York Neuroimaging Centre

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DataViewer3D

An open-source, cross-platform, multi-modal imaging data visualisation tool

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Introduction:

Despite the large number of excellent analysis and data visualisation packages available, few have functionality allowing users to easily integrate and display results from multiple imaging modalities (structural MRI, fMRI, DTI, MEG, EEG) and analysis techniques simultaneously within the same coordinate frame and in 3 dimensional space. Some products are also commercial, limiting user-community development.

DataViewer3D (*DV3D*) is designed to facilitate overlay of data from a number of different analysis packages and output formats. DV3D currently supports NIFTI and ANALYZE formats for MRI data display (including statistical overlays generated by SPM and FSL). Formats for other data types vary. Some examples of supported outputs include FSL, SPM, mrVista, Freesurfer, SurfRelax, Brainstorm, EMSE, and EEGLab. Software architecture is highly modular allowing easy integration of additional routines for importing and interpreting different data formats with relatively low user/developer investment.

Methods:

With an intuitive user interface built on Python and wxWidgets, DV3D utilises the powerful routines of The Visualization Toolkit (VTK) for 3D data interrogation and rendering.

DataViewer3D (*DV3D*) has the ability to track coordinates in multiple datasets simultaneously. Simply providing a second dataset as a 'reference volume' along with a a transformation matrix (generated by FSL's FLIRT for example) allows the user to determine where the equivalent coordinate to the current data point is in the reference volume.

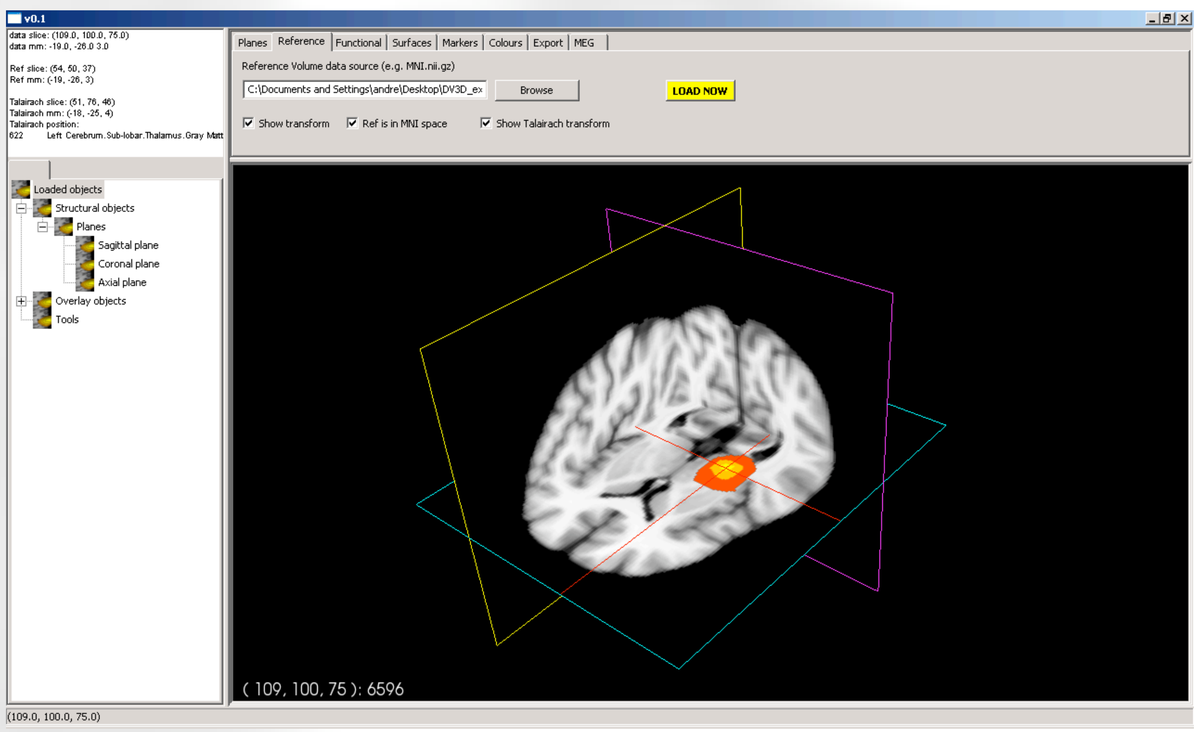

Figure 1. : *The DV3D user graphical user interface (GUI) on Windows XP. Multiple data objects can be simultaneously loaded and their properties (including colour, transparency and threshold) manipulated using list controls (left). A message panel informs users of errors (top left) and can be used to display current data, reference volume and even equivalent standard coordinates (e.g. talairach / MNI)*

Summary:

DV3D is a multi-modal imaging data visualisation tool developed for and by users at the York Neuroimaging Centre. It represents a truly cross-platform, open-source solution to simultaneous data overlay visualisation requirements of modern multi-modal imaging studies. Whilst DV3D is primarily a visualisation tool, the intrinsic functionality of the package lends itself to an analysis approach with which the results one mode of imaging can be used to guide and/or compare analysis of another modality in a single co-ordinate space. The program has been tested on Mac OS X, Debian Linux and Microsoft Windows XP.

REFERENCES

[1] W. Schroeder, K. Martin, and W. Lorensen, *The Visualization Toolkit: An Object-Oriented Approach to 3D Graphics,* 2nd ed., Prentice-Hall, Old Tappan, N.J., 1998.
[2] Guido van Rossum, 1991. www.python.org

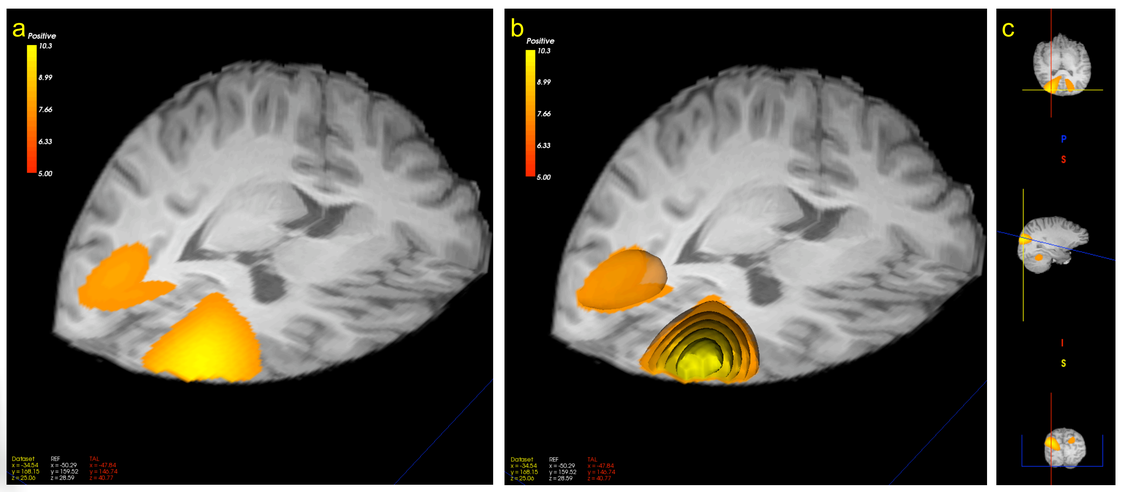

Figure 2. : *Statistical (z-map) overlay in 2d-inplane (a), 3d-multisurface(b) and orthogonal reformat (c) views.*

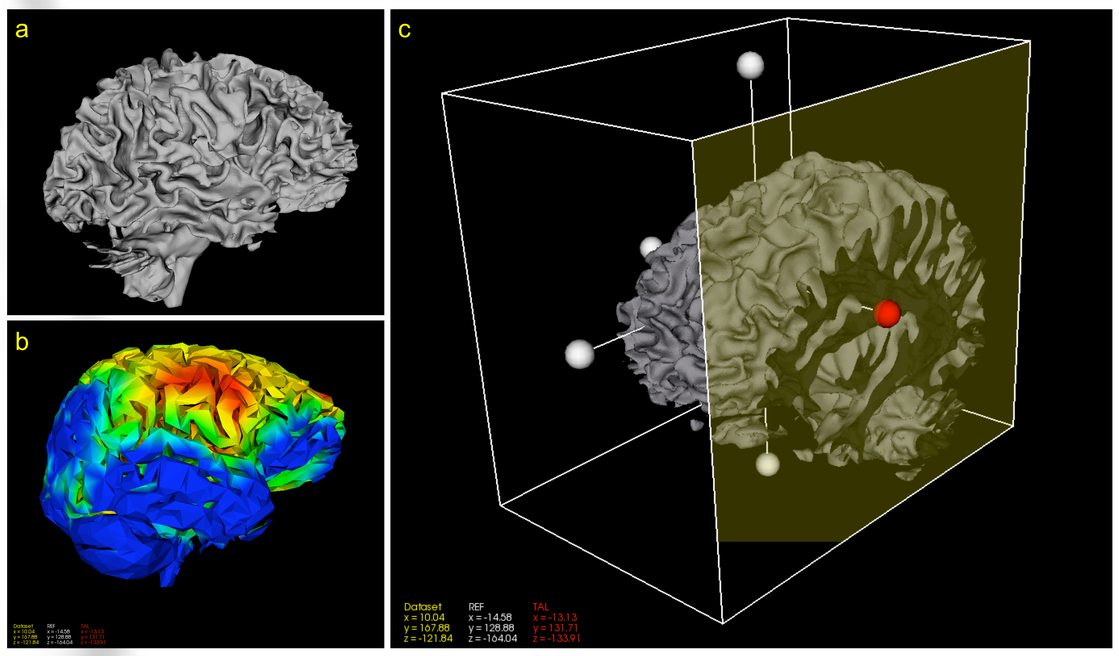

Figure 3. : *Using surfaces in DV3D**: Surfaces can be loaded from programs like SurfRelax (a) or Freesurfer; surfaces can have colour maps which interrogate underlying statistical data (b); surfaces can be clipped(c), decimated(b) and generated on the fly, then exported for later re-import*

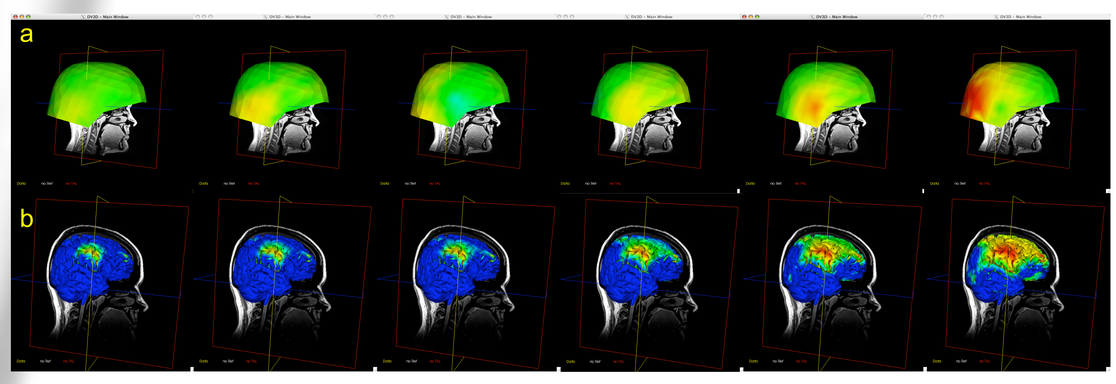

Figure 4. : *Viewing time-series data in DV3D:* *(a) Evolution of MEG field displayed via 3d-contour plot. (b) Evolution of minimum norm projection via surface scalar lookup table. In all instances frames can be automatically generated by cycling data and exported for movie creation.*

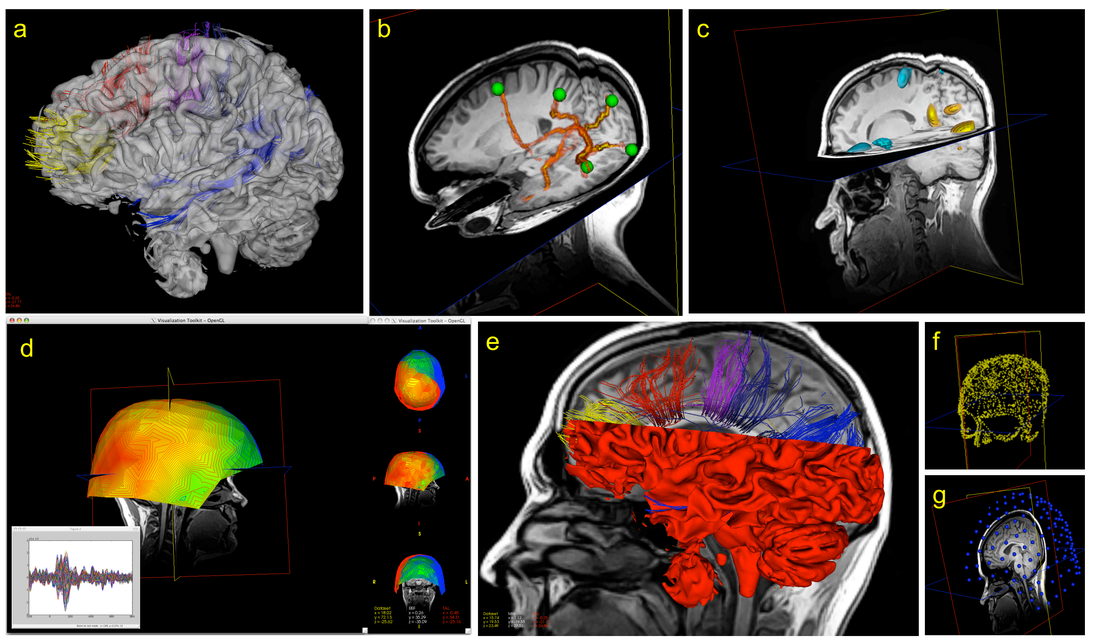

Figure 5. : *Combining DV3D functionality**. (a) DTI fiber data with 3d-glass brain overlay. (b)3d-probabilistic DTI maps seeded from MEG beamforming maxima. (c) Positive and negative t-maps from fMRI activations. (d) MEG 3d-contour plot and timeseries butterfly plot. (e) Gray-white cortical boundary clipped to show underlying DTI fiber pathways and structural MRI. (f) Head surface points from EEG co-registration routines. (g) MEG coil sensor positions relative to head.*