Is spatial special?

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It is sometimes suggested that spatial data is just another form of data that can now be maintained in a data base and that in reality there is nothing "special about spatial". Nothing could be further from the truth. For example spatial data is not the same as integer, alphanumeric or symbolic data for a number of reasons. These are: spatial data is scale dependent: do I query for 37.3N 45.2W..or?

spatial queries are endemically computationally expensive: how does one efficiently query for such position or, even harder, distances, angles, etc., between locations? These types of queries are different from, for example, symbolic queries, as "locations" or "distances, angles" involve more than the actual numbers to include the underlying topology to search (there are implicit values between explicit numbers) and defined measures: a data model.

The data model is essential, particularly when associating spatial terms (location, relations, etc.) with an ontology. For example, optimizing where to locate a hospital given population densities, topography, transport data, etc., demands different kinds of spatial data information. No single data model applies to all situations.

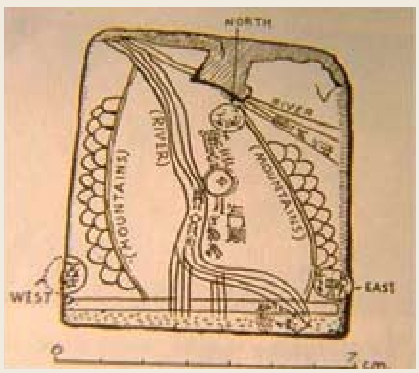
Integrating spatial data with other data types requires additional data types. For example, associating symbolic representations of locations (place names, etc.) is quite a different data structure than the reverse. So, while it is correct that spatial data can now be included and manipulated in large data bases along with textual data, understanding the collection, management, manipulation, integration, use, presentation and querying of spatial data is complex. The complexity and need to understand spatial data has been a central driver in the development of one of the oldest professions – land surveying – and one of the oldest disciplines – geography. Historically even hunter-gatherer societies used topologically correct mappings to communicate spatial information. Such spatial depictions are the essence of aboriginal paintings in Australia. Humans simply think spatially.

Urbanisation and the start of civil society meant that there was a need for spatial information which was less 'relative' and more 'geographic'; less symbolic and more quantitative. The result was the development of maps of cities and countries, which supported early cadastral systems for property ownership, infrastructure management and tax, as well as supporting trade and defense. These maps, which first appeared over 8500 years ago, exhibited consistent scale and orientation in order to meet the needs of government. These needs have continued to the present day where we see spatial data infrastructures (SDIs) supporting a wide range of economic, environmental and social objectives. Spatial information is now acknowledged as a key infrastructure and enabling technology in supporting modern society, in delivering the "triple bottom line", supporting good governance, being critical in defence, promoting efficiencies in business and in recent times supporting such things as e-government and our emerging virtual society.

The disciplines of surveying and geography are built on the spatial paradigm. Today almost every piece of data has a location, with the ability to assign a location to all natural and human activity having transformed the way modern societies manage both the natural and built environments. The result is that the traditional views of surveying and geography are coming closer together as they support the creation and maintenance of a virtual world.

The enabling science, technology and infrastructure provided by spatial information (SI) are transforming the way governments do business. However it is important to remember that SI is not an end in itself – it is an enabling infrastructure. This infrastructure, often termed a spatial data infrastructure as mentioned previously, is not just about databases. It is about linking people to data with a range of policies, technologies and standards. One of the biggest challenges facing the spatial information discipline is how to raise the level of awareness about the importance of this key infrastructure.

In order to capitalise on the potential SI offers a modern society in delivering the "triple bottom line", requires bringing together expertise in measurement science, GIS, ICT, land management and administration, natural resource management, law and public policy. In particular it is not possible to deliver sustainable development objectives unless we can consider the interaction between the natural and built environments. This requires bringing together natural and built environmental data in order to model both physical and human processes



and presenting them in a usable manner for analysis and use by decision and policy makers. Such use, integration and analysis present many problems and challenges.

For example spatial data presents particular issues when we try to integrate it with alphanumeric data. Spatial data is a very different type of data as compared to financial data for example, which has a specific data model and type – there are no choices with financial data while there are almost unlimited data model and data type choices with spatial data.

A specific data model and data type needs to be chosen for every piece of spatial data. There is a wide range of choice about the geoid, projection, accuracy and precision, and scale. Further, there are a whole range of uncertainty and fitness for use issues arising from the range of data types available, and from complex choices about data integration, aggregation and generalisation – and if not done with great care and expertise the results can simply be nonsense.

Spatial querying is also another very complex area with such technologies as a "spatial Google" still over the horizon. Again spatial querying relies on many assumptions about the data model and data type.

This almost takes us full circle to how early humans required topological pictures to understand their world – today we are no different in that a good picture or map or 3D visualization will always be easier to comprehend than pages of textual data generated from a data base.

In summary spatial data describes the location of objects in the real world and the relationships between objects. It provides both an infrastructure and enabling technology for modern society. It is recognised as fundamental for wealth creation, good governance, good decision making and supporting "triple bottom line" objectives.

Simply "spatial data is a special type of data" and requires a dedicated commitment and strategy in order to capitalise upon this enabling infrastructure and technology. As a result of the interest in the Australian Government's Department of Agriculture, Fisheries and Forestry (DAFF) on the topic, Brian Lees, Reader in Geography, Australian National University and Ian Williamson, Professor of Surveying and Land Information, University of Melbourne (at this time a Visiting Fellow, ANU) presented a Bureau of Rural Sciences Seminar on Friday 12 November, 2004 titled "Why is spatial special?" where the ideas in this section were explored further. The presentation can be viewed at http://www.affa.gov.au

Thanks also to Dr Brian Lees and Professor Terry Caelli, NICTA, ANU for ideas and discussion on this topic.