Instancing

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Instancing – What and why?

- Instancing is the ability to draw the same object multiple times
- It uses all the same vertices and the same graphics pipeline data structure each time
- It avoids the overhead of the program asking to have the object drawn again, letting the GPU/driver handle all of that

vkCmdDraw(CommandBuffers[nextImageIndex], vertexCount, **instanceCount**, firstVertex, **firstInstance**);

BTW, when not using instancing, be sure the **instanceCount** is **1**, not **0** !

But, this will only get us multiple instances of identical objects drawn on top of each other. How can we make each instance look differently?

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Making each Instance look differently -- Approach #1

Use the built-in vertex shader variable **gl_InstanceIndex** to define a unique display property, such as position or color.

gl_InstanceIndex starts at 0

In the vertex shader:

```
layout( std140, set = 0, binding = 0 ) uniform sporadicBuf
{
	int		uMode;
	int		uUseLighting;
	int		uNumInstances;
} Sporadic;
. . .
void
main( )
{
	. . .

	float DELTA	= 3.0;
	float s = sqrt(  float( Sporadic.uNumInstances )  );
	float c = ceil( float(s) );
	int cols = int( c );
	int fullRows	= gl_InstanceIndex / cols;
	int remainder = gl_InstanceIndex % cols;

	float xdelta = DELTA * float( remainder );
	float ydelta = DELTA * float( fullRows );
	vColor = vec3( 1., float( (1.+ gl_InstanceIndex) ) / float( Sporadic.uNumInstances ), 0. );

	vec4 vertex = vec4( aVertex.xyz + vec3( xdelta, ydelta, 0. ), 1. );
	gl_Position = PVM * vertex;
}
```

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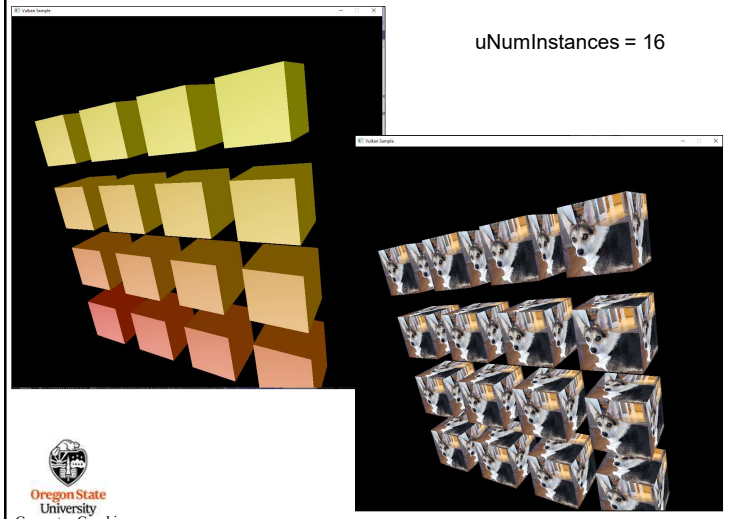

uNumInstances = 16

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Making each Instance look differently -- Approach #2

Put the unique characteristics in a uniform buffer array and reference them

Still uses **gl_InstanceIndex**

In the vertex shader:

```
layout( std140, set = 4, binding = 0 ) uniform colorBuf
{
	vec3  uColors[1024];
} Colors;

out vec3 vColor;

	. . .

int index = gl_InstanceIndex % 1024;	// gives 0 - 1023
vColor = Colors.uColors[ index ];

. . .
 vec4 vertex = vec4( aVertex.xyz + vec3( xdelta, ydelta, 0. ), 1. );
gl_Position = PVM * vertex;
```

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