Flexible Atlas Framework in AFNI

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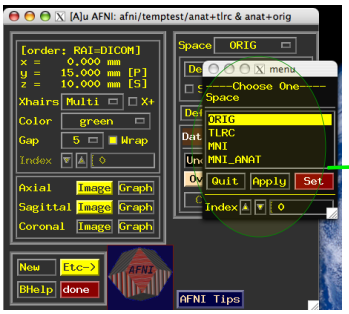
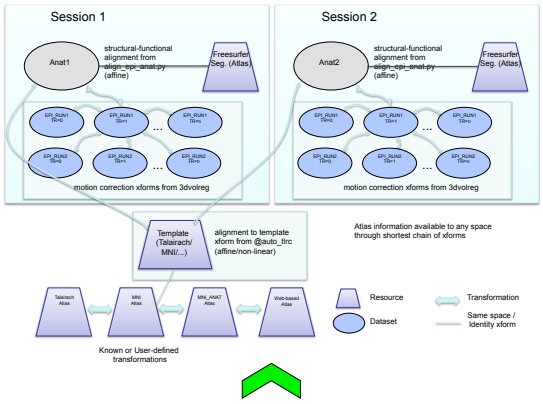
Introduction: The AFNI software package has recently been transformed to handle atlases in a relatively generic and transparent way. The principal basis for this change is that spaces are defined at dataset and individual volume levels. The term "space" refers to a state of coordinate correspondence, i.e. each location corresponds to the same or similar structure in another dataset with that same space. In the past, AFNI was hard-coded for use with Talairach-space atlases. Here we describe the general capabilities of this new approach to dealing with dataset spaces.



Use Any Space (in development)

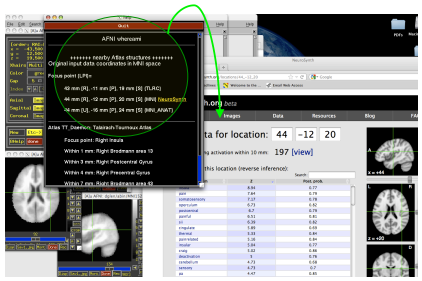
Transformation Chains Example



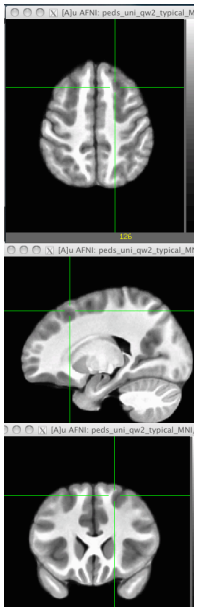
Methods: The software allows for on-the-fly transformations across spaces. This transformation allows for simplified use of standard spaces like MNI or Talairach spaces, as shown above. It also allows for transformations across multiple sessions, as shown in the diagram on the left.

The framework allows for relatively easy addition of new atlases and templates. Infant atlases have recently been added to the AFNI distribution, and soon pediatric atlases and templates will be available also.

The whereami atlas tool in AFNI also allows for addition of web-atlases, remote atlases, that may be available only through a browser connection. With this capability, specific subject data can be queried against a remote atlas. Prototypes have been developed for Neurosynth.org and Elsevier's BrainNavigator.



Live links to web-based atlases – Neurosynth.org, Elsevier,... (in development)

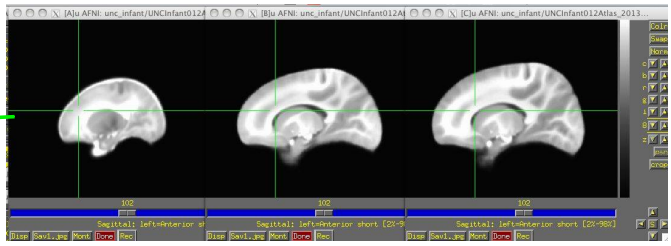


Pediatric Templates and Atlases

with Peter Molfese, Haskins Institute (NIH grant PO1 HD-01994)

nonlinear warping (3dQwarp) across multiple subjects to "typical" subject

New Atlases



UNC infant templates and atlases – neonate, 1 yr, 2 yr old

Conclusions: We have now created a flexible platform for accessing brain atlases in AFNI. MRI researchers can use almost any available digital atlas with their own subject data. Remote server-based atlases may be queried that can provide an even richer set of resources. Users may easily create and contribute new templates and atlases.

AFNI can use XML files and header attribute fields for its internal database of available atlases, spaces and transformations. This information can be used with command line and the AFNI GUI to compute coordinates, transform volumes among spaces and extract structural information.

Feng Shi, Pew-Thian Yap, Guorong Wu, Hongjun Jia, John H. Gilmore, Weili Lin, Dinggang Shen, "Infant Brain Atlases from Neonates to 1- and 2-year-olds", PLoS ONE, 6(4): e18746, Apr. 2011. doi:10.1371/journal.pone.0018746.

Yarkoni, T., Poldrack, R. A., Nichols, T. E., Van Essen, D. C., & Wager. T. D. Large-scale automated synthesis of human functional neuroimaging data. Nature Methods.