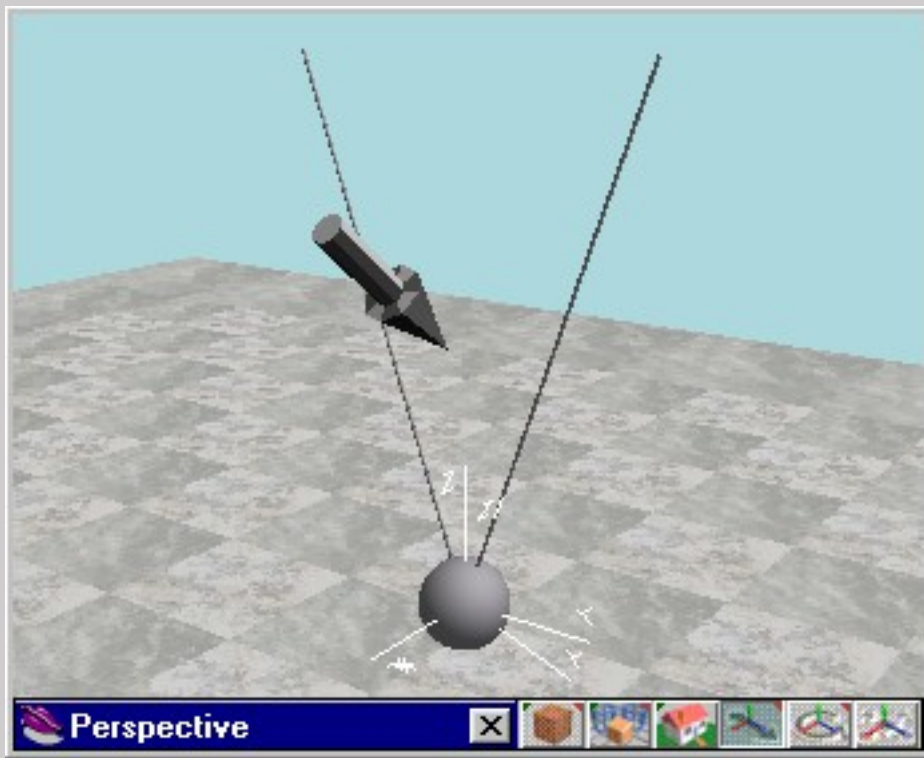


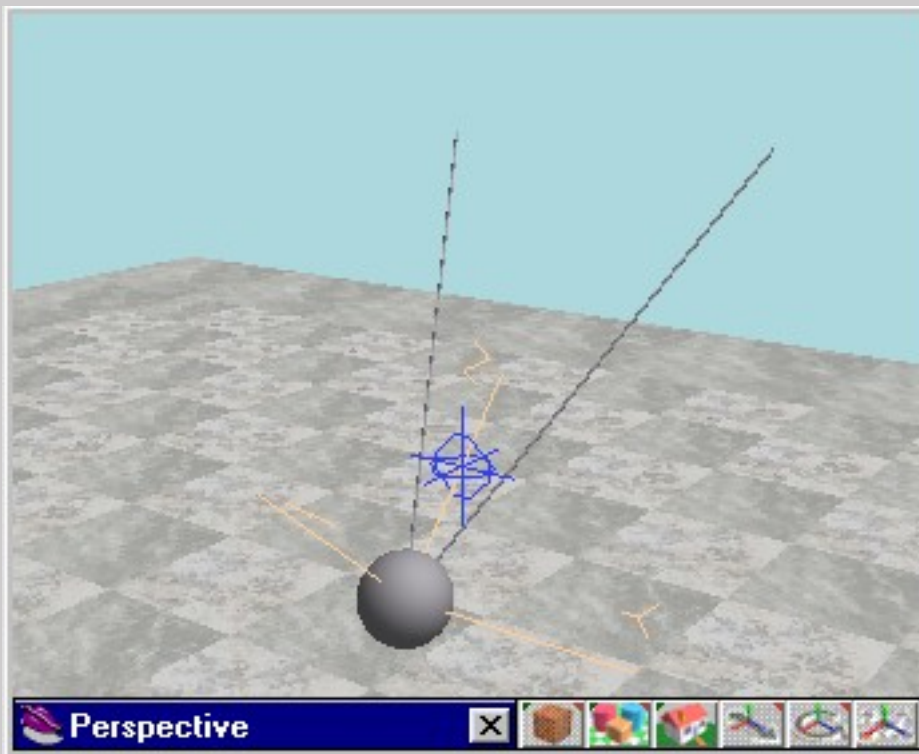
Desktoy © Matthew Bennett

For this tutorial I will cover another aspect of the physical simulation capabilities in trueSpace. We will use the Object Fixation Points to allow our object to make a nice accurate swinging path. A little bit of care is needed to be able to extract the animation path and use it on multiple objects. It would be fun if the physical simulation capabilities were such that we could just create the pendulum toy and watch it work, but they are not. Ok, so enough feeling sorry for ourselves.

The first step is to draw the ball with the support strings attached. Gluing will work fine. I usually try to avoid boolean adding if it's not necessary. The object is shown below. It's a simple sphere with two long and skinny cylinders. I was careful to make sure the cylinders were tipped away at the same angle. The easy way to do that is to create one, while it is verticle, position the bottom at the center of the sphere. Then move the axis of the cylinder to the center of the sphere by using the axis tool. Now when you rotate the cylinder it will rotate about the center of the sphere. I believe I used about 20 degrees on the lines, but whatever looks correct is what you should use. Save this object, and call it 'resting.cob' - this will make sense later.

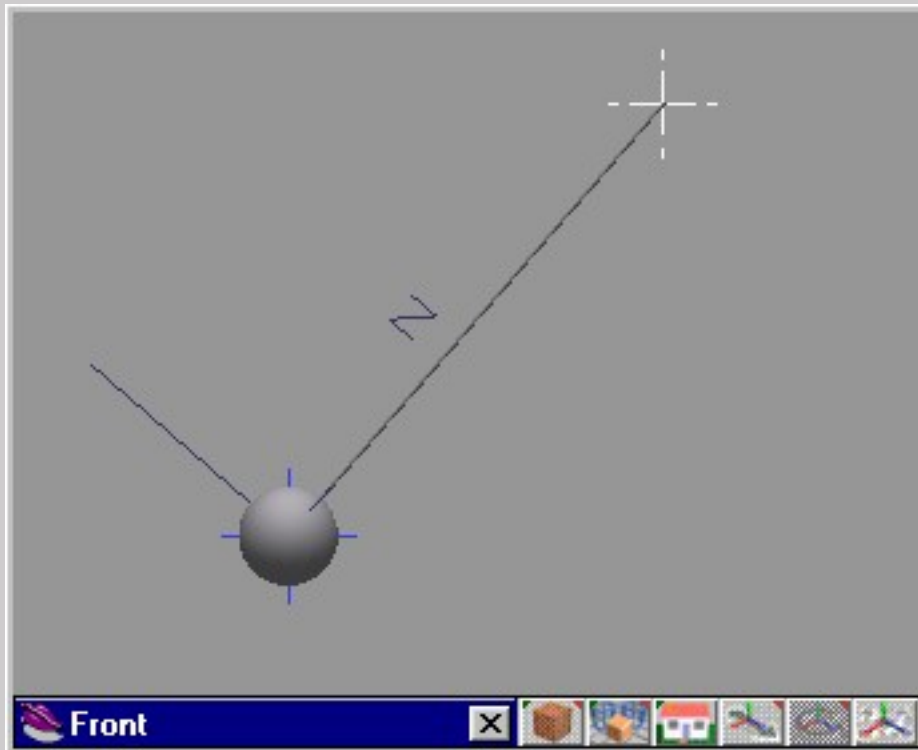


The next thing to do is to ready the pendulum to swing. We want to tilt it. Usually when I am going to tilt something I move the axis to where I want to rotate about. Here it will be easier to leave the axis where it is. From a side view, tilt the pendulum so that it looks proper. Once it's tilted, save this object as 'tilted.cob'. Next we are going to set the physical properties, and set the Object Fixation Point. Click on the local physical attributes button to bring up the local physical attributes panel. Set the objects properties as glass (it doesn't matter too much, just make sure it has some mass - so paper is probably not a good choice). Next we need to put the center of mass at the center of the sphere. You should see a blue cross hair of where the center of mass is located. If you do not, it's because the object axis is showing. Click on the axis button, and then press delete. Now you should see the following



We can position the center of mass by clicking on the center of mass button (in the local physical attributes panel), and then use the object move button to position it. You should be able to move it along the objects Z axis to move it down to the center of the sphere. (if you moved it in the Z direction in the world coordinates, it would go straight down). Yes you could have set the physical attributes prior to tilting it, but then you wouldn't have seen a good example of the difference between the coordinates.

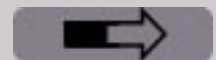
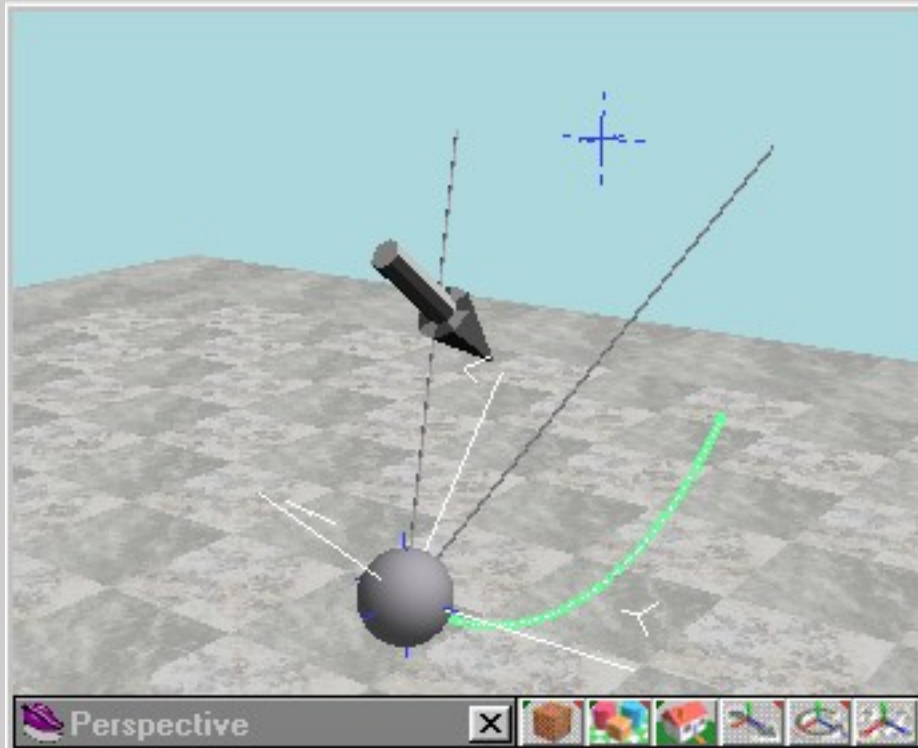
Ok, where were we....Right, we now need to set the Object Fixation Point. Click on the little half button with the '1' on it. An additional set of axis will appear. Move this axis along the objects Z axis so it is even with the top of the strings as shown below.



You should note that the object fixation point button remains depressed. This means that it is active. So leave it on. We won't be needing the 2nd fixation point for this tutorial. One thing I did notice is if you click on the activated fixation point button (turning it off), and then click it again to reactivate it, you then have to reposition the axis. Bummer. So don't do it!!!

Ok, so we are almost ready to press the start physical sim button. Before we do that, click on the Global Physical attributes button and turn off the atmospherics. What we are creating is a perpetual motion toy, so no need of pesky air to slow things down. Before pressing the start simulation button, let's review what we are trying to get. All we are interested in here is a motion path of a pendulum swinging back and forth. So as soon as the ball has come all the way back to the beginning, we want to stop the simulation. But don't stop it too soon. Let the ball come all the way back, and then start back down before stopping

the simulation. (the simm can be stopped by the esc key or by double right clicking). So go ahead and create the motion path by starting the physical simulation. When you are done, click on the path button to see the motion path you created. It should look something like this:

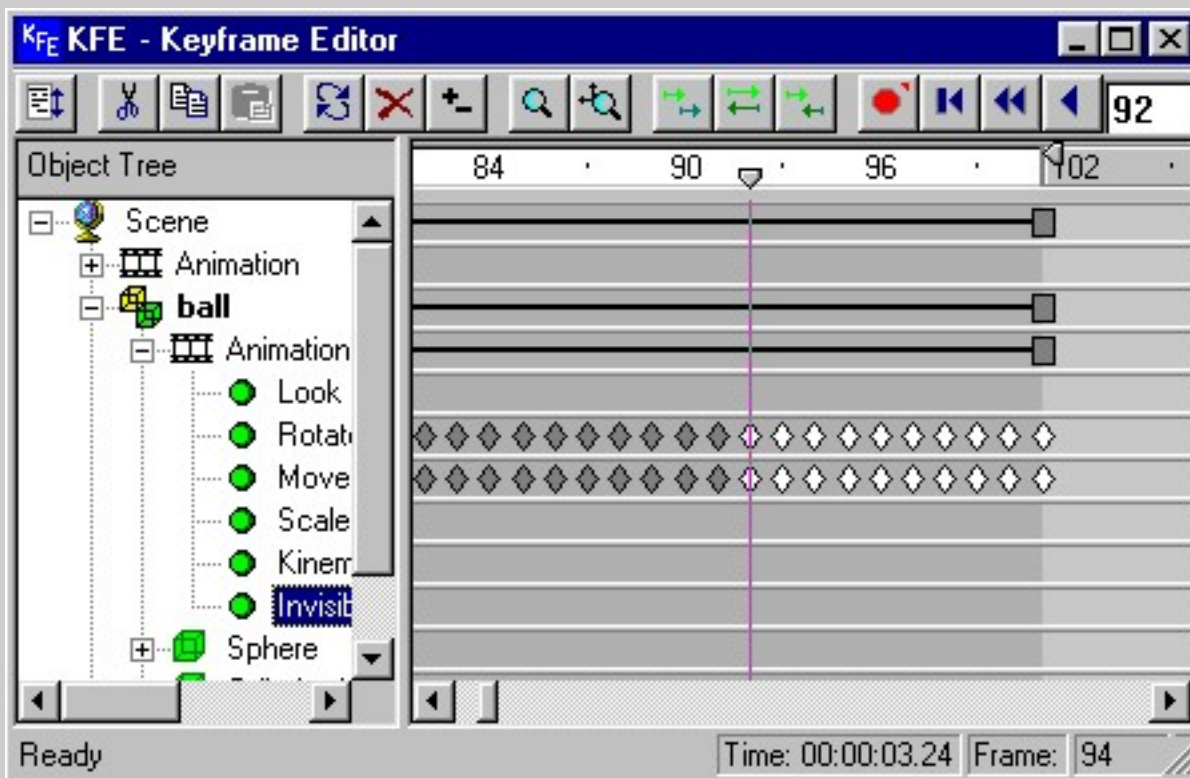


Desktoy © Matthew Bennett

Ok, that's cool, but we need to fix it up a bit. But before we get any further, lets all save. Additionally, save the current object as 'phys ball.cob'. The reason to do this is we want the original pendulum ball with no physical attributes available to us later. Saving it as something else means we won't overwrite the one we saved earlier. Ok, now that the pesky crash that was looming closer has been avoided we can rest easier. Actually I have very few crashes while playing with the physical simms, however saving often is a habit that always pays off. I also saw a great tip by Frank Rivera about saving the scene in steps so you can go back to any part you need. Ok, back on track here. What we need to do with our motion path is crop off the last bit so we have a smoothly seamless swinging pendulum. Using the spin control on the animation tools, step through the animation until you have found the frame where the ball just starts to move down again. We will want to delete that frame and all the ones after it. So remember the number or jot it down somewhere. For mine it was frame 92.

To get rid of the keyframes, open up the key frame editor (KFE) and expand so you can see the keyframes. Use the zoon button (little magnifying glass icon) to stretch out the keyframes so you can start highlighting at exactly the frame you need. Below is a picture of what my KFE looks like after highlighting the keyframes to be deleted. If you left the current frame selected from when you found

where to delete from, you have a nice line showing you what frame is the start for the ones to delete.



To test out the smoothness, right click on the play button, click on the loop check box. Press play and watch to make sure the motion looks seamless. Mine had a little extra jump at the end so I deleted one extra keyframe. If you delete too many, just rewind to frame zero, and start the physical simulation again to create all the keyframes. Spend some time to get this right because the rest of the animation is dependant on it.

The last thing is to adjust the path length so that it is a nice number of frames. I am going to adjust mine so that it is 60 frames in length (two second swing). Using the KFE, click and drag the end of the animation path so it is exactly 60 frames long. This also has the effect of speeding up the swing. And alternately you

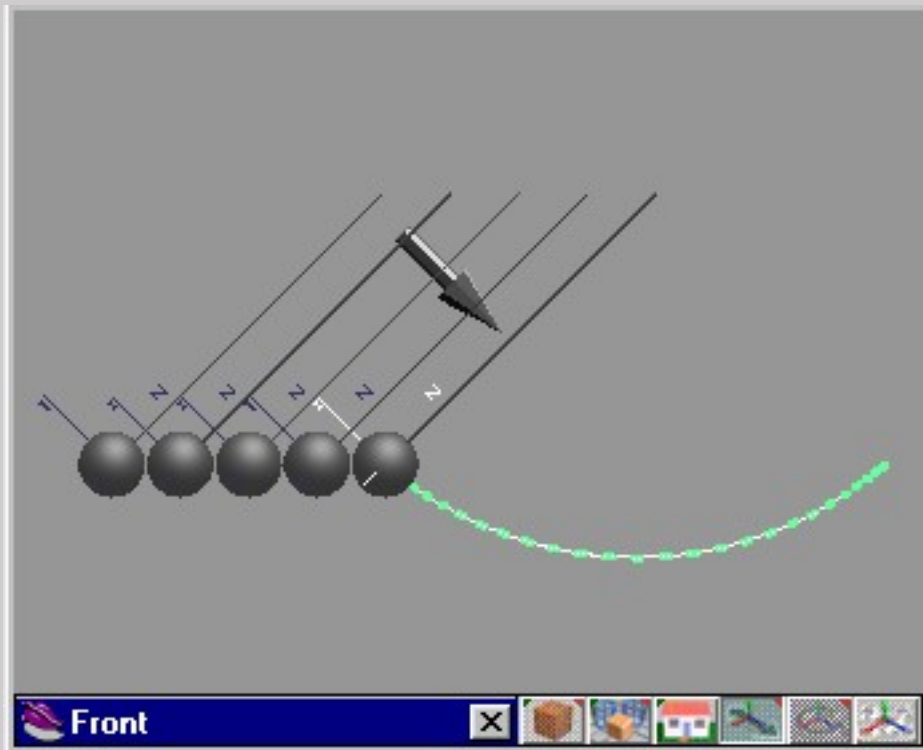
could slow it down by making the motion take more frames. Play with it a bit until you get a swing time you like - remember 30 frames is one second of animation.

So now, we have the desired motion path. Lets save it to a new path library. I usually end up creating a material library and a path library for each animation I create. It makes it easier then digging through a bunch of premade ones. Click on the Path Library tool, and then click on the Load/Save Path Library button and click new. Assuming the path on the ball is still visible click on the Add Path to Library button. (if you can't see your animation path click on the Path tool to make it visible. If it's not visible, you can't add it to the library.) You should now have a path called 'Anim' listed. If you click on it, the name will appear on the left allowing you to type a better description for it. I labeled mine 'Swing'. Save the path library.

Ok, save the scene and then start a new scene. Yup, you heard me, start a new scene. Load up the 'tilted.cob' object. We are going to apply our motion path to this object. Yes I know we just spent time creating it on the very same object, but we are going to make more copies of this, and I think it's cleaner to have an object with just the motion path assigned and no messy physical simulation properties clogging up cpu time. (and yes you could use the delete physical properties button, but I like to try to keep things very clean). Assigning paths is a good thing to practice as well. So with the 'tilted.cob' object loaded, click on the Path button, and then click on the 'Swing' path in the path library (if your path library isn't visible, first click

on the Path Library button and then load your library up). Right click on the object tool, and label this object 'swing 1'. Save this object as 'swinger.cob'. I tend to be a bit over cautious with the saving, but better that than losing hours worth of work.

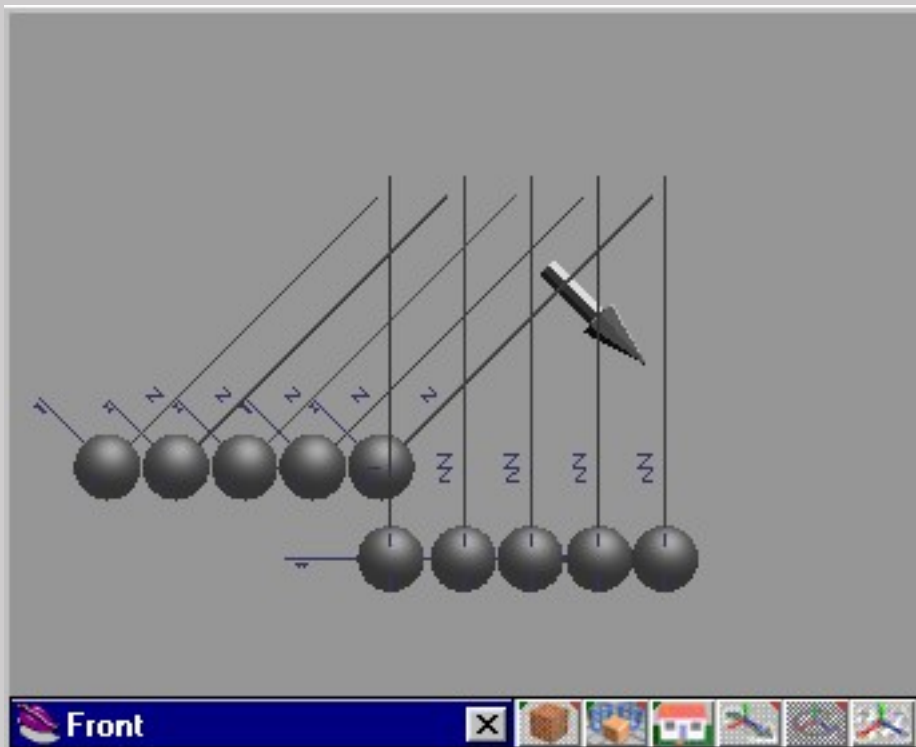
With the motion path visible on the object, click the copy button. Now move that object so it is just to the side of the first pendulum. Name this object 'swing 2'. Repeat this until you have 5 pendulum balls all lined up and names 'swing 1' through 'swing 5'.



Press play to make sure they all move like we are expecting. If they all tend to jump back to the starting point of the first ball, then you didn't have the animation path visible when you moved the balls. Additionally if the current frame wasn't at zero you could get some undesirable results.

Next we need to load up 'still.cob' - the pendulum

object prior to any tilting or simulation properties. After loading the object, right click on the Play button, click on the 'scene' radio button, and advance to the frame that is 1/4 through the animation. This should be close to the point where the balls are at the lowest point in the swing. Move forward or back a frame to get the one that is the closest. Click on the 'still.cob' object and then switch the animation parameters to 'object'. Position this object so it is overlapping the first ball. Label this one 'still 1'. Make a copy of it and label it 'still 2' and position it over the 2nd ball. Repeat this until you have 5 still balls all positioned over their swinging siblings.. Switching back to 'scene' in the animation paramters box, and then returning to frame 0 should result in something similiar to what is shown below.



The next steps are easy. We will be setting keyframes for when the balls are visible/invisible. Before you start, make note of what frames the balls are at the

lowest in their swing. For mine, they are frames 16 and 43. Since I want three balls to swing down, the last two swing balls need to be set to invisible.

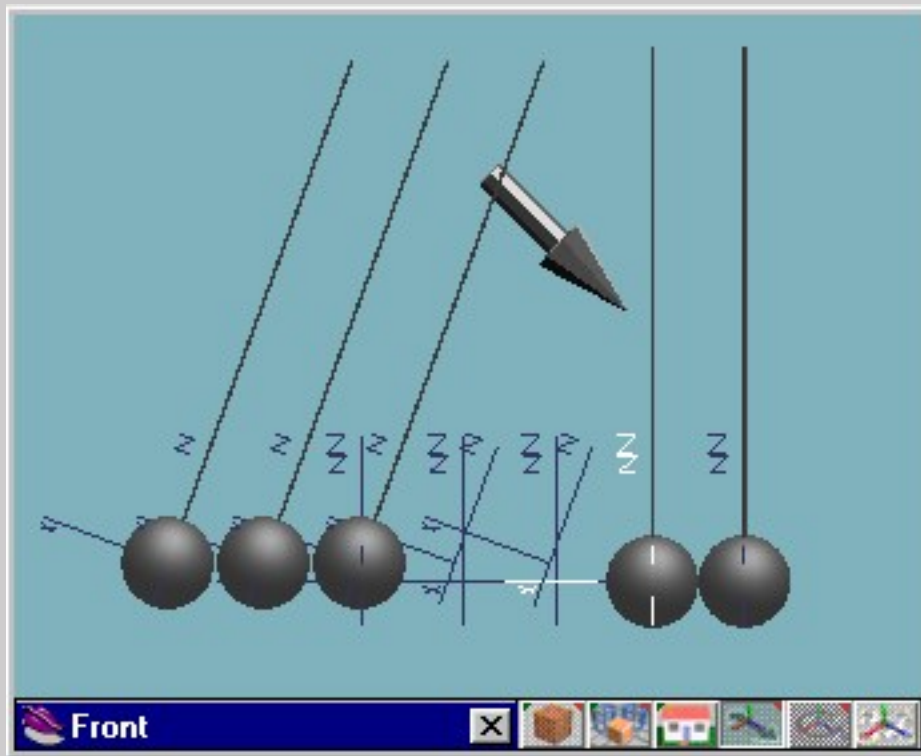
Starting at frame zero: Right click on the Object Tool icon to bring up the object info panel, click on the render options button to bring up the Object render options panel, and finally click on the Invisible checkbox. This needs to be done for objects called 'swing 4', 'swing 5', 'still 1', 'still 2', 'still 3'.

Advance to frame 16 (or whatever is your appropriate frame) and this time we will need to make swing 1 - 2 invisible, still 1 - 2 needs to be visible, still 4 - 5 need to be invisible, and finally swing 4 - 5 needs to be visible. Since the middle ball always moves, we really don't need the middle still ball, but it keeps other options available.

Check the animation by pressing play. The three balls should swing down, and three should go up and come back down and then they will keep going looking very improper. So at frame 43 (or your appropriate frame), make swing 4 - 5 invisible, and still 4 - 5 visible.

Additionally we need to make swing 1 - 2 visible, and still 1 - 2 invisible. It's probably about 10 times harder to read this than it actually is to do it.

The picture below is just to show one other sort of cool feature. If you have at some point selected the object axis (and not pressed the delete key to make them go away), they will show up even if the object is set to invisible. This really helps to keep an eye on things.



One thing that is nice to do, assuming you labeled the balls, if you have the animation parameters set to scene, you will be able to use the arrow keys to go from object to object. This is very helpful when trying to select an invisible object. If you don't like that method, then use the KFE to select the invisible object.

One other side note. If you wanted to continue the animation by having different balls sequences, then before setting the keyframes it would be a good idea to open up the KFE and press the Repeat button a number of times.

The last step would be to set up a frame for the balls to be suspended from. I'll leave that to your imagination.....

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