied professions that use them to focus on their proper and effective use in a complimentary manner. There is a tendency to criticise excessively the way cartography and GIS are practised, first it was critical cartography in the 1980s -1990s (Abbot, Chambers et al. 1998; Crampton and Krygier 2005, p62) and then critical GIS in the mid-1990s (Aitken and Michel 1995; Harmsworth

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1998). Whereas the criticisms are valid to a large extent, they should be used more to progress the disciplines. Both cartography and GIS are highly technical and practical disciplines and their practice has continued to evolve with the changing technologies. The fact that both are now practised largely within a digital environment means that their evolution advances much faster than it has been in the past due to rapid developments in information and communication technologies. Nonetheless, there is need for practitioners to have the basic knowledge in both fields; concepts, conceptual frameworks, the technology, and the requirements of the professions; including standards of the practice and qualification and accreditation programs. There is also need to reconcile the apparent discord between cartography and GIS (Goodchild 2013); where there seems to be uncertainty about the future of cartography because of the GIS. In addition and mainly because of the internet, public domain cartography and GIS (web-cartography, mobile cartography, web-GIS, mobile GIS) have seemingly democratized both disciplines, this has caused concern, although it really should not. The paper pursues two objectives. The first objective seeks to provide basic concepts and conceptual frameworks, the technology, the practice and standards that the spatial science practitioner should have and why this is important. The second objective seeks to contribute to clarify the apparent discord between cartography and GIS professions. Many people have entered the mapping and GIS fields who have very little or no background of cartography or GIS, this has introduced non conventional renditions of maps and GIS structures and questioned the integrity and continuance of these disciplines. Then there is GIS cartography, where the cartographers within GIS environments do not necessarily follow conventional map design principles. Since the early 2000s there has been intense research on: "geocomputation, spatially integrated social science, social informatics, information ecology and humanistic GIScience" (Sui 2004, p62), therefore the application of GIScience has expanded extensively into areas that were not using GIScience and technology before, this further expands the required knowledge base that GIScience practitioners need refer to in their various job environments.

Background

Cartography has been defined as the art, science and technology of producing and using maps. Maps in turn have continued to evolve in shape and structure, from previously simplified and symbolized graphic representations of geographic space (land/earth surface) usually drawn to scale to public constructions of the land surface that do not look like the conventional maps,. A map therefore is a symbolized graphic which shows features in space and thus reveals their relationships within that space. In this sense, maps may represent any type of feature placement on varied surfaces, imagined, virtual or real, however, in this paper, maps are assumed to be representation of geographic space. Conventional maps are static 2D representations of a 3D earth or portion of, however modern maps produced from computer supported production environments could be dynamic/interactive and be rendered in 3D. GIS has been defined in many varied ways but it is essentially a map based information system that uses maps stored in a geographic database and spatial analysis routines to output analytical maps that are used to support varied types of decision making by virtually all disciplines. There are a number of basic concepts that spatial science practitioners should have, these include, geodetic models of the earth, uses of the earth models, map projections, datums, surveying and coordinate systems, mapping projects and GIS conceptualizations as well as the attendant conceptual frameworks.

In mapping and GIS projects, there is the requirement that the maps must have a common reference system. This means that the project leader must be provided with a preferred map projection and coor-