Perlin Noise, Procedural Generation, and Minecraft

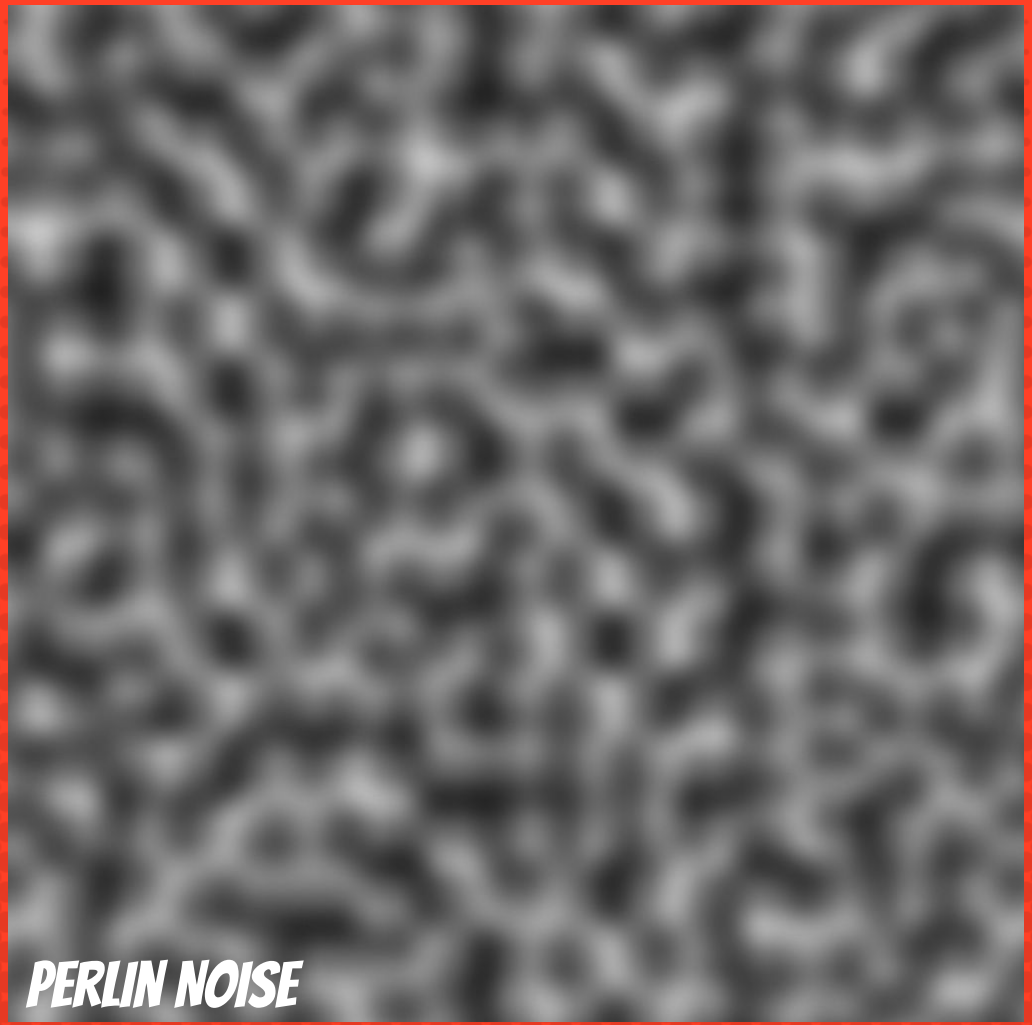
WHAT IS NOISE?

Noise is stochastic, or a...

"RANDOM AND UNSTRUCTURED PATTERN"

PERLIN NOISE

- Perlin Noise was first revealed in 1985 by Ken Perlin in “An Image Synthesizer”
- Improved upon in 2002 with “Improving Noise”, where fade function and use of Unit Cube for gradient vectors
- Often used in procedural content generation (Minecraft)



PERLIN NOISE

PERLIN VASE

WHAT'S PROCEDURAL GENERATION?

Procedural generation is the **"PROGRAMMATIC CREATION OF CONTENT"**

PROCEDURAL GENERATION

Procedural generation is tied to the experience and design of a certain work.

How it works:

Content is created based on random generated values. In this project blocks are textured using procedurally generated numbers which correspond to different materials.

In games:

In games like Minecraft, procedural generation is used to fill the world in which the player interacts, creating a unique experience each time a new world is created. The different biomes in Minecraft are created using procedural generation.


*NOT MY PROJECT

THE PROJECT

How can we create a procedurally generated Minecraft scene in Maya that utilizes Perlin Noise?

```
import maya.cmds
import random

from random import shuffle

class Perlin():
    def __init__(self,x,y):

        self.p = [151,160,137,91,90,15,131,13,201,95,96,53,194,233,7,225,140,36,103,30,69,142,8,99,37,240,2
    88,237,149,56,87,174,20,125,136,171,168, 68,175,74,165,71,134,139,48,27,166,
    77,146,158,231,83,111,229,122,60,211,133,230,220,105,92,41,55,46,245,40,244,
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    135,130,116,188,159,86,164,100,109,198,173,186, 3,64,52,217,226,250,124,123,
    5,202,38,147,118,126,255,82,85,212,207,206,59,227,47,16,58,17,182,189,28,42,
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    129,22,39,253, 19,98,108,110,79,113,224,232,178,185, 112,104,218,246,97,228,
    251,34,242,193,238,210,144,12,191,179,162,241, 81,51,145,235,249,14,239,107,
    49,192,214, 31,181,199,106,157,184, 84,204,176,115,121,50,45,127, 4,150,254,
    138,236,205,93,222,114,67,29,24,72,243,141,128,195,78,66,215,61,156,180]

        self.x = x
        self.y = y

        self.xi = self.x & 255
        self.yi = self.y & 255

        self.xf = self.x-self.x
        self.yf = self.y-self.y



    def gradient(self,h,x,y):
        hashedValue = h & 15
        u = x if h < 8 else y

        if(h < 4):
            v = y
        else:
            v = x

        return (u if (h&1) == 0 else (7*u)/8)+(v if (h&2) == 0 else (7*v)/8)


    def fade(self,t):
        return t * t * t * (t * (t * 6 - 15) + 10)
```
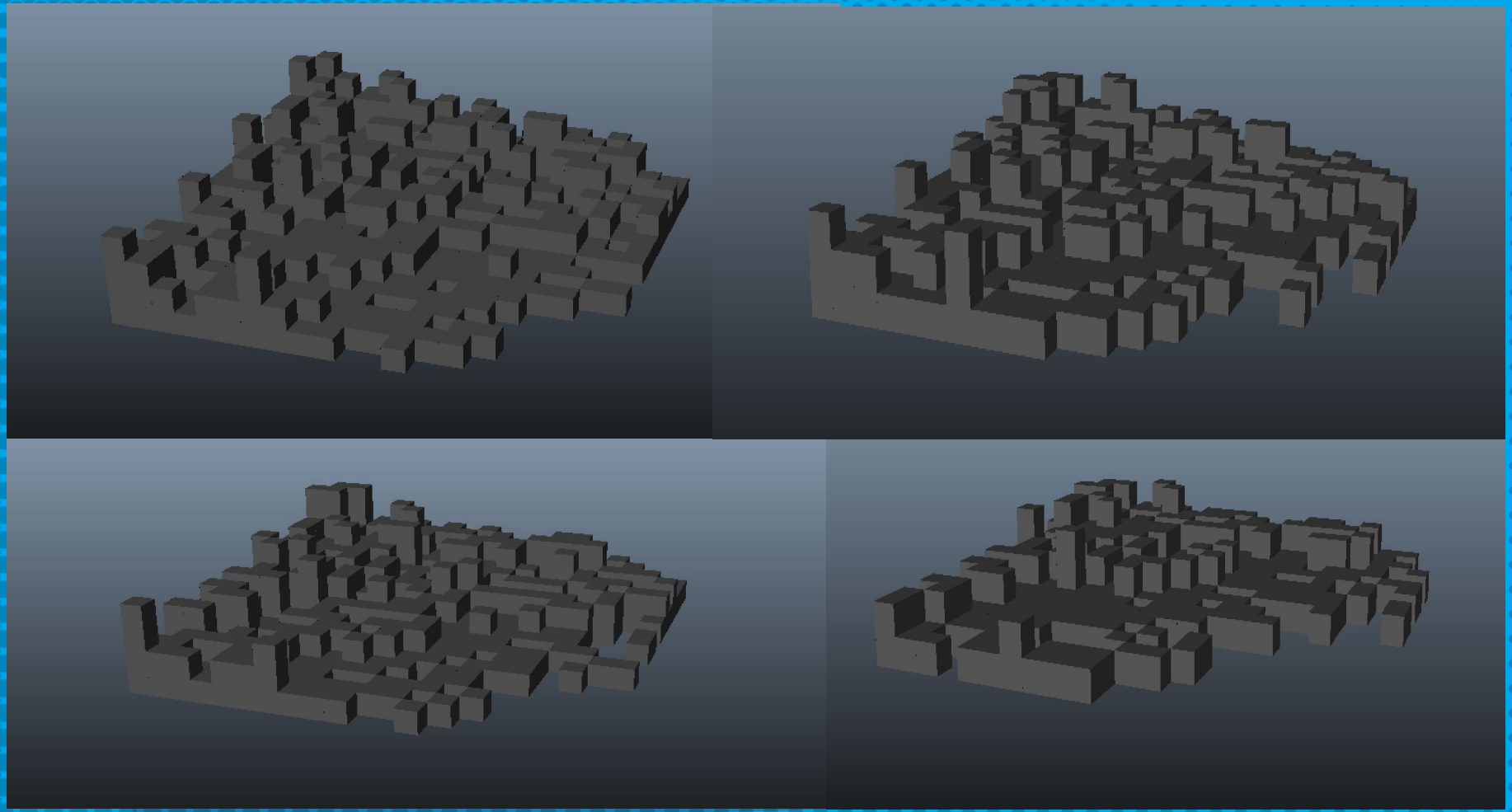
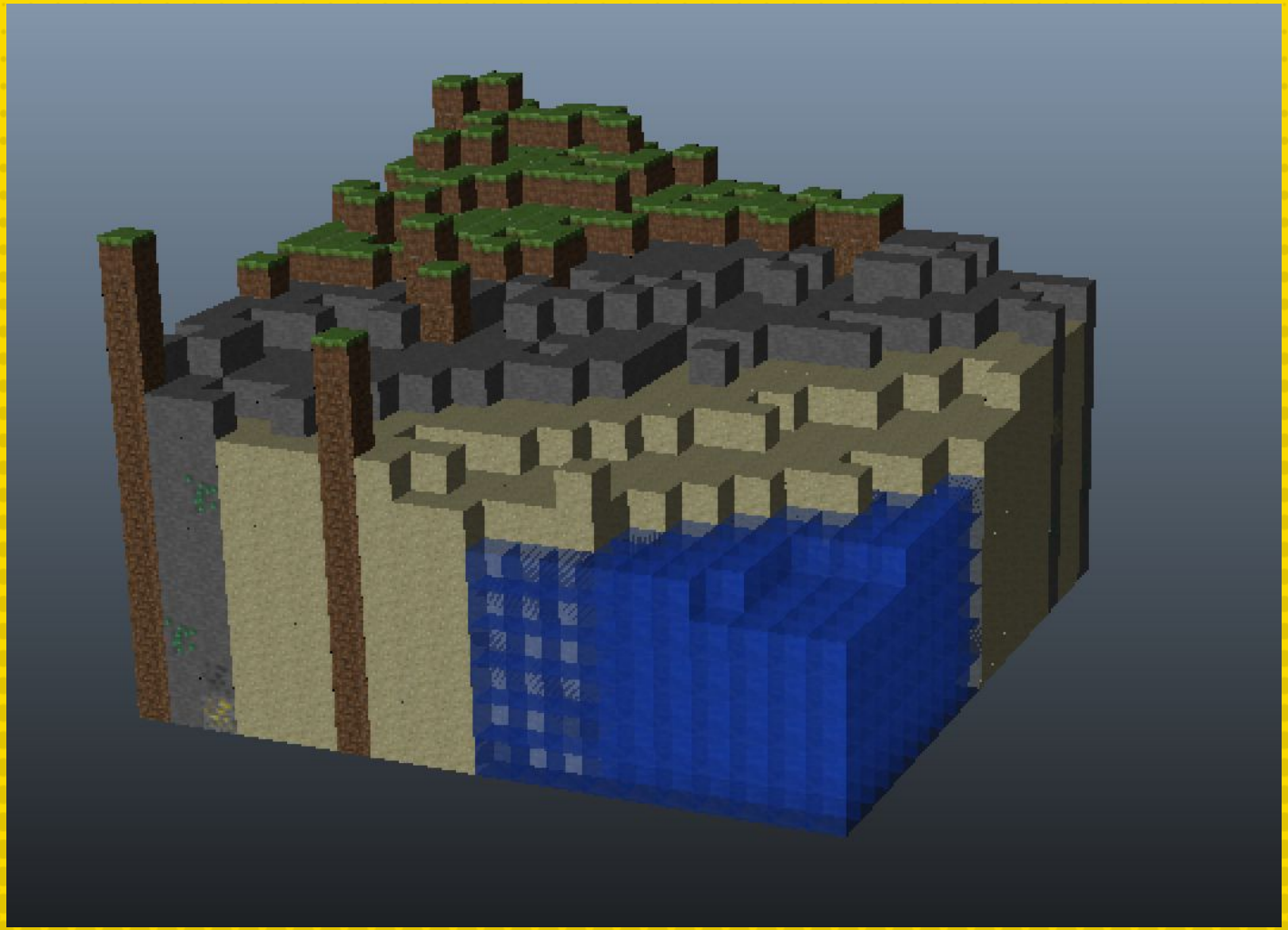
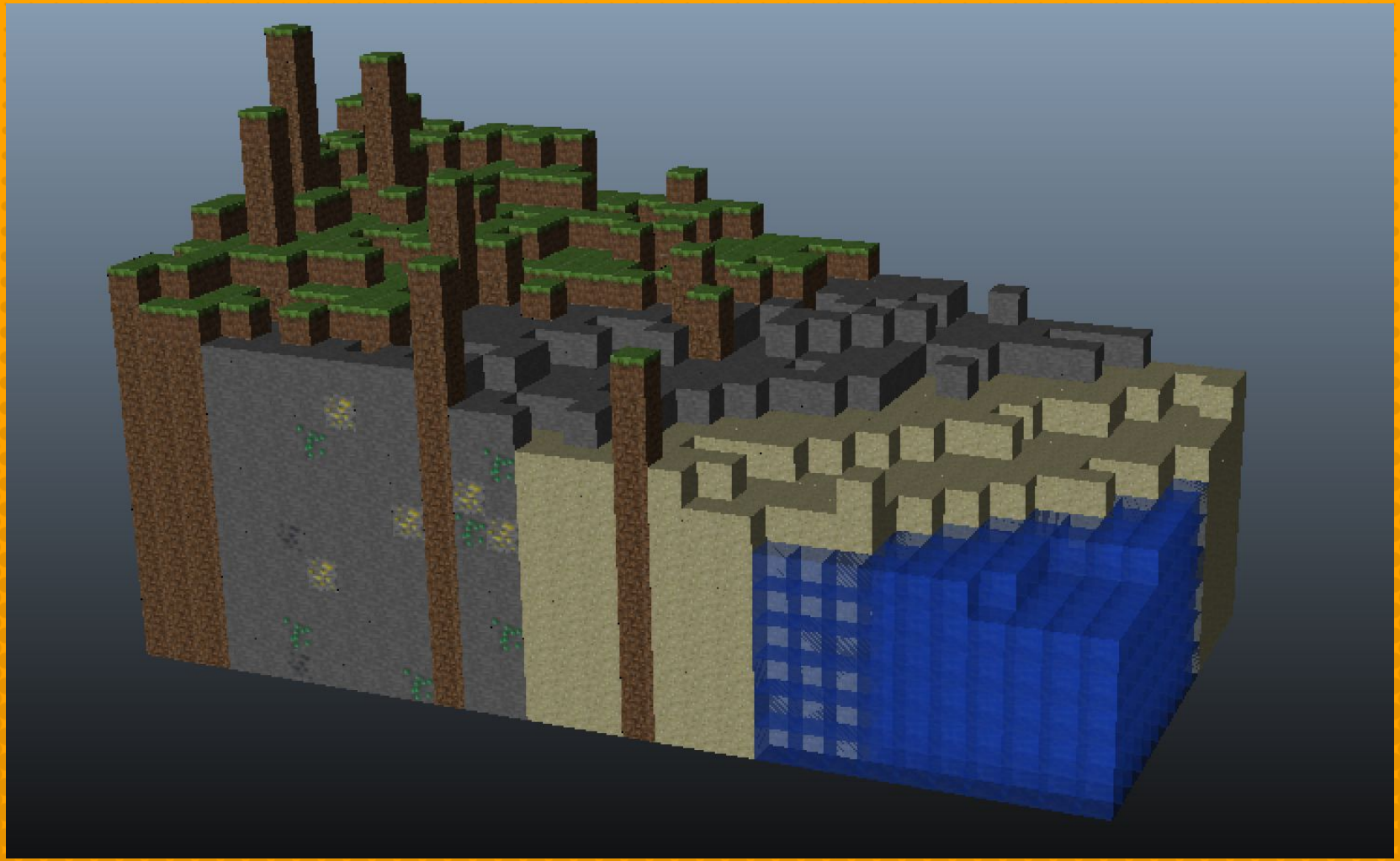
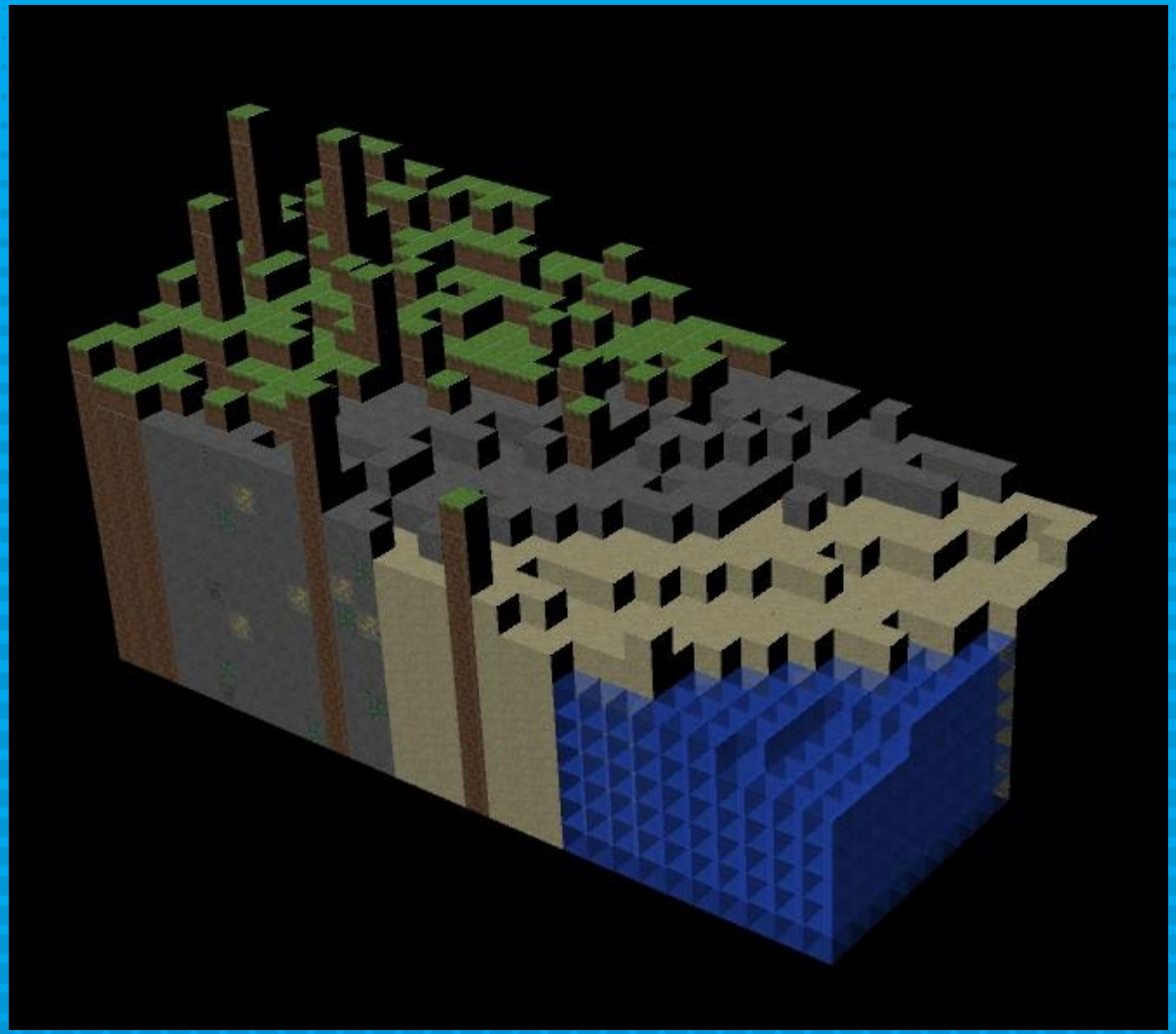

Ln: 1 Col: 0

Perlin Noise topography and procedurally generated textures









SOURCES

Lagae, A., S. Lefebvre, R. Cook, T. Derose, G. Drettakis, D.s. Ebert, J.p. Lewis, K. Perlin, and M. Zwicker. "A Survey of Procedural Noise Functions." *Computer Graphics Forum* 29.8 (2010): 2579-600. *EBSCO Host*. Web. 7 Dec. 2016.

Perlin, Ken. "Improving Noise." *ACM Transactions on Graphics* 21.3 (2002): 1-2. Web. 7 Dec. 2016.

Smith, Gillian M. *Expressive Design Tools: Procedural Content Generation for Game Designers*, University of California, Santa Cruz, Ann Arbor, 2012.http://ezproxy.ithaca.edu:2048/login?url=http://search.proquest.com.ezproxy.ithaca.edu:2048/docview/....

Perlin, Ken. "An Image Synthesizer." ACM SIGGRAPH Computer Graphics 19.3 (1985): 287-96. Print.