MOVING FROM MAPPING TOOL TO DIGITAL PEEP-BOX

Towards Geodata-based Communities

Rapidly evolving technologies such as Web services transform the former digital-map toolbox for specialists into a challenging digital peep-box for everyone. Introduced in 2005, Google Earth is one of the first examples of digital peep-boxes that will soon, suggest the authors, lead to Geodata based Communities (GeoCom).

In the late fifties Waldo Tobler developed MIMO (Map In/Map Out). The three basic elements, map input, map manipulation and map output, still form the basis of todayâ€™s geo-information tools. The scientific evolution from MIMO via geo-information systems to Geographic Information Science (GIS) reflects fifty years of changing thinking. Todayâ€™s technology enables digital creation of three-dimensional (3D) look-alike representations of the real world. Still a representation, a descriptive model but, as Fisher and Unwin remarked, â€œVirtual reality is the ability of the user of a constructed view of a limited digitally-encoded information domain to change their view in three dimensions, causing update of the view presented to any viewer, especially the userâ€. â€˜Theirâ€™ and â€˜anyâ€™ refer here to sharing the view; the view is 3D and no longer a 2D cartographic projection. Fisher and Unwinâ€™s publication and those that succeeded it show how fresh and innovative is research on Virtual Reality and geo-visualisation; up pops the metaphor of a digital peep-box.

Peep-box

As children many of us rose to the challenge of transforming a shoebox into a peep-box. We decorated the faces inside with pictures cut out of glossy magazines or painted them, glued cardboard objects onto the floor of the shoebox and hung them from the ceiling on bits of string. The faces formed boundaries and the light coming through one or more holes, often covered with coloured cellophane to create a mysterious atmosphere, illuminated the scene. Looking through the peephole gave the feeling of being in an imaginary world. The peep-box metaphor helps explain the transition from digital map to geo-virtual reality, referring to its three main components. Firstly, the 3D scene represents the peep-box boundary by a given extent of a 3D geo-referenced scene. Secondly, data forms the building blocks for constructing a 3D scene mostly founded on (2D) georeferenced data. Several digitally defined objects consisting of simple or more complex geometry in combination with digital pictures (bit-maps) may be placed on this base; for example, the â€˜facesâ€™ could be â€˜mappedâ€™ by digital
photos. Some objects represent atmospheric lights: fog, dusk, clear blue skies, night, so standing in for cellophane. And a complex 3D scene finally becomes a good example of data fusion. However, all the objects in a 3D scene are initially static in nature. Third, the interface between user and 3D scene represents the peephole, and the 3D scene may be experienced from different viewpoints and angles, graphic and geometricproperties such as level of detail, and items of interaction.

Change to GeoCom

The metaphor leaves aside state-of-the-art items of technology in interfacing, data fusion, data representation, simulation and feedback, all of which rely substantially on distributed computing. For this the metaphor could be extended to express new user perspectives. Interfacing refers to user interaction with a 3D scene. The viewer provides two ways of interaction:

- in the 3D scene, giving the user the impression of being in the virtual world
- off the 3D scene: with the help of viewer settings the user defines how the 3D scene will be experienced and analysed.

A 3D scene becomes much more powerful when supplemented by simulation and feedback mechanisms. Simulation enables changing the 3D scene using predefined algorithms operating on certain objects or geo-data class. Examples are water level, CO_2 emission or traffic-intensity forecast. The impact of change can be determined by feedback mechanisms connected to the 3D-scene which essentially analyse the effect of simulation results and, depending on the modes of the 3D scene, show these either visually or by sound. Many geo-data analysis tools can be used to check possible effects. Distributed computing and interoperability also offer possibilities to communicate via avatars with others interested in the same subject represented by a 3D scene. Alerts within a community will spread information about 3D scenes of interest that can be shared. The latest technologies could thus offer a dynamic, multi-response digital peep-box the significance of which is based on interaction, simulation, feedback and scene sharing: the transition of MIMO into Geodata-based Communities (GeoCom) has begun.

Integrated Systems

Google Earth shows the possible impact of GeoCom: everybody will support geo-data based communities. Many multi-user games show that community members could be addressed via the geo-virtual world; the user also becomes a geo-coded object! An important event in the domain of Geo Information Science (GIS) was the change from command-line-driven GIS towards an enterprise system which integrated dataflow and processes with other spatial and non-spatial processes and workflows. Begun in the late 1970s, the development towards more user-friendly systems moved along with the introduction of Microsoft-Windows operating systems, resulting in GIS tools becoming available to a larger group of users. Of course, the issue of data collection is important too. In the 1970s, satellite data-capture moved from simply weather information into a broader dimension. The first Landsat satellite was launched in 1972. Year by year, data was collected, stored and used. Then the US Department of Defense initiated the search for a self-adjustable, decentralised networking system; ARPANET founded internet exchange and sharing of data.

Free of Charge

In the 1990s GIS technology moved increasingly towards integrated enterprise systems. Data got stored in centralised databases. Later tendencies were service-oriented data provision, where data began to be managed at source holder while users connect to the service using always the most up-to-date version of a dataset. Finally, data enclosure came to be of political interest. In the US in 1993 the concept of the â€˜Information Highwayâ€™ was launched by the Clinton administration: data collected by the government was made available free of charge, to be used by the spatial community. When each GIS software vendor had his own data format, use of the data on another system required data conversion. Since storage structure depends on format, conversion usually resulted in loss of information. With the foundation of the Open Geospatial Consortium (OGC) in 1994, came agreements on open data standards, making data exchange easier by means of interoperability. GML is an example of a commonly supported data format. Closely related to data exchange is data delivery by means of Web services, where data is kept at the data holder. Users of a data source can connect to it using third-party data in their (Web) map presentations. The evolution of internet and Web-based applications using GIS technologies made interactive maps available to a large public. For example, navigation maps and route instructions can be obtained by simply inserting â€˜start locationâ€™ and â€˜end addressâ€™.

Virtual Globes

Credit is due too to organisations that dared make GIS functionality available to a large public: Google introduced Google Earth and Microsoft, Virtual Earth. In addition to these two commercial developments, NASA initiated World Wind Moon. The functionalities here concern mainly the GIS output site: map presentation. All three systems present their data according to the peep-box concept. In Virtual Globe users can manipulate the view by rotation, zoom, pan and so on. These systems match the ideas of Al Goreâ€™s Digital Earth as expressed in his speech as Vice-President, on 31st January 1998. In a Digital Earth data is not ordered alphabetically but by geographical location. Digital Earth initiatives use own data standards, since OGC standards on Web mapping are not supported. OGC-compliant Web mapping services cannot be integrated in a system such as Google Earth. Web-based Digital Earth activities stimulate the establishment of user interest communities, and specialised interest groups are already sharing their own data which can be viewed by others, for example by using Google Earth as â€˜backgroundâ€™. Although the data format is not OGC-compliant, the KML format (KMZ when zipped) is XML-structured and therefore easily and transparently converted. The growing number of (freeware) tools for converting and inserting spatial data in Google Earth also cover existing GIS software for exporting GIS data, together with 3D-object capabilities.

Concluding Remarks

Since GeoCom will gradually be integrated into society, there really is a need for awareness, understanding and keeping up with the developments involved. Whereas GIS education was originally embedded in other Earth Sciences, today GIS education programmes are on the curricula of all schools, from primary to higher-education institutions. So perhaps it is not at all surprising that our interest in geo-information begins with constructing a (digital) peep-box!

Further Reading

- Buhmann, E., Paar, P., Bishop, I., Lange, E. (eds), 2005, Trends in Real-Time Landscape Visualization and Participation, Wichmann.
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- Fisher, P., Unwin, D., 2002, Virtual Reality in Geography Systems, Taylor & Francis.
- Peng, Z., Tsou, M., 2003, Internet GIS. Distributed Geographic Information Services for the internet and wireless Networks, John Wiley & Sons.