


Automating Pen and Ink Landscape Renderings

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NYSGIS State Agency Advisory Group Meeting
Summer 2006



Classic Block Diagrams

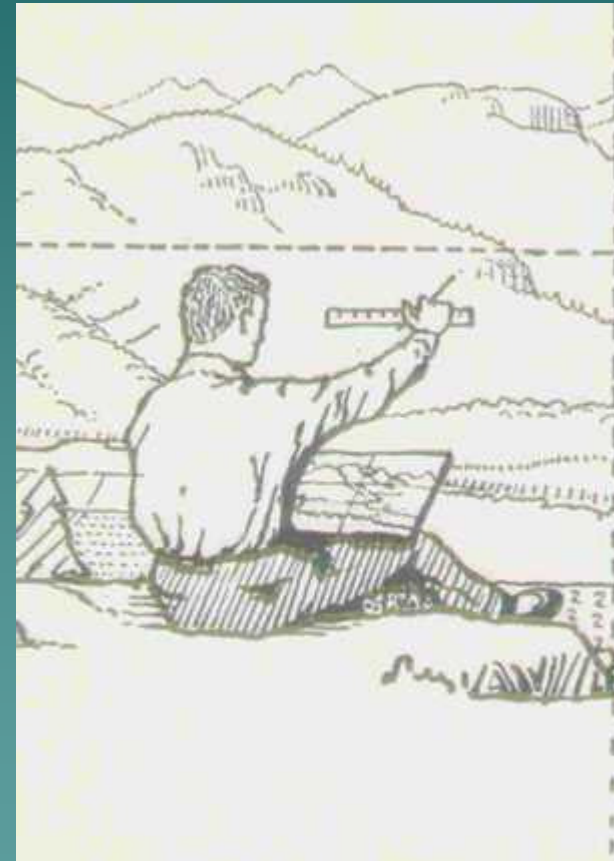
- ◆ Block diagrams represent
 - Landscape views in perspective
 - Underlying bedrock geology
- ◆ They employ
 - Large scale views
 - Pen and ink renderings

Armin Lobeck

- ◆ Lobeck wrote a wonderful book on block diagrams and other perspective landscape illustrations
 - Lobeck, A.K (1958) “*Block diagrams and other graphic methods used in geology and geography.*” Emerson-Trussell Book Co., Amherst, MA.
- ◆ It contains drawing instructions and many examples


Purpose of My Project

- ◆ Automate pen & ink rendering techniques
- ◆ Generate views from DEMs using expert systems approach
- ◆ Several interesting problems arise...



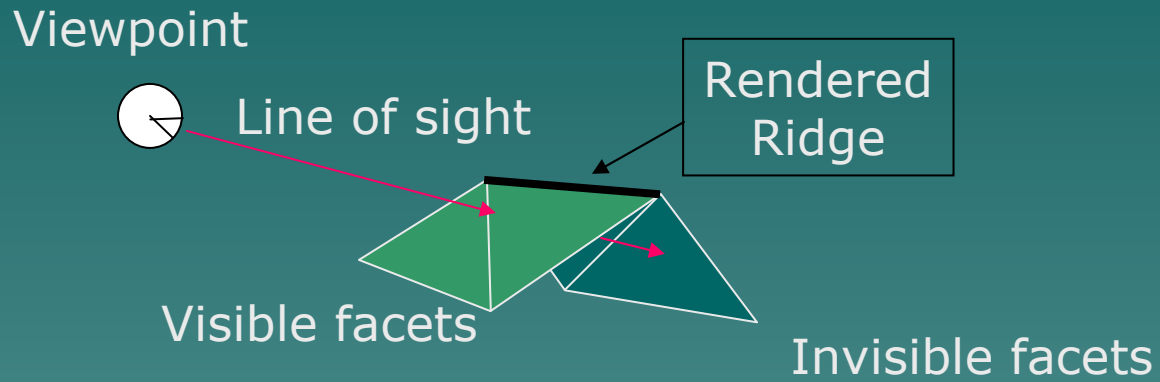
Easy Problems to Solve

◆ Geometry

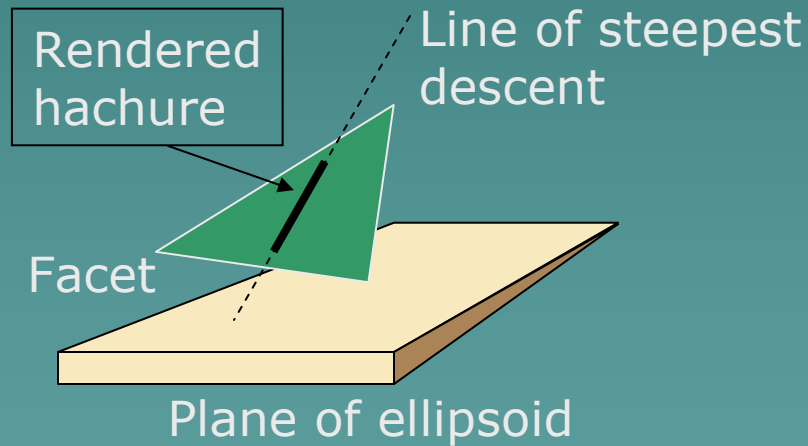
- Using Direct3D, render surface using only “ridge lines” and hachures
 - Hachures are implemented as the line of steepest descent through a triangular surface facet
 - Ridges are implemented as boundary lines between visible and invisible facets relative to the viewpoint
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Rendered Lines

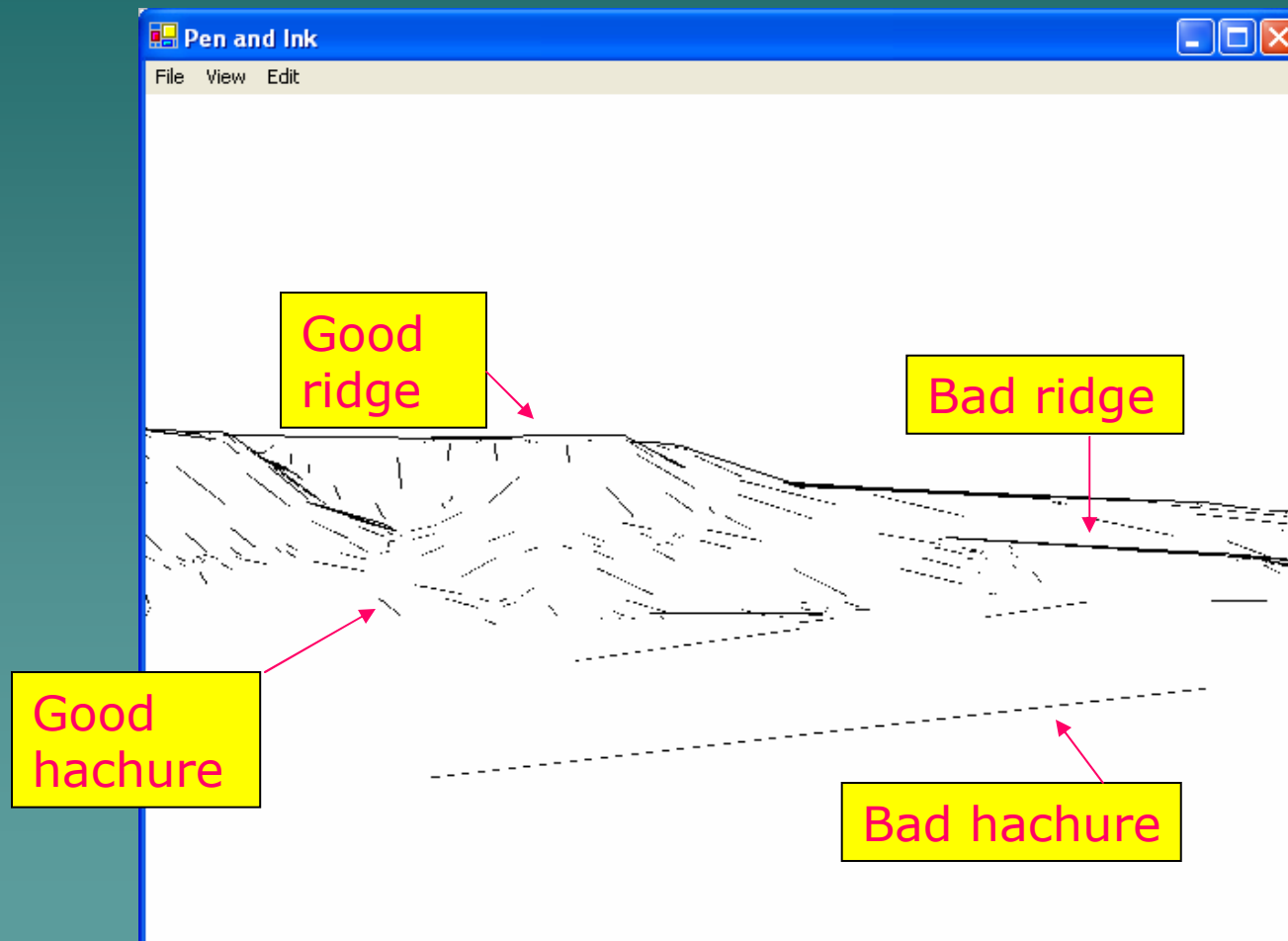
Ridge



Hachure



Easy Problems Solved! But...



How Do You Eliminate Crud?

- ◆ Controlling hachure and ridge density automatically
 - A generalization problem
 - At a given rendered thickness, hachures should never touch one another
 - Both ridges and hachures should not be drawn for purely geometric reasons
 - Must define significance for both types of renderings

Defining Significance

◆ Slope criteria

- Only show a ridge line if the angle of the intersecting facets is greater than a minimum value
- Only draw a hachure if its plane exceeds a minimum slope and is beyond a minimum distance from the VP

Other Significance Criteria

- ◆ Only show a ridge line if it coincides with a hydrological ridge
 - A drainage basin boundary
 - Might be too restrictive
 - ◆ Escarpments are not necessarily drainage basin boundaries
- ◆ Detect 2D line proximity after rendering
 - Create buffers around hachures, check for intersection, delete lowest slope

Significance Criteria (cont.)

- ◆ Adaptive surface resampling
 - The input DEM is a TIN with variable resampling with distance from the VP
 - Resampling is currently performed from a densely sampled DEM in a separate program
 - Could perform resampling on the fly in this program

Lots of Things To Do

- ◆ But that's the fun part!
- ◆ Questions?