Participatory 3D Modelling

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INTRODUCTION

Mapping is a fundamental way for displaying spatial human cognition. "It is a representational medium that both has a history and is part of the practice of history" (Herrington, 2003). For centuries and increasingly with the advent of Geographic Information Technologies (GIT), graphic representations of part or the whole of Earth in cartographic, electronic, two or three dimensional formats have been playing significant roles as media (Sui & Goodchild, 2001) used to store, display and convey information and as basis of analysis for decision support.

BACKGROUND

In the past maps have been made primarily to serve precise tasks like describing discoveries, navigating space, defining boundaries, registering ownership and locating resources. In the early '90s, Monmonier (1996, p. 2) wrote that "*a single map is one of an indefinitely large number of graphical models of the spatial aspects of reality that might be produced for the same situation or from the same data*."

Changes have occurred since GIT have become accessible to civil society and graphic representations of space have been used as channels for two-way communication purposes to support social learning, dialogue and negotiation processes.

The participatory use of maps started in the late '80s. At that time, development practitioners were inclined to adopt PRA[1] *sketch mapping* tools (Mascarenhas et al., 1991) rather than venturing into more complex, demanding and time consuming *scale mapping*, particularly because preference was given to eliciting village dynamics and facilitating communication between insiders and outsiders (researchers), rather than to courses of action enabling communities to interact efficiently with policymakers (Rambaldi et al., 2002a). In addition, in many developing countries aerial photography, satellite imagery and official large-scale topographic maps were under governmental control and their access restricted because of national security concerns.

The situation changed in the '90s, with the diffusion of modern GIT including geographic information systems (GIS), low-cost global positioning systems (GPS), remote sensing image analysis software, open access to data via the Internet and steadily decreasing cost of hardware. Spatial data, previously controlled by government institutions became available to and mastered by non-governmental and community-based organisations, minority groups and sectors of society traditionally disenfranchised by maps and marginalized from decision-making processes (Fox et al., 2003). This new environment facilitated the integration of GIT into community-centred initiatives particularly to deal with spatial information and communication management (ICM). Practitioners and researchers around the world have been working on different approaches making use of a variety of GIT, but all sharing the goals of placing ordinary people in the position to generate, analyse, manage and exchange geo-referenced data, integrate multiple realities and diverse forms of information to foster social learning and broaden public participation across socio-economic contexts, locations and sectors. This has spurred a rapid development in the management of spatial multimedia information through what is generally termed as Public Participation GIS (PPGIS), where maps are conceived as interactive vehicles for discussion and information exchange, are physical or virtual, in 2-or 3-Dimensional formats and are enriched by an array of data types including sound and images (Aberley et al., 2002).

Large scale maps (> 1:20,000 scale) and physical or digital terrain elevation models have been used for conducting collaborative research (Hampson et al., 2003; Tran Trong Hieu et al., 2002; Martin et al., 2001; Tan-Kim-Yong, 1994 and 1992), community-based planning, monitoring change, asserting territorial claims (McCall, 2004; Bersalona et al., 2004; Rambaldi et al., 2002a; Zingapan et al., 1999; Poole, 1995), managing territorial disputes and supporting related negotiations (Chacon, 2003; Carton, 2002a; Rambaldi et al., 2002b; Wood, 2000; Johnson, 1999) and consultative policy making (Carton, 2002b). While most authors point to the effectiveness of GIT & GIS used in a participative mode, McCall (2004), Fox (2003), Rambaldi (2002a), Abbot (1998) and Rundstrom (1995) call for caution as these may lead to increased conflict, resource privatization, and loss of common property.

PARTICIPATORY 3D MODELS

Participatory 3D Modelling (P3DM) is a relatively new communicative facilitation method conceived to support collaborative processes related mainly to resource use and tenure and aimed at facilitating grassroots participation in problem analysis and decision-making.

P3DM integrates people's knowledge and spatial information (contour lines) to produce stand-alone scale relief models that have proved to be user-friendly and relatively accurate data storage and analysis devices and at the same time excellent communication media. Relief models works best when used jointly with GPS and GIS facilities.

Participatory 3D models are manufactured at the village level based on the merger of traditional spatial information (elevation contours) and peoples' spatial knowledge (cognitive maps). Elevation contours are used as templates for cutting out sheets of carton board of a given thickness (i.e., expressing the vertical scale). Cut-out sheets are progressively superimposed to build the relief. Based on their spatial cognition, informants depict land use and cover and other features on the model by the use of pushpins (points), yarns (lines) and paint (polygons). Once the model is completed, a scaled grid is applied to transpose spatial and geo-referenced data into GIS. The grid offers on one hand the opportunity of adding geo-coded data generated by GPS readings or obtained from secondary sources to the model, and on the other hand to take approximate coordinates on the model and verify these on the ground by means of GPS. This is extremely useful when models are used to support boundary negotiations.

P3DM brings GIS potentials closer to rural communities and bridges the gap existing between externally supported GIS and capacities found among marginalised, isolated, and frequently natural resource-dependent communities.

Figure 1. Discovery learning, the first step for informed decision-making

The manufacture of a 3D model leads participants through a collective learning process (Figure 1) to the visualization of their economic and cultural domains in the form of scaled and geo-referenced relief models which can be used subsequently for different purposes.

One major constraint of physical elevation models is their limited mobility. Their use is therefore confined to those in the position to convene around them.

To upscale its utilization, P3DM is best integrated with GPS and GIS. Such integration allows adding precisely geo-referenced data, conducting additional analysis and producing impressive cartographic outputs. Resulting synergies make community knowledge portable and sharable at all levels of society and more importantly add veracity and authority to it. This paves the way for peer-to-peer dialogue and more balanced power-sharing when territorial issues are at stake.

Practitioners using relief models at the community level in the Philippines (Rambaldi et al., 2002a and 2002b; PAFID, 2001; Zingapan et al., 1999), Vietnam (Rambaldi et al., 2003; Hardcastle et al., 2004), Thailand (Tan-Kim-Yong, 1992; Hoare et al., 2002) and India (Chakraborty, 2003), have experienced that when informants are provided with a blank relief model instead of a blank contour map or a blank sheet of paper, they can easily depict their spatial knowledge in a scaled, geo-referenced manner and add a lot of precise details.

The fact that 3D models augment the power of mind and facilitate scaling, allows for filling in information more fully and accurately on a given area. Generally this is not the case with sketch mapping, which has been widely used to represent spatial knowledge in the context of participatory action research. The difference between a blank contour map and the corresponding relief model is the physical vertical dimension that provides essential cues for stimulating memory, establishing spatial associations and depicting cognitive maps (Rambaldi et al., 2002).

LESSONS LEARNED

By carefully documenting and analysing over 20 cases where P3DM has been applied in developing countries (Tan-Kim-Yong, 1992; SM-HDP, 1998; Srimongkontip, 2000; Rambaldi et al., 2000, 2002a, 2002b, 2003; Martin et al., 2001; Tran Trong Hieu et al., 2002; Hoare et al., 2002; Hampson et al., 2003; Hardcastle et al., 2004) practitioners and users noted the following advantages of P3DM.

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