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# Using Hexels for 3D Terrain Generation

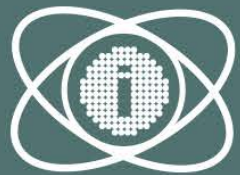
Tabby Rose  
Creative Director, Axon Interactive

GDC

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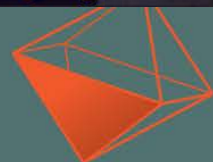
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Tabby Rose  
@tabbyrose



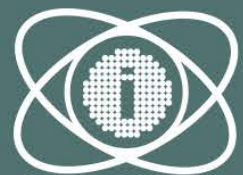
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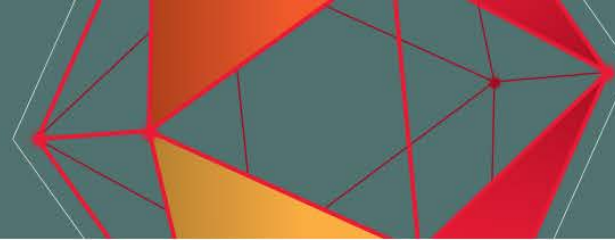


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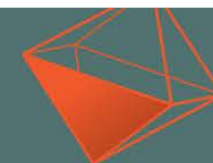


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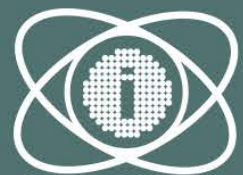
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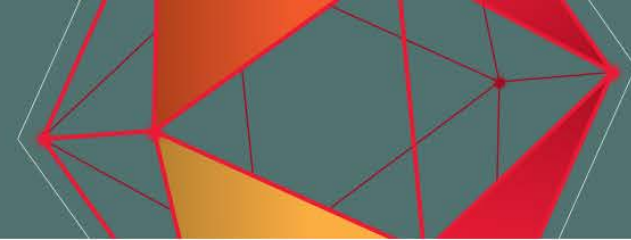


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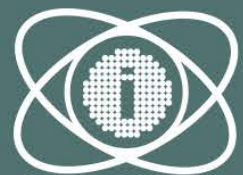
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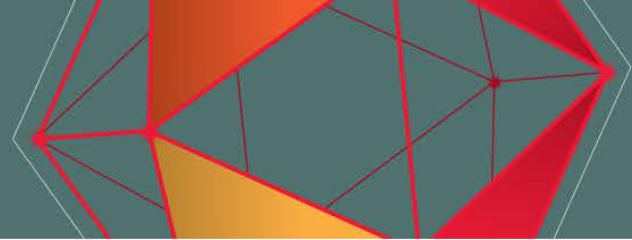


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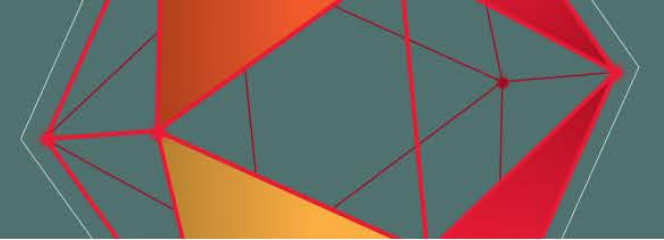
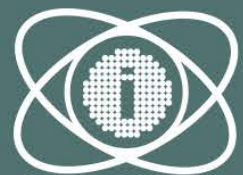
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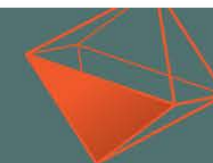
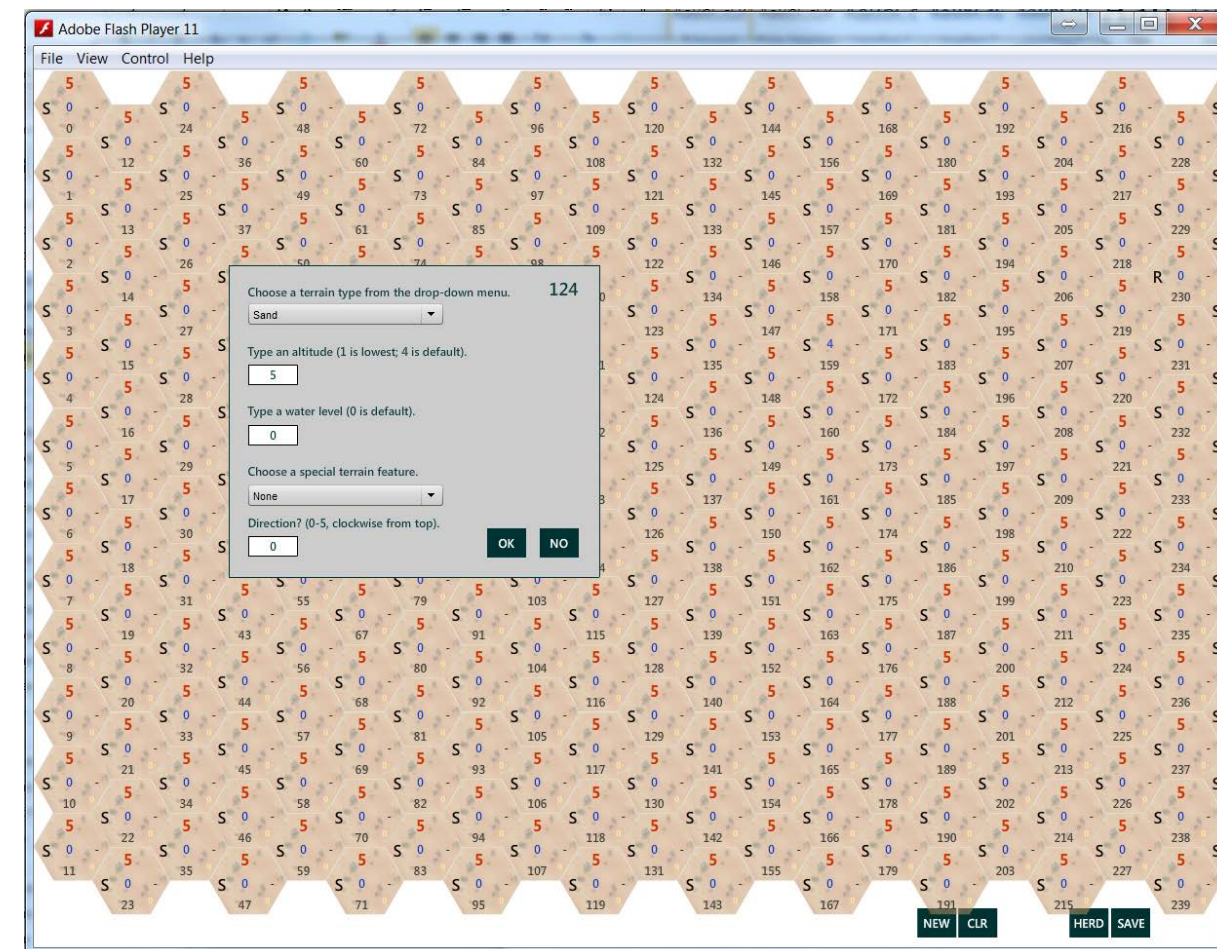
# Hex Maps

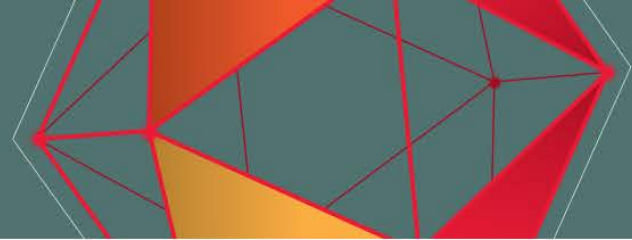
## Guide to hex math by Amit Patel

<https://www.redblobgames.com/grids/hexagons/>

## HexGrid Library by Jeff Rose

<https://github.com/DigitalMachinist/HexGrid>





# Design Problem

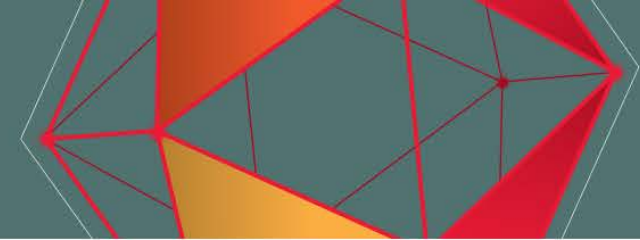
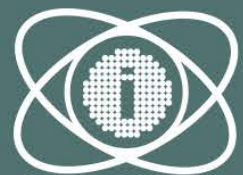
How do we make a **visual** level editor where you can **paint** the simulation values on each hexagonal tile?

# Needs

- Both bulk tile editing + fine detail tweaks
- Immediate visual feedback
- Simulation layers



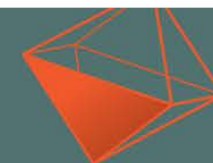


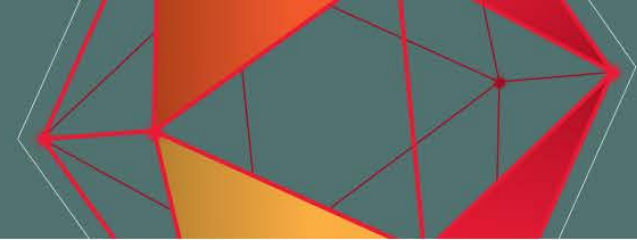


# Design Problem

How do we make a  
**visual** level editor  
where you can **paint**  
the simulation values  
on each tile?

# Solution?





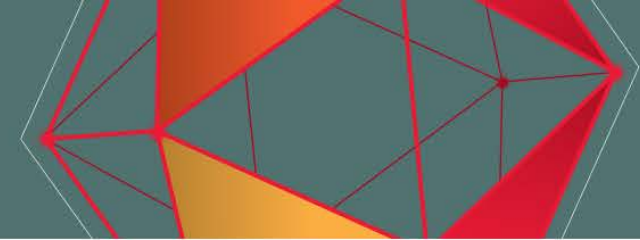
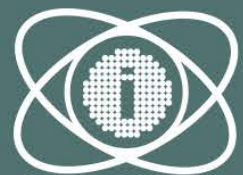
# Hexels!

A program for making grid-based vector art (pixels, trixels, hexels...)

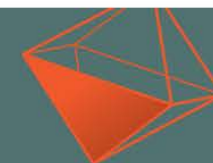
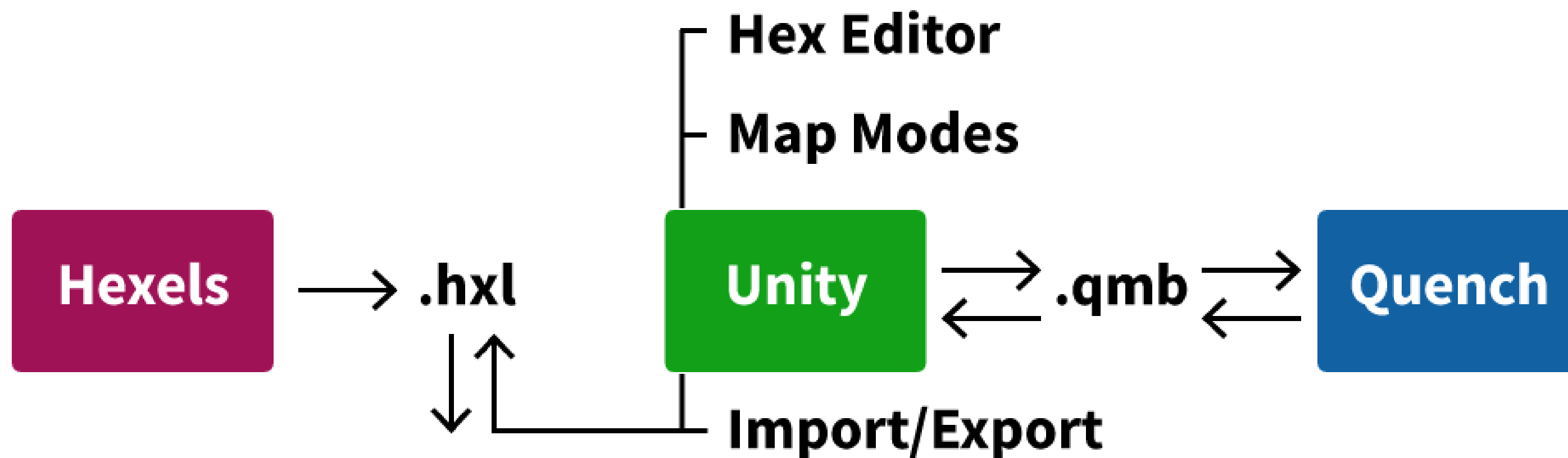
Thanks to Ken Kopecky for help with parsing .hxl files, and the Marmoset team for all their help and support <3

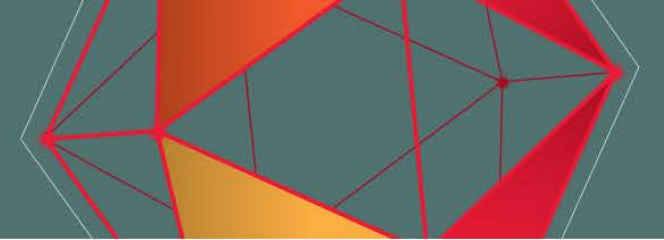






# Hexels to Unity Workflow





# Simulation Variables

- Ground height
- Terrain type
- Ground water
- Surface water
- Life
- Heat
- Ash
- Sand
- Pollution

```
public class QuenchHexCachedData
{
    #region Fields/Properties/Events

    // Values
    public float Ash;
    public float GroundHeight;
    public float GroundHeightModifier;
    public float GroundWater;
    public float GroundWaterFraction;
    public float Heat;

    // Intermediates
    public float HeatFraction;
    public bool IsBurnedOut;
    public bool IsOnFire;
    public float Life;
    public float ModifiedGroundHeight;
    public float Sand;
    public float SandHeight;
    public bool[] SandStability;
    public float SurfaceWater;
    public float WaterHeight;

    #endregion
```

```
/// <summary>
/// Data to be serialized along with the map so that it is persistent between saves and loads.
/// </summary>
[Serializable]
public class QuenchHexPersistentData
{
    #region Fields/Properties/Events

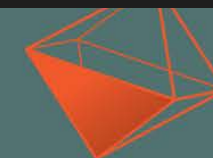
    /// <summary>
    /// Whether the tile is currently polluted.
    /// </summary>
    public bool IsPolluted { get; set; }

    /// <summary>
    /// The minimum allowable level of ground water saturation for this hex.
    /// </summary>
    public float MinGWSaturation { get; set; }

    /// <summary>
    /// The type of terrain that this hex represents (grass, rock, scrub, etc...).
    /// </summary>
    public HexTerrainEnum TerrainType { get; set; }

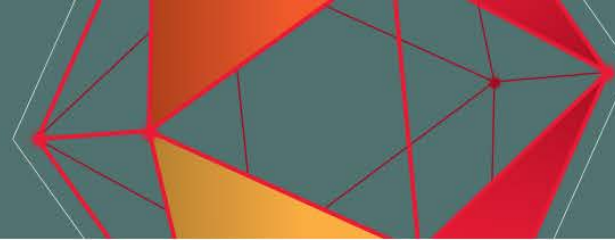
    /// <summary>
    /// The number of direction steps that the UV coordinates of this hex are rotated, relative
    /// to due East, in order to make it appear less like other hexes around it.
    /// </summary>
    public int UvRotationSteps { get; set; }

    #endregion
}
```

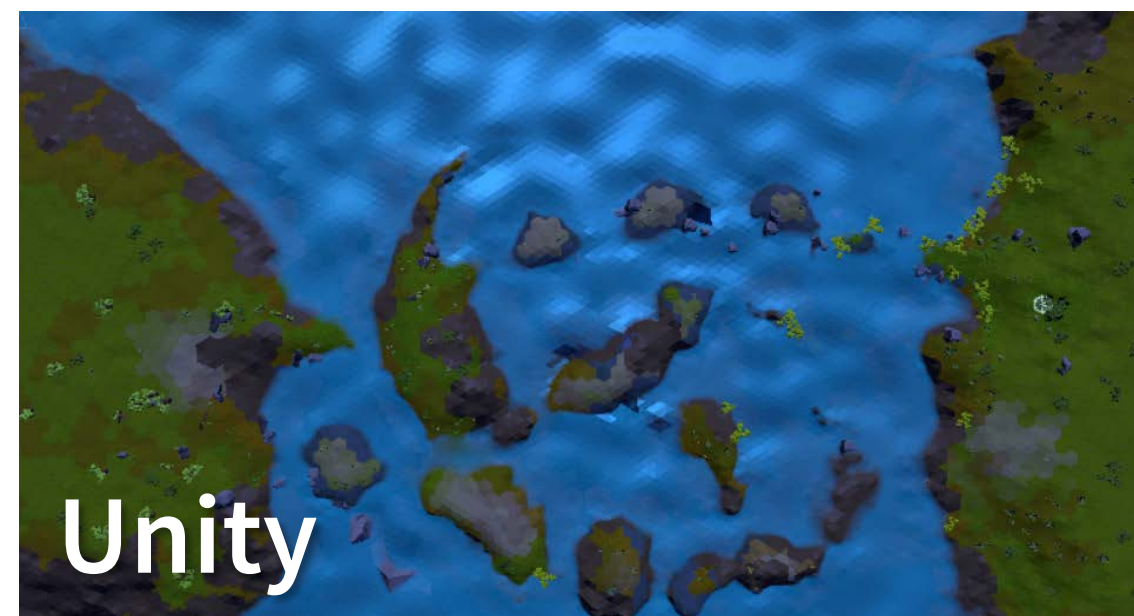
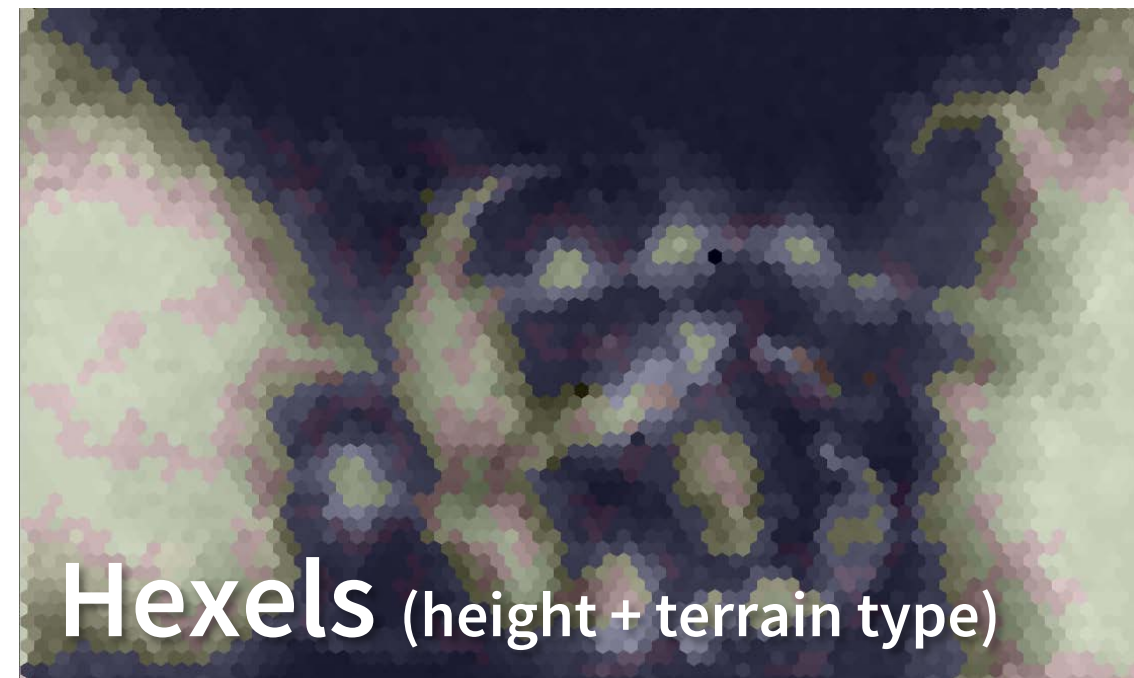




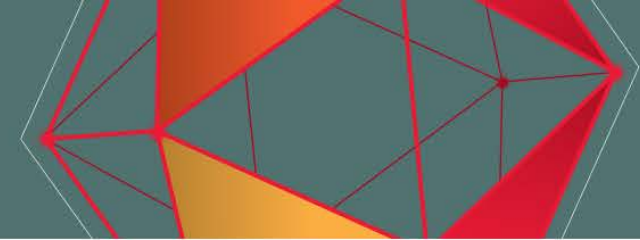
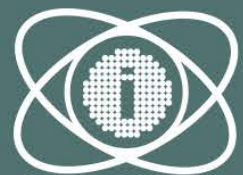




# Example Level







# Lessons Learned

1. Well-designed tools allow less-experienced team members make meaningful contributions.
2. Use and adapt pre-made tools when you can (even if they aren't specifically for games?!)
3. Ask for community/dev help!

