



state of **AUSTRALIAN CITIES**

national conference >03

Carlton Hotel, Parramatta

3-5 December 2003

# Democratising GIS: Progress and prospects for Australian cities

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## **ABSTRACT**

One of the important trends in the governance of Australian cities in the last decade has been the diffusion of geographic information systems in local government. This paper explores the engagement of GIS with participatory and democratic styles of urban governance in theory and practice in Australian cities.

In the last decade the face of GIS has changed. It has moved from the backroom technical part of the office to the public arena and World Wide Web. In the UK this trend has been actively fostered by the goal of electronic government in 2005 (Office of Deputy Prime Minister, UK). The technology can contribute to the technical, business and governance dimensions of local government. GIS has roots in the technical mapping and drafting functions of local government. It has been a technical tool for managing complex spatial data. GIS is also a database management system, contributing to the efficient management of cadastral databases and rating systems. More recently GIS has been used to provide information to the public and to facilitate participation in planning. Web-based GIS has facilitated public access to local government information and enabled new forms of participation in planning.

This paper is based the results of survey and focus group research in Western Sydney on the application and translation of GIS in the context of participatory styles of local government planning. It examines the prospects for the democratisation of GIS against the background of the multicultural reality of the contemporary Australian city.

## **INTRODUCTION**

In the last ten years geographic information systems have been adopted and implemented by an increasing number of government and non-government agencies concerned with the governance of cities. Some of this process remains relatively hidden in the administrative support functions of urban governance agencies, but some systems are becoming increasingly public and accessible to a wider range of stakeholders in the governance of cities. In the United Kingdom there is a policy goal by the central government aimed at achieving electronic government (e-government) by 2005 (Office of Deputy Prime Minister, UK, website). The process of technology transfer and diffusion is strongly promoted by the central government. In the same period in Australia there has been a general retreat from urban policy at the federal level, but there has been vigorous activity at the state level with the promotion of GIS and urban policy.

In this paper the engagement between GIS and planning is examined with emphasis on public participation in planning. This has been a relatively recent development and is confined to a small but growing group of planning agencies. The first step for most organizations has been the development of land information systems with a strong cadastral focus. These systems have helped achieve administrative efficiencies and by doing so have released resources for more complex tasks like strategic planning. The more direct application of GIS to planning with public participation has come later with the development of more sophisticated systems and a commitment to more communicative styles of planning.

## **PROGRESSING BEYOND LAND INFORMATION SYSTEMS**

The eighties and early nineties saw the strong development of land information systems at the state level right across Australia. Garner and O'Callaghan (1997) have documented this progress. This facilitated a lagged but parallel development of land information systems in local government, which benefited from the data capture programs of state government departments (Hickson, 1994) and major statutory authorities. However much of this development took place in the public policy environment of neo-liberal reform and economic rationalism. It was top-down policy with local government at the end of the process. A referendum to give local

government constitutional recognition had failed. The weakness of the local government tier was illustrated by the way in which it could be dramatically changed by state governments. For example, the Kennett Liberal government in Victoria reduced the number of local councils in Victoria from 211 to 84 through forced amalgamations (Gleeson and Low, 2000, 103).

Land information systems diffused downward in a hierarchical fashion from the state level to the local level. There were certainly many difficulties along the way (Peterson and Wigan, 1995) but now many of those difficulties have been overcome. At the same time there were strong top-down pressures on local government from the commonwealth and states to implement micro-economic reforms. It seems that the development of land information systems facilitated managerialism and was in turn promoted by managerialism. This is not to say that there is any essential link between the technology of land information systems and styles of management. It is a technology capable of being democratised, but has some history of association with bureaucratic and technocratic governance. Victoria now has highly developed spatial data infrastructure (Jacoby et al. 2002) and this may have been helped by the centralization of state power, but such infrastructure can be turned towards participatory planning.

GIS development has been fostered by more stringent information requirements. Councils supply residents and developers with information on planning and zoning. Errors in this information can result in litigation so GIS is used to manage the risk by providing better database management and better methods of error detection through the graphic user interface with the database. Requirements for higher standards of asset management by councils have promoted the implementation of GIS because it organizes data spatially and the spatial component of local government assets is extremely important. One Sydney Council developed an asset management system using very high (15 centimetre) resolution, digital orthophotography. A spinoff from this is that it has very high quality information about the environment and a means of checking the GIS.

The professional associations involved with GIS and planning in Australia tend to be weakly linked. The newly formed Spatial Sciences Institute (SSI) has emerged from five founding institutes and associations: Australasian Urban and Regional

Information Systems Association (AURISA), Institution of Engineering and Mining Surveyors, Australia, Institution of Surveyors, Australia, Mapping Sciences Institute of Australia and Remote Sensing and Photogrammetry Association of Australasia. The newly formed Planning Institute of Australia (PIA) formerly the Royal Australian Planning Institute has had a separate history and different set of preoccupations. The SSI is deeply interested in the workings of GIS, while the PIA is mainly interested in what GIS can do. At the present time administrative efficiency gains are starting to accumulate while the use of GIS as a core-planning tool is undeveloped. Pullar and McDonald (1999) have explicitly related planning tasks to GIS. They generate a matrix based on a model of planning which is concerned with the allocation of activities to locations. GIS comes into to play through reducing the uncertainty associated with unknown activities and unknown locations. The matrix is illustrated diagrammatically below.

**A Taxonomy of Planning Tasks (after Pullar and McDonald, 1999 )**

	Known Location	Unknown Location
Known Activity	Urban Management	Site Selection
Unknown Activity	Impact Assessment	Strategic Planning

Most of the development of land information systems has been in the urban management quadrant. This is really the management of a spatial database. It is important, no doubt, but more concerned with the administrative support for planning than the core planning activity. Site selection, impact assessment and strategic planning involve the more complex tasks of planning and it is here that GIS is less deeply engaged, though Pullar and McDonald provide examples of developmental projects in each area.

In planning theory the rational instrumental paradigm has lost ground to the theory of communicative action (Forester, 1989, Healey, 1997 and Sandercock, 1998). The key GIS activities of measuring, mapping, monitoring and modelling (Star and Estes ,1990,12) align easily with the rational instrumental paradigm. GIS is readily adaptable to the formally structured problems in this paradigm. Though it is a very old example predating GIS, the Sydney Area Transportation Study (SATS) of 1974 is a particularly clear example of the rational instrumental paradigm. SATS assumed a pre-existing consensus on the need for an extensive freeway system to solve Sydney's future transport needs. Some communicative action approaches use the idea of consensus, but it is constructed through communication, not assumed to be there already. SATS modelled existing relationships between people places and transport and projected them into the future. In communicative approaches the status quo can be contested and alternative future scenarios vigorously debated. GIS can still be used in the communicative paradigm, but it becomes a medium of graphic communication, a means of achieving spatial understanding, not a black box producing the preferred alternative.

If we think of GIS as a socio-technical system (Appelbaum, 1997), then we can talk about democratising GIS. If we just think of machines, texts, hardware, software and

data, then it makes less sense speaking of democratising GIS. If GIS is incorporated in democratic practices in the workplace and in the community then we have democratised GIS. Garner and O'Callaghan (1997) used Rostow's stages of growth model (Rostow, W. 1960) as a framework to describe the history of GIS in Australia. The 'preconditions for takeoff' assembled in the seventies, the eighties produced the 'takeoff', while to early nineties produced the 'drive to maturity'. The weakness of the Rostow model is its assumption of a single progressive path of development. In socio-technical systems, the steady march of progress is much less assured. The technical progress of GIS described by Garner and O'Callaghan and the increasing number of people involved is one indicator of the democratisation of GIS. It is not the only indicator of democratisation, which relates to the distribution of power in a socio-technical system. Computerisation can increase surveillance and control and erode the space for democratic engagement.

## Postcolonial GIS

The roots of GIS in Australia go back to the colonization of Australia. Colonial cartography (cf. Ryan, 1996) and map-making were important instruments in bringing about possession by the colonists and dispossession of the indigenous people. The doctrine of *terra nullius* survived until the Mabo judgment of the High Court. Parchment, paper maps and their digital successors represented the property interests of the colonists and their successors. Cartographic blanks and silences corresponded to *terra nullius*. The geographic knowledges of the indigenous peoples of Australia were, for a long time, unrepresented in GIS. Before the colonial occupation of Australia the land was known and mapped, 'sung and signed' by the indigenous people (Watson, 1989).

The early land information systems were little more than property information systems. Land tended to be equated with property and land information systems were focussed on property boundaries and the attributes of land parcels. Property data could be easily represented in vector GIS as property could be reduced to points, lines, polygons and attributes. The attributes were usually dichotomous and the points lines and polygons were accurately surveyed and could be tied to systems of coordinates that formed the basis of GIS. The cadastre became the multi-purpose cadastre and later the concept of spatial data infrastructure was constructed. Topographic and environmental data has been added to the framework, now no

longer empty containers but multi-layered representations of the land incorporating data from many sources including aerial photography and satellite imagery.

The context of GIS development in Australia now is postcolonial. The context changed with the passage of Aboriginal Land Rights legislation and the Mabo and Wik judgements of the High Court. Ownership is now a more complex and nuanced relationship with land and multiple representations of land and landscape are becoming recognised. In this context the cadastre should be just a layer in a GIS not the pivot of the whole system. The GIS is not a mimetic representation of reality, but a culturally relative representation of a socially constructed reality. Maps are texts capable of many interpretations, not scaled down versions of reality. Maps are also rhetorical devices representing power relations in relation to land. The practice of GIS construction in Australia, will eventually reflect the postcolonial context. In Canada and the United States postcolonial GIS is probably further advanced. Aboriginal people in Canada have become involved in mapping their land and thereby asserting their identity and relationship with land (Aboriginal Mapping Network). Native Americans are developing community based GIS (Laituri, 2002, Bond, 2002). In Australian cities much of the aboriginal heritage was obliterated before it had any legal protection. Community-based GIS by Aboriginal and Torres Strait Islander groups is more likely to emerge away from the cities.

The landscape of Australian cities now reflects the multicultural character of urban society. Successive waves of migration have seen layers of landscape change in the built environment. While colonial heritage is well recognised there is a need to preserve post-colonial heritage and the evidence of people who came to Australia in the twentieth century. A future challenge in the development of GIS in a multicultural society like Australia is the capture of other representations of land and other forms of map-making. Democratising GIS is not simply about the dissemination of official maps but opening up the mapping process to other perspectives. GIS is a highly visual culture. Making GIS available to people with visual impairment is a difficult challenge for democratising GIS.

Active involvement in GIS at present is largely the preserve of an educated elite. The community in general is the passive recipient of an increasing array of GIS-based products. GIS largely valorises the knowledge of specialists and professionals. It

rarely incorporates local knowledge or recognises contested representations. However there are signs of change. In Western Sydney there has been controversial proposal to develop the former Australian Defence Industries (ADI) site, which is located in the Penrith and Blacktown local government areas. A resident action group (ADI Residents Action Group, 2002, website) has maintained a website for some years and now presents maps there to illustrate its argument about the loss of native vegetation on the Cumberland Plain. This is not yet GIS on the web but it is a step in that direction.

## **Public Participation GIS**

There is a growing literature on public participation GIS. A recent example of this is Craig W J, Harris T M, & Weiner D Eds. (2002). Most of the examples in this work are from North America mainly the United States. There is one example from Australia (Walker et al. 2002) based on the Herbert River Catchment established on the model of a multi-agency Collaborative Resource Information Centre (CRIC). The project was funded by the Australian Surveying and Land Information Group, and is presented as a model of best practice that could be adapted to other areas and run on a self-funding basis. The Herbert River Catchment is predominantly rural and the system has a clear focus on a limited number of land-use and environmental issues.

The Blue Mountains City Council has a PPGIS. It has been used recently to support public participation in the making of Draft Local Environmental Plan 2002. This plan covers the urban corridor of the Blue Mountains. While all of the councils in Western Sydney have a GIS (Herborn, 1999, Ronaldson et al. 2000), Blue Mountains are in the forefront with PPGIS. The circumstances in the Blue Mountains are unusual and help account for its early lead in PPGIS. Most Outer Western Sydney Councils are involved in the Urban Development Program of the NSW government and are under pressure to cope with the planning of large greenfield land releases. Most of the councils are large and have had cadastral land information systems and have used them to achieve administrative efficiencies. Some are upgrading to GIS, but the engagement of planning with GIS is not very developed. GIS has often entered the organization as a low-key departmental function. At Blue Mountains City Council GIS became a corporate function (City of Blue Mountains, 1997) and engaged deeply with the planning function in the mid-nineties. A key role was played by dual professional with planning and GIS experience. The innovation has been confirmed

staff development and administrative structures so that now GIS is critical and central to the council's information management. The corporate GIS is widely available throughout the organization.

The Blue Mountains GIS is particularly notable for the quality of its terrain modelling and vegetation data. The urban area is surrounded by National Parks and is adjacent to a World Heritage Area. Environmental conservation and bushfire risk management are very high priorities and these have been reflected in the profile of the GIS. The local community is well established and there are a number of organizations concerned with environmental conservation and preserving the sense of place landscape quality of the Blue Mountains. The fast food chain McDonalds has been trying for seven years to develop a key site in the upper mountains in the face of strong resident opposition. The Draft Local Environmental Plan addresses local character and incorporates some place management approaches in addition to the usual zoning provisions.

## **The Prospects for Public Participation GIS**

Democratising GIS means making it available to more people in the community. Web-based GIS immediately springs to mind, but there are many other ways GIS could be made more accessible. Community access to GIS for environmental and community planning can take a number of forms. Leitner et al. (2002) outlined six models of GIS availability:

- Community-based in-house GIS
- University-community partnerships
- Publicly accessible GIS facilities at universities and libraries
- Map rooms
- Internet map servers
- Neighbourhood GIS centre.

Community-based (in-house) GIS is rare in the United States and is likely to be rare in Australia also at the present time. However the falling cost of hardware platforms and software combined with the increased availability of spatial data infrastructure make it easier for well-resourced community organizations to use GIS to enhance their effectiveness. Community organizations that rise above the usual NIMBY (Not In My Backyard) concerns and have more altruistic longer-term aims could develop

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Spatial Understanding Support Systems (SUSS) cf. (Couclelis and Monmonnier, 1995). A certain level of GIS expertise is required to set up and maintain such systems. While GIS expertise is becoming more common, GIS experts with the time and inclination to become involved with activist volunteer organizations are rare. Community groups need the ability to produce customised maps cheaply at varying scales. Government organizations tend to be focussed on the production of expensive high quality maps for exhibition purposes. Scale tends to be fixed by regulation and mapping can be broken up into tiles that do not relate well to the specific issues of community groups. Government agencies with GIS could easily develop the technical capacity to produce customised maps. If government agencies are not responsive to requests for customised mapping from the community, then we could see the development of community-based (in-house) GIS.

University-community partnerships involving GIS provide communities with an established GIS and expertise. The communities provide the universities with a channel for community engagement and grounding research and teaching in real problems. An example of a developing University-community partnership is the Regional Integrated Monitoring Centre on the Hawkesbury Campus of the University of Western Sydney. The Centre has been involved in a major program of data capture for the Hawkesbury Nepean Catchment and is currently involved with a community group mapping rainforest remnants in the local region. Community access was a key feature of the design of the building and the GIS facility. Community users of the Centre can borrow laptops equipped with ArcView and spatial databases. UWS has also been involved in a regional data-sharing project (Hawkesbury City Council).

Publicly accessible GIS facilities at universities and libraries can provide members of the community with access to a GIS as a user of university or library facilities. Some university libraries in Australia have functioned as public non-lending reference libraries, but now the University of Western Sydney (UWS) is one of the few remaining. As well as the traditional paper media, libraries are becoming major nodes for an extensive array of electronic databases. Printing and photocopying can be supplied on a user pays basis. A GIS such as CADATA2001 fits quite easily into the electronic database environment of university libraries and could, if licensing restrictions were removed, be accessed by community groups requiring tables and

maps from the 2001 Australian Census of Population and Housing. CDATEA2001 provides detailed demographic, social and housing data for areas with about 200 to 300 people. This level of spatial resolution is useful for community groups as it can distinguish between neighbourhoods in a suburb. CDATEA2001 tends to be a stand-alone GIS and may be difficult to integrate with other mapping undertaken by community groups. Many electronic databases, with the exception of CDATEA2001, are available to community users of libraries at UWS.

Map rooms are publicly accessible map collections located in government offices or in universities. Leitner et al. (2002) provide examples from the United States but there appear to be few examples of such a specialised facility in Australia. However some local government libraries have sections devoted to local history and local affairs with related map collections. A GIS could be part of an upgraded facility housed in library providing the community with a range of resources in local affairs including planning. GIS combined with traditional paper maps, books, planning documents, council business papers could provide support for community groups to actively participate in community affairs. Groups would need meeting rooms allowing normal discussion without disturbing other library users.

The World Wide Web has been used very effectively by the Blue Mountains City Council to exhibit its Draft Local Environmental Plan. The Blue Mountains Council has taken great care to base its planning instruments on accurate data about the local environment. It has also put the Draft Local Environmental Plan on a CD-ROM as well as running the traditional exhibitions. It is the amount and quality of data available from the web that puts the Blue Mountains Council a long way ahead of other councils with maps on the web. There are twelve maps for each tile in the Plan. The web browser enables zooming, panning and re-centring maps. The maps themselves show only the detail and labelling appropriate to the scale at which they are viewed. Residents are able to obtain detailed information on slope, vegetation and other data within land parcels. By making this information public it is open to challenge and updating. Not everybody has access to the web so the web supplements but does not replace the traditional exhibition.

The Blue Mountains like any community is open to pressure from individual landowners intent upon maximizing their own usage of land without much regard for

the impact on the environment. Members of focus group of users of the GIS felt that the GIS gave such landowners more ammunition to fight for concessions for themselves. However this was offset to some degree by the overall strength of the information base for the plan. A focus group member, deeply involved in conservation, felt that paper maps were still needed by community groups at non-standard scales for non-standard areas. This is a request for greater GIS functionality than the web browser currently has, but could be provided to a community group with its own GIS platform.

What is currently available at the Blue Mountains City could become widespread in the future. It is a medium-sized Council using readily available software with limited enhancements. It has invested in its own data capture where it needs higher quality data than is readily supplied. In the last ten years a very high proportion of Councils have developed a website. Some provide maps that can be browsed and downloaded as a portable document format (pdf) file than can be read and printed with software such as Acrobat. The Blue Mountains City website is distinguished by its greater depth and the degree of interactivity with its mapping system. It provides a model that could be imitated by other councils striving to encourage public participation in planning.

In New South Wales planning information is being made available through the web through a system called iPlan (iPlan - Planning information and services for New South Wales [website]). At the time of writing a substantial number of the local government areas (LGAs) in New South Wales had some information such as a Local Environmental Plan on this system. It makes planning information more accessible and is a major step towards the democratisation of GIS. The development and real estate industries would probably derive more benefits from iPlan than local communities as it facilitates scanning across a number of LGAs. However local communities need information about planning controls in neighbouring LGAs and iPlan could provide improved access to that information.

Neighbourhood GIS centres are more of a concept than an empirical reality in the US experience (Leitner, 2002, 45), at this time. The idea of a neighbourhood GIS centre in the Australian context seems to be highly unlikely. However a neighbourhood centre making intensive use of computers and databases could add GIS to their suite

of software. This would be more likely to happen if neighbourhood centres grew in importance and became involved in a broader range of activities. A neighbourhood centre involving emergency services, environmental and community development groups may find that a GIS makes them more effective. Neighbourhood centres could develop to fill the vacuum caused by the closure of bank branches and the centralization of other services. Neighbourhood centres could be associated with new opportunities for internet cafes and home-based employment close to child care facilities. The neighbourhood as a site for face-to-face communication has a long history as a planning ideal that has often failed to be realised. We could see a revival of the neighbourhood, not in its old form but in a form supported by information technology and involving the use of GIS for effective participation in local affairs.

### **GIS in an Expanded Urban Democracy**

Amin and Thrift (2002) have addressed the task of imagining an expanded urban democracy. They drew inspiration from the Progressive Era (1890-1920) in the United States. It was a time in which civic institutions flourished. It began to unravel in the 1920s as social workers gained more influence and as consumerism drew commitment away from education and public deliberation. Amin and Thrift argue for the re-establishment of the basic principles of the Progressive Era in the contemporary city.

The World Wide Web is a new space in the contemporary city, an electronic version of the town square of the Progressive Era. The web is not a substitute for face-to-face meetings, it is more of an additional channel of communication. The content of that communication can be documents, maps and images. The City of Kamloops (City of Kamloops, British Columbia, Canada) has a very comprehensive website which includes material for the organization of an urban design charrette for a site within the city. It is an example of the type of practice that seems likely to become increasingly common. For some years AURISA sponsored a GIS in schools competition. In the future we could see GIS in the school curriculum as it becomes an aid to the teaching of geography, environmental studies and related subjects. In any event the proportion of students with skills in handling graphics with computers appears to be steadily rising. Web-based mapping by planning agencies are likely to be used by an increasing proportion of the population and more organizations are likely

to be able to undertake their own mapping to contribute to debate on the future of cities.

Citizenship and the franchise are tied to place and property. Amin and Thrift look at the city in terms of a complex of flows in networks not as spatial containers. They envisage a future form of world citizenship for an increasing number of people, ranging from business elites to refugees, detached from physical places. But GIS models cities as spatial containers. In Australian cities people vote in local government electorates on the basis of where they sleep and own property. This may not be where they spend most of their waking life. Cities such as Sydney, especially the inner areas, accommodate large numbers of non-citizens. The nexus between place and the ability and desire to shape it through involvement in the long drawn out process of planning can be weak or absent. Conversely, the web and GIS may empower people to lobby and become involved in the struggle for social justice or environmental conservation in faraway places. It is possible to measure the clearing of rainforests in Brazil and urban encroachment on the West Bank with satellite imagery.

Planning agencies, emergency services, environmental and community groups have increasing access to maps as a means of better understanding problems with a spatial dimension. They have the means of becoming mapmakers and being able to contribute to political debate with maps as well as text. The democratisation of GIS has started and seems to be gathering momentum.

Progress has been achieved in making GIS more accessible to the community. In the last ten years Australian cities have been represented in increasing depth and detail through the medium of GIS. Local government in particular has benefited from earlier GIS development in state government departments. Councils are starting to move beyond administratively focused land information systems towards engagement with more complex planning tasks. The context of planning is also changing as Australian cities reflect a postcolonial multicultural society. GIS will need to reflect the postcolonial and multicultural context of cities if it is to achieve its potential as a medium for planning. Public participation GIS is the site for engagement for communicative styles of planning and GIS accessible to the community. Community

groups are starting to use the web to contest planning proposals and the mapping and representation of land.

Prospects for public participation GIS in Australian cities are bright. The thresholds for the use of GIS are becoming lower. This means that more people are potentially able to use GIS to enhance their access to planning information and to actively debate planning proposals. GIS should supplement, not substitute for, traditional modes of public participation. The digital divide needs to be overcome by providing public access to GIS through existing local government, educational and community facilities. At the local government level Blue Mountains City Council provides a good example of the development of GIS to underpin a planning instrument and to widen and deepen public participation. Similar systems are probably being developed in other LGAs throughout Australia. At the state level, the New South Wales system iPlan is providing the infrastructure for public participation GIS. Other Australian states are likely to develop similar systems. The democratisation of GIS is not simply about the web, but about multiple means of access to GIS. Democratisation is also about finding spaces for local knowledge, ground truth and the voices of marginalised communities and non-citizens.

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