

# Description of master thesis

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## Rapid modeling of geological structures

Geologist often make sketches of geological structures, both in order to communicate ideas amongst themselves, and to other interested people. We propose to develop a computer program to aid in this sketching.

In developing this program, the following techniques will be explored:

- Having an initial empty sandbox from which the structures can be “carved”
- Drawing layers by turning and sketching on the sides of the box
  - Constraints on drawing. No layer-/self-intersection
  - Layers will be interpolated from this
  - Modifying layers by sketching on them and pushing or pulling
- Drawing rivers by sketching on the surface of horizons
  - Will carve out a plausible river following this path
  - Allows adjustments of size and depth
  - Adjusting of sealeves determines deposits
- Drawing ridges and valleys
  - Drawing the path of the new feature on existing terrain
  - Adjust look of contour along this path
  - Possibly change the height by similar approach as in Teddy
- Picking layers with mouse pointer
  - Further editing of layer is then possible

- Changing color
  - Setting transparency
- Expanding sketch with new cubes
  - Drawing layers in the new cube might use the edges of layers in adjacent cube
  - While drawing lines will snap to existing lines
- Representations
  - The terrain features will be modeled and stored by some sort of implicit representation
  - Might be possible to go back and forth in the history of this structure to make changes without losing later work
- Procedural geologic modeling
  - Generate deposits by specifying terrain and sea level and such
  - Changes to the generated structures might change the initial conditions needed to make such an end result
- Visualization options
  - Generating simulations of seismic data

## Illustrations of use case

Here we show a possible sequence of manipulations to quickly create some geological structures in a scene.

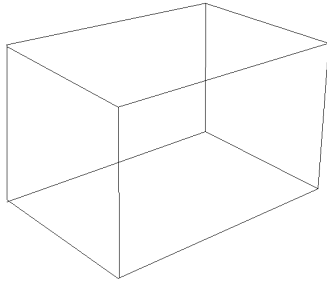


Figure 1: We start with the empty box

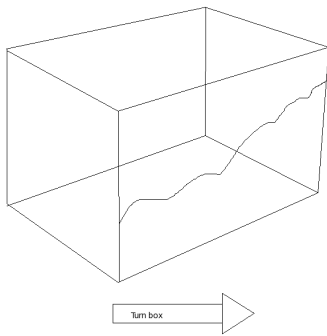


Figure 2: We draw the imagined layer in the box by turning it and drawing on the sides

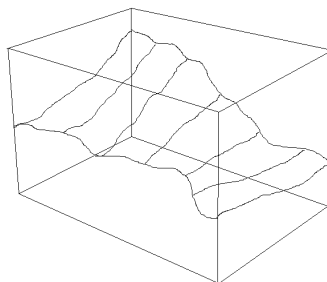


Figure 3: A layer is interpolated from the four sides we draw

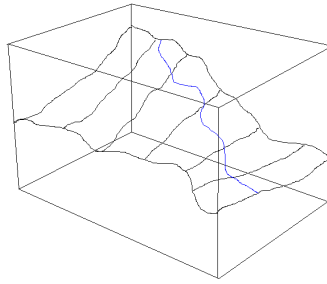


Figure 4: We draw a river path on this layer

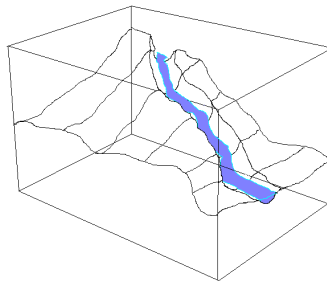


Figure 5: The computer will carve out from this layer as needed to make a river follow this path in a plausible way

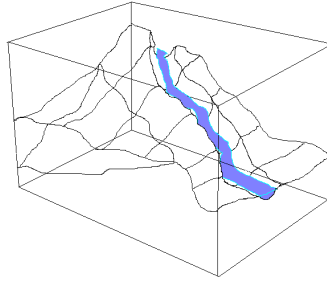


Figure 6: Now we draw a new layer. This can use the previous layer as a drawing surface in stead of only the sides of the box

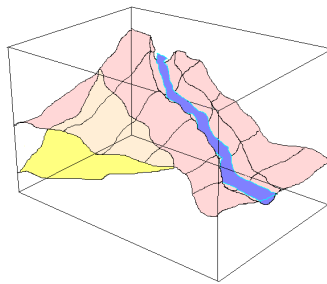


Figure 7: We add some color to the layers. In this figure the layers are partially transparent.

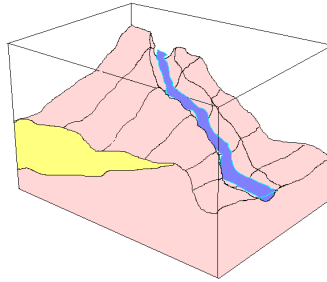


Figure 8: Here we have turned of tranparency and the sides become opaque

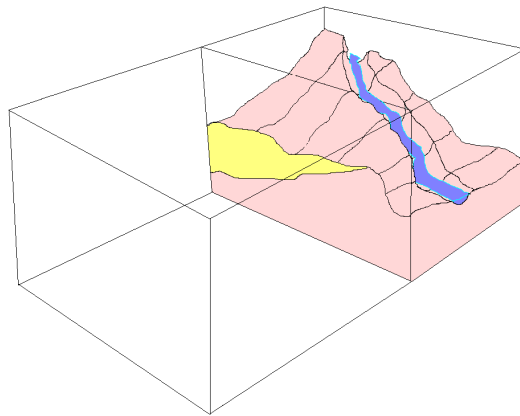


Figure 9: Now we might add a new cube to expand our drawing

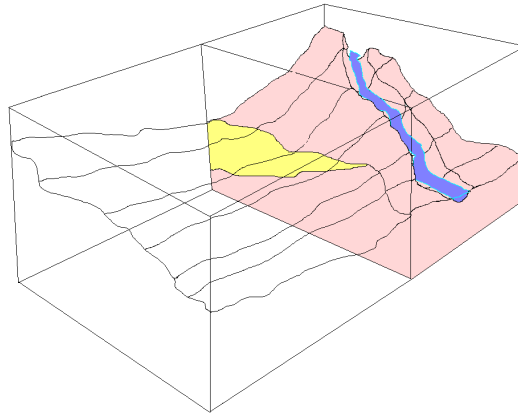


Figure 10: Drawing a new layer. Lines snap towards existing lines in adjacent cube.

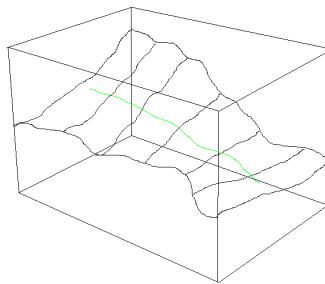


Figure 11: To create a new ridge or valley, start by drawing the ridge or valley path on the existing terrain.

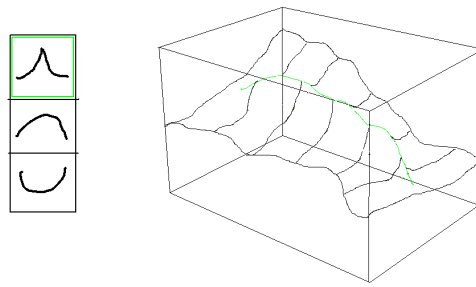


Figure 12: Now chose how the contour will look like and the new feature will be created. It should be possible to create different contours along different positions on the path drawn.



## Reading list

- Sequence stratigraphy-A global theory for local success, Neal
- Interactive thickness visualization of articular cartilage, Mlejnek