Digitizer Leapfrogging

Leapfrogging lets you digitize objects that are larger than your digitizing arm. You start with one section of the object, then leapfrog around by creating leapfrog stations in both Rhino and on the object to digitize.

In this tutorial, the front corner of a car is digitized. You could continue the process all the way around the car. This process also works when you need to flip an object over, or move the object rather than the digitizing arm.

## Orienting Rhino with the Real World

The first step in all digitizing projects, whether you need to leapfrog or not, is to orient Rhino with the real world. Because Rhino's coordinate system has a natural "up" direction, it is easiest if the first step in digitizing is to orient Rhino with a corresponding flat plane in the real world. The ground or a table top is a good choice.

To orient Rhino with the real world:

1   From the **Tools** menu, click **3-D Digitizing**, then click **Calibrate**.

2   Select your digitizing arm from the list, and press Enter.

3   At the **Select origin with the digitizer** prompt, pick a point on the ground.

   A good point to choose is near the driver's side front tire.
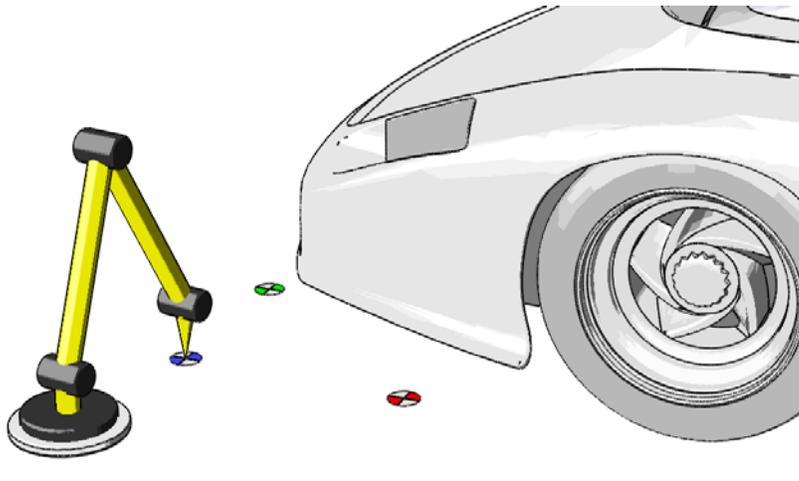
4   At the **Select X axis** point with digitizer prompt, pick a point behind the front tire.

   Try to make the line formed by the first two picks parallel to the body of the car.

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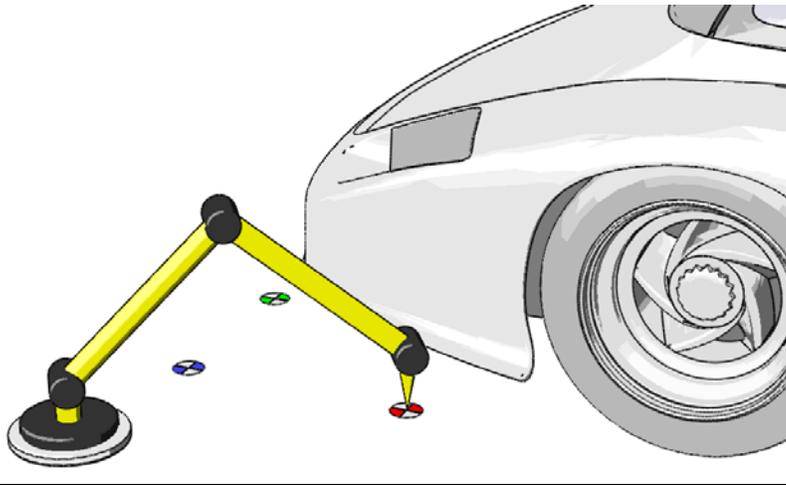
5 At the **Select Y axis** with digitizer prompt, pick a point toward the other front tire.

You now have a plane defined that will correspond to the world XY plane in Rhino.
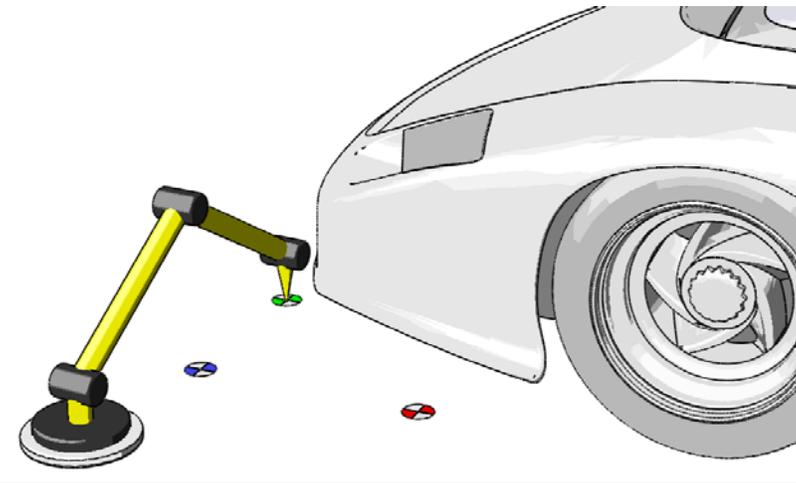
6 At the **Enter Origin in Rhino** prompt, press **Enter**.

Pressing **Enter** tells Rhino to orient the points you picked with the digitizer with the world XY plane. This is the plane visible in both the Top and Perspective viewports.

Display the Extents of Your Digitizer

Rhino now knows the orientation of your digitizing arm, but does not know the size of the object you will be modeling. It can be frustrating to start digitizing but not see anything appear on screen. This is simple to fix by drawing a simple polyline that establishes the extents to which your digitizing arm can reach.

To set the extents and zoom the viewports:

1   Draw a polyline by picking several points with the digitizing arm.

Be sure to choose points that are as far away from each other as possible.

2   Select the polyline.

3   From the **View** menu, select **Zoom**, then select **Selected All**.

4   Delete the polyline, since you don't need it anymore.

All your viewports are now zoomed to the extents of the reach of your digitizing arm. You will be able to see everything that you digitize.
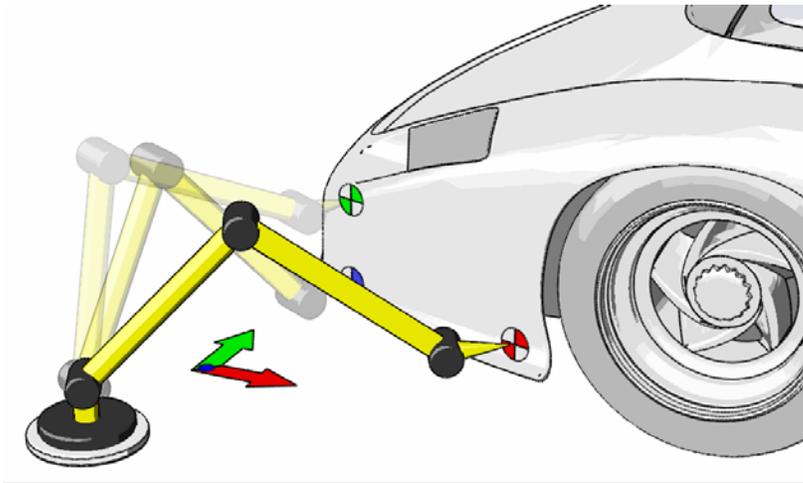
At this point, you have the world oriented with Rhino. Notice that we've really done nothing with the object that you're going to digitize. This is the next step:

## Create the First Leapfrog Position in Rhino

Before digitizing any of the object, you should create at least one leapfrog position. This makes it possible for you to recalibrate the digitizing arm to your object. This is very useful if you accidentally move the digitizing arm or the object.

To create a leapfrog position:

1   Mark three points on the object.

These points are the first leapfrog position. They should be in the shape of an approximate right triangle (it doesn't matter if it's exactly a right triangle, just eyeball it). The points should be 4-6 inches apart from each other. The further you space the points, and the closer to a 90 degree angle the form, the more accurate the calibration will be.

2   Label the points **O**, **X**, and **Y** for "Origin," "X," and "Y."

In the images that follow, blue targets correspond to the origin, red targets correspond to X, and green targets correspond to Y.

3   In Rhino, **draw a polyline** between the three points.

Start with point **Y**, then **O**, then **X**. You will see an L-shaped two-segment polyline in Rhino. This is your first leapfrog position.

4 Use the **Dot** command to create dots labeled O, X, and Y at the appropriate places on the polyline.
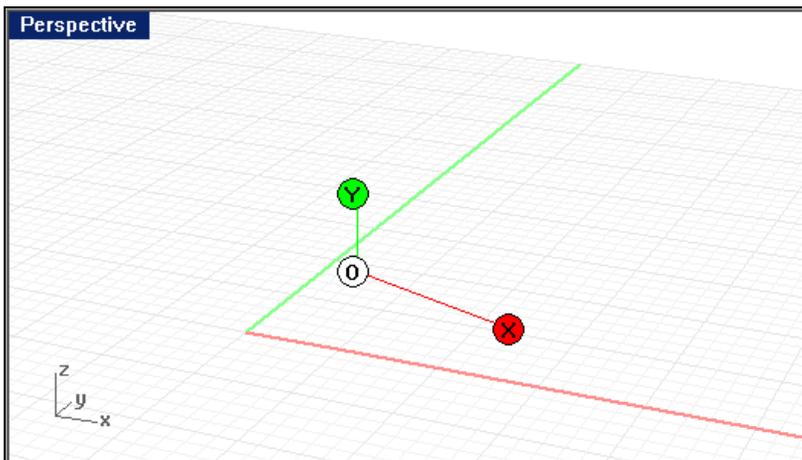

5 **Save** your work.

At this point, you have Rhino oriented with the object you are going to digitize. If you save your work now, you will be able to easily recalibrate Rhino with the points marked on your object. See the section "Moving the Digitizing Arm or the Object" below.

Digitize Some Curves

Now that the digitizing arm is oriented with Rhino, and you have reference points both in Rhino and on your object, you can begin digitizing.

Digitize curves on the object in such a way that it will be easy for you to use Rhino's surface modeling commands to create the surfaces of the object. This tutorial only provides a superficial view of digitizing strategies in order to focus on how coordinate systems and leapfrogging works.

After a few minutes of digitizing, the curves might look like this.
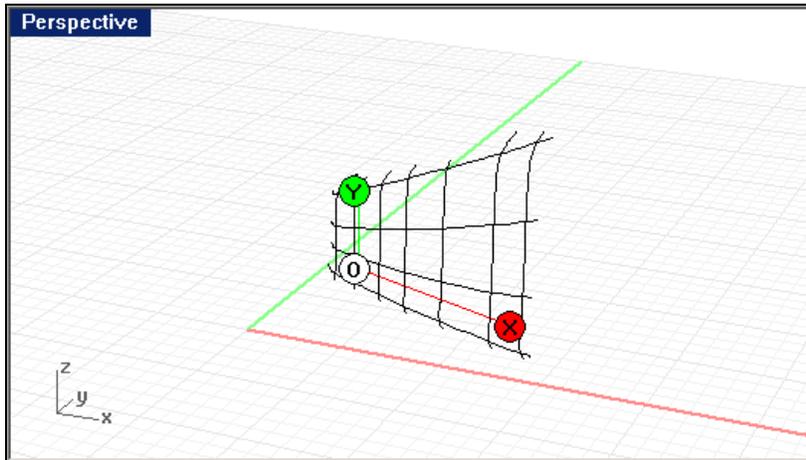
Moving the Digitizing Arm or the Object

Once you move the arm, or the object you're digitizing, you will need to recalibrate Rhino. This is simple, since you have the leapfrog positions marked on your object, and you have the corresponding objects in your Rhino model.
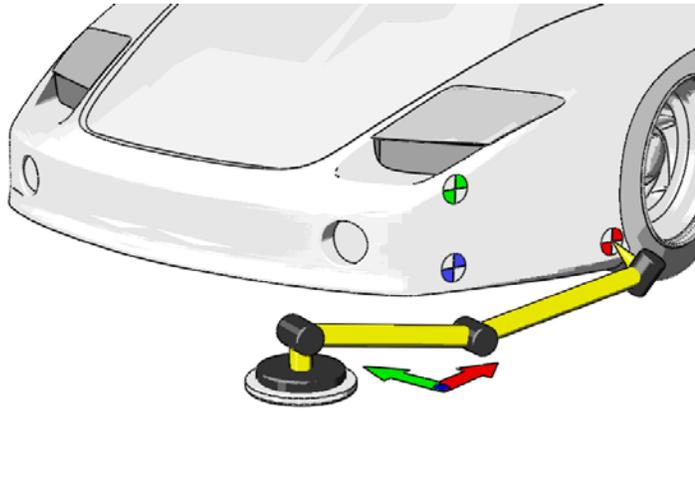
To recalibrate Rhino's position:

1   From the **Tools** menu click **3-D Digitizing**, then click **Calibrate**.

2   At the **Select origin with the digitizer** prompt, pick the point marked **O** on your object.
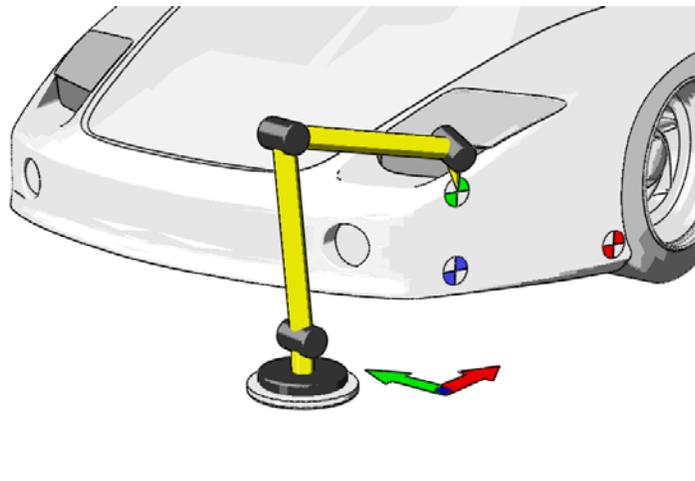
   This is the origin of the leapfrog position.
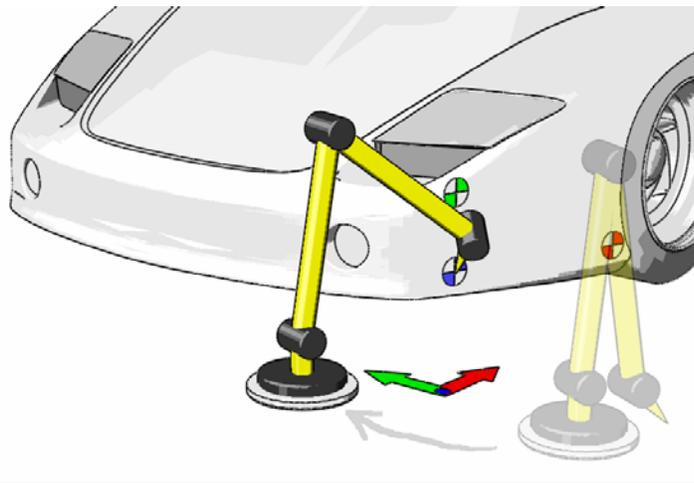
3   At the **Select X axis point with digitizer** prompt, pick the point marked **X** on your object.
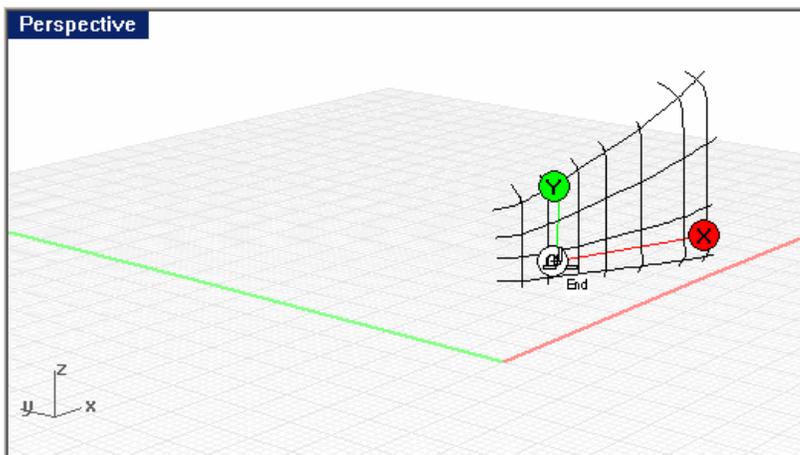
   This is the X axis of the leapfrog position.

4 At the **Select Y axis with digitizer** prompt, pick the point marked **Y** on your object.
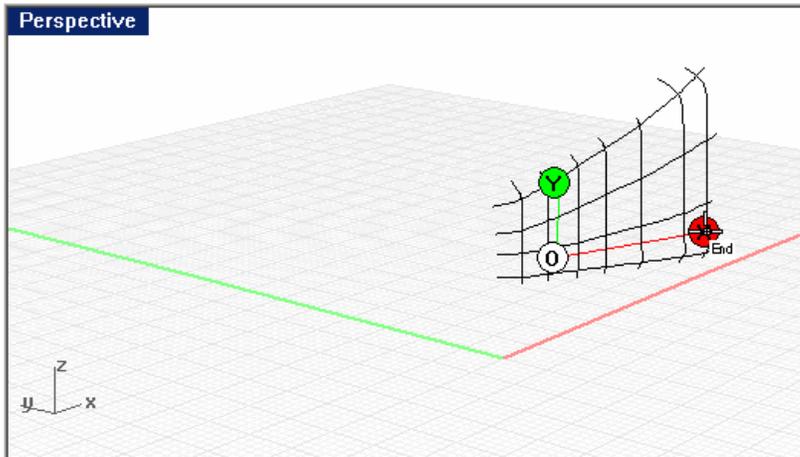
This is the Y-axis of the leapfrog position.

5 At the **Enter origin in Rhino** prompt, use the **End** object snap to snap to the corner of the polyline that represents this leapfrog position.
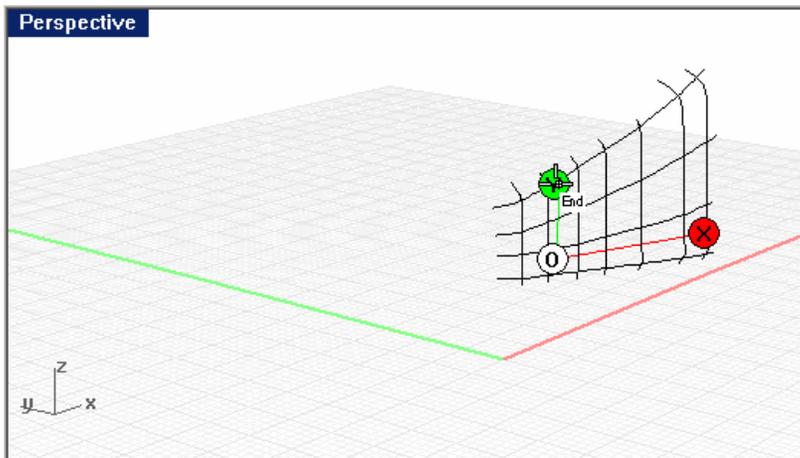
6 At the **Enter X axis in Rhino** prompt, use the **End** object snap to snap to the X end of the polyline that represents this leapfrog position.
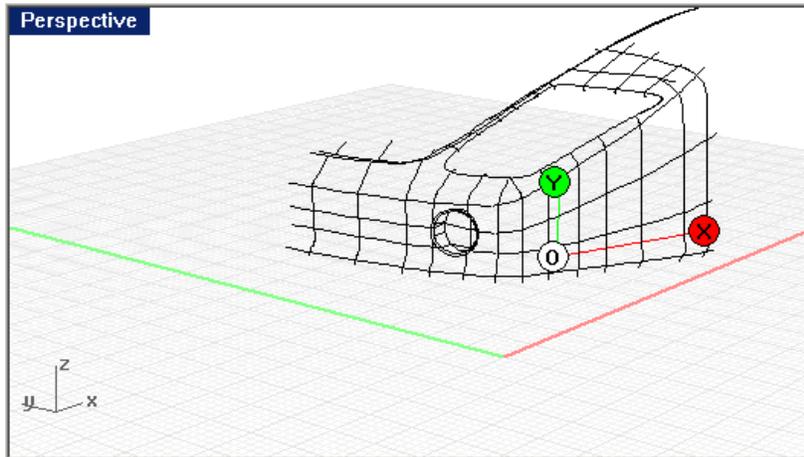

7 At the **Enter Y axis in Rhino** prompt, use the **End** object snap to snap to the Y end of the polyline that represents this leapfrog position.

Continue Digitizing

Continue digitizing. You now might have something that looks like this:

Create a new leapfrog position on another part of the vehicle, and keep digitizing.