

Introduction to MNI-Display 2.0

Robert D. Vincent
robert.d.vincent@mcgill.ca

McGill Centre for Integrative Neuroscience

9 Nov 2015



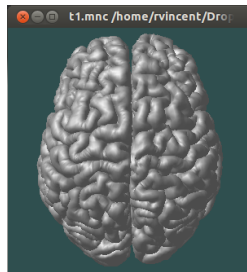
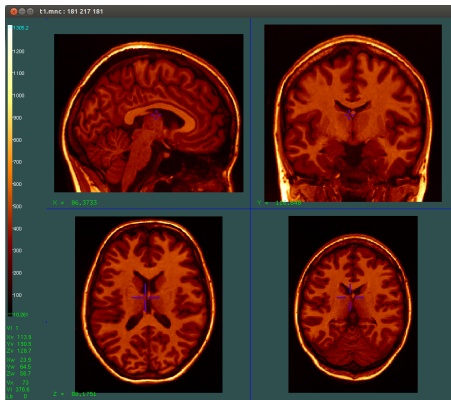
Montreal Neurological Institute and Hospital
Institut et hôpital neurologiques de Montréal



What is MNI-Display?

- ▶ Versatile tool for visualization of individual scans and surfaces.
 - ▶ Volumetric data.
 - ▶ CIVET surfaces and other geometric structures.
 - ▶ Anatomical labeling or segmentation.
 - ▶ AnatoMarkers,
- ▶ Simple surface extraction.
- ▶ Intensity histograms.
- ▶ Manual volume transforms.
- ▶ Surface and volume cropping.

User interface



History of MNI-Display

- ▶ Started in 1991 by David MacDonald.
- ▶ Written in C.
- ▶ Uses GLUT and OpenGL, so can run on many platforms.
- ▶ Cousin to MNI-Register.
- ▶ Actively enhanced for several years.
- ▶ Only rarely changed since early 2000's.

Why MNI-Display?

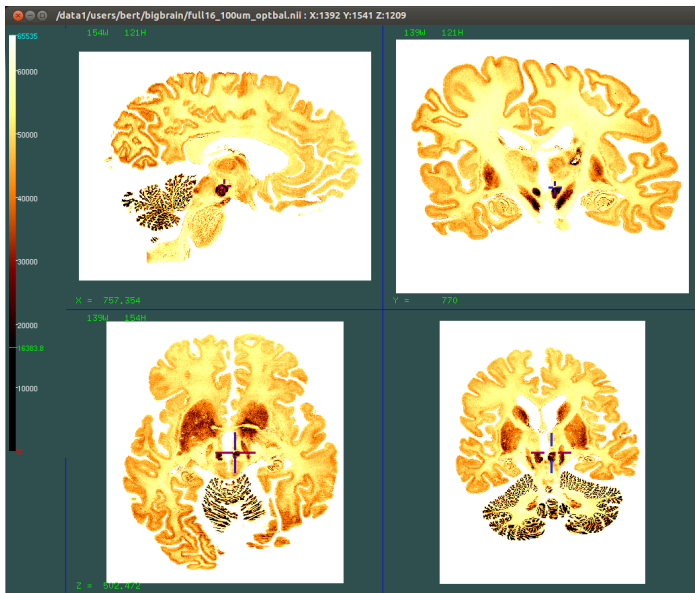
▶ Strengths

- ▶ Can display large (gigavoxel) images.
- ▶ Can overlay images with different sampling grids.
- ▶ Oblique (non-orthogonal) slices.
- ▶ Versatile anatomical labeling functions.
- ▶ Powerful 3D visualization features.
- ▶ Open source.

▶ Weaknesses

- ▶ Idiosyncratic user interface.
- ▶ Minimal documentation for users or developers.
- ▶ No support for dynamic images (PET, DTI, fMRI).

Oblique slices at $100\mu\text{m}$



What is MNI-Display 2.0?

- ▶ Part-time project begun in April 2015.
- ▶ Technical goals:
 - ▶ Expanded user documentation.
 - ▶ Enhance maintainability and stability.
 - ▶ New surface visualization features.
 - ▶ Support dynamic scans.
 - ▶ Improve ease-of-use.
- ▶ Strategic goal - increase user acceptance.

Expanded user documentation

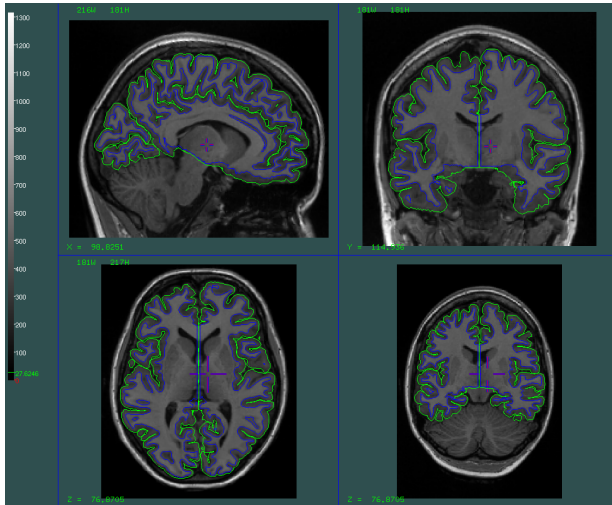
- ▶ Complete menu reference.
- ▶ More background explanation.
- ▶ Describe new features.
- ▶ Detailed usage instructions.
- ▶ Reveal hidden/obscure features.

Enhance maintainability and stability

- ▶ Developer documentation via doxygen comments.
- ▶ Lots of manual testing.
- ▶ Remove unused files and functions.
- ▶ Fix compiler warnings.
- ▶ Dynamic program analysis (Valgrind and Address Sanitizer).
- ▶ Use modern OpenGL.

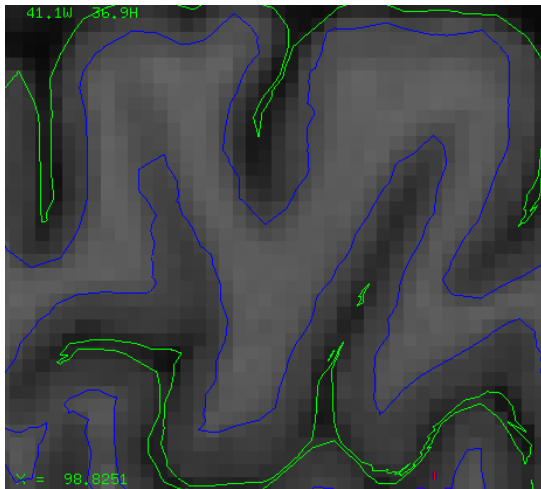
Improved surface visualization

- ▶ Superimpose surface trace on slice views.



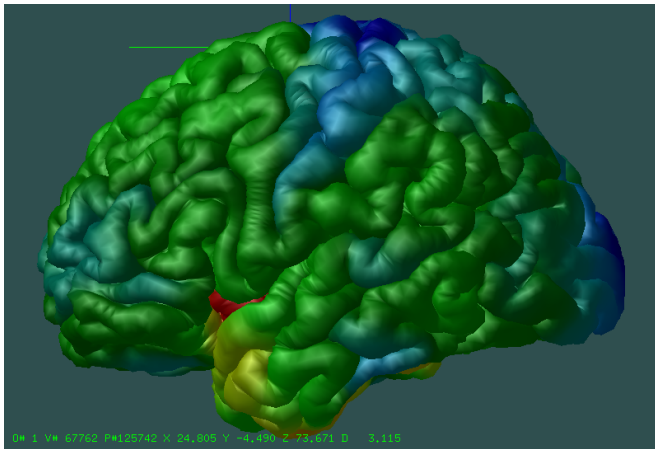
Improved surface visualization

- ▶ Superimpose surface trace on slice views.



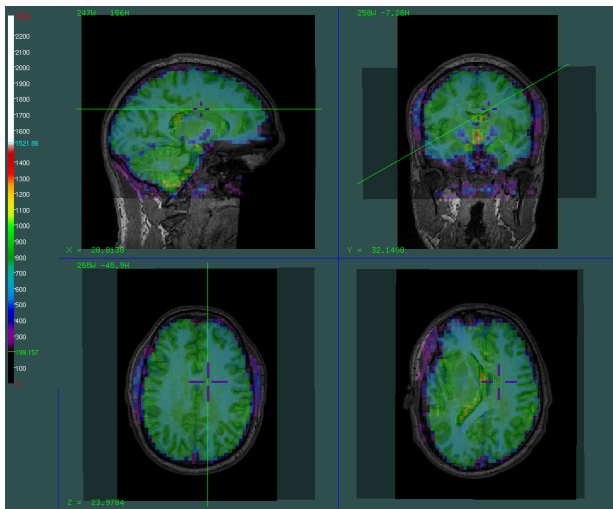
Improved surface visualization

- ▶ Support for per-vertex (e.g. thickness) data.



Support dynamic scans

- ▶ Can load raw DTI, fMRI, PET 4D scans.



Enhance ease-of-use

User interface *largely* unchanged, however:

- ▶ Support for modern mice and trackpads.
- ▶ Menu help text.
- ▶ Dialog boxes for user input, with option to cancel operation.
- ▶ Load NIfTI-1 and FreeSurfer volumes.
- ▶ Save and restore window layout.
- ▶ Standard keyboard shortcuts.
- ▶ N-step undo.
- ▶ Remove obsolete commands.

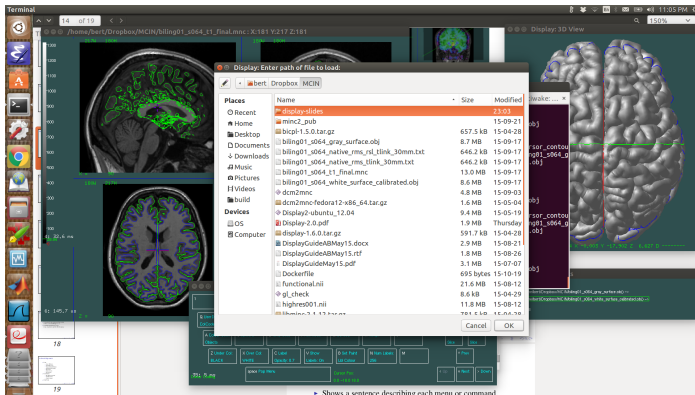
Menu help text

- ▶ Shows a sentence describing each menu or command.
- ▶ An attempt to offer some assistance while remaining unobtrusive.



Dialog boxes for user input

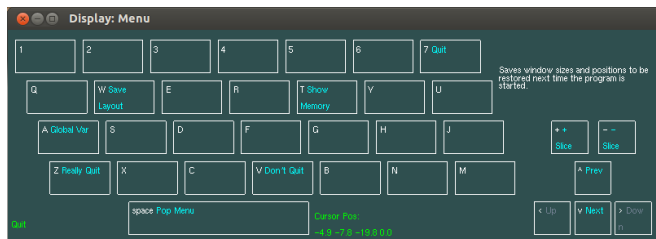
- ▶ Uses an external program, zenity, to display dialogs.
- ▶ Every dialog can be canceled.



▶ Shows a sentence describing each menu or command.

Save and restore window layout

- ▶ The 4-window UI is somewhat unwieldy.
- ▶ You can now save your preferred layout and it will be automatically restored the next time you start MNI-Display.



Standard keyboard shortcuts

- ▶ Ctrl-Z - Undo last voxel paint operation.
- ▶ Ctrl-O - Open file
- ▶ Ctrl-S - Save file
- ▶ Please suggest additions...

Other new features

- ▶ Distance calculations.
- ▶ Separate object list window.
- ▶ Field-of-view display.
- ▶ Ratio display (e.g. $V0/V1$).

What next?

- ▶ Still very much a work in progress.
- ▶ Draft documentation is available here:
`https://www.dropbox.com/s/pak0b86sksi6oil/Display-2.0.pdf?dl=0`.
- ▶ Contact me if you want to help test:
`robert.d.vincent@mcgill.ca`
- ▶ Contribute suggestions or code:
`https://github.com/BIC-MNI/Display`.

Acknowledgments

- ▶ **Users:** Ayça Altinkaya, Gabriel Devenyi, Najmeh Khalili-Mahani, Penelope Kostopoulos, John Lewis, Lindsay Lewis, PJ Toussaint
- ▶ **Contributors:** Haz-Edine Assemblal, Vladimir Fonov, Andrew Janke, Claude Lepage, Peter Neelin, Steve Robbins, John Sled, Andrew Wood
- ▶ David MacDonald
- ▶ Alan Evans

Thank you

- ▶ Questions
- ▶ Demonstration