Neuroinformatics based on VRML

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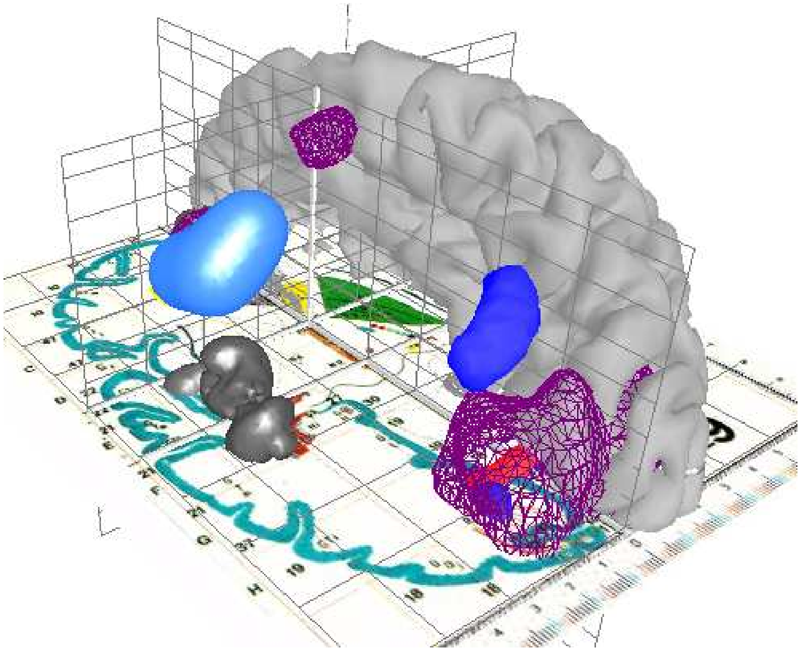
Neuroimaging experiments based on PET, and in particular on fMRI, are accumulating vast spatio-temporal databases at a rate that calls for new innovative informatics tools. Neuroscience databases are conceptually and physically linked in complex socio-scientific networks of human relations, publications, and funding programs. It is the grand challenge of neuroinformatics to organize these networks and make them transparent for the neuroscience community.

Given the spatio-temporal structure of the data, the dense linking of concepts, and the need for cross-platform interactivity, we find WWW based virtual reality, i.e., VRML — Virtual Reality Modeling Language — an obvious tool for neuroinformatics [2]. VRML is a WWW standard adopted by ISO [1]. VRML is a new text-based language (or file-format) for general purpose 3D polygon interactive visualization. There exist VRML viewers for many platforms [3] and they support 3D navigation and geometric "hyperlinking", i.e., by mouse clicks on geometric objects the user can activate links to other Web documents. Dynamic environments are implemented through "behaviors" associated with specific geometric objects. Behaviors can, e.g., be activated by proximity of the users point of view. Future versions of VRML are planned to support multiuser virtual environments.

At our Web site `http://hendrix.imm.dtu.dk/vrml` there is access to +20 virtual environments illustrating the use of VRML in neuroimaging. Our environments range from displays of 3D brain maps from specific experiments, to abstract representations of neuroscience project infrastructure. In the figure we show an example of an environment summarizing and linking brain map data from a number of experiments in a "value added" Talairach frame of reference. Fiducial markers, grid lines, blob subsets etc. can be included or excluded at the users convenience.



At the current level of VRML, available viewers, and the graphics capabilities of standard workstations, we can recommend the use of VRML in neuroinformatics based on the unique possibility for cross-platform communication of 3D dynamic data and based on the informatics potential of geometric hyperlinking of all types of WWW data including imagery, video, and text. The main drawbacks of current VRML versions are the technological limitations to the complexity of manageable 3D environments.

Within a not so distant future of high bandwidth WWW, more powerful graphics workstations and support for multiuser VR, VRML could be the Big Bang for neuroinformatics.

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References

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3. San Diego Supercomputer Center, The VRML Repository, Internet, 1998, `http://www.sdsc.edu/vrml/`.