Interactive 3D Landscape Editor Using 2.x-Dimensional Fractals And HeightMaps
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Overview

• Computer Application
• Generates 3d Landscapes based on 2d sketches drawn in Adobe Photoshop or Microsoft Paint
• Improves realism of landscape by smoothing terrain or adding small hills; uses modified version of Fractal Algorithm
• User-friendly
• Non-technical users
• Simple and quick creation of landscapes (on the order of minutes)
• Relies on new DirectX 10 technology
Practical Applications

• Virtual Reality
  – Lighting and depth add to sense of immersion
  – Texture blending, vertex manipulation runs faster on DirectX 10; thus, faster real-time generation

• Game Design & Planning
  – Quickly design basic layout of terrain
  – Gives 3d modelers simple visualization

• Geographic Simulations
  – Illustrate geographic transformations to audiences
  – Navigate through the scene to view from any angle

• Other Software That Imports Grayscale HeightMaps
Simple Creations (2d)

- Transform this...
Simple Creations (3d)

• ...into this
I Wonder...

• “How do you do that?”
First...

• Create a basic 2d sketch of desired landscape
  – White = higher elevation
  – Black = lower elevation

• Use any paint program: eg, Adobe Photoshop

• Save it anywhere on the hard drive
Import

- Open the 3d Landscape Editor and choose “Import” to open the 2d Sketch you created
- Remember:
  - White Pixels = higher elevation
  - Black Pixels = lower elevation
Toolbar

- **User Customization**
  - **Noise**: level to improve realism
  - **Add Noise**: update the landscape using the specified Noise value
  - **Gamma**: adjust the appearance mountains
  - **Grass/Dirt/Water**: dynamically adjust the altitude at which each of these terrains appear (% based)
  - **Refactor**: update and view your changes to Gamma/Grass/Dirt/Water
  - **Import/Export**: load/save 2d sketches
  - **New Fractal**: generates an entirely new, random realistic landscape
Noise Example

- **Noise**: improve realism of the User’s original sketch using our modified version of Fractal Algorithm

Original Imported Sketch (Blocky, Unrealistic)  
Added Realistic Fractal Noise (Natural, Smoothed, Hilly)
Next...

- **Export**: Save the improved terrain back to file to view again later. Or perform further sketching in paint program.
Technical Details

• **DirectX 10 Technology**
  – **Pixel Shader**: dynamic, seamless blending between textures
    • Improves Landscape Realism
    • Computed in real-time
    • No need for pre-blended textures
    • Saves hard drive space

  – **Geometry Shader**: eliminate repetitive vertices
    • Reduces size of terrain meshes by a factor of 4!!!
    • Decreases system/video RAM usage
    • Increases computation speed/efficiency and lowers system requirements
    • Allows capability for much larger real-time generated terrain meshes
**Modified Diamond-Square Fractal Algorithm**

- **Fractal Algorithm**: A specialized algorithm by which irregular geometric surfaces are produced. No classical geometric equation can reproduce these results.

- **Diamond-Square**: A recursive fractal algorithm, that when applied to 3d meshes, produces entirely new, natural-looking landscapes.

- **Modified D.S.**:
  - An iterative counterpart to the DS algorithm, which improves computational efficiency.
  - By modifying variables as well as the starting point at which we begin the algorithm, we add realism while maintaining *template* of the User’s original sketch.
Final Results
Final Results
Final Results

Lakaemper Canyon
Final Results