spatial structures

Spatial Data

Scientific Visualization

Assumes:

discrete sampling of continuous spatial data

Challenge:
virtual (screen)
is not reality

Advantage:

humans are good at interpreting spatial data

Advantage:

SciVis can go beyond "realism"

You control:

lighting, contrast, resolution, density, and other data parameters.

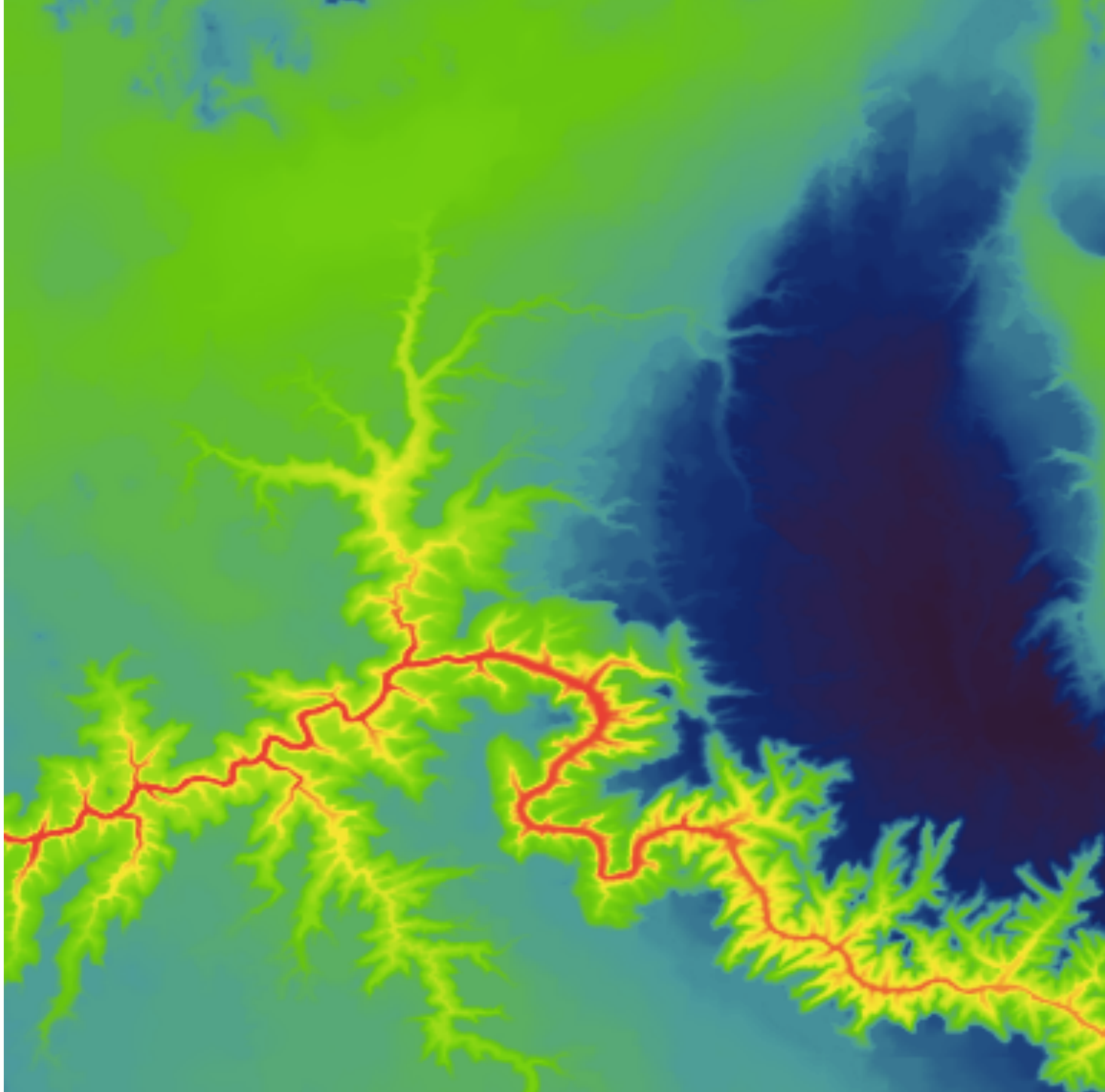
1d

bar, line, heatmap, area

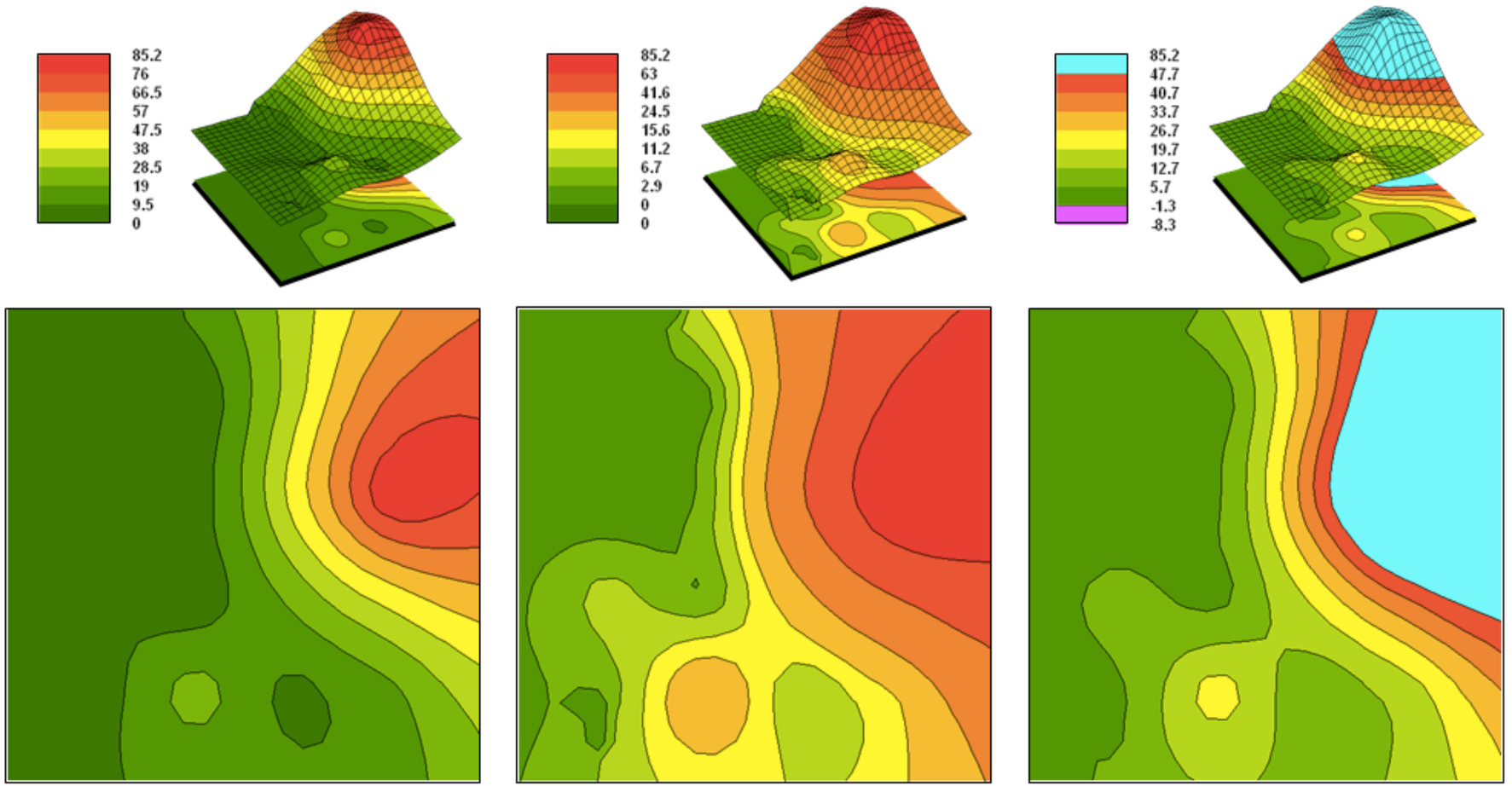
form the basis for SciVis techniques for abstract data

2d

Grids



Concept: contours



3d

Continuous

v.

Discrete

Continuous

v.

Discrete

Explicit

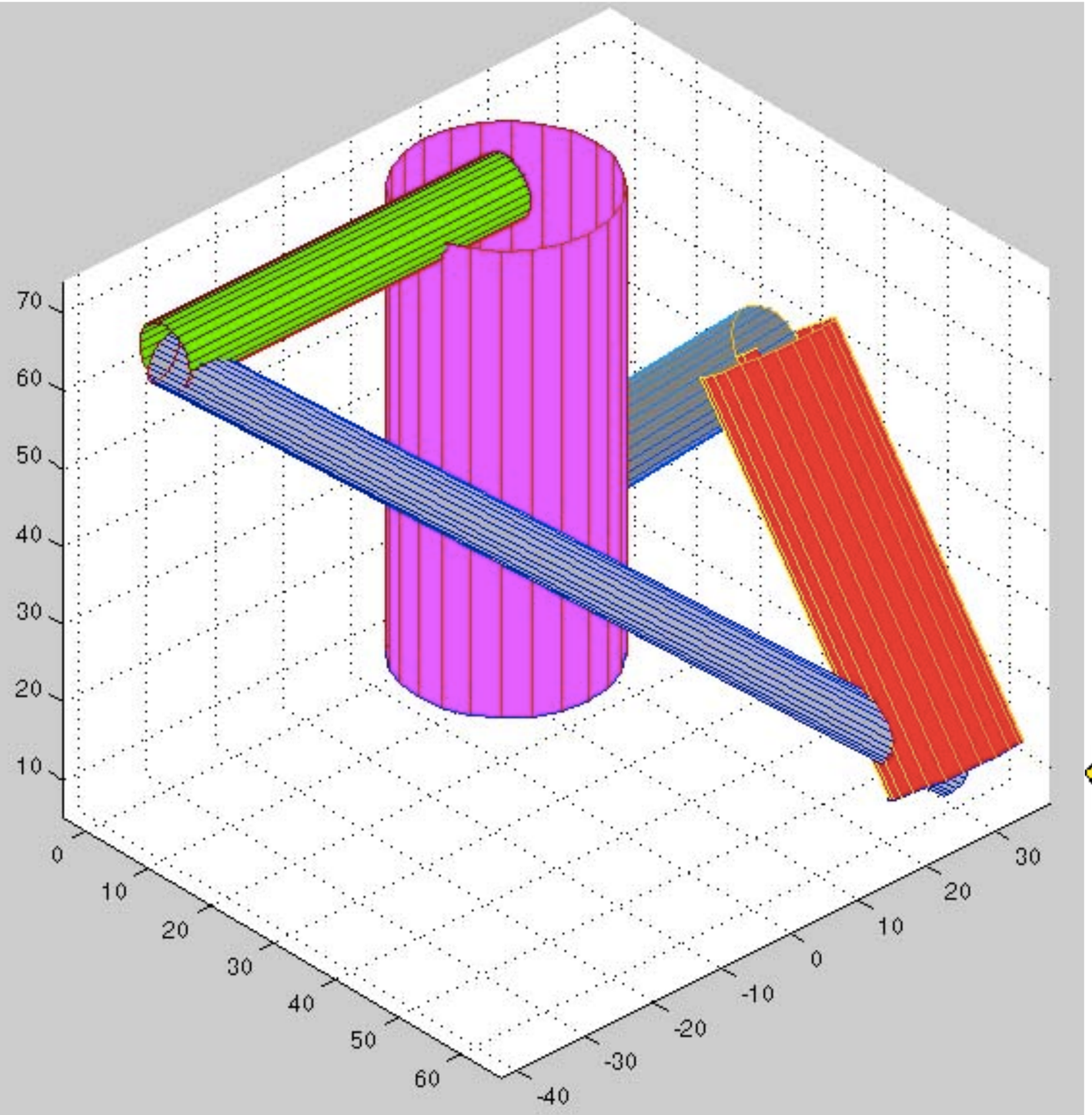
v.

Implicit

Explicit Surfaces

Characteristics:

- *topology (vertices, edges)*
- *polygons*
- *parametric eqs*


70
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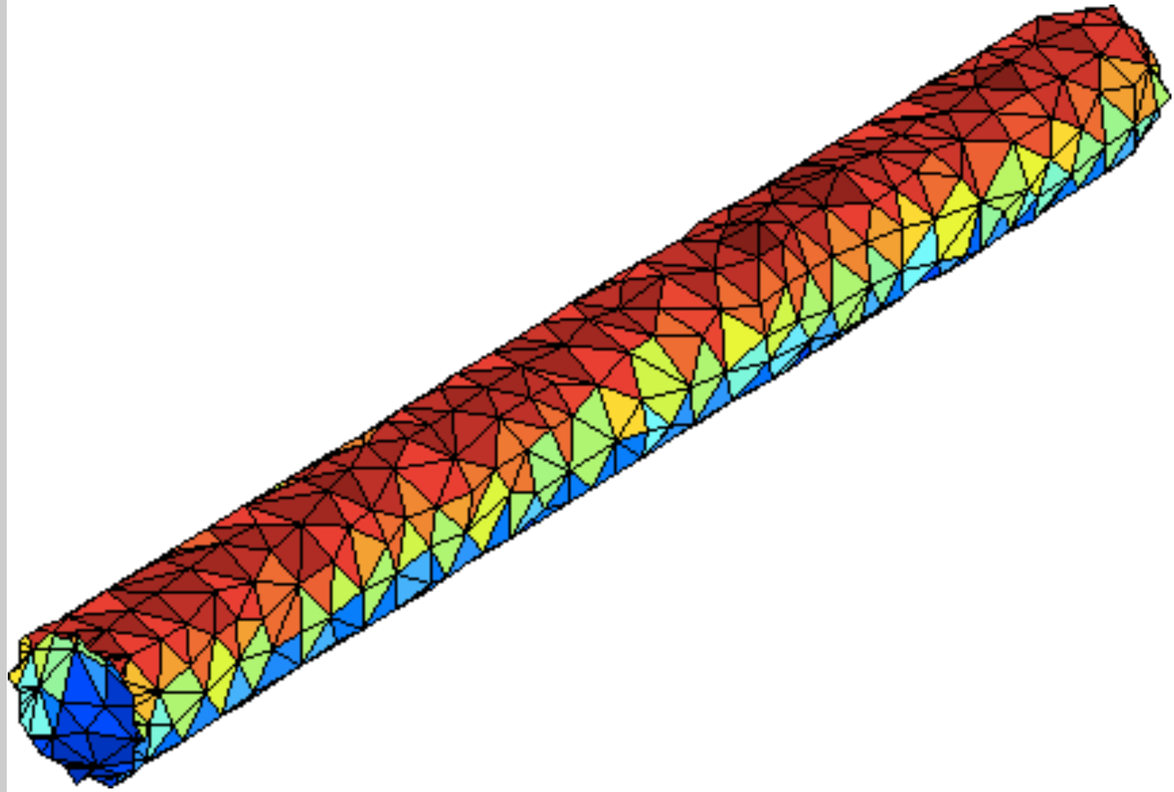


Volume Data

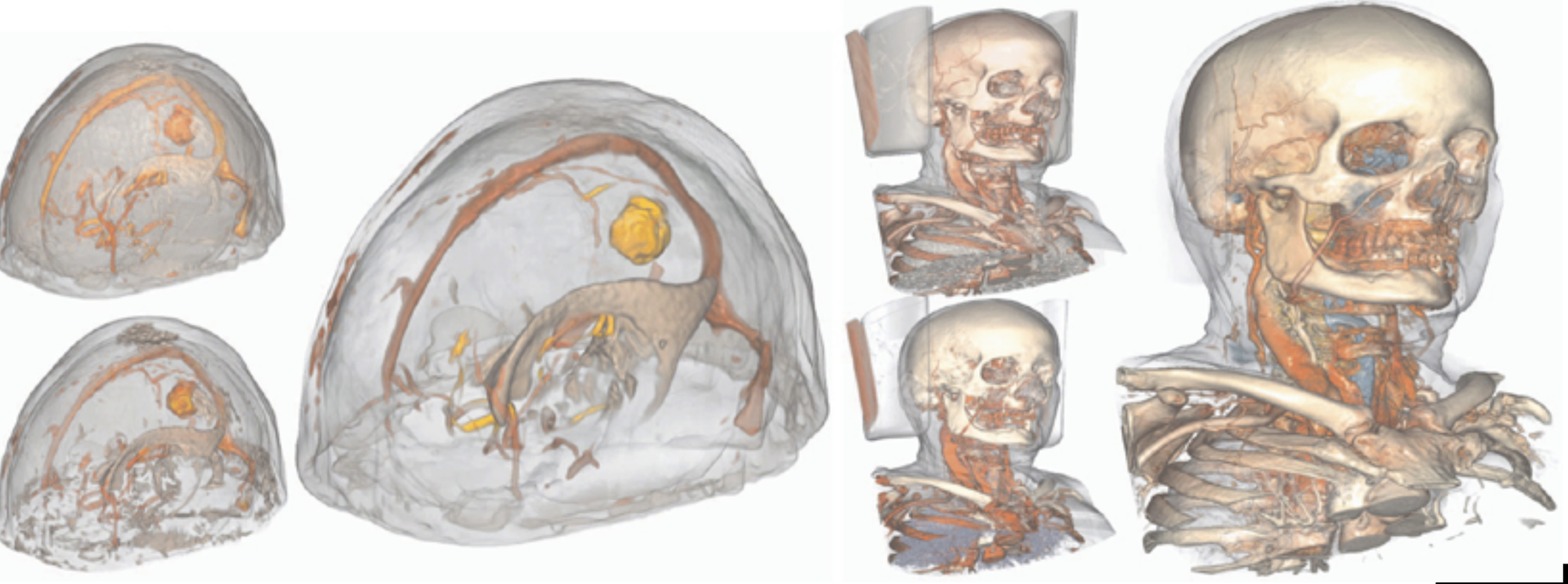
Voxel (3d pixel)

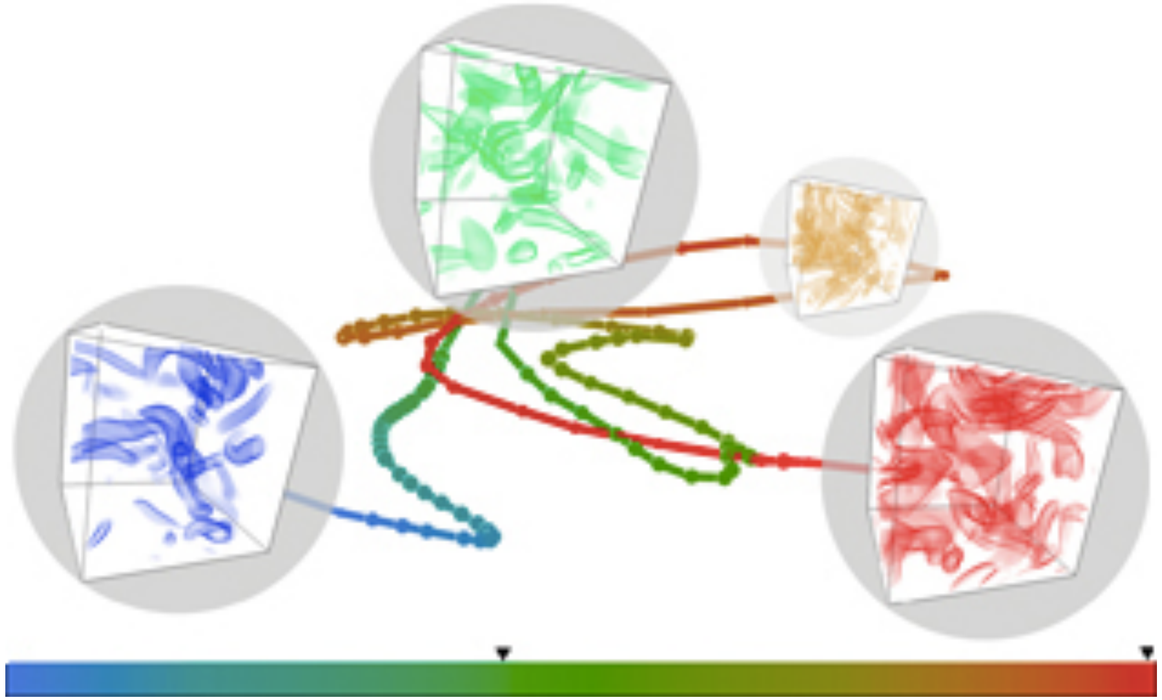
Sources:

- *sensors*
- *interpolation*
- *simulation*

Techniques:

- *Slicing*
- *Isosurface*
- *Direct rendering*





Concept: re-sampling

Slicing

Orthogonal

or

Arbitrary?

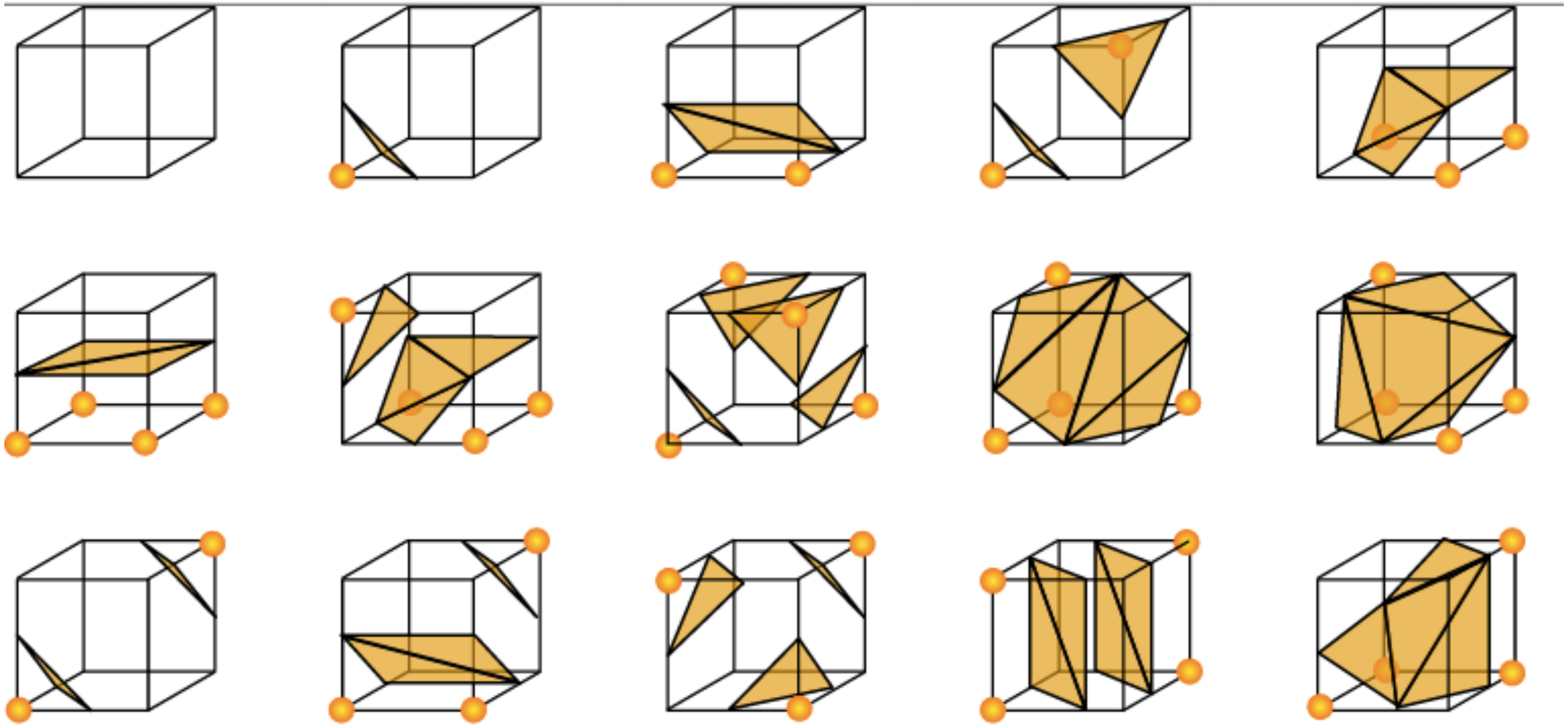
Variations:

- *non-planar*
- *multiple*

  (to remove data)

Isosurfaces

Marching Cubes



Direct Volume Rendering

Idea: make views without surfaces

Voxels -> Viewing coordinates

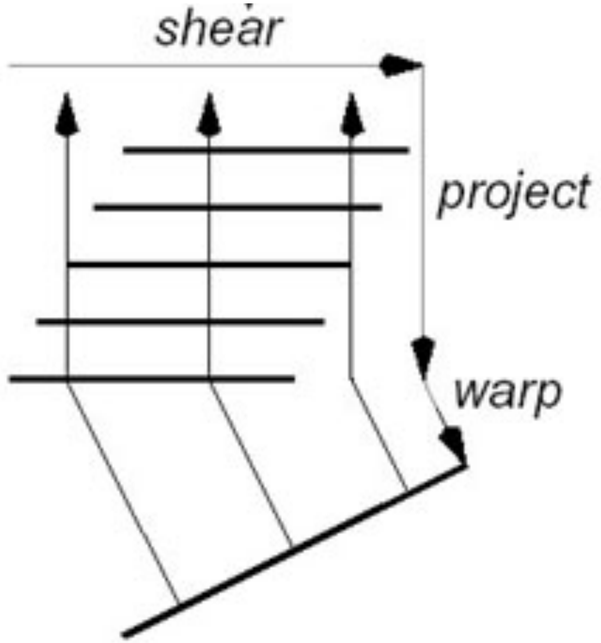
Two approaches:

forward mapping

inverse mapping

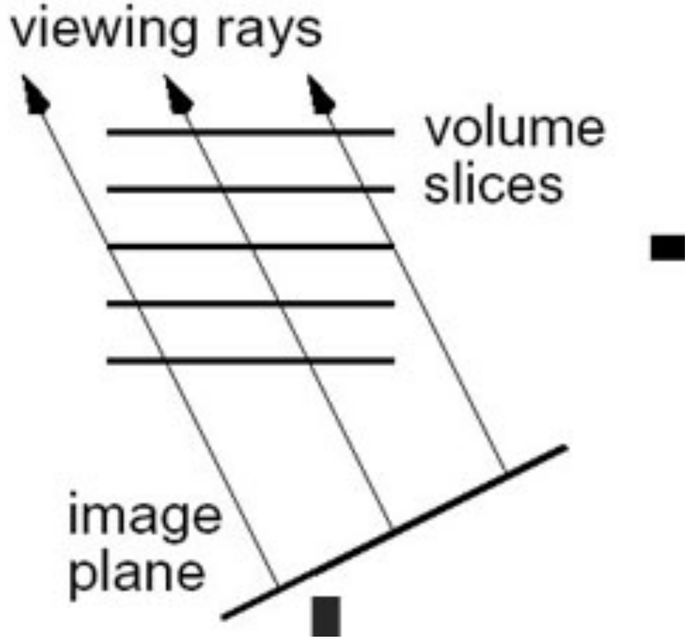
Forward:

- *voxel -> projection plane -> pixel*



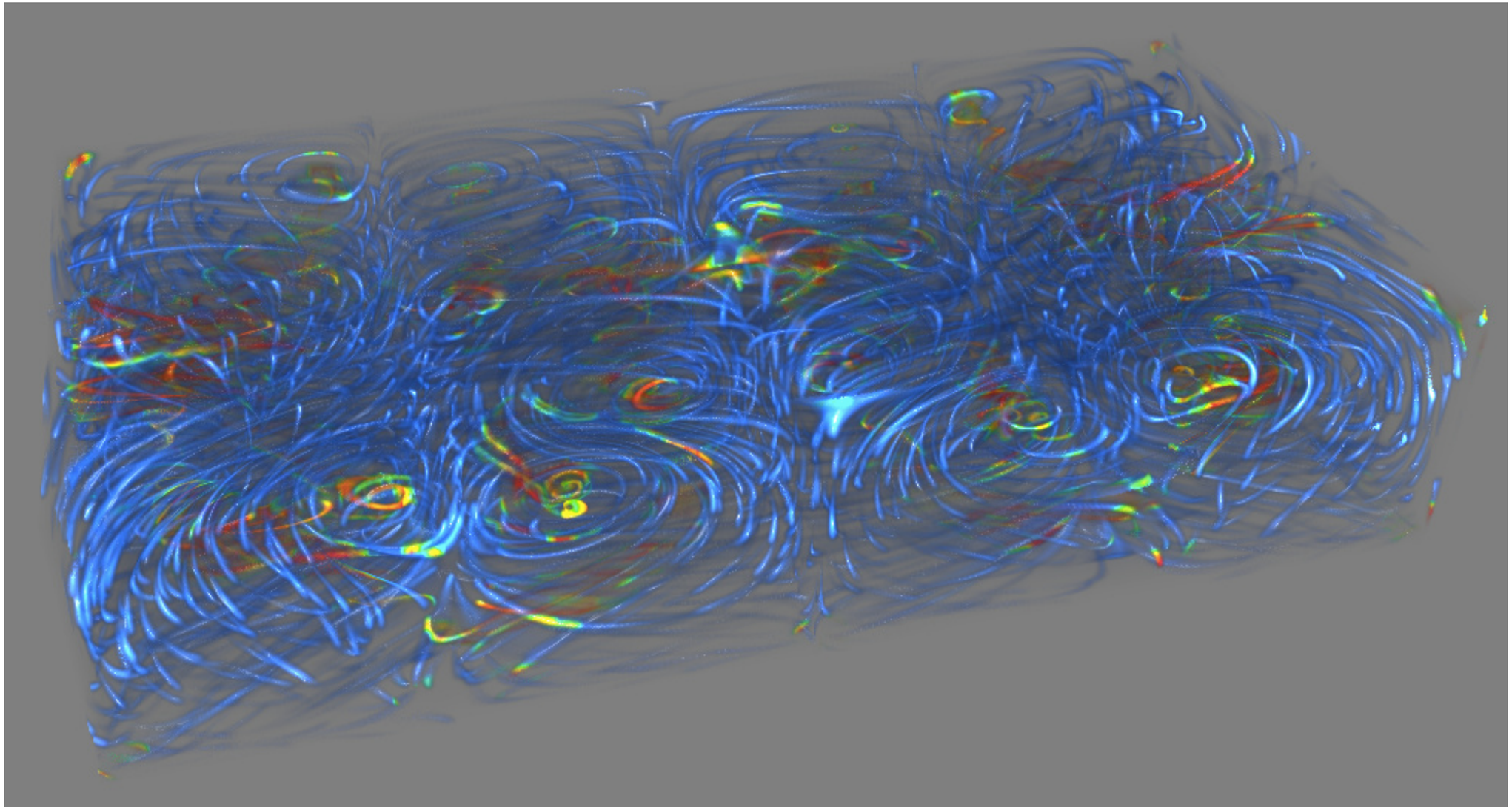
Inverse:

- *pixel ->*
  ray ->
  voxels
  (sampling)

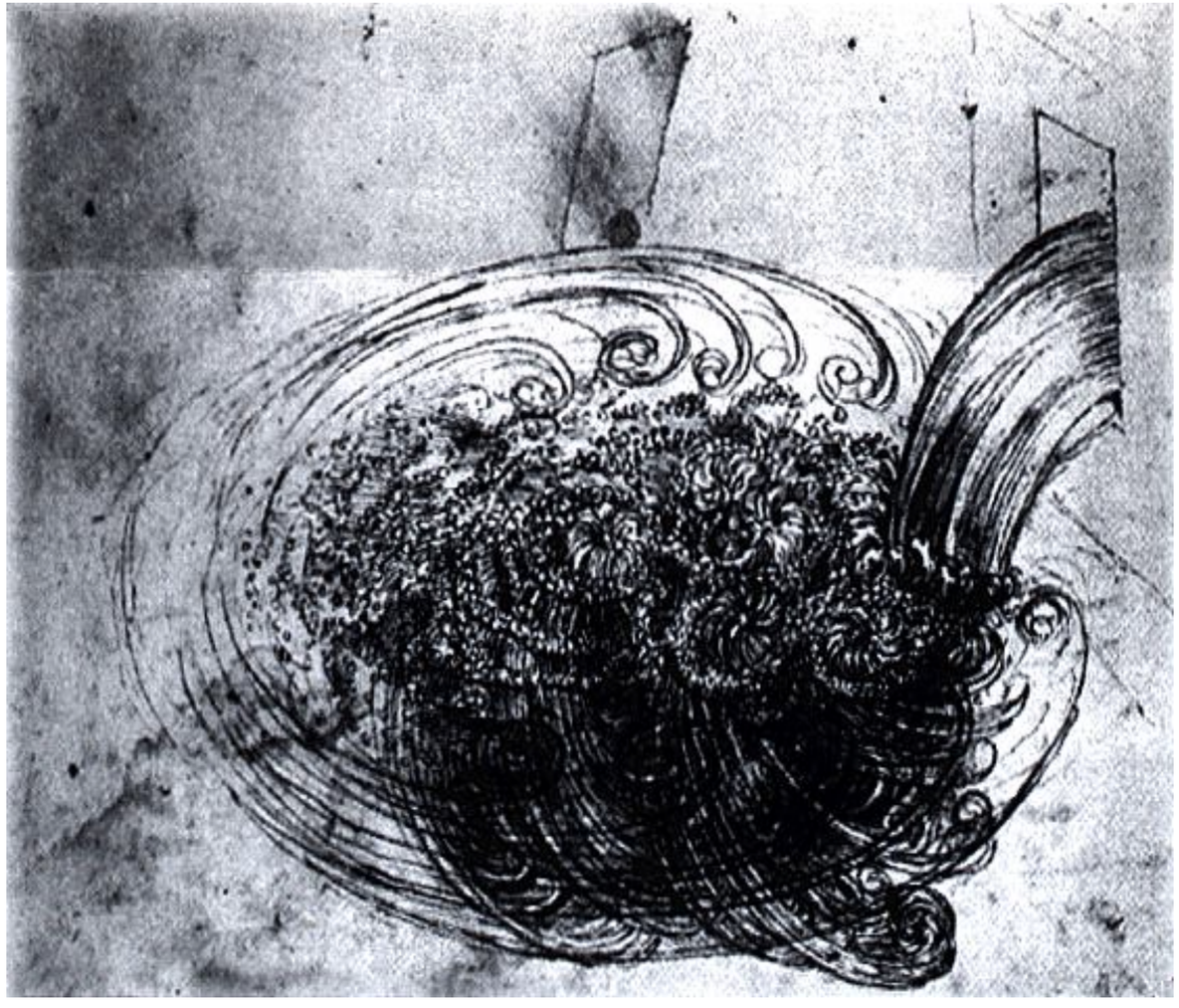


Dynamic Data

“Flow” vis



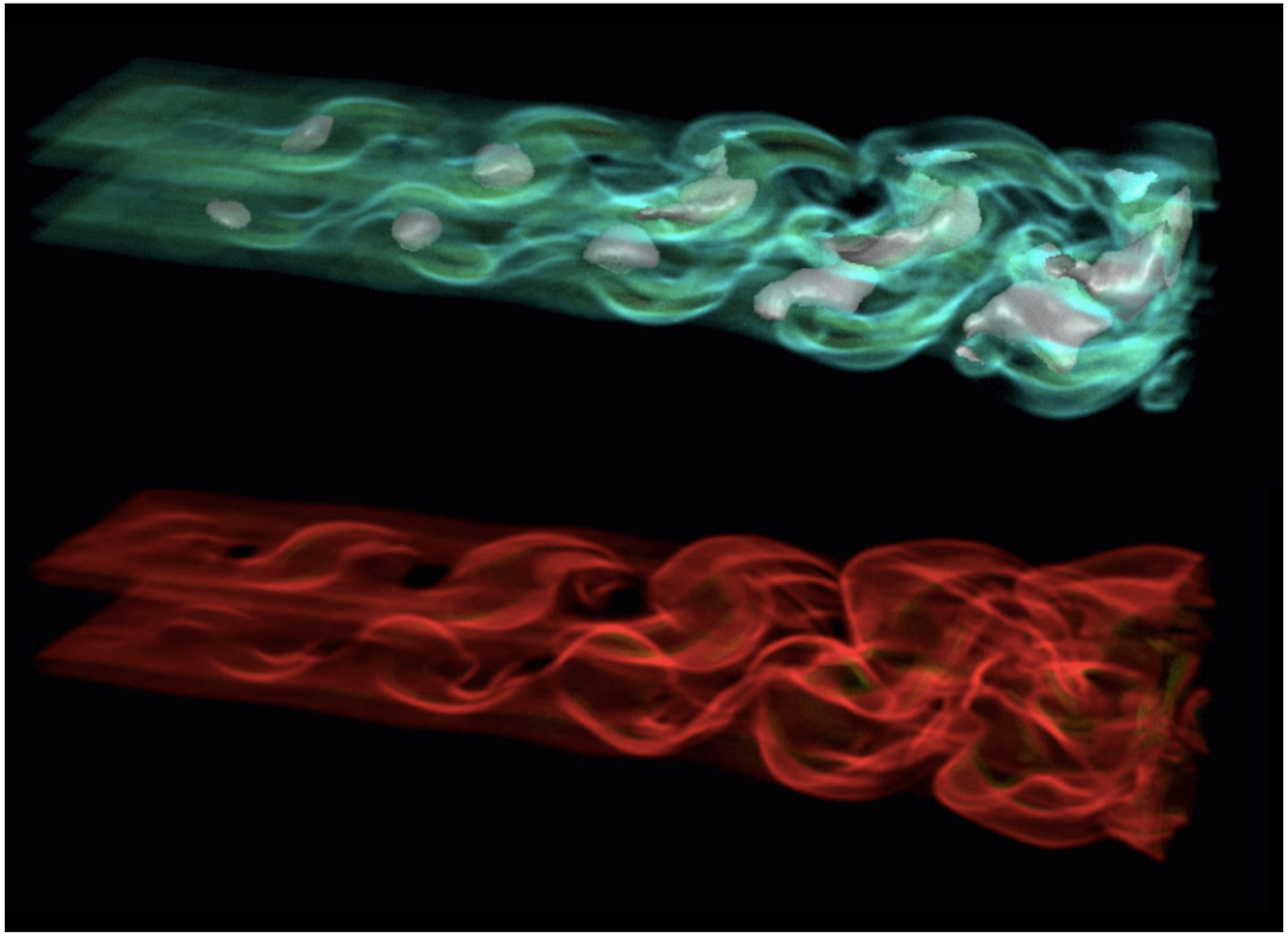
Leonardo da Vinci



Structure: 2d or 3d grid of velocity vectors

Common goals: analyze saddle points, turbulence, vortices

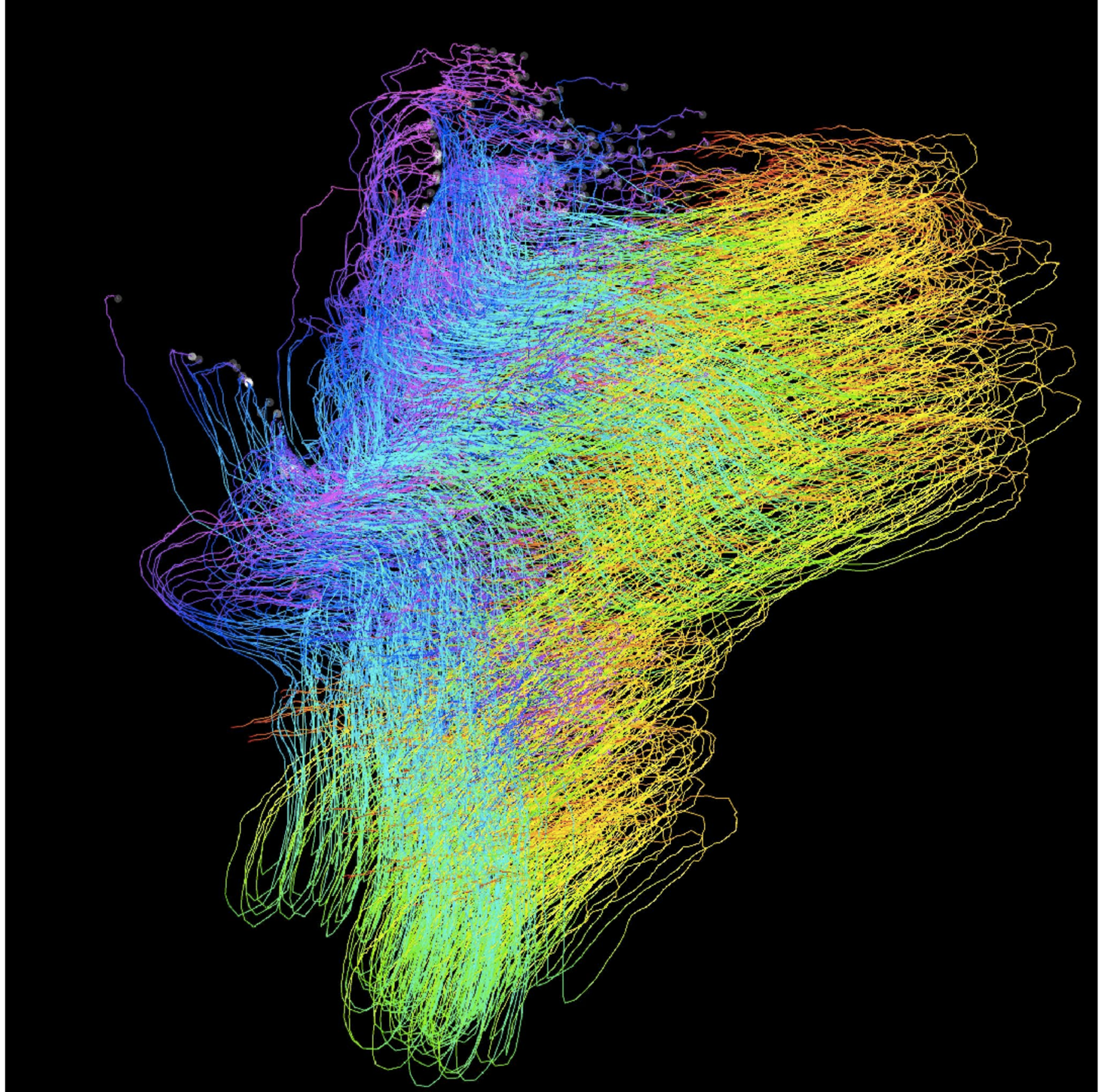
3d + time



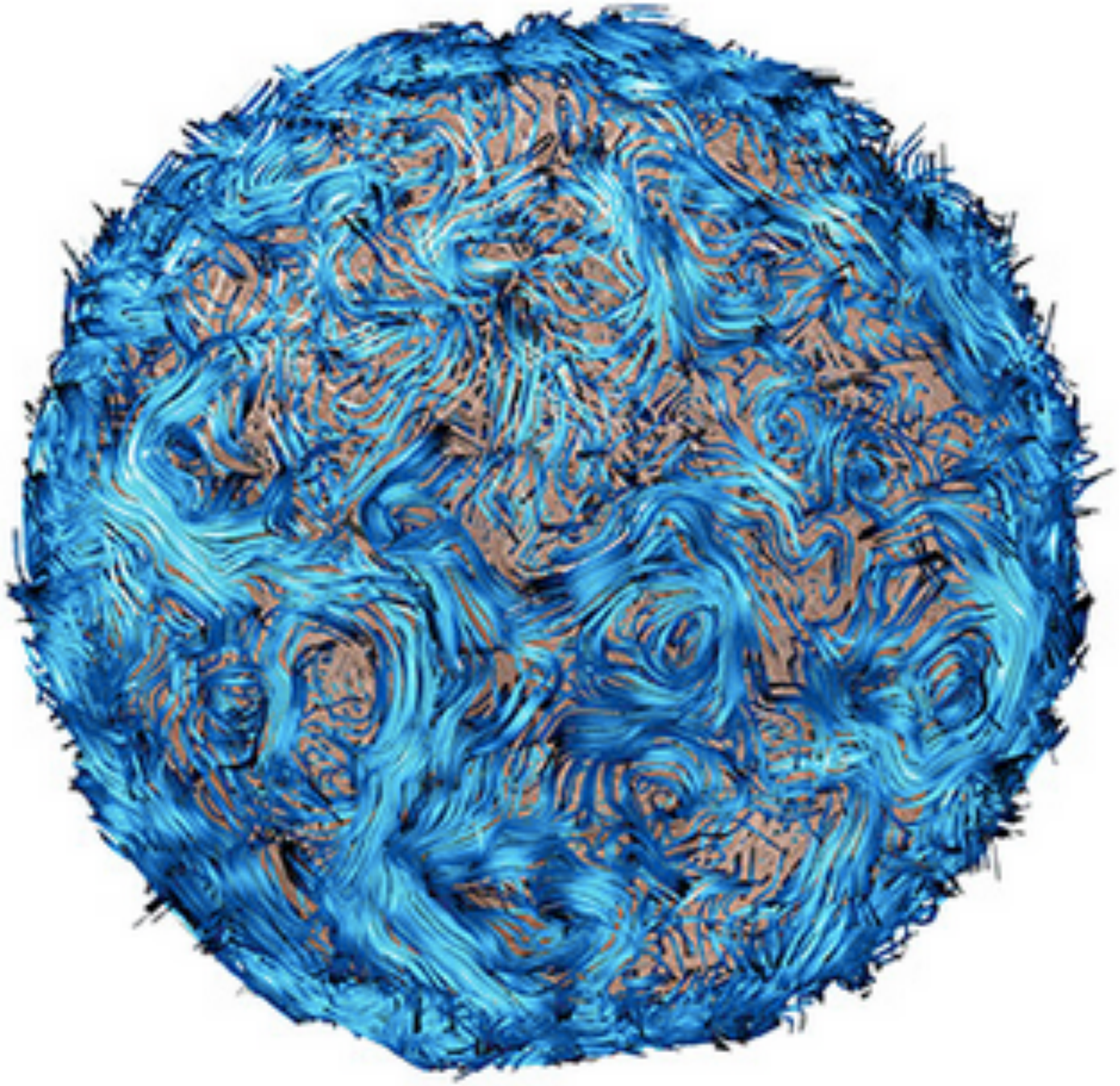
Lines:

path-, streak-, stream-, time-

Pathline



Streamline

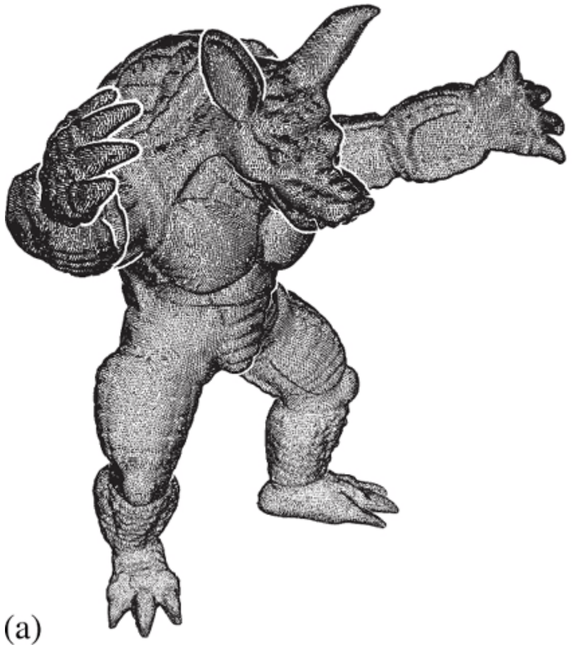


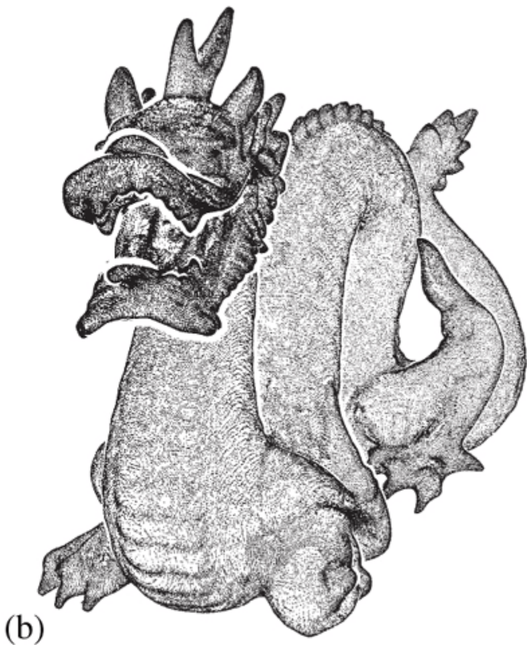
Illustrative rendering

dti tracts

time-varying

better than real?





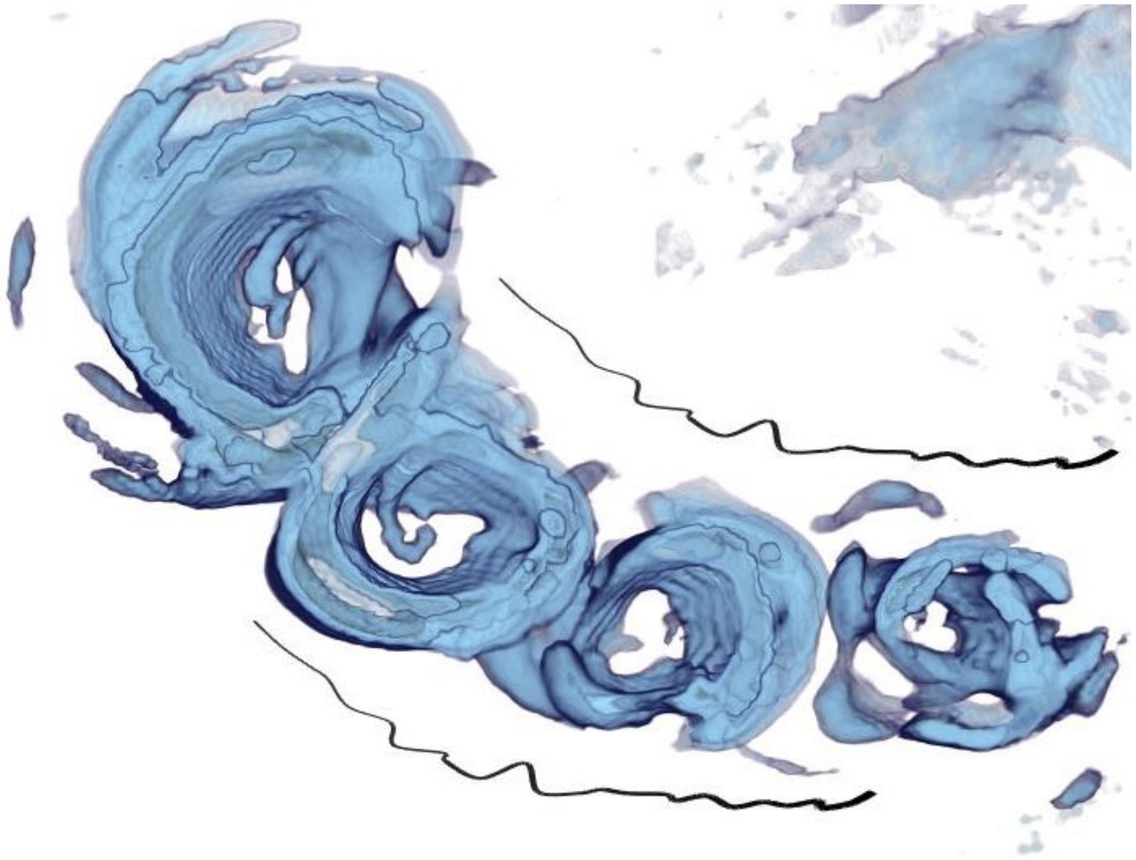


illustration-inspired