Chapter XIV
Modelling Spatiotemporal Developments in Spatial Health Systems

Björn Gottfried
University of Bremen, Germany

ABSTRACT

This chapter introduces spatial health systems, identifies fundamental properties of these systems, and details for specific applications the methods to be applied in order to show how problems are solved in this field. On the one hand, this chapter gives an overview of this area, on the other hand, it is written for those who are interested in designing spatial health systems. The result is that different spatial scales and purposes require different representations for describing the spatiotemporal change of objects, that is their spatiotemporal development, showing how fundamental purposes of spatial health systems are dealt with.

1. INTRODUCTION

Spatial health systems support disabled people and the elderly in dealing with everyday life problems and concern every kinds of health related issues that develop in space and time. These systems have been introduced in (Gottfried 2006). They are to be contrasted with health information systems which focus on the management of health data by providing access to general or individualised health information; in this way those systems support prevention, diagnosis, and disease management (Heine & Kirn 2004; Mea, Pittaro & Roberto 2004).

This chapter focuses on spatial health systems. A central aspect of those systems is that they monitor the physical activity of people in order to determine how to support the monitored individu-
als. Those systems try to find out for example if everything is fine, or otherwise, if something is wrong how they can help. One of the most fundamental aspects concerning the physical activities of an individual is her locomotion behaviour, i.e. the change of location by motion, giving the system information about how one behaves in space and time. This is the reason why fundamental issues concerning the locomotion behaviours of individuals and objects will be detailed later on in this chapter.

Before coming to locomotion behaviours a more general overview of the field of spatial health systems is given in the first part of this chapter. Here it shows that similar fundamental issues like the activities of individuals are other spatial changes, such as in the context of the geography of diseases, i.e. their spatiotemporal spreading, the large scale planning of health services, or at the city size scale the efficient dealing with emergency cases.

The general idea of this chapter is to put forward spatial health systems as a fundamental area in which many research questions arise. In particular during the design process problems are to be solved regarding the choice of spatial concepts which are appropriate for a given spatial health problem. The analysis of different scenarios will provide designers solutions about how to represent spatiotemporal information at the conceptual level of spatial health systems.

This chapter consists of three main parts: the first one introduces spatial health systems which complement a large body of work in the health care area and it provides a categorisation of sub-areas, enabling a better overview of this field (section 2). The second part identifies fundamental properties of spatial health systems and divides them up into a number of different categories (section 3). The third part motivates the importance of the monitoring of spatiotemporal developments and details for specific applications the methods to be applied in order to show how problems are solved in this field, which concern the design of spatiotemporal representations for spatial health systems (section 4). The last two sections present future trends (section 5) and summarise the main goals of this work (section 6).

2. SPATIAL HEALTH SYSTEMS

The spatial scales at which spatial health applications have to deal with spatial information provide a fourfold categorisation scheme: details considered from the point of view of orthopaedics and similar fields in which movements of the patient’s body are of interest, we are faced with the scale of the human body; monitoring patients, and in particular the elderly, the scale of a flat or nursing home is of interest (instead of the movements of body parts, the patient’s locomotion is observed); in rescue and emergency cases even the scale of a city has to be taken into consideration; still larger scales are of interest when considering geographic variations in population and several further dimensions, such as culture and economic status for the purpose of analysing and planning health services. These four scales are summarised in Fig. 1 together with typical objects found at these scales. They are of interest for the designer of a spatial health system, who has to decide which spatial information is to be modelled for the problem to be solved. For the consideration of different spatial scales compare the survey of (Freundschuh & Egenhofer 1997).

2.1 Large Scale Space

The geographic variation in population and several dimensions such as culture and economic status affect the analysis and planning of health services in a country. These parameters concern the ability of people to travel to obtain health care and the types of services they are willing and able to utilise (McLafferty 2003). Geographical information systems are used to link diverse layers of population and environmental infor-