



AFNI, SUMA, and NIML: Interprocess Communication in fMRI Data Analysis

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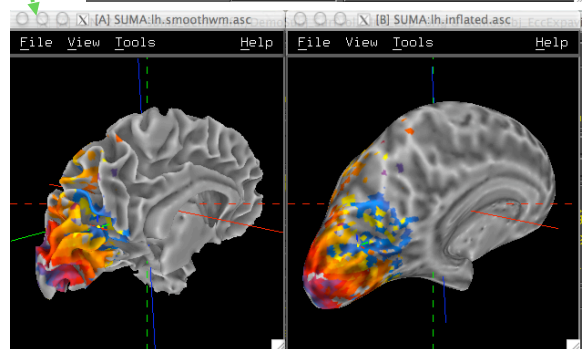
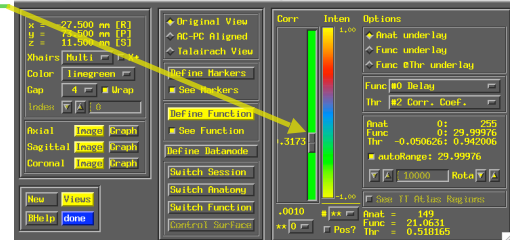
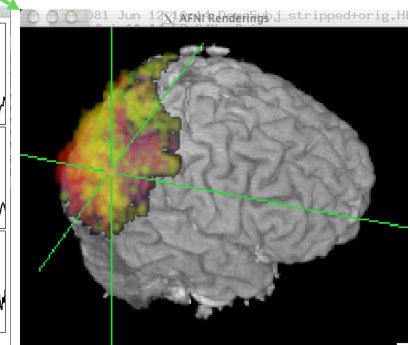
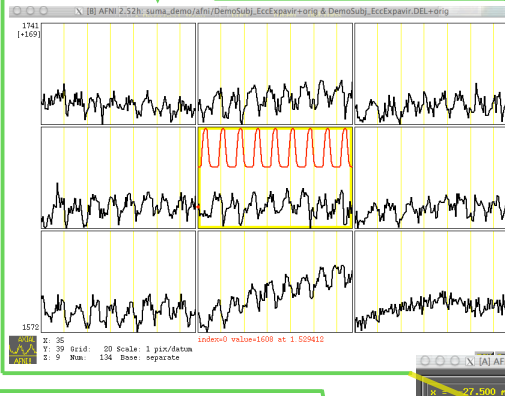
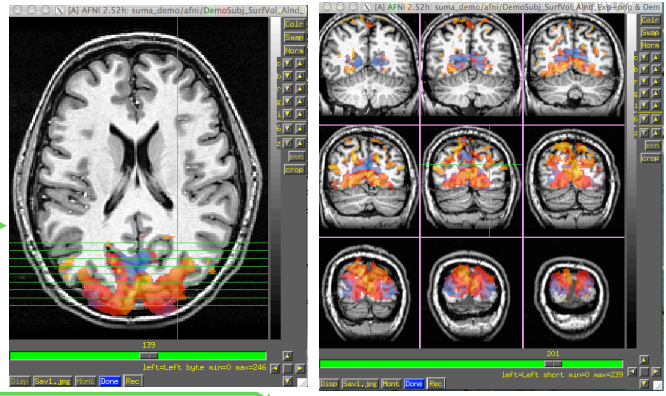


Linked Programs

- **AFNI** = software package for display and analysis of 3D and 4D fMRI datasets defined on rectangular grids
 - Reads AFNI-, ANALYZE-, and MINC-formatted datasets
- Visualization Tools in AFNI:
 - 2D Slice Viewers
 - 3D Volume Rendering
 - Time Series Graphs
 - Translucent Color Overlays
 - Interactive statistical thresholding
 - Focus point (crosshairs) linked

- **SUMA** = Surface display and analysis program (part of AFNI package)
 - Shows multiple representations of the same surfaces
 - Linked to AFNI for focus point and color overlay display
 - Drawing ROIs on surface; displaying and using in volume dataset (via AFNI)
 - Reads surfaces created by FreeSurfer and SureFit packages

- **NIML** = Data formatting and interprocess communication protocol for "live" connection of AFNI and SUMA [i.e., this is the [link](#)]
 - Storage and communication of data use same formatting — based on XML standard
 - Data abstraction is a 2D table of "values"
 - XML element header contains string "attributes" which describe each data column, plus any other info that goes with the data table
 - Each column of a table can be a different type
 - Supported types:
 - byte, short, int, float, complex, double, String, RGB, RGBA
 - user-defined built-up types ("structs") — e.g., a 3-vector
 - Data is read from and written to "streams":
 - Files, TCP/IP sockets, shared memory buffers, Web addresses
 - Data can be encoded as ASCII text, Base64, or binary
 - NIML can be used to transmit/store small data tables with little overhead and also to store large multi-dimensional arrays



Getting the Software

- AFNI and SUMA are freeware
- Download from the AFNI Web site
- C Source code and some binaries available
- Runs on Unix+X11+Motif+OpenGL
 - Supported platforms: Linux, Mac OS X, Sun Solaris, SGI IRIX

Things to Read for Fun and Edification

- 1 — Cox RW. AFNI: Software for analysis and visualization of functional magnetic resonance neuroimages. *Computers and Biomedical Research* 29:162-173 (1996).
- 2 — Cox RW and Hyde JS. Software tools for analysis and visualization of fMRI data. *NMR in Biomedicine* 10:171-178 (1997).
- 3 — <http://afni.nimh.nih.gov> = AFNI & SUMA Web site [includes reprints of 2 papers above]
- 4 — <http://surfer.nmr.mgh.harvard.edu> = FreeSurfer Web site
- 5 — <http://stp.wustl.edu/resources/cortcart.html> = SureFit Web site
- 6 — <http://www.xml.com> and <http://www.xml.org> = XML Web sites

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