Interactive Information Visualization in Neuroimaging

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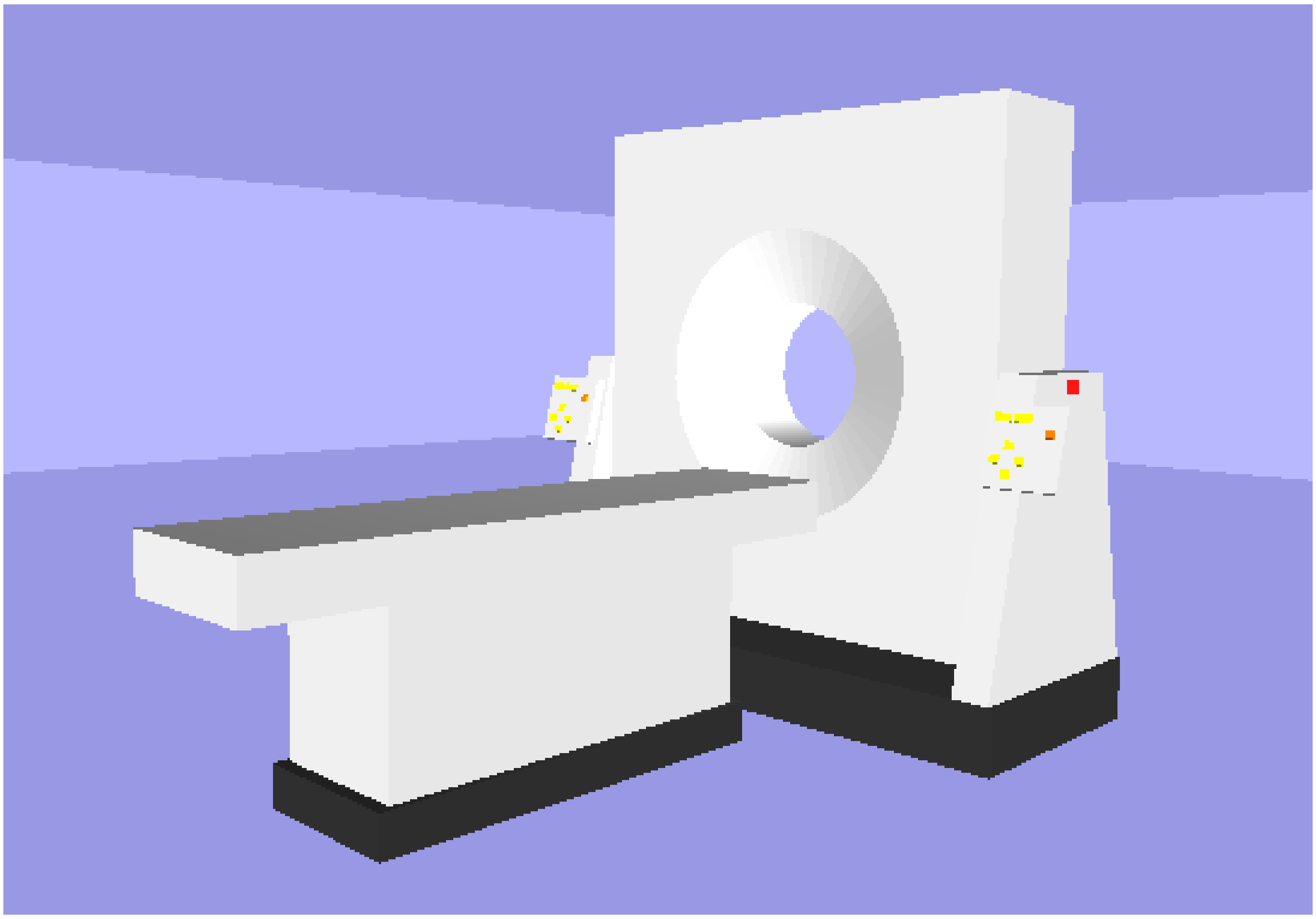
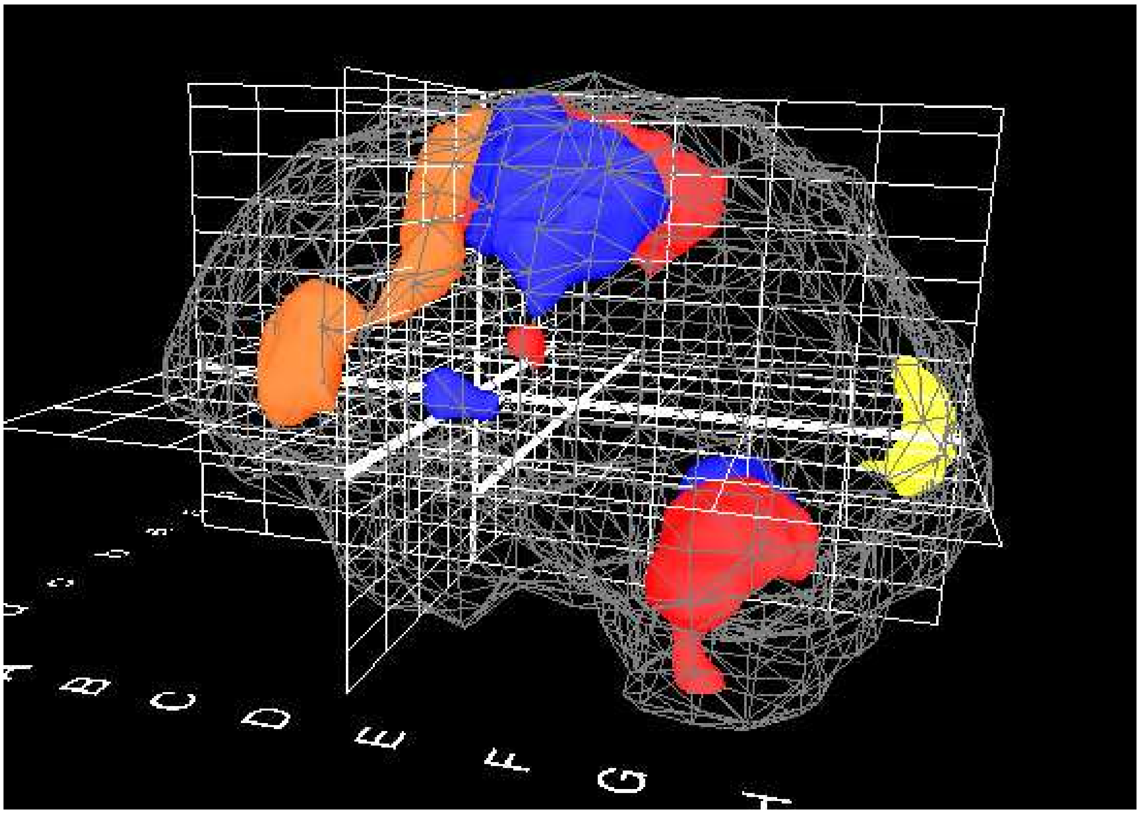
CONTENT



- Neuroimaging
- Volume visualization
- Process visualization
- Virtual reality system
- Observations and goal

NEUROIMAGING



What is functional neuroimaging? Blobology!

Understanding how the brain works from images obtained with brain scanners (fMRI, PET, MEG, . . .)

Characteristics

- Interdisciplinary
- Geographically spread
- No unique methodology
- Data usually 3D

INTERACTIVE VISUALIZATION IN NEUROIMAGING

Needs

- Interdisciplinary: Pictures! Images!
- Geographically spread: Internet-based
- Methodology: Integration environment
- 3D data: 3D graphics

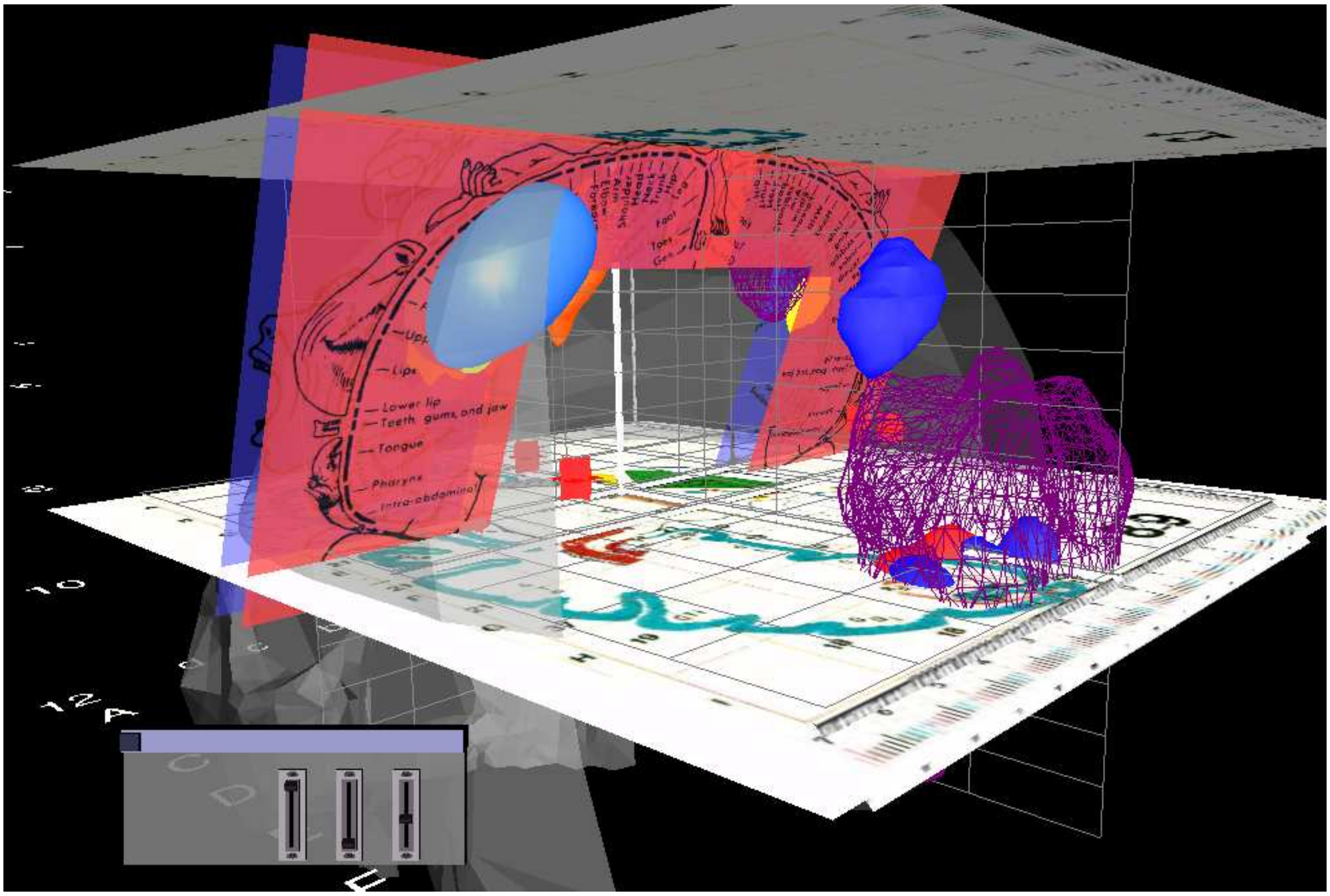
Visualization: Two kinds

- Volume Visualization — Homogeneous data visualization
- Process Visualization — Heterogeneous information visualization

Solution: VRML

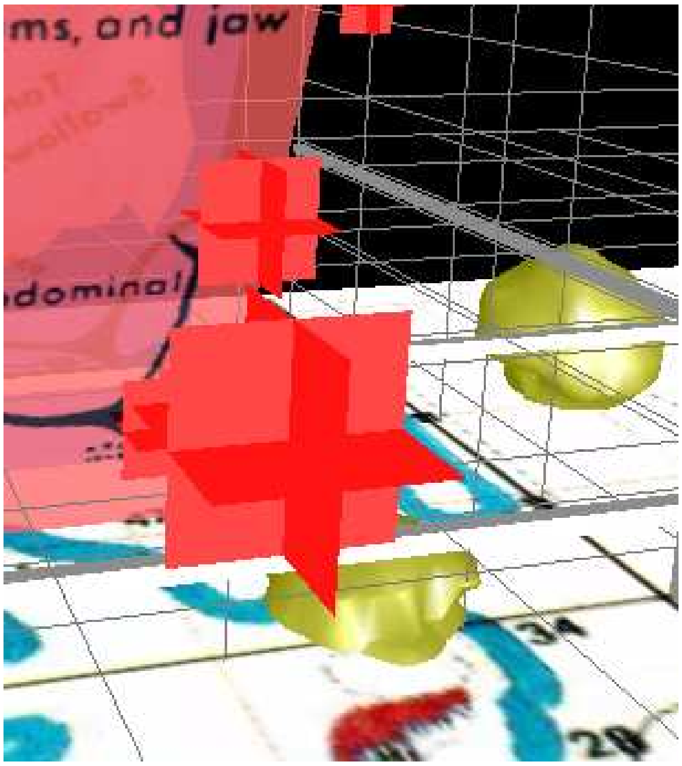
- Alternatives: 2D graphics, movies, volume rendering, dedicated program
- Standardized free format, Interactive, Basis for hypermedia
- Confined (to some extent), i.e., publish-able yet still open

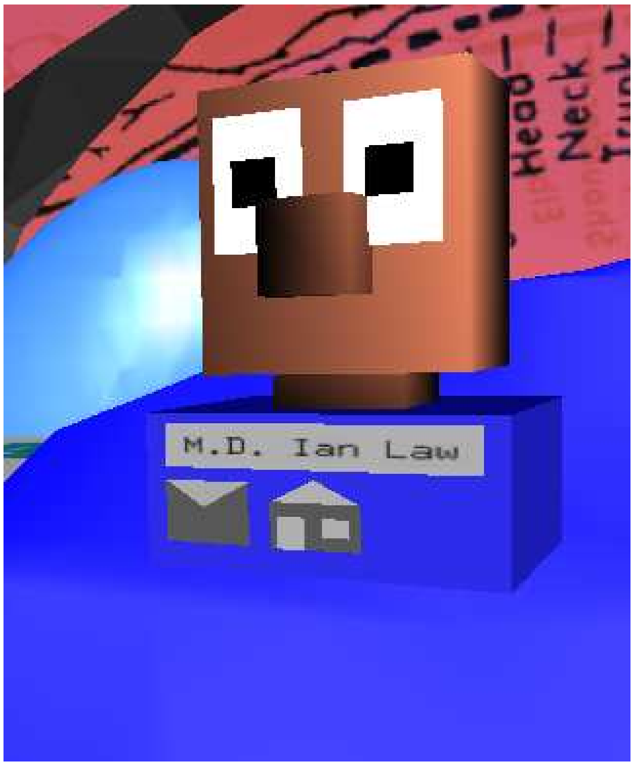
VOLUME VISUALIZATION COMPONENTS



- Framework: Talairach Atlas
- Orientation clues: 3D axes, 3D grid, rulers, . . .
- Reference Volumes (Atlas, Anatomical)
- Functional volumes
- Database "volumes"
- Assorted gimmicks: Skull, electrodes, . . .

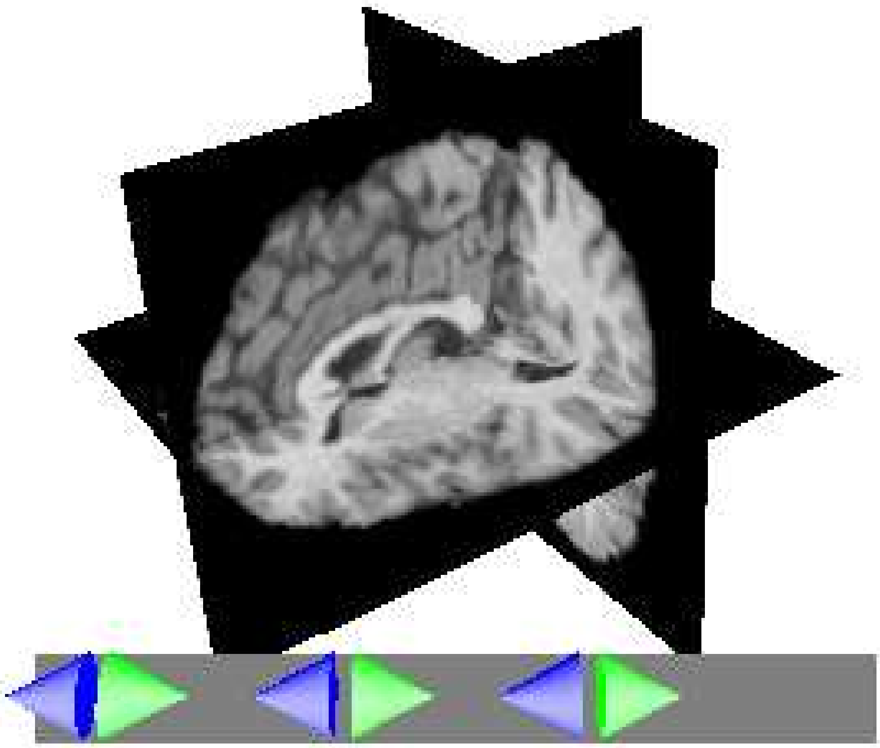
SYMBOLIC ENVIRONMENT & GLYPH





- Volume
  - Marching Cube isosurface
  - Slices
  - Volume rendered?
  - Symbolic representation. Glyphs.
- Simplified (symbolic) representations might be easier to compare
- Interactive configurable connection between the geometry and the data component

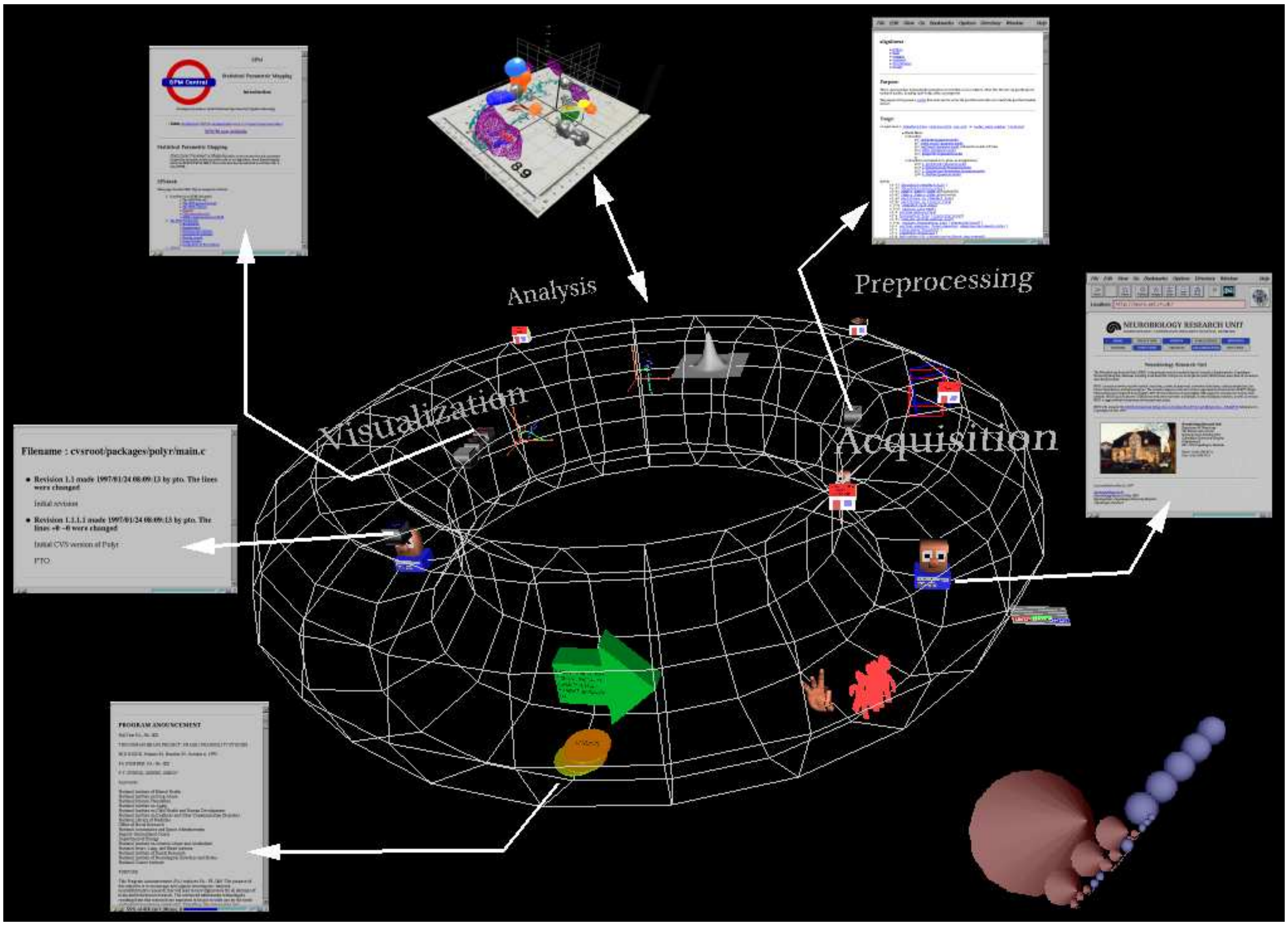
INFORMATION OVERLOAD



It is easy to include: just write `Inline` or use a `PROTO`.
Interactive exclusion: A control interface is needed!

- VRML or external Java(-applet) program
- Control interface should be integrated with the included components (add-able, hide-able)
  - On separate panel or an attribute with the geometry
  - Should still be consistent with the overall control interface
  - Panel: locked to viewpoint and locked to world

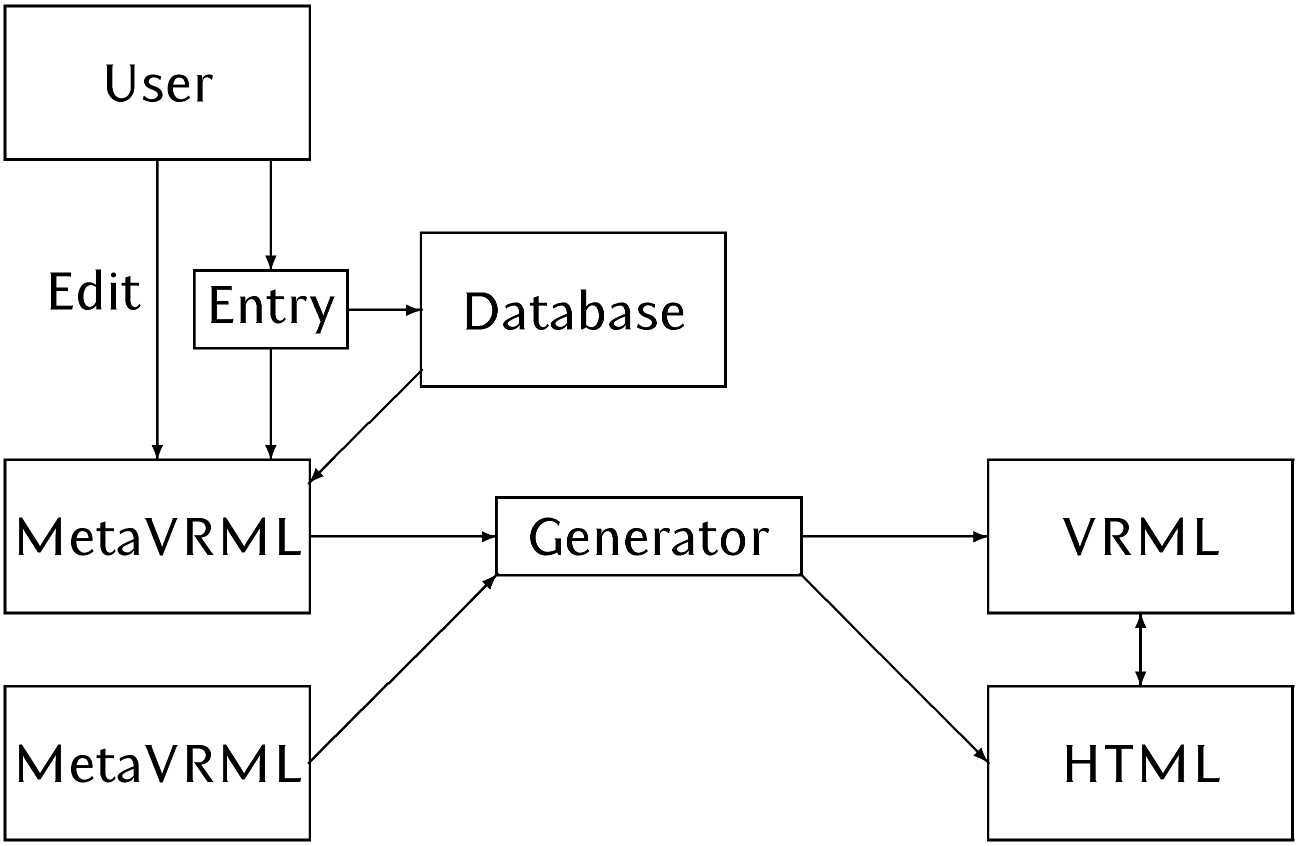
"PROCESS" VISUALIZATION



- Dimension (Process, discipline, User level, reference type)
- Connections between components
- Hyperlink to other documents

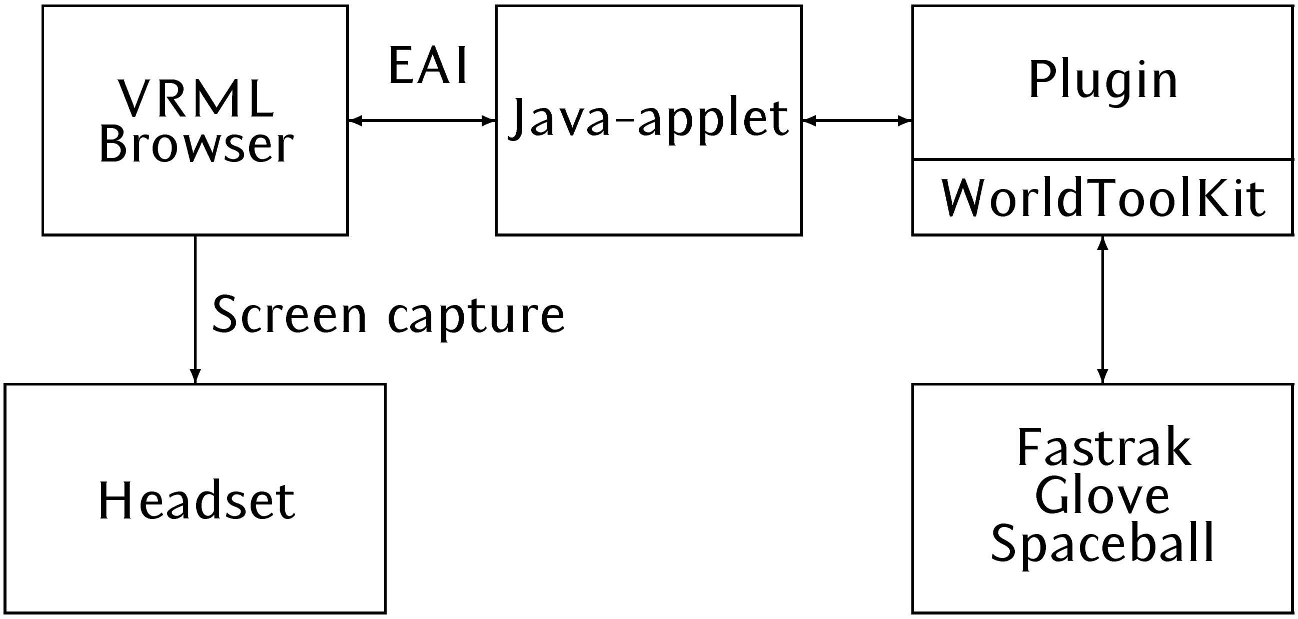
"METAVRML" LANGUAGE

Need for a language to describe a process



- No explicit graphic values. VRML should be generated from the metaVRML.
- How general? Dynamic?

VIRTUAL REALITY SYSTEM ...



OBSERVATIONS & CONCLUSION

☹ Difficult interaction with a volume using VRML

- Java (probably) not fast enough to handle a volume.
- Difficult to communicate with mathematical programs written in C, Matlab, or IDL. Only one way data flow.

☹ Need for a MetaVRML language

☹ Text integration in VRML difficult

- 3D text hard to read
- Hard to generate text as textures
- Cannot cut and paste

☹ "Platform independence": No VRML-browser for several platforms

☺ Volume visualization both for the researcher and the public, and IT'S FUN!

Goal: Conference model (Robert Savoy)

Authors submit descriptions of their study along with the abstract. VRML worlds are constructed: Symbolic Talairach world and process torus.