Functions of Time: Timers, Keyframes, & Simulation

**Simulation** - using a frame event (processing py)

Timer -- turn the ball red after 3 seconds

Physics Sim -- Start with a position, add (random) velocity, add collisions, add gravity

Challenge: combine timer and physics sim to stop the ball from moving after 10 seconds

**Keyframes** (maya)

Linear motion in Maya

Open up the graph editor and play!

Tweak the tangents & keys
- see what happens (visual explanation of keyframes)
- ease in/ease out

Bouncing in Maya -- do the same thing we did in p5py, but do it in Maya

**Expressions** - functions of time (maya)

Try this: pSphere1.translateZ = frame;

Try this: pSphere1.scaleY = sin(frame*0.1);

Try this: pSphere1.translateZ = 50*noise(0.2*frame);

make the ball squash:

\[ pSphere1.scaleY = \min(pSphere1.translateY, 50)/50.0; \]
\[ pSphere1.scaleX = 50/(\min(pSphere1.translateY, 50)); \]

**Hierarchies of movement** - one parameter controlling others (maya)

Add an attribute to the pSphere called “squash”

Use it in your expressions (instead of the number “50”)

\[ pSphere1.scaleY = \min(pSphere1.translateY, pSphere1.squash)/pSphere1.squash; \]
\[ pSphere1.scaleX = pSphere1.squash/(\min(pSphere1.translateY, pSphere1.squash)); \]

**Challenges**

Helical motion (move x with cos, y linearly, and z with sin)

**Assignment**

The 12 Principles of Animation (or the paper by Lasseter)

bubble motion (random sphere scattered, plus random timer, plus helical motion)

OR

swarm of flies motion (using noise and periodic motion)

**Further Reading**: Computer Animation: algorithms & techniques by Parent

**Preview**: multiple bouncing balls