

EuroSDR Commission 5 Workshop Report

'Visualisation and Rendering'

ITC, Enschede, The Netherlands, 22-24 January 2003

By Etien Koua and Peter Woodsford

Delegates from Denmark, France, Germany, Netherlands, Sweden, Switzerland, UK and USA attended the first Workshop to be organised by EuroSDR (formerly OEEPE) since its change of name. The Workshop was organised by EuroSDR Commission 5 (Delivery and Integration of Data and Services) in conjunction with the International Cartographic Association (ICA) Commission on Visualisation and Virtual Environments and the Netherlands Geodetic Commission. It was hosted by ITC, Enschede. The Workshop was opened by Sjaak Beerens, Director of External Affairs, who welcomed the delegates to ITC. Chris Paresi, EuroSDR Secretary-General then briefly outlined the history and structure of EuroSDR and its current mission statement and research agenda ([Paresi](#)). Peter Woodsford then summarised the Objectives of the Workshop and the issues to be addressed in the Breakout Sessions before opening Session 1 on 'Overview - The wider context'.



Sjaak Beerens opening the Workshop



Workshop delegates in session

Session 1: Overview - The wider context

Arnold Bregt, Wageningen University / Alterra, Netherlands, opened on '[From reality to virtual reality and back](#)', starting from the metaphor of the 'Peep Box', and categorising the user functions of view, navigate and interact relative to position (outside/inside) with respect to virtual reality. He also categorised 2D/3D and static/dynamic realisations, concluding that VR is not a crisply defined concept, but a container term hosting different approaches. The trend is 3D visualisation of dynamic processes (the Cave, described more fully in Session 2 by [Erik Kjems](#)) and incorporating VR into reality. But, he urged, do not forget the "classic" approaches!

Jayant Sharma, Oracle Corporation, USA, described the '[Oracle 9iAS MapViewer](#)'. This was originally designed to meet internal requirements to visualise geospatial data held in Oracle Spatial. It is now available as a map rendering component in 9iAS, offering 3 API's (XML, Java and JSP tags). Map requests specify a data source (database schema containing spatial layers). Basemaps and dynamic themes (query results) are defined and styled according to map metadata managed by a Map Definition Tool. Customised maps portraying data held in a centralised repository and using common symbologies

are thus available to e-commerce applications, location-based services and for publishing via web services. The Map Viewer is an embeddable Java component providing tight integration with the data and application servers and their development and deployment infrastructures.

Mikael Jern, University of Linköping, Sweden and AVS, Denmark spoke on '[Light-weight exploratory geovisualization for the Web](#)'. Drawing on a long research and industrial experience (his Ph.D. on raster graphics in 1976 marked the debut of colour raster plotting), he emphasised the need for effective and simple development environments. The MUSIC project is developing a Visual User Interface and Web-enabled 3D Visualisation for a flood forecasting system, using a layered atomic component architecture (OpenViz). The FloodViewer presents a rich selection of 'snap-together', coordinated 2D and 3D visualisations from forecasting data, DTED, radar, satellite and GIS data. Components are integrated using a Visual Basic environment into customised user interfaces for standalone analysis and exploration and for networked collaborative analysis. Crucially, ActiveX/COM components can also be embedded in dynamic documents for presentation and journalling, thereby playing a key role in the marshalling of distributed interpretive expertise and in improving the communication and dissemination of results to the authorities. An interesting tentative conclusion is that decision-makers are comfortable with 2D but do not yet readily use 3D visualisations.

In describing '[Visualisation and the OpenGIS Specifications](#)', Peter Woodsford, Laser-Scan, UK described the consensus-based consortium approach to the development of implementation standards as exemplified by the World Wide Web (W3C) and OpenGIS (OGC) consortia. He outlined the Interoperability goals and the current set of adopted specifications together with the sequence of Testbeds and Pilots through which they had emerged. The Styled Layer Descriptor (SLD) specification recently adopted adds symbolisation of feature and grid data to the Web Map Server specification. Work in progress includes the Sensor Web Architecture, which will provide significant visualisation challenges as data becomes available from a plethora of on-line sensors. Data discovery via registry services will also need good visualisation. The presentation concluded with a summary of OGC activities in Europe.



Mikael Jern demos FloodViewer



Sisi Zlatanova and Peter Woodsford

Break Out Session 1 - What are the technology drivers? Which standards are key?

The blend of inputs from the visualisation, computer graphics, database and standards/interoperability perspectives set the scene to discuss these two issues:

Findings were summarised as follows:

Opensource was discussed at some length. It presents many advantages, but there are problems related to their use:

- *Technology takes so long to come out as Opensource*

- Versions get outdate quickly
- Their actual development is very slow
- How to deal with the update problems?

The update problems are due to the software suppliers. We need to have some type of financial support to keep the development of these products moving.

Standards might even disappear after sometime (VRML is an example)

Standards that survive are those that have some funding agencies behind (e.g. XML was supported widely including by Microsoft, Java was pushed by Sun Microsystems and later by IBM)

SEDRIS (see <http://www.sedris.org/>) is doing relevant/useful work for Virtual Reality applications.

What could be the piece of magic? What do we want the hardware/technology people to come up with?

- We need to actually use Mobile and PDA devices for visualisation. Two main problems related to this usage:
 - the platform aspect
 - how to get several applications to work together (Interoperability).
- The only real limitation seems to be the display size!?
- Emerging hardware support for XML (compression and parsing) was noted as important.

Session 2: Research Activities

This session, chaired by Mikael Jern, opened with a presentation entitled '[Overview of Research - Visualisation and Virtual Environments](#)' by Menno-Jan Kraak, ITC, Netherlands. He presented the research agenda as seen by the ICA Commission on Visualisation and Virtual Environments (of which he is co-chair). Key topics are grouped under representation, interaction, integration and knowledge discovery and cognition and usability issues. He noted that choice of graphics technology represented a gamble - is this the 'right horse'. Cross-cutting themes are experiential representation, extensible tools, support for group work (a resonance with MUSIC project above) and human-centred geovisualisation. A book is currently under way on these topics. The next major event for the commission is at the ICC conference in Durban, July 2003.

Lars Bodum, Aalborg University, Denmark presented the work of the '[Centre for 3D Geoinformation - from Idea to Realisation](#)'. The centre, of which he is Director, builds on a long experience in multi-media, and has its major focus on 3D mapping and 3D data-modelling. Object-oriented modelling shows significant promise, but there are still outstanding issues. The North Jutland regional project involves the Centre, the national mapping agency (KMS) and commercial partners. In addition to support for planning, a particular driver is Danish legislation on property ownership and rights, which is 3D in scope, requiring a mix of 2D and 3D and textual data sources. Detailed terrain data derived from LIDAR is a promising new development. This 'cutting-edge' activity, particularly in its 3D aspects, will in time need attention from standardisation efforts.

Juergen Doellner, Hasso-Plattner-Institut Universitaet Potsdam, Germany, presented their ongoing work on '[Semantic-preserving, texture-based visual mapping of vector 3D data](#)'. For 3D vectors he introduced the concept of the 'perfect line segment' that always lies on an underlying surface. In addition textures, including multi-resolution vector data textures, can be applied to any surface, re-using existing scene-graph technology. On demand texture pyramids support multi-representation. Techniques have been developed for identifying objects in textures and for editing 3D vector data and inserting 3D objects. An example application is in adaptive precision labelling and stand-up bill boards in 3D cartography. Research is ongoing in 3D extensions to SVG, high level primitives and cartographic generalisation.

Erik Kjems, Director, VR Media Lab, Aalborg University, Denmark gave a generic presentation of '[The CAVE as the Ultimate Virtual Environment](#)'. The CAVE was launched at SIGGRAPH '92. Graphics hardware

has now progressed to the point where the major cost is in the projectors. Applications are diverse, in architectural and industrial design, in biochemistry, in art and education and in data mining ('sometimes too revealing!'). Geospatial applications are relatively few, GeoViewer (performer-based) being an example. The largest concentration is in the oil and gas industry where the Panorama approach is favoured. Ongoing developments include passive and active stereo and mobile Caves. Urban areas and volume analysis are promising fields - Caves are suitable whenever the fully immersive experience has a value.

Menno-Jan Kraak brought the session to a timely close with '[Visualisation of Temporal Phenomena: some old ideas and new technology](#)'. He presented a range of cartographic presentations of journey times, historical sequences and growth patterns and then re-visited Hägerstrand's 1970 concept of the 'space-time path'. The 'space-time aquarium' can be used to represent coupling in space, time and space-time. The space-time cube has been used to represent the progress of Napoleon in 1812 and of GPS-recorded sports actors. It can also be extended to handle attributes. He concluded with some speculations on the role of the space-time cube in Location Based Services.



Juergen Doellner



Etien Koua summarises a Breakout session

Breakout Session 2 Technically we can do many things – where is the real market? What should cartography offer in the future?

*This session addressed two questions arising from the research agenda:
On the market, the discussion went as follows:*

- *Is there a market for 3D visualisation?*
 - *Hardware is not anymore a limitation*
 - *Software is the limitation*
 - *Specific software (middleware) needed*
 - *Data issue is a concern*
- *What are the commercial applications?*
 - *Provision of 3D data to mobile application is an application that can bring money*
 - *People make the money by providing the data*
 - *Money can be made in services related to 3D applications (e.g. offering services to city councils)*
 - *Virtual London is an example of funded project,*
 - *The issue is the quality of the 3D visualisation tools*
- *Current problems with 3D?*
 - *The tools don't necessary meet the expectations of users*
 - *New generations will expect even more from 3D*
 - *3D visualisation should be as realistic as possible*

- *What's needed is analysis and interaction capabilities*
- *What's missing is the data*
- *Need for added value when using 3D compared to 2D*
- *The adoption of 3D is difficult because the goals of this kind of technology are not always clear*
- *Usefulness and usability are important to keep in mind*
- *Awareness problem about the availability of the data*
- *There is no need to change everything into 3D*
- *Should try to make the use of 3D possible for everyone rather than trying to have everyone use it the way we want*
- *What is 3D good at?*
 - *In some cases, it adds more information and insights to the data*
- *What could be the future of 3D?*
 - *More on large screens*
 - *Augmented data*

And on the future of cartography, the following views emerged:

- *Cartography can still play its traditional role of offering opportunities to look at data in different views, different scale, with possibility of selection, querying,...*
- *Cartography can contribute in different aspects of the presentation of modern visualisations*
- *Provides design rules*
- *We should combine speed, functionality and quality of maps all together and not only rely on the aesthetic of the visualization (that cartography can bring in)*
- *In the future, cartographic rules will certainly be implemented in algorithms to apply to visualisation*



Christoph Mueller and Lars Bodum address the Rijstaffel



Michel Grothe, Mikael Jern and Menno-Jan Kraak

Session 3 -Applications

This session, chaired by Lars Bodum, opened with a presentation by Pieter Bresters, Meekundige Dienst van Rijkswaterstaat, Netherlands on '[3D Visualisations with the Height Model of the Netherlands \(AHN\)](#)'. AHN started in 1996 and has three owners (RWS, the water boards and the provinces). It has a minimum density of one point per 16 sqm and can be delivered as a point file, as a 5x5m grid or a 25x25m grid. The production process, using laser altimetry and subcontractors, is quality assured in house. Distribution is via Geoloket. Applications include coastal monitoring, maintenance of dikes and polders, volume

calculations, spatial analyses and archeology. Visualisations combine AHN data with remote sensing, GIS and CAD data, using stills and animations, Internet VRML, stereo renderings, physical models and holograms. A number of these are presented [here](#).

Andrew Hudson Smith, CASA, UCL, UK presented '[Online Planning: Web based 3D for Public Participation](#)'. To be useful for public participation in outline planning, systems had to operate within the 56Kb limitation of modem access. In 1999 the Augmented Reality for Planning Inquiry project with Wates Homes incorporated ACAAD data. A restriction was on walking into the scene. The Woodbury Down project (www.hackney.gov.uk/woodberry) used an accurate model with height and roof shapes, and presents options. An associated chat room did not serve a useful purpose because of restrictions on planners giving responses in writing. A more widely ranging 'Virtual London' project had just received one year's funding. This will provide a wire-frame base with photo realistic renderings in key areas and should be influential as a flagship project. Experience is growing rapidly in enabling public participation over the Web.

Sandrine Balley of the IGN COGIT Laboratory, France addressed the theme of user interface to process in '[A user interface to specify the parameterisation of GIS function](#)'. She took the example of building generalisation parameterisation, within the context of the CONSUL project to provided users with tailored geographic information over the Web. A specific module within this concerns specification of constraints and parameters to be used in generalisation, using map samples and a natural language interface. Dialogue proceeds by the exchange of discourse objects from the user and graphic objects from the system. The database schema to support this was outlined. The sample manager has to propose restricted, relevant candidate parameterisations from the dense set of possibilities. The prototype shows the value of visualisation in the advanced interface required to achieve convergence in the management of complex processes. It is now being testes and validated by users.

Continuing the theme of Web delivery, Christoph Müller, CTO of GEONOVA AG, Switzerland gave a presentation on '[Web-based regional to national 3D geoinformation services - applications and technical solutions](#)'. The company is a spin-off from the Basle University for Applied Sciences and specialises in server technology for huge vector and raster databases and realtime visualisation. Fly-throughs, with terrain display as per Imhoff (1922) and including multiple channels, work with ISDN, but to have fun use DSL. Customers include cantons, winter sports and tourist facilities and mapping agencies. The vision is to provide the 3D visualisation service integrated with situation, weather, routing and news services. Service providers licence the technology and generate income from end user services such as booking, real estate and sponsored links. The professional market, which is not necessarily Web-base, includes simulation, aviation, rail networks and engineering survey.



Sandrine Balley of IGN COGIT Laboratory



Barend Kobben of ITC expounds SVG

Breakout Session 3 - Who needs special visualisation services?

The discussion concluded that Visualisation is needed:

- *Where things are either impossible or inaccessible in reality*
- *To get more objective views*
- *For collaborative work, discussions,...*
- *Manipulating data (add, select, query,...)*
- *Gather opinions, discussions, alternatives (e.g. in planning situations, ...)*

Visualisation tools however need to be more realistic and flexible to adapt to different situations.

Session 4: Data and Modelling Issues

This session, chaired by Menno-Jan Kraak, addressed database, vector and raster issues. Jantien Stoter, TU Delft, Netherlands, with Sisi Zlatnatova, addressed '[Visualisation and editing of 3D objects organised in a DBMS](#)'. The research follows emerging OGC specifications for complex features and 3D geometries. Use of a DBMS supports editing, query and visualisation. The database used is Oracle Spatial, and visualisation tools include VRML, Microstation and ArcGIS. A use case has been developed in 3D property registration (as in Denmark, cadastre in Holland is 3D). Further work is required to implement a 3D primitive in a DBMS, in handling vertical polygons, in generating VRML from the database on-the-fly and in adapting to X3D.

Barend Köbber, ITC, Netherlands and freshly arrived from Malaysia described '[SVG and the TOP10NL Project](#)'. He identified the shift of graphics from raster pictures to resolution-independent vectors, based on XML and with client-side rendering - the SVG standard from W3C. Using the capabilities of SVG, high quality cartography is achievable authored from desktop packages and rendered in standard web browsers (as plug-ins become available). He illustrated this with demonstrations in a browser of dynamic hill-shading (style of Imhoff) and an animated map of the London Underground. Finally he described the second generation TOP10NL vector data project of the Dutch national mapping agency, using an object-

oriented model, delivered in GML and rendered using SVG. This has currently being prototyped, for full delivery in 2005.

Finally, Sanjay Rana, UCL, UK described ['Framework for augmenting the visualisation of dynamic raster surfaces'](#).

Dynamic raster surfaces are used extensively to visualise temporal and attribute change, but suffer from sampling shortcomings and information overload. The framework being developed to address these issues involves simplification (spatial and temporal smoothing), abstraction, enhancement (e.g. by use of graphic lag) and design. The framework has been used to implement a Surface Network Visualiser, leading to investigations on how to interact with an animation. In conclusion, the parallel was drawn out between the stages in traditional cartographic practice and the processes of the framework for visualising dynamic raster surfaces.



Jantien Stoter on 3D in databases rasters



Sanjay Rana concludes on dynamic rasters

Breakout Session 4 - Where are the Data Gaps?

The discussion on data gaps led to the following:

- *We are using 2D data. And we want other kinds of data for 3D visualisation*
- *There is need for 3D data, but are 3D data relevant to a country or a nation as such?*
- *Producing 3D data costs money -there are more areas for commercial companies*
- *There is need for large scale data.*
- *Most companies earn their money for large scale data*
- *There is need for cross border geo-data infrastructure in Europe*

Conclusions

The concluding session was necessarily brief but drew out the following points:

- *Visualisation is a cross-cutting topic, with research and development going on in computer graphics, geomatics and virtual reality/entertainment. 'Islands' of activity need more mutual awareness and interaction.*
- *Market demand is diverse, with concentrations in planning, design, disaster management and tourism*
- *Visualisation has an important role to play in collaborative working, and this is an important research area*
- *Public participation in planning is greatly aided by good web-based visualisation*
- *Good cartographic principles need to be built in to rendering services*
- *Standards play an enabling role, but need to be broadly based and supported*

Delegates were invited to submit ideas for future EuroSDR workshops or projects. Sisi Zlatavova (TU Delft) subsequently pointed out that there are significant problems to be solved in 3D modelling and topology - this topic could be incorporated in the planned Workshop on 'Data Modelling' following on the 'Next Generation Spatial Database - 2005' Workshop held in 2002, or form a future EuroSDR project

Thanks

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Etien Koua (rapporteur, Breakout sessions)

Peter Woodsford

February 2003.