Illustrative Visualization for Rapid Interpretation in Geosciences
The essence of scientific illustrations

Data
- Raw data
- Visual overload

Illustration
- Abstracted
- Shows essential aspects
Techniques in geoscientific illustrations

- Textures on planar surfaces to emphasize layers and faults
  - Textures bent along layers
  - Discontinuities over faults

- Opaque cubes with textured surfaces for 3D context
  - Axis-aligned cut outs
  - Extruding features

More about geological textures

• To ease communication, geologists and geoillustrators use a standardized texture language for representing rock types.

• Textures have advantages in that they can give an integrated visualization of layers and faults.

• The layer type and its orientation is communicated locally at any point on the texture as opposed to when using labelling.

• Visualizations are easier to digest.
US standard geological textures

620 Clay or clay shale

627 Limestone

634 Cherty and sandy crossbedded clastic limestone
Illustrative rendering of uninterpreted data
Seismic data

-derived attributes
-well logs

Data
Chaos
Dip
Reflection intensity
Frequency
Automatic interpretation

- Horizon finding
- Parameterization
Well logs

- Textures are extrapolated along horizons by using a parameterization.
Results – use case developed with StatoilHydro
Illustrative rendering of uninterpreted data

- Tight interpretation-illustration loop speeds up interpretation
- Work faster by studying combinations of attributes instead of one at the time
- Communicate easier by sharing expressive images instead of mental images
- A good way to handle seismic data with its chaotic nature
- Textures give an integrated visualization of layers, faults and attributes
- Images are aesthetic regardless of zoom factor
Illustrative rendering of *interpreted* data
Illustrative rendering of faults, layers and cut outs

- Horizon and fault surfaces define a parameterization volume
- Parameterization volume describes texture flow and layer segmentation
- By moving a roaming box into the dataset a cutout is created
3D features

- Volume rendering in cut outs
  - Targeted in selected layers or regions of interest

- Smooth blending in 3D
  - From interpreted to uninterpreted data for verification
Illustrative rendering of *interpreted* data

Advantages of geology illustrations

- all big oil companies have illustrators, this can cut time and cost
- for use in reports and government drilling applications
Comparison

- Insight
- Reservoirs
- Interpreting: Bottom-up approach
- Data: Color coding
- Horizons
- Faults
- Illustrating: Top-down approach
- Textures/icons
- Abstractions

Diagram showing geological layers and reservoirs with water-saturated permeable reservoir rock, oil, and gas.
2D vs 3D texturing

2D textures

- Recognizability after final projection to 2D screenspace
- Spatial coherency
- Frame-to-frame coherency when moving cut-plane
- True 3D that works with transparency

3D textures

- Underdetermined dimensional extrapolation

Dense

Sparse

2D texture on 2D proxy

3D texture on 3D proxy
From 2D textures to 3D textures
Deformed 3D sparse textures
THE END