Conceptualisation & Development of a Socio-Technic approach to Visualising Cart-Ruts

Saviour Formosa BA (Hons) Soc., MSc GIS (HUD), Dip.ApScSt., FRGS
Information Resources - Malta Environment and Planning Authority (MEPA)
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Setting the Scene

Overcoming the challenge to depict a real-life analogue set of cart-ruts in a digital setting offers a unique opportunity to experiment with a variety of technologies whilst envisaging the user's social and psychological interpretations of such a product.

The Cart Ruts project presented this opportunity as their interpretation has over the ages varied from the frankly enigmatic to the strictly scientific. This article reviews the methods used to analyse the raw data, the visualisation options considered and the process employed to deliver a scientifically reliable product.

Artist's impressions were avoided in the presentation to avoid tainting the user's visualisation process. Such a process is only possible should other methods of conveying information be made available; ones that do not inject new descreet options for bias. This socio-psychological barrier is countered through the integration of such interpreatable concepts with the employment of high end technology. To this end, technologies such as spatial information system, computer aided-design, imagery tools as well as 3D applications were used. The final result conveys photo imagery, aerial zoning imagery and databases integrated within a user-friendly interface. Experimentation into technologies such as Virtual Reality Modelling Language (VRML) has enabled a new input to the project, where users can explore the areas under study within a virtual world setting.

The end result posits the issue that multi-disciplinarity helps enable new methods of visualisation to be developed for both the academic as well as the general public. Spatial information systems and VRML can be used within the process to develop a product that normally lies within the archaeologist's realm and depicts that within an approach that is easily understandable to the layman.

Methodology

The project's remit for a fully-functional dissemination tool, has been aided through a multi-tiered approach to the development of the project's data structure. The process involved the following phases:

i) data structure analysis
ii) database creation
iii) 3D model analysis
iv) imagery scanning and sampling
v) spatial data input and analysis
vi) spatial data extrusion and conversion
vii) web-enabled technologies for multimedia dissemination
viii) application development

Data from diverse sources were gathered, analysed, and structured for the different processes.

i) data structure analysis

Data and information was presented in diverse formats; i) textual (for conversion to a database function), ii) tabular (spreadsheets) and iii) spatial (GIS vector and raster, dxf and dwg).

This entailed the use a varied number of proprietary applications and a number of unique applications created for the project. The former method employed such software as vb.net, Excel, Access, MapInfo, Vertical Mapper, 3D Max, ArcGIS, Multimedia and Web-authoring software. The end result was targeted as the production of spatial data into a VRML format, whilst the database was based on MS Access.

ii) database creation

The database module entailed the extraction of data from within a MS Word document that it was originally stored in. Whilst in an ideal world the data should have been created in a database, the original project was aimed at an analogue publication. This meant that reconstruction was necessary for database finalisation.

iii) 3D model analysis

Diverse 3D formats were presented, mainly dxf and dwg. The dxf files resulting from the scanning process were delivered in sections due to the large size of an integrated model. Even so the sections averaged 50Mb that would tax any operating system. The process required the use of 3D Max to convert the sections into VRML format. Welding of the sections into one unique area model gave very large VRML files that were not deemed feasible for normal users, however the files have been created for further study.

iv) imagery scanning and sampling

Photos and videos were cropped and resampled to enable a flowing sequence of visual presentation. These formats were web-enabled through the creation of an application that was eventually binded within the multimedia structure. Other imagery such as rectified and orthorectified aerial imagery were embedded in the application that would allow viewers to zoom and move within the image, enabling hi-definition analysis.

v) spatial data input and analysis

Having analysed the dxf file status and the option to convert into a format that would allow low-level scene viewing, the best option was to go for a GIS format. Through geocoding of the pts file within MapInfo This process required the use of a lineage to determine the conversion process of large files, in one case in access of 500Mb, generating such raster imagery that bordered on a 2Gb size.

vi) spatial data extrusion and conversion

Once the spatial data was inputted and analysed, the data was interpolated through Vertical Mapper. This process enabled the vector-to-raster conversion where the latter would result in one seamless data layer, eventually allowing 3D modelling. The 3D modelling enabled the analyst to extrude the data in 3D and export to VRML, following such processes as colour rectification, cropping, viewpoint editing, viewshed and cross-sectional analysis. The resultant VRML files were then integrated in the multimedia application by binding the web-enabled VRML file within the application.

vii) web-enabled technologies for multimedia dissemination

Technologies alternate to the above were experimented with, some too new to risk binding within the application, others were integrated such as VRML, swf and audio-video formats. Options such as 360degree panoramas were opted for and integrated.

viii) application development

In-house application development enabled the creation of a multimedia DVD, a number of imagery and audio-video tools, web-enabled applications such as HTML and VRML as well as a database function. These applications were binded within the main multimedia application to enable a seamless interaction that allows the user to browse the data without worrying on the technologies involved.

Integrating the results

Reviewing the above process and the methodology employed enabled the team to visualise the cart-ruts data in a progressively detailed scenario. This resulted in the creation of a product that enabled users to go beyond the data phase and into the information phase. Combining the information with multimedia helps contribute to develop an application that enhances knowledge dissemination. In effect the aerial imagery combined with on-the-ground photos lay the ground for immersion preparation. The other applications take the user to a different dimension in that they allow 3D visualisation through immersion technology based on pseudo-3D imagery, where 3D is enabled on to a flat screen as against a full virtual 3D 360 degree user-interface. The pseaudo-3D immersion provides the basis for user familiarisation with the area under study, though the enabling of walk and fly option as well as rotatable models of the areas.

The user can then further analyse the pseudo-3D virtual worlds through the dxf-extracted vrml section files where each section of an area can be examined.

This detailed analysis can then be contrasted to the photo imagery as against data extracted from the database. This allows for a knowledge building of the cart-ruts origins and use based on the perceptions of the users, aided by the scientific studies carried out by archaeologists and other disciplines. The return to the socio-technic approach as against the techno-centric approach outlined in the methodological description allows users to appreciate the method used to deliver the results without losing out on the focus of the study: the presentation of concrete facts enabling instigation for interpretation of the cart-ruts.

Future Issues

This methodological process can be improved with further studies into 3D and VRML research such as data integration within the models, better integration with dynamic GI and multimedia data. In addition, innovations in immersive technology would help data interpreters and scientists alike to build scenarios of the data and envisage possible interpretations of their models. This real-time immersive process would inject both arts and sciences with much needed tools.

References

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Websites:

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