Game Architecture

2/12/16: Wavelet-based Noise
The Gist

- Lerped wavelets on a grid
Lerped Whats?

• Wavelets aren’t as scary as they sound
• A function that evals to 0 outside some region (clear beginning and end)
• For our use, it needs to integrate to 0
• i.e. an oscillation that has a balanced positive and negative region
The Algorithm

- Given an input point
- For each of its neighboring grid points:
  - Pick a "pseudo-random" gradient vector
  - Compute linear function (dot product)
- Take weighted sum, using ease curves
The 4 grid points bounding \((x, y)\)
The 4 pseudorandom gradients associated with the grid points
Vectors from the grid points to \((x, y)\)
Influences from the grid points
\[ x^2 \]
\[ 2x - x^2 \]
\[ 3x^2 - 2x^3 \]
$3x^2 - 2x^3$

$6x^5 - 15x^4 + 10x^3$
• Pattern repeats over 256 units:

```javascript
```
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```javascript
```
The Optimization

• Use a specific set of fixed gradient directions, hashed out of P value:

• $(1, 1, 0), (-1, 1, 0), (1, -1, 0), (-1, -1, 0),

• $(1, 0, 1), (-1, 0, 1), (1, 0, -1), (-1, 0, -1),

• $(0, 1, 1), (0, -1, 1), (0, 1, -1), (0, -1, -1)$

• avoids the main axis, preventing funny clumping

• dot products are now just additions!
noise

\[ \sin(x + \text{sum } \frac{1}{f(|\text{noise}|)}) \]

\[ \text{sum } \frac{1}{f(\text{noise})} \quad \text{sum } \frac{1}{f(|\text{noise}|)} \]
\text{noise}(p) + 1/2 \text{ noise}(2p) + 1/4 \text{ noise}(4p) \ldots
\[ |\text{noise}(p)| + \frac{1}{2} \, |\text{noise}(2p)| + \frac{1}{4} \, |\text{noise}(4p)| \ldots \]
sin(x + |noise(p)| + \frac{1}{2} |noise(2p)| + ...)