

## Overlaying, Analysis and Visualisation of Heterogeneous Data Mapping Archaeological Features

*Archaeological features taken from aerial photos can be further enhanced and the result represented in various ways using special software tools. Just a few of the many possibilities are demonstrated here, by application of the professional tool for analysis and visualisation: IDL / ENVI.*

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IDL stands for 'Interactive Data Language'. This tool enables the processing of geo data from the mathematical analysis of data to graphical visualisation. Customised solutions can be generated with the GUI-toolkit. An array-oriented 4GL-programming-language forms the base for IDL. Processing sequences can be composed in addition to specific graphical user interfaces. World-wide users come from disciplines such as astrophysics, remote sensing, climate-research, medicine, oceanography and other geo-scientific disciplines. The input may be multiple data types (2-D/3-D),

vector- and raster-images or irregularly distributed mass-data-points. Processing-functions are mainly related to mathematical/statistical analysis. The IDL-language has very short commands and is therefore very powerful in use.

ENVI is a powerful image-processing tool with many functions. The output offers 2-D-plotting and 3-D-surface-plotting, beginning with transparent wire-frame-models and ending with coloured shadow-rendered-views. Animations merge static representations to form dynamic compositions. All this is not restricted to specific

platforms; it is open to all operating-systems. IDL/ENVI is used with success, among other practical applications, in scientific institutions.

### Single Representations

To illustrate the graphic possibilities, the following illustration is given. The ground/moisture feature of the Lüningsburg (Lower-Saxony) shows bright and dry regions. These may be visualised as positive heights. Darker parts with humid components (filled ancient ditches) are represented as negative heights. Figure 1 shows examples using an imagery in TIFF-format. Of course, other data types can be handled by the software.

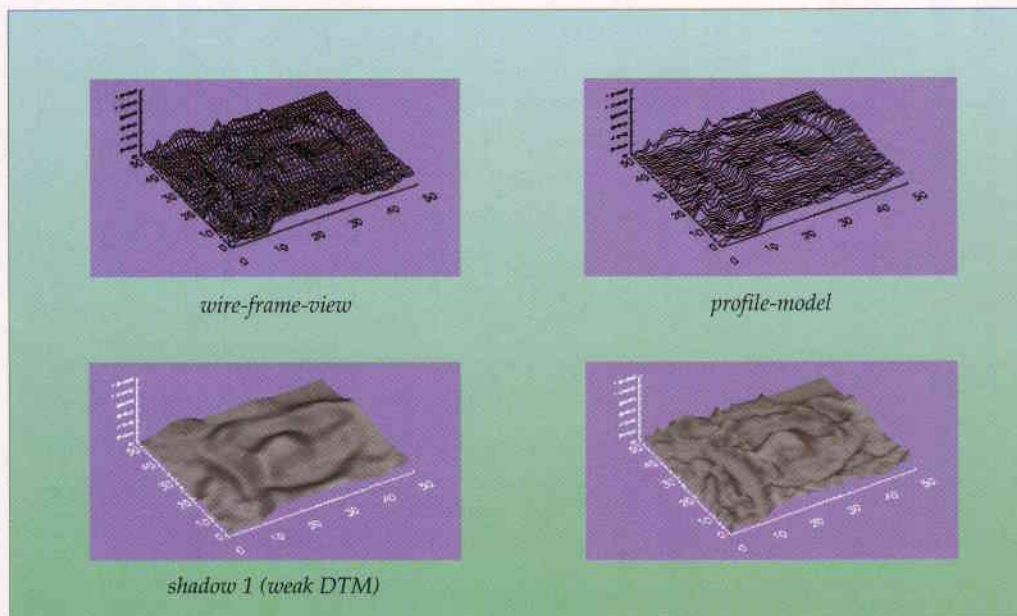
With other axis-markings, height-scaling and colour-tables, these representations can be altered. The views can also be rotated arbitrarily through interactive mouse handling by click-and-drag (IN-SIGHT).

### Combination of Heterogeneous Data

The combination of several data sources is illustrated with a DTM and geophysical measurements (Figure 2). The upper-left part of Figure 2 shows a DTM with low profile information concerning an ancient archaeological site. The upper-right part of Figure 2 shows geophysical raster-/profile measurements. These two data-layers separately offer a certain information value. However, the integration opens a completely new view, shown with a grey-scale colour table (bottom-left) and natural colours (bottom-right).

### Other Features

With the 'fly-through' feature, one can fly through all the canyons and ditches of the texture-overlaid



**Figure 1.** Example of terrain visualisations: upper-left: a wire-frame; upper-right: profiles, below: two shadowed models, the left representation has a higher surface detail and relief energy than the right one

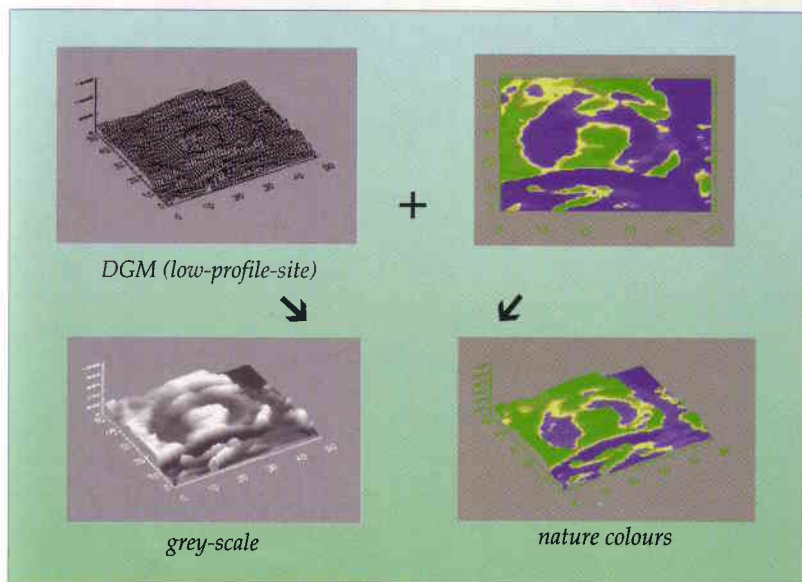


Figure 2, Combination of a DTM and texture

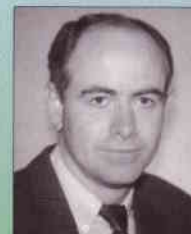
terrain-topography, in order to study details. For various depth measurements taken at the same (x,y) location, IDL offers the ability to analyse the 3-D volume-sphere. The set of irregularly dis-

tributed discrete points can be transformed into continuous surfaces by spatial interpolation-algorithms. Analysis may be carried out on sub-volumes and cross-sections. The result will resemble an

X-ray screening of the subterranean ground, where, for example, old brickwork contrasts geo-magnetically as a disturbing body in its environment. We recognise this principle of 3-D visualisation from impressive spatial views in computer-tomography. ♦

#### Biography of the Author

After Mr Heller's study in 1987 of geodesy at the University of Hannover (emphasis on photogrammetry) he worked for five years in the image-processing development of military missiles in the German defence industry (Lake of Constance), before he changed into GIS, where he is now busy as system/application manager in the urban utilities of Bochum.



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