An Approach to Content Creation for Trainz

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Part 5

Simple Animation

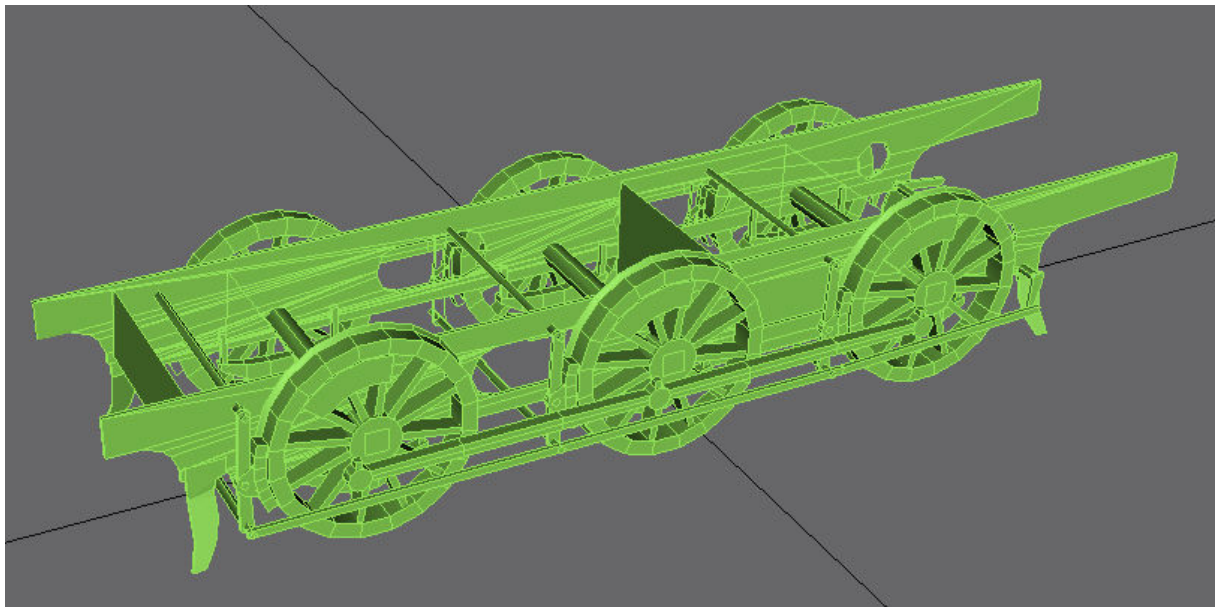(Updates and sample files available from http://www.44090digitalmodels.co.uk/)

Simple Animation

Calling animation for Trainz models 'simple' has probably drawn a hollow laugh from some of you reading this, as from reading various Forum posts over the years it would appear to be anything but simple.

In fact if certain rules are followed it is certainly not as difficult as it appears at first sight, and a team loco with inside cylinders can be animated in about five minutes, a diesel or a wagon without coupling rods in even less. Outside cylinders or outside valve gear is a bit more complicated though and we'll go into that another time.
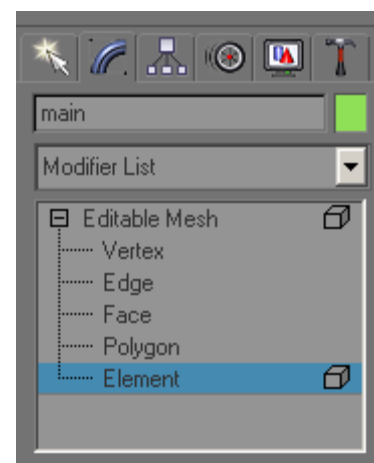
Firstly ensure you have read part 1 of this opus and that GMax is set up as described therein – **in particular the bit about setting the system units to metric. Failure to do this will result in nothing but frustration!**
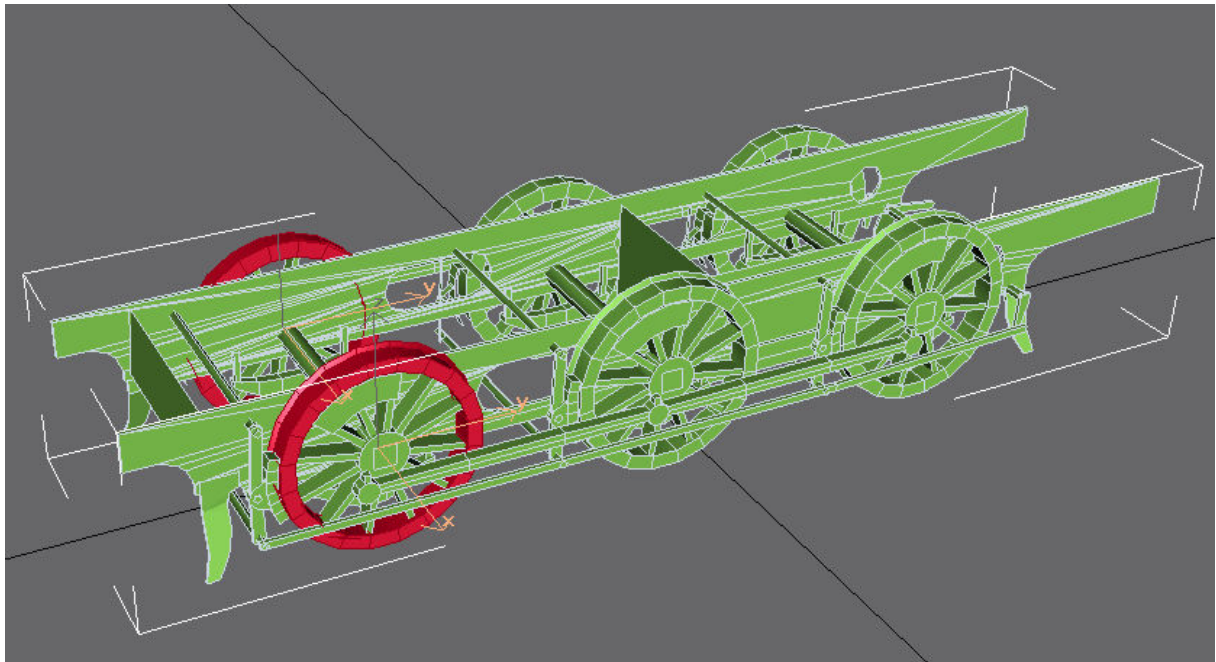
This is what I'll be animating for the purpose of this tutorial – the 'bogey' for the 'Brighton Works' Terrier. This example file can be downloaded here so you can try the tutorial out.

This is one mesh at the moment, so the first thing to do is to detach the wheel rims so that we can position the wheel animation dummies. If your wheels are already separate meshes you will not need to do this, but it illustrates moving pivot points of meshes which is an essential skill to learn when creating animations.

So, select the mesh and enter 'Element' mode as shown. Selecting the front pair of wheel rims will result in them turning red – if the whole rim doesn't turn red try pressing 'F2'. If only the individual faces are selectable then the model has not been welded together so do that first.
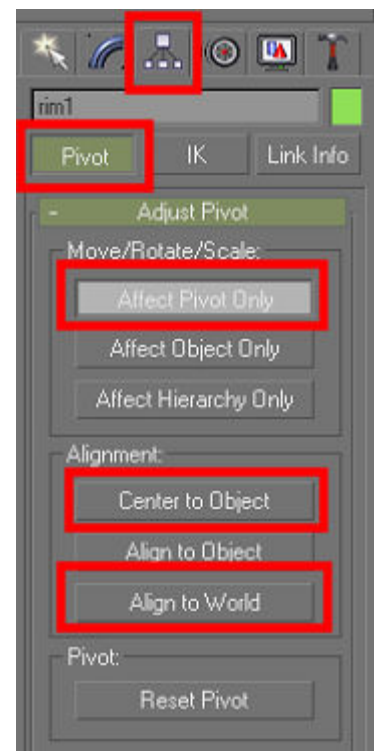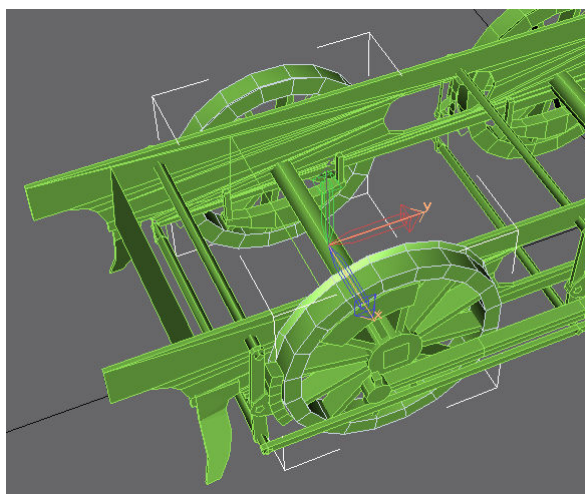
Right click on the selected elements and detach them, giving them a meaningful name such as 'rim1'. Repeat for the other wheels.

Next, move the pivot points of each of the rim meshes to the centre of the wheel. Click on the 'Hierarchy' tab (the box with three smaller boxes below it), then 'Affect Pivot Only' followed by 'Centre to Object' and 'Align to World'.

The Pivot Point (denoted by the red, green and blue arrows) will jump to the dead centre of the wheel set.
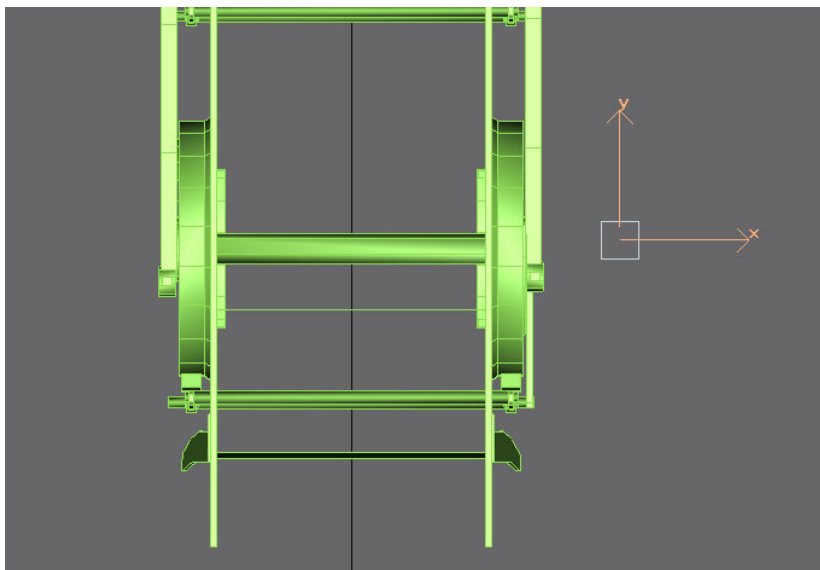

Failure to align the pivot points to World Coordinates is also a cause of much hair loss in the Trainz Community as this will also result in your animations being scattered all over the landscape!

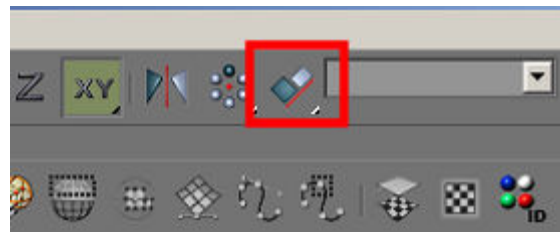Again, repeat the operation for the other two wheel rims.

Next we need to create the animation dummies. GMax will allow you to animate the meshes directly but Trainz will not recognise this as a valid animation – you have to animate dummies and then attach the meshes to them. **Never, ever animate a mesh directly as this will mess everything up.**

Very important - All dummies must be created in top view. This is to ensure that the pivot points of the dummies are correctly aligned.
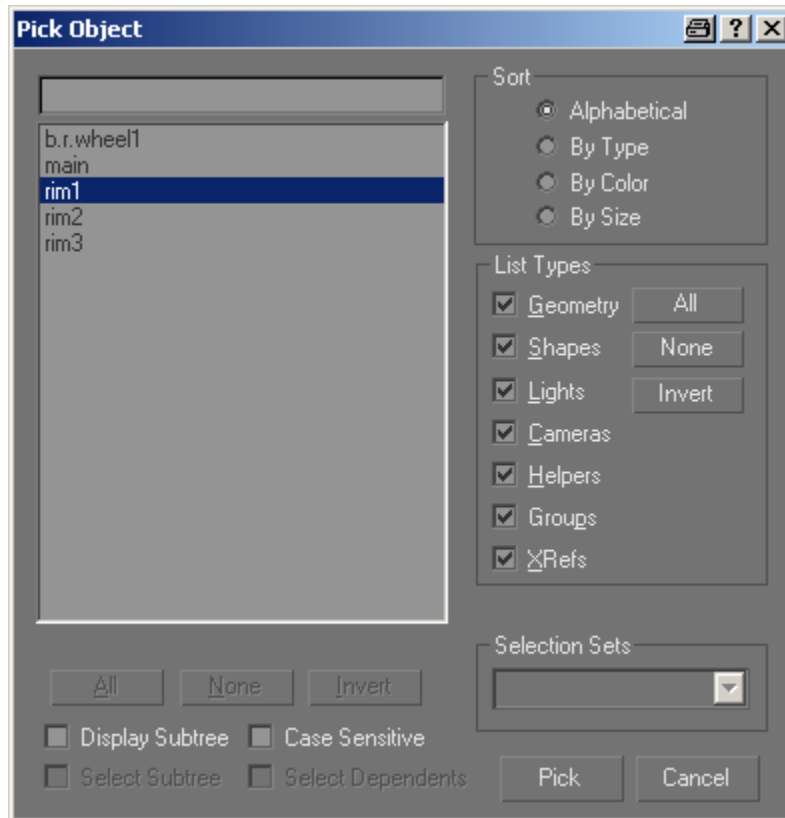
So, switch to top view by pressing 'T' and create a dummy called 'b.r.wheel1' (**only the 'b.r.' part of the name is important**)
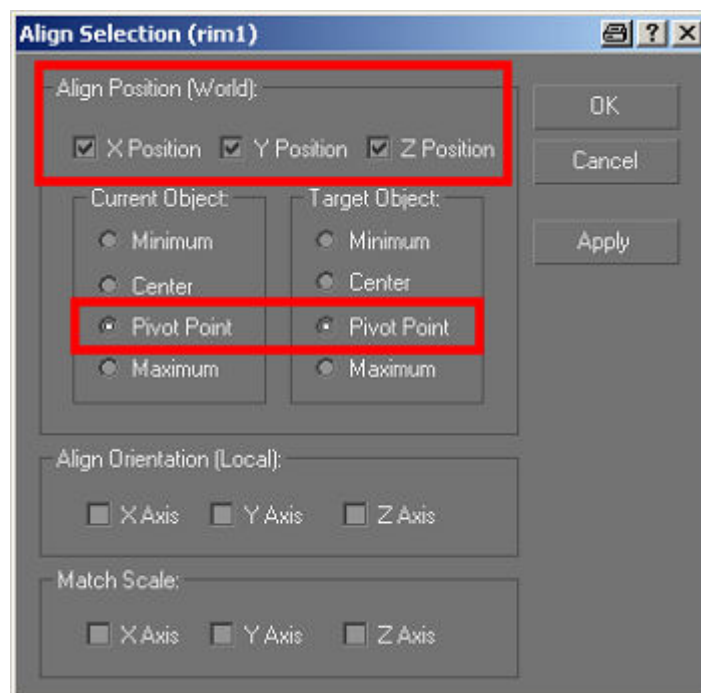

Now align the dummy to the centre of the wheel rim mesh by selecting the dummy and choosing the 'Align' icon. Now press 'H' to open the object selection dialog box and choose 'rim1' from the list.

If the bogey will have connecting rods later, position the coupling rod dummy on the crankpin of the wheelset that has the connecting rods – this will make the valve gear/connection rod animation simpler (see Part 8 for details).

A further dialog box opens where you can choose how to align the objects. Choose 'Pivot point' for both objects and 'Align Position World' should have X,Y and Z selected

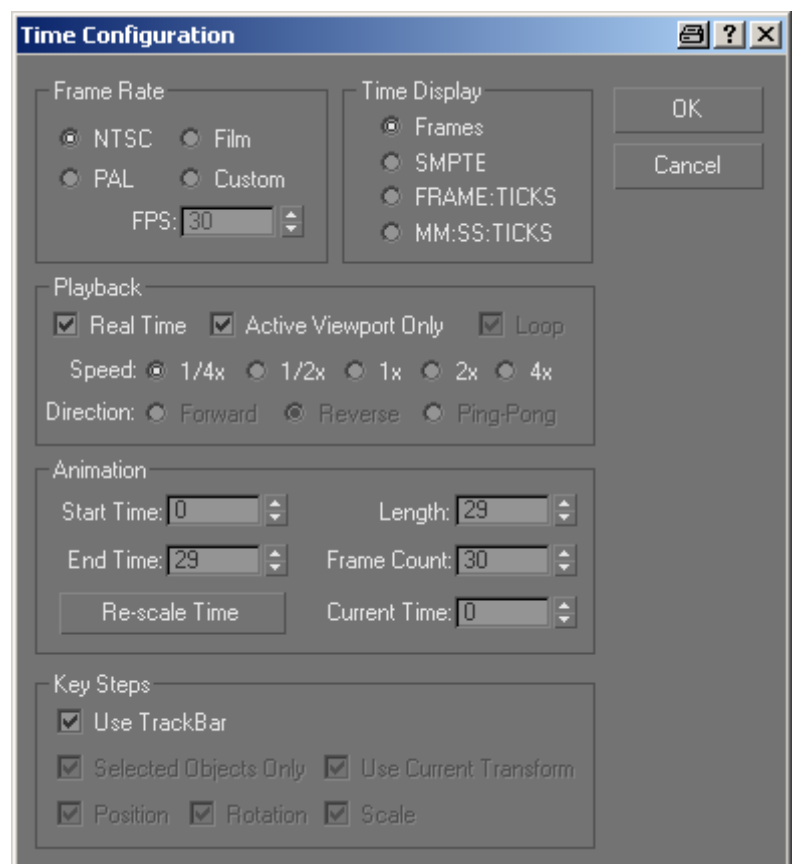

The dummy now jumps to the centre of the wheel set. .

We'll now animate the first dummy for the very good reason that once we've got one animated we can simply copy it for the other wheel sets. I'm not going to animate three wheel sets when I can get away with just doing one…

Before we start though it is important to set the number of frames for the animation. **When animating bogies it is important to animate over 30 frames, which are numbered 0-29 by GMax.** Doing so will make writing the config file for the bogey easier – it's not a disaster if this is set to something else but it does make things more complicated later, especially if you are animating outside valve gear.

To set the number of frames click on the 'Time Configuration' icon as shown.

In the next dialog box make sure that the values under 'Animation' are as shown and click 'OK'
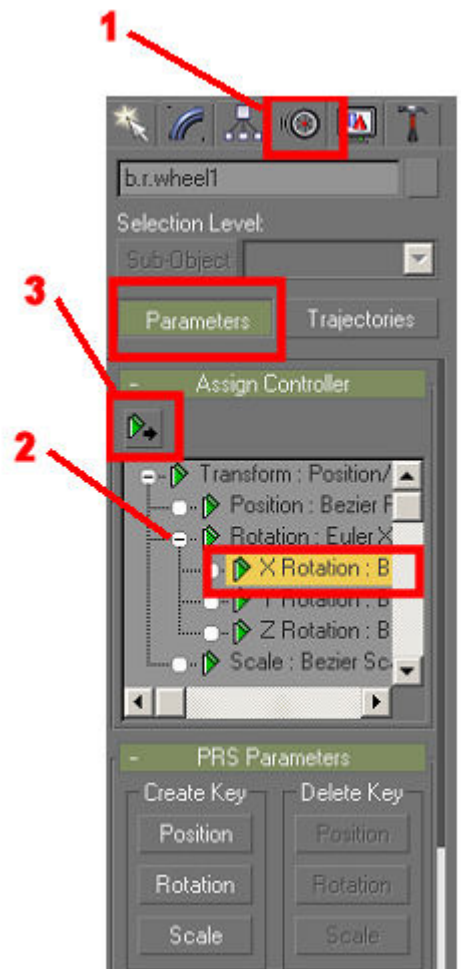
Select the dummy and then the 'Motion' tab (marked with '1'. Open the 'Assign controller' rollout by clicking on the '+' icon and then the 'X Rotation: Euler XYZ' also by clicking on the '+' next to it (marked '2').

If you don't see ''Rotation: Euler XYZ' in the pane, click on 'Rotation' and then on the green icon above the Pane (marked '3'). Select 'Euler XYZ' in the dialog box and then click on 'OK'.
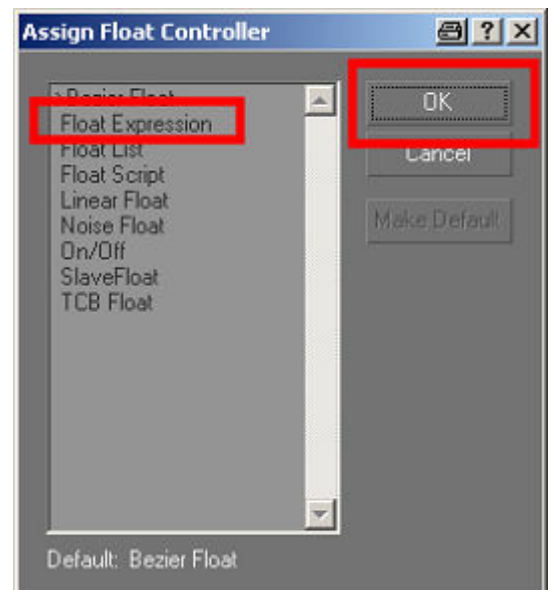
Finally select 'X Rotation: Bezier Float' and then click on the 'Assign Controller' icon (marked '3').

If you really want to know who Bezier and Euler were I'm sure the Wikipedia will have something on them.
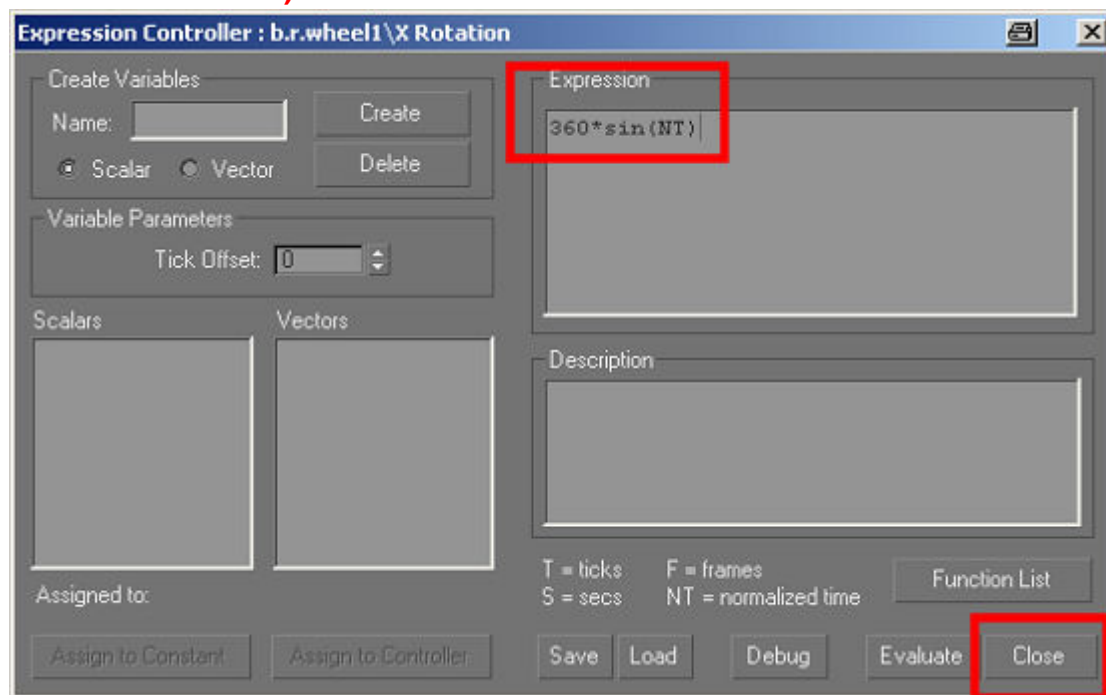
By now you will have gathered that I'm not animating with keyframes here as is sometimes recommended, this method is much easier for simple animations.
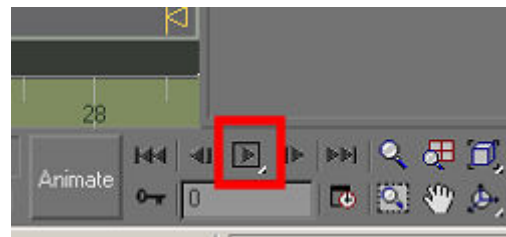
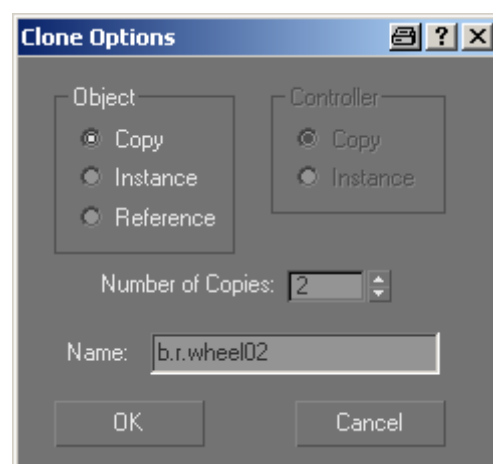A new dialog box opens now, select 'Float expression' and then 'OK'

In the next dialog type the magic spell '360*sin(NT)' exactly as shown **(including the case of the letters).** And then click on 'Close'.
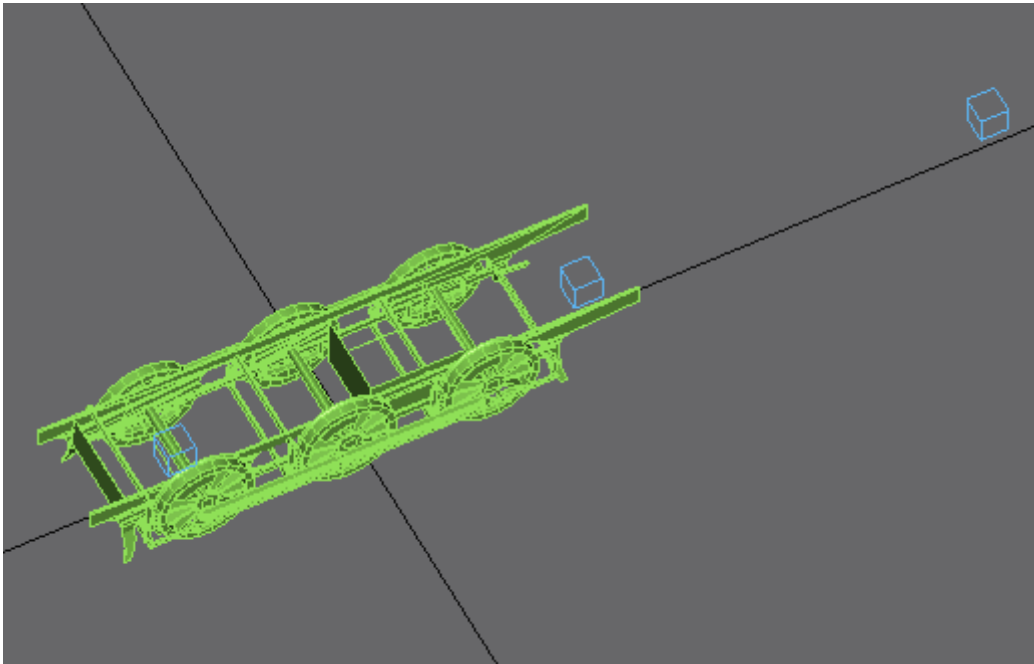

That's it, the dummy has now been smoothly animated over 360 degrees – wasn't so hard was it? If you click on the 'Play Animation' icon you will see the dummy rotating.
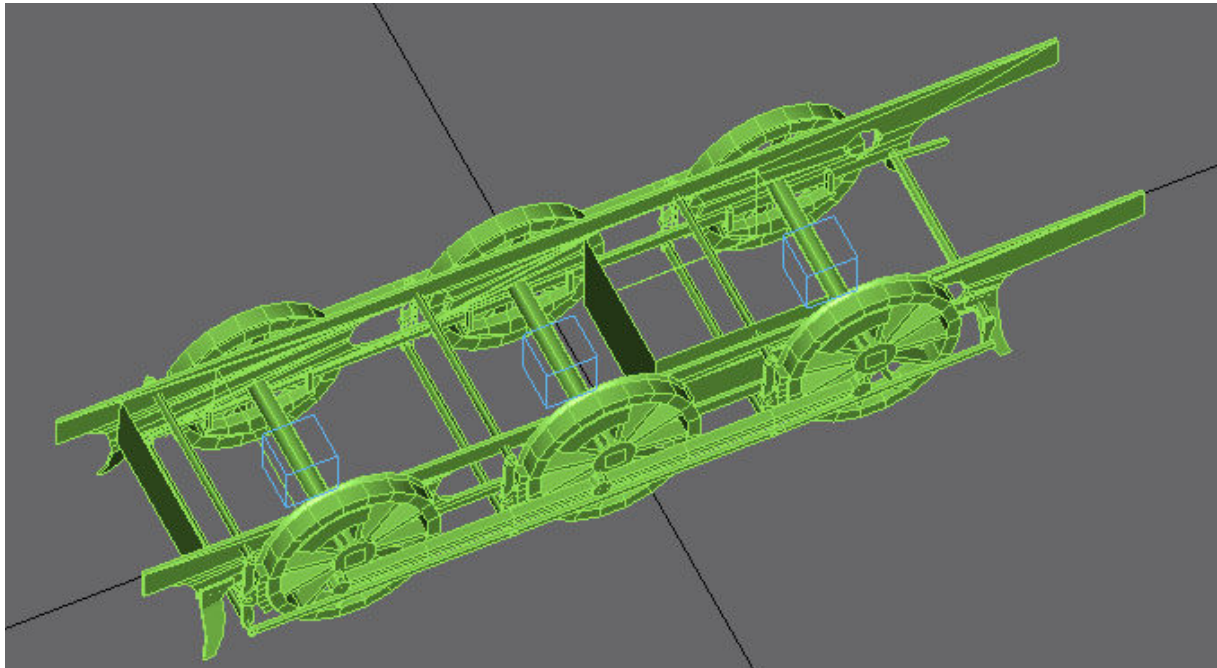

Select the dummy and click on the 'Move' icon in the top toolbar with the SHIFT key depressed and drag it to a position somewhere behind the bogey model. When the 'Clone Options' dialog box opens enter '2' in the 'Number of Copies' field to create two new dummies in this case. Also make sure that 'Copy' is selected and not 'Instance' or 'Reference'.
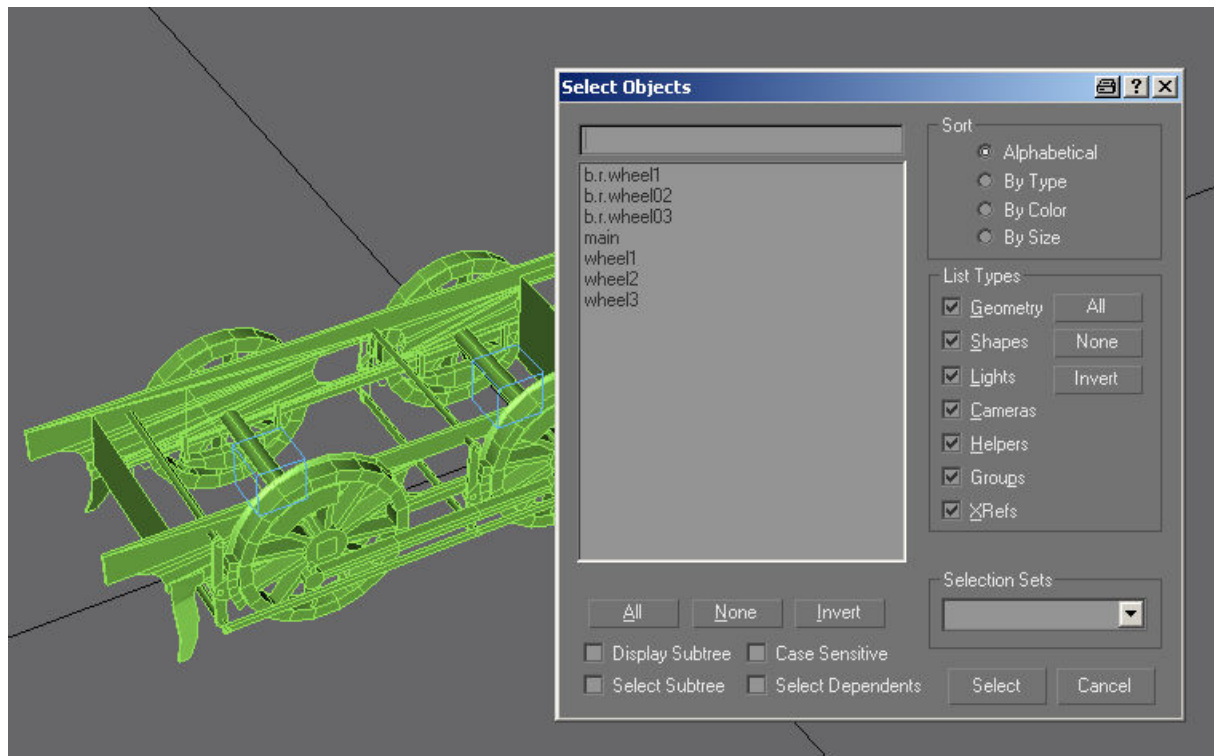
Rename the two new dummies 'b.r.wheel2' and 'b.r.wheel3'. Align the dummies to the wheel rims 'rim2' and 'rim3' in the same way that we did for the first dummy so that all of the dummies are centred on the respective wheels.

We'll need to sort out the rest of the bogey mesh now, as the parts that should belong to each wheel set need to be detached from the main mesh and reattached to the appropriate wheel rim. Obviously if making your own bogey you will have planned ahead a bit better and not attached everything together in the first place…

A short time later the bogey model and the list of objects looks like this:

I've renamed the objects 'rim1', 'rim2' and 'rim3' to wheel1', wheel2' and 'wheel3' as this is easy enough to do and helps to keep things tidy.

One more thing to do now before we start linking things together and that is to create a new dummy called 'b.r.main'. **This time the exact name is important!**
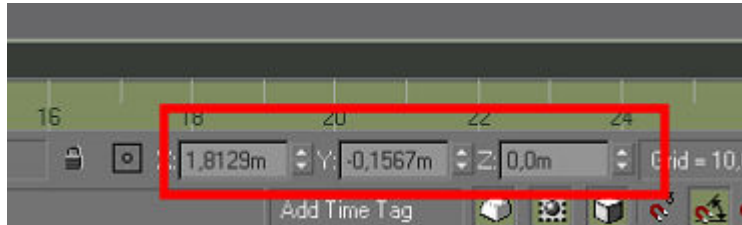
Again, create this dummy in the top view and move it to the same position in 3D space as the a.bog0 point in the loco body model. This should be at X=0 and Y=0, the Z coordinate is open to debate.

The Auran content creation docs state that the bogey attachment points in the loco body model should be at the axle height, i.e. half the wheel diameter. The case of this bogey that is how it has been built, however, I wouldn't do it like that now. A lot of people (me too!) think that to do this is absolutely barking mad as it makes it harder to export the bogey and much harder to use the bogey for anything else as the heights in the loco body and the bogey must match to get them positioned correctly.
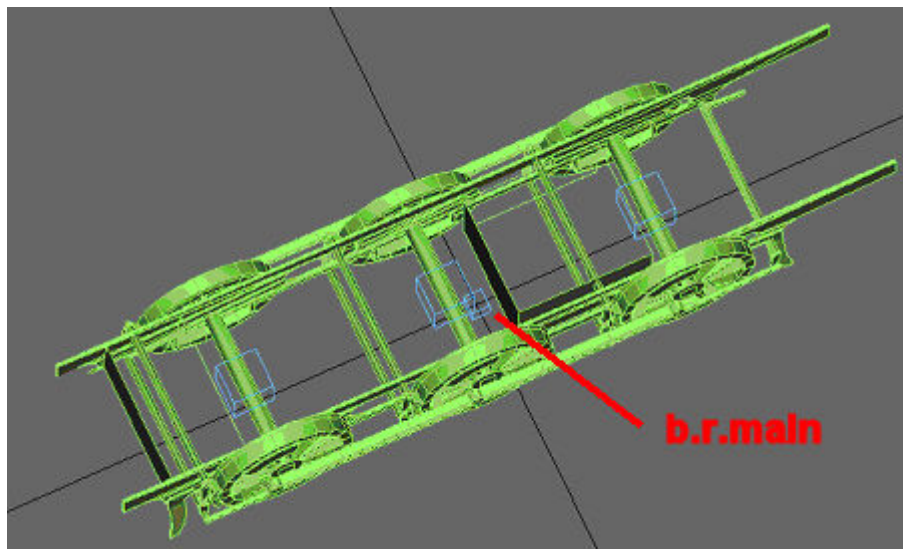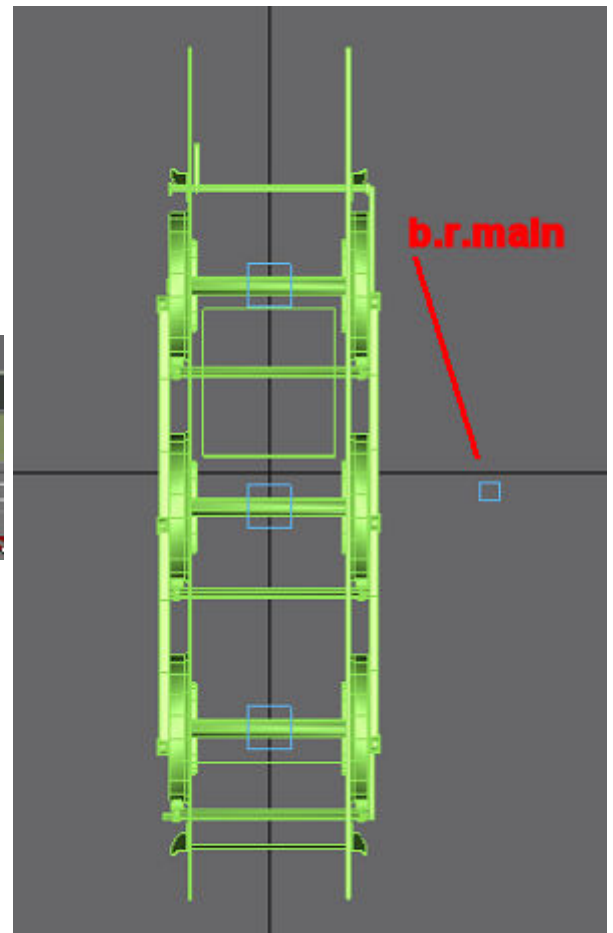
Having said that there have been versions of Trainz and/or service patches that have broken content not following these guidelines, so we'll do it the hard way first.

In this case we'll put the 'b.r.main' dummy at the axle height, so create it in top view somewhere on the XY plane.

Now to move it to the right place (good trick coming up here) – select the dummy and then the 'Move' icon on the top toolbar. At the bottom of the main GMax window there is a readout of the current position of the object (note that this is actually the position of the object's pivot point which can be used to our advantage).

Simply right click over the up/down arrows next to the coordinate boxes to set the value to 0. This works for all such fields that GMax displays. Do this for the X and Y boxes to position the dummy at 0,0,0 (Z was already 0).
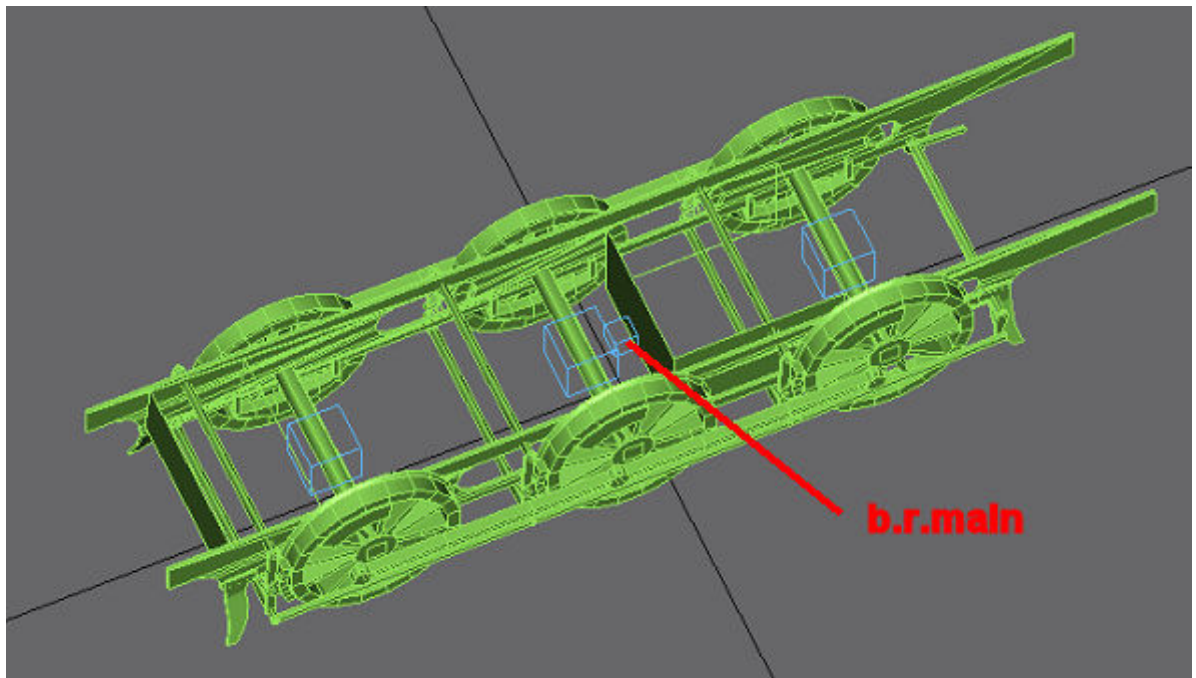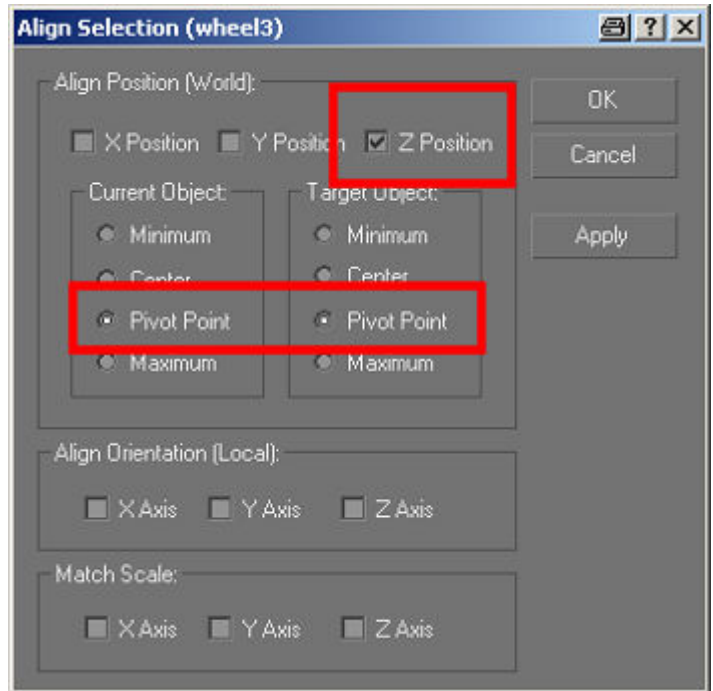

These days I would leave it there to make things easier, but the attachment point in the loco body is set at axle height so I need to align the Z coordinate of the dummy 'b.r.main' to one of the wheels.

So, select the dummy then the 'Align' icon in the top toolbar and finally one of the wheel sets.

Make sure 'Pivot Point' is selected for both Current Object' and Target Object' and choose 'Z' in the 'Align Position (World)' part of the dialog box.
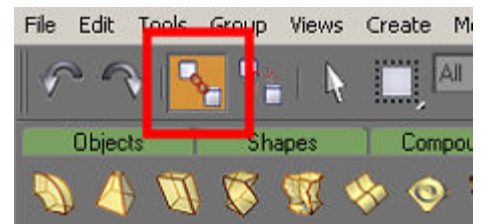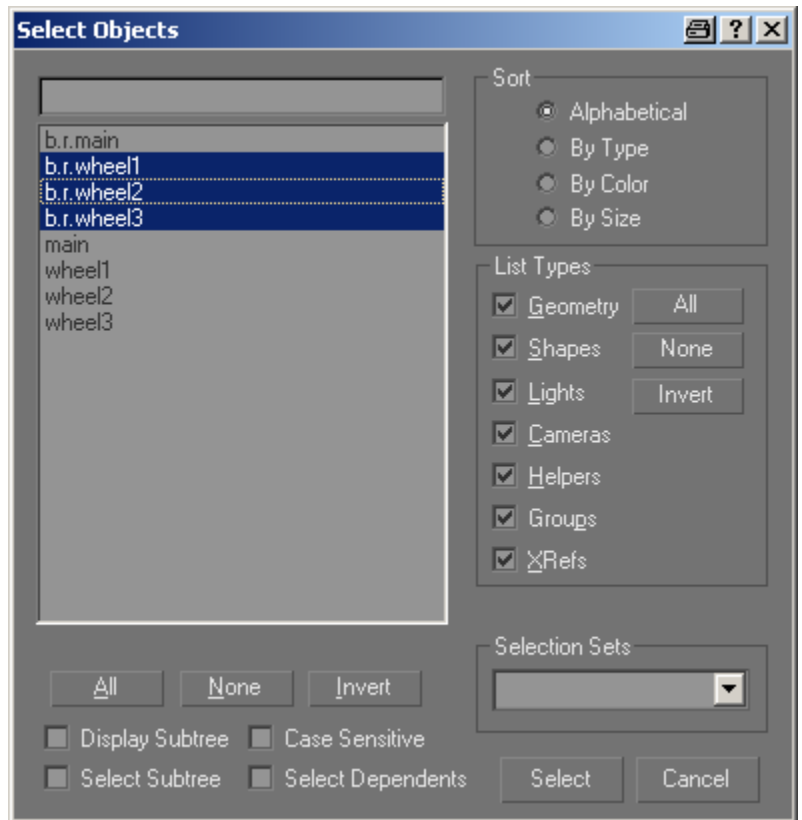
Click on 'OK' and the dummy will be positioned.

Nearly done now (for a basic bogey without coupling rods anyway) – we just have to link things together. This is a stage that can also be responsible for extreme hair loss when making stuff for Trainz, so listen up.

You have called your main dummy 'b.r.main'? You haven't animated the wheels themselves instead of the dummies? You did set the GMax system units to metres didn't you?

OK, now to do the linking. You'll probably find it easier to do all selections via the 'Select Objects' dialog box (opened using the 'H' key).
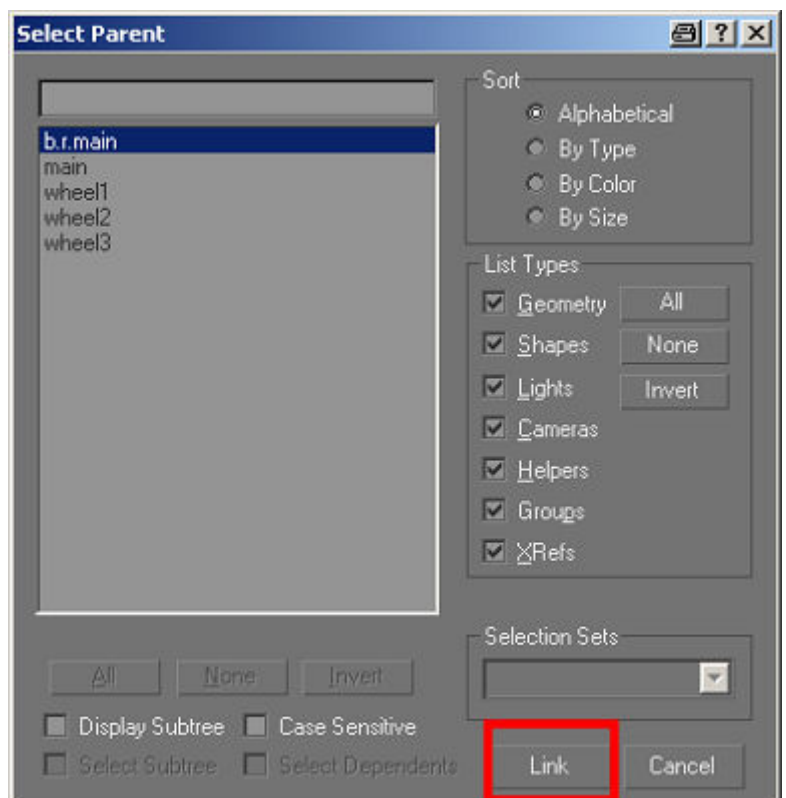
It's vital to pick the correct objects and to link them to the right dummies or you'll have this rotating about the wrong centres.

Press 'H' and open the 'Select Objects' dialog and choose 'b.r.wheel1', 'b.r.wheel2' and 'b.r.wheel3'.
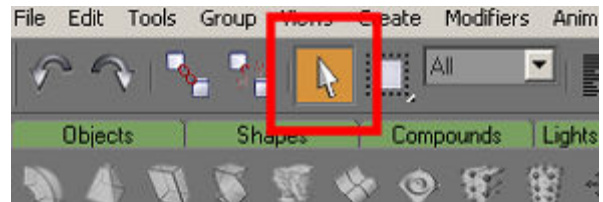
Now click on the 'Select and Link' icon in the top toolbar, followed by the 'H' key again to open the 'Select Objects' dialog box.

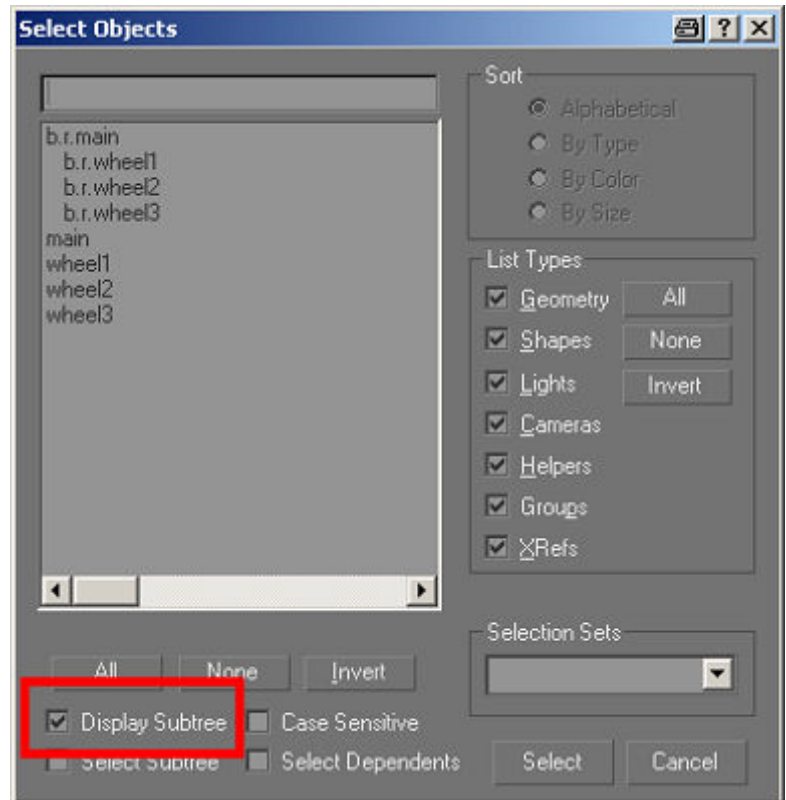Select the 'b.r.main' dummy and click on 'Link'. .

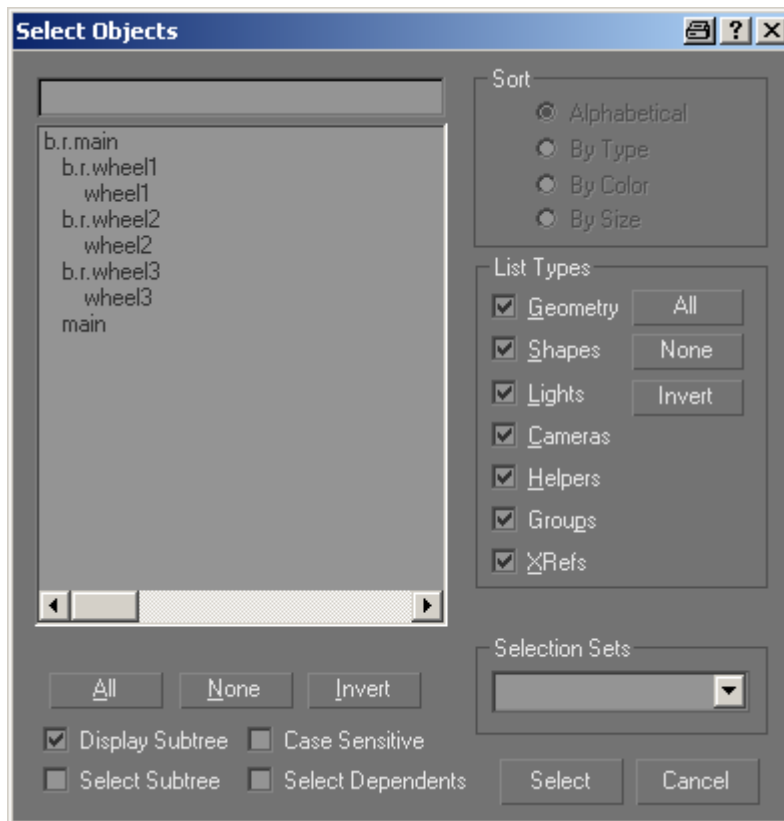Select the 'Select Object' icon in the top toolbar and press 'H' again.

Select the option 'Display Subtree' and you can now see representation of the linking in that things that are linked are shown indented.

Important! When the bogey is exported only 'b.r.main' and anything linked to it will be included in the export!

We need to link 'main' to 'b.r.main', ,wheel1' to 'b.r.wheel1, 'wheel2' to 'b.r.wheel2' and 'wheel3' to 'b.r.wheel3'.
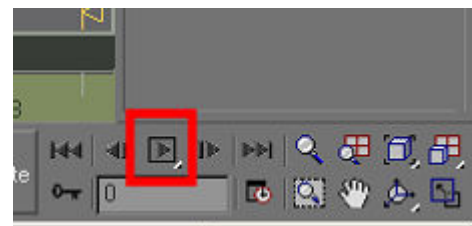
The final tree should look like this:

As you can see the non-animated bits ('main') is linked to 'b.r.main'. If the non-animated parts where split into several objects it would be necessary to link all of them to 'b.r.main' so it's probably a good idea not to have too many of them.

I've seen and fixed a few bogey models over the past few years and a common mistake is that the linking was incorrect.

For a simple bogey without coupling rods we are done now, so we can hit the 'Play Animation icon and watch the wheels go round (hopefully).
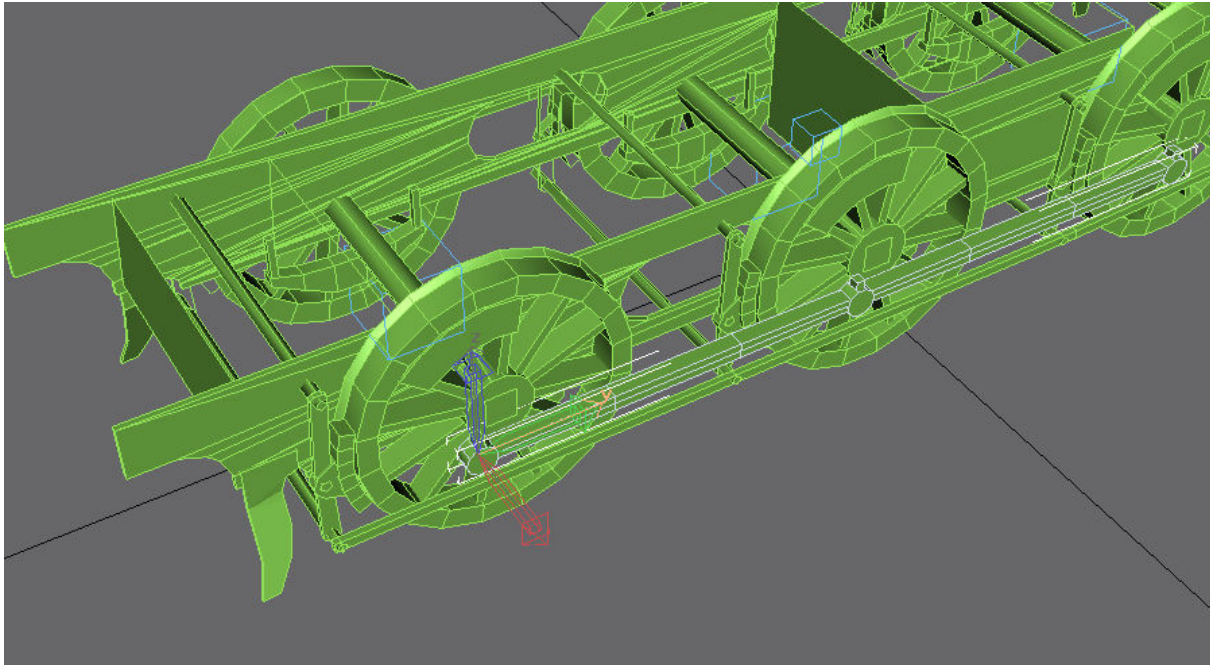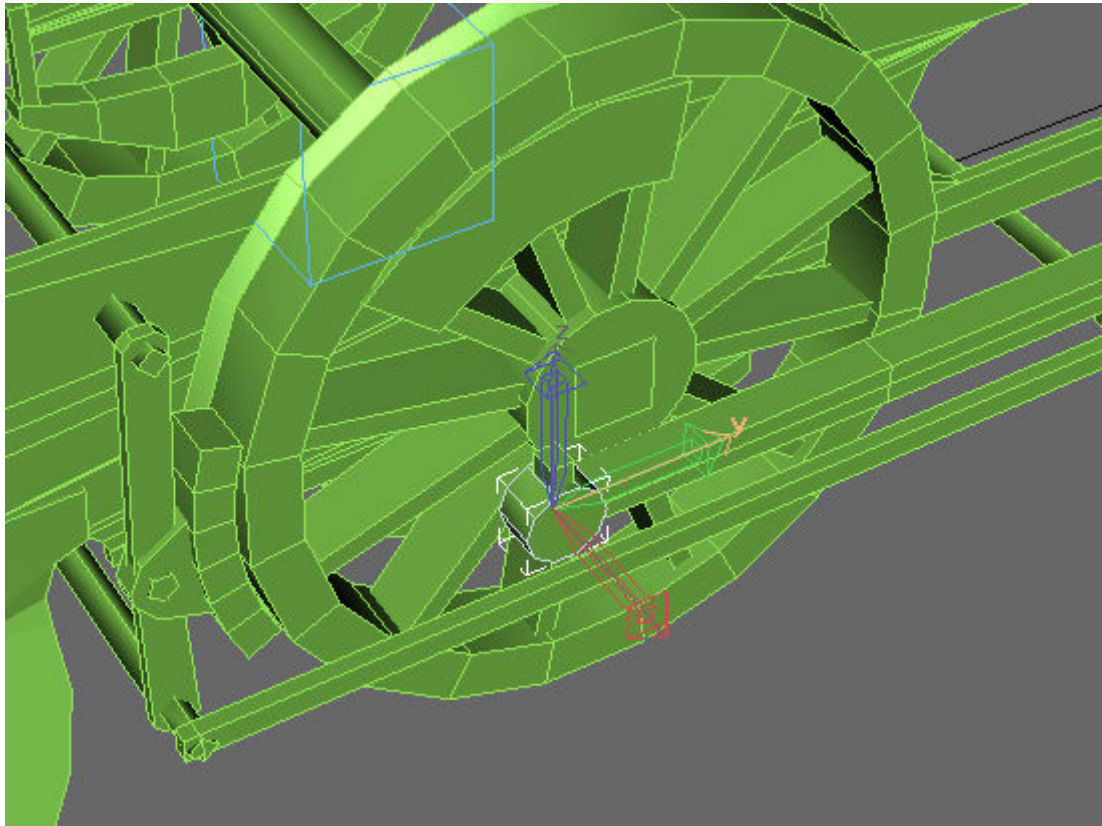

The coupling rods are also very easily animated, in this case though I'll need to detach them from the 'main' object.

I've made things a bit hard for myself by not modelling the rods at the bottom dead centre on the left hand side, so the first thing to do is to move the pivot point of each rod to the centre of the frontmost rod boss as we are going to have to position another couple of dummies at these points.

Detach the front rod boss from the rod and move the pivot point of the boss to the centre of the object. Now attach the rod back to the boss, which creates a single object with the pivot point centred on the boss.
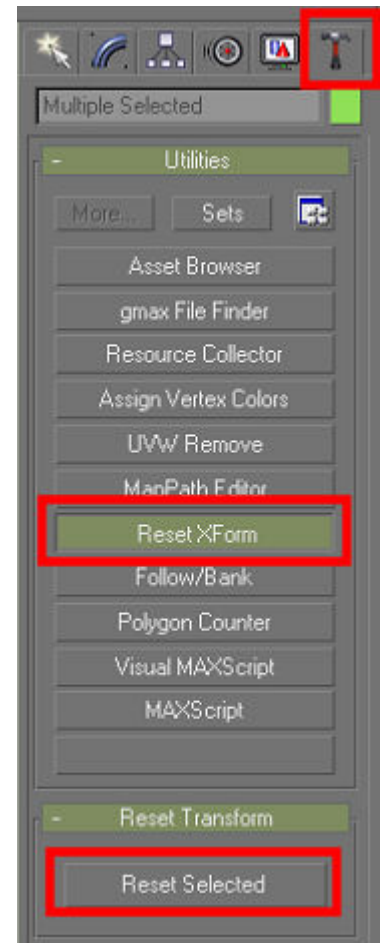
Repeat for the right hand rod.

It's also worth doing a 'Reset Xform' on the rods as these seem especially prone to getting turned inside out by the Trainz exporter, just select both rods and then in the 'Utilities' tab choose 'Reset Xform' and 'Reset Selected'
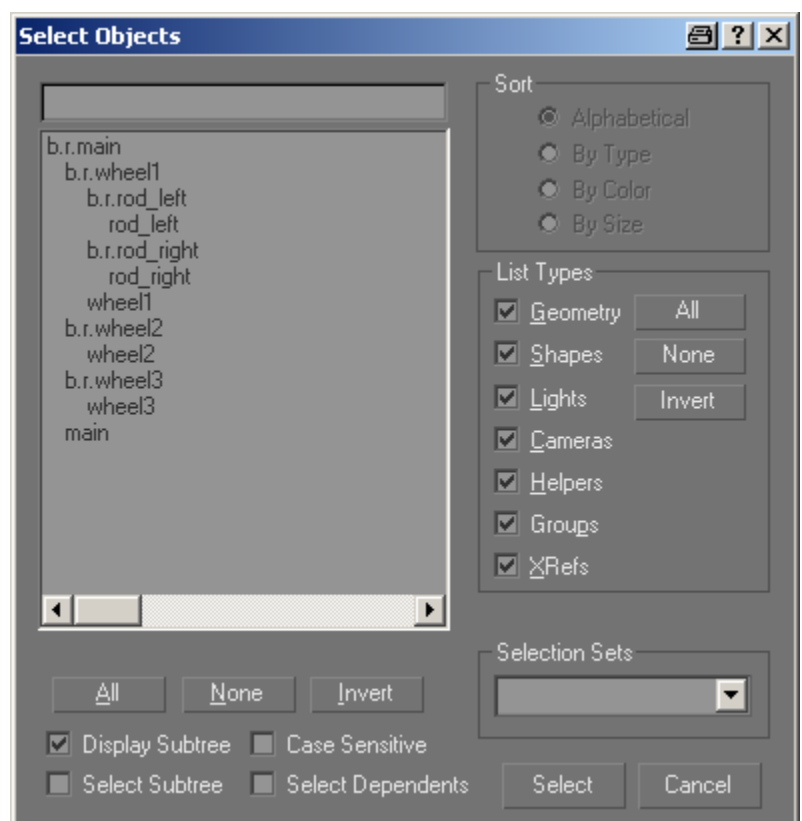
Select each rod object and do a 'Collapse all' on the modifier stack.

Create two more dummies in top view called 'b.r.rod_left' and 'b.r.rod_right' and align these with the pivot points of the objects 'rod_left' and 'rod_right'.

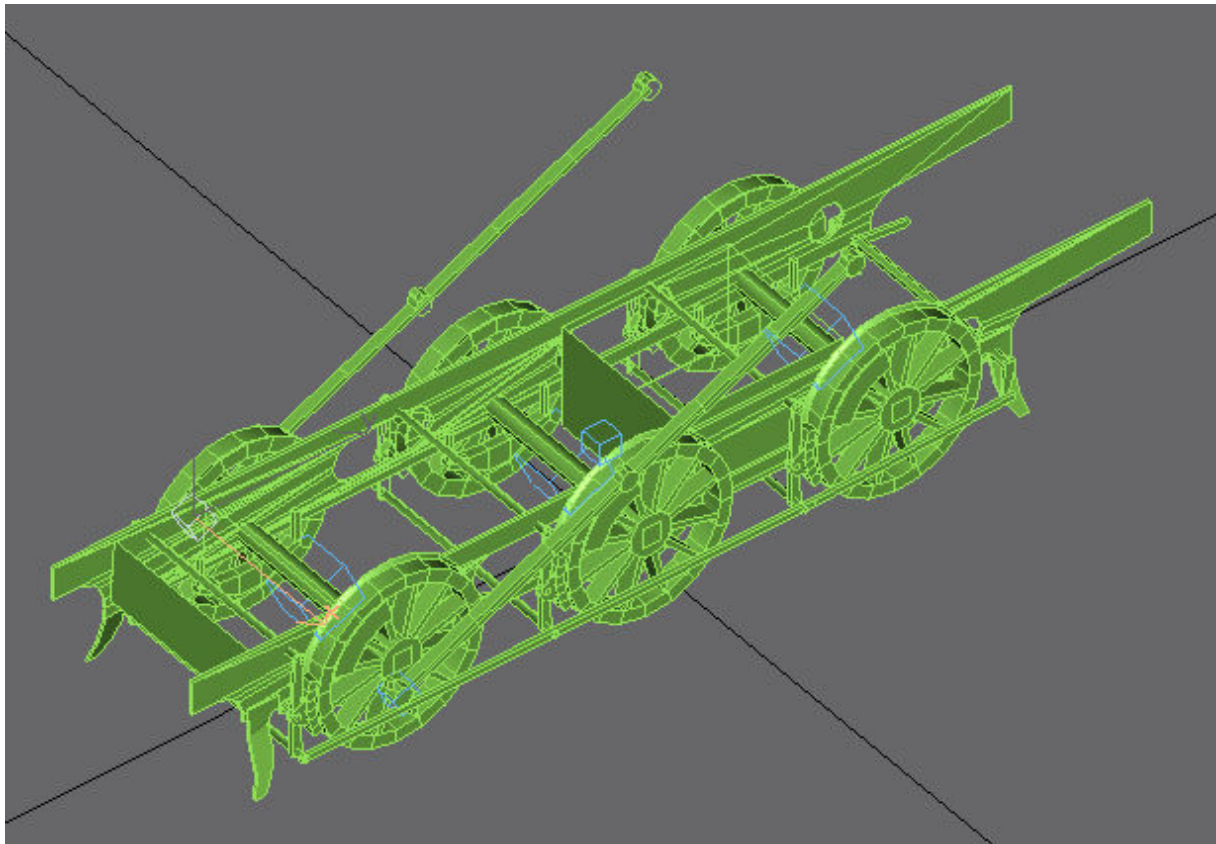Now using your newly acquired knowledge on how to link things together link 'rod_left' to 'b.r.rod_left', 'rod_right' to 'b.r.rod_right' and 'b.r.rod_left' and 'b.r.rod_right_ to 'b.r.wheel1'. Got all that? The new tree should look like this:

It doesn't matter in which order you do the linking.

If you now play the animation you'll notice a slight snag – the rods are rotating with the wheels…

Never mind, this is easily fixed. Select the dummy 'b.r.rod_left' and select the 'Hierarchy' tab and 'Link Info' and uncheck the 'Inherit -> Rotate X' box. This prevents the dummy from following the X rotation of the wheel, which is exactly what we need to keep the coupling rods level as the wheel rotates.

Repeat for the right hand side 'b.r.rod_right' and play the animation again – it should now be OK.

Congratulations, you now have a working animated bogey that can be exported into Trainz.

This principle can be used for any bogey, it doesn't matter how many wheels it has or how complicated the valve gear is. You can always animate the wheels and coupling rods this way. It's not as hard as it's made out to be, creating the wheels and rods in the first place will take you longer than animating them.

Any questions, requests for more explanation or corrections needed – please mail me at paul.hobbs@web.de