Understanding Noise and the Expression Editor

Consider the noise function to be a messed-up sine wave. Both functions are characterized by their frequency, amplitude, and phase. Computer animation software often refers to phase as either offset or bias.

Open a Maya session and create a locater. Rename it expr_locator1. It is good to name nodes in a way that describes the purpose of the node. Here we intend to use this locator to hold expressions. Do not confuse expr_locator1 with the expression node now connected to the locator node. Select TranslateX from the channel editor, then right click to select Expressions ... . This will open the Expression Editor. Quickly create an expression on translateX by double-clicking on it in the Selected Obj & Attr field, press <ctrl-c>, then in the Expression window press <ctrl-v>. Select sin() from the Insert Functions menu. Type "time" for the argument of the sin function. Remember to type a semi-colon before pressing the Create button at the bottom of the window. The final expression is:

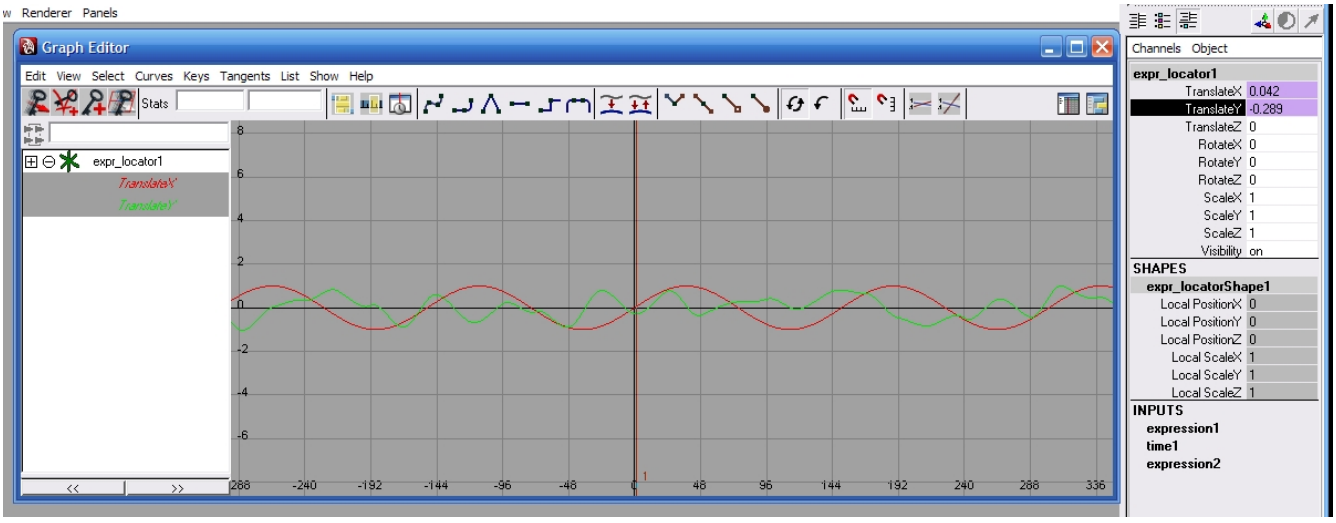
```
expr_locator1.translateX = sin(time);
```

Notice that the name of the object is prefixed to the channel name once the expression is created. In the same manner enter an expression for TranslateY. However in this case insert the noise function to create this expression:

```
expr_locator1.translateY = noise(time);
```

With expr_locator1 still selected, open the Graph Editor and check Show Results from the View menu. Set the playback range to 300 and with both TranslateX and TranslateY channels selected, set Frame Playback Range.

Figure 1.

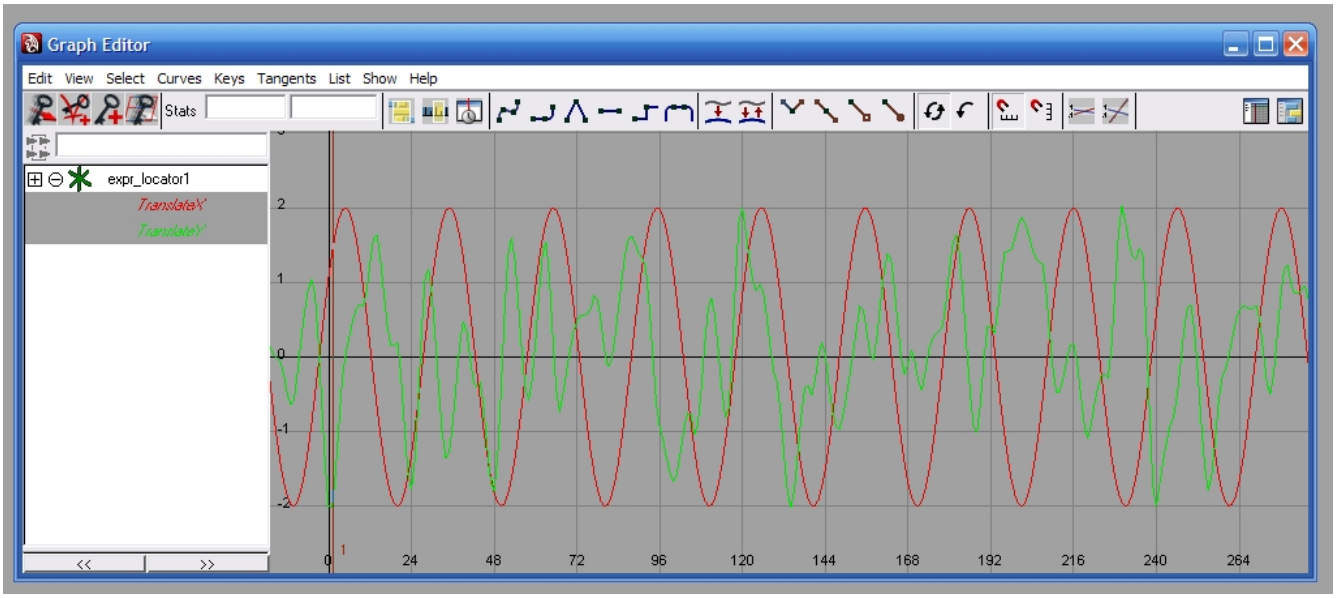


For both curves the frequency argument is time and the amplitude is 1. Now experiment by increasing/decreasing both frequency and amplitudes on both functions. It is good practice to study the

resulting graphs from channel expressions. The next figure shows the graph for these expressions. Notice there is a phase shift or offset of 12. It is easy to see the shift of the sine wave from the origin. The only way to discern the shift in the noise function is to compare with a graph without the noise shift. Adding an offset to a noise function serves the purpose of generating a different noise sequence.

```
expr_locator1.translateX = 2*sin(time*5 - 12);
expr_locator1.translateY = 2*noise(time*5 - 12);
```

Figure 2.



Hide the expr_locator1 and create a nurbs sphere with a 1-unit radius. Translate the sphere 1-unit in Y, set the pivot at the base of the translated sphere, and select Freeze Transformations under the Modify menu. In the Timeline Preferences, the Playback speed should be set to Play every frame. Enter the following expression in the TranslateY channel.

```
nurbsSphere1.translateY = noise(frame * 0.5);
```

In the Front View play the animation and note the sphere's movement. Now modify the expression on the TranslateY by enclosing it in a call to abs().

```
nurbsSphere1.translateY = abs(noise(frame * 0.5));
```

Play the animation again to see how the behavior has changed. In each case, also refer to the graph editor to view the curve resulting from these expressions.

Lets make our sphere dance for us. Scale it in Y by 3 units and enter these expressions:

```
nurbsSphere1.translateX = 0.5 * noise(frame * 0.1 - 3);
nurbsSphere1.translateY = 2.0*abs(sin(frame * .35));
nurbsSphere1.rotateX = 30 * noise(frame * 0.1);
nurbsSphere1.rotateZ = 30 * noise(frame * 0.1 - 13.1);
```

Make a playblast to view the animation in real-time. Experiment by increasing/decreasing the frequencies and/or amplitudes on these channel expressions. Perhaps key-frame a slide in the Z channel.

Discussion: Describe various effects where it is appropriate to use procedural techniques such as what has been presented in this lesson.

Discuss how noise and rand were used in these effects:

Rustoleum commercial - jackhammer animation

The Mummy Returns - flame flicker & lightning flashes

Assignment: Do a small amount of research on perlin noise and write up a description that is no more than one page. Using a locator node, create various expressions by combining math functions. For instance one may add together several noise calls using successively increasing frequencies and decreasing amplitudes. However, do not only use noise. Try other functions and also experiment with combining key-frame animation with expressions. Use spheres with simple deformations and animate using your procedural techniques.