GEN11219

The Most Dynamic Class on the Block – Creating Dynamic Blocks in AutoCAD

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Learning Objectives

- Learn how to create Dynamic Blocks with the following abilities: stretch, mirror, array, rotate, align, multiple insertion points
- Learn how to limit block variations through lists and increments
- Learn how to apply constraints and parameters to control block behavior
- Learn how to implement Block Tables as well as the Lookup Action to quickly select the desired block iteration

Description

Why should you be using dynamic blocks? Quite simply, dynamic blocks can greatly reduce the number of blocks in your library, improving your efficiency. While it does take a little more time up front to create a dynamic block, the timesavings on the back end are well worth the effort! Even better news: if you are a proficient user of AutoCAD software, you should have no problem converting those boring, static blocks into shiny, new, dynamic blocks.

Your AU Expert

Tracy Chadwick serves as coordinator and instructor for the Computer Drafting Technology program at Hutchinson Community College (HCC) in Hutchinson, Kansas. He is responsible for teaching a wide range of courses, including those on engineering graphics, AutoCAD software, Inventor software, and Revit Architecture software. Prior to his role in the Associate Degree program, Tracy served as the manager and instructor of HCC's Autodesk Authorized Training Center from 2001. In 2007 Autodesk recognized Tracy with the North America Award for Distinguished Performance in AutoCAD Software Training. Tracy holds professional certifications for AutoCAD software, Inventor software, and Revit Architecture software, and he is an Autodesk Certified Instructor for AutoCAD.

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Introduction to the block creation environment

Why should you be using dynamic blocks? Quite simply dynamic blocks can greatly reduce the number of blocks in your library, improving your efficiency. While it does take a little more time up front to create a dynamic block, the time savings on the back-end are well worth the effort! Even better news: if you are a proficient user of AutoCAD, you should have no problem converting those boring, static blocks into shiny new dynamic blocks!

To see the benefit of dynamic blocks, let's look at the dynamic Door block that appears on the Architectural Tool Palette. This door contains the following options:

- Three door jam sizes
- Six door widths
- Five opening options
- Flip horizontally
- Flip vertically
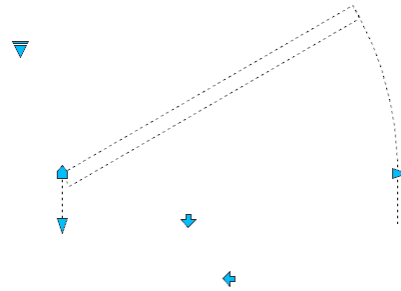
Multiply all those options and you are looking at 360 possible combinations, all replaced by one dynamic block!

Before we begin creating dynamic blocks, let's first start with a rundown of the block creation environment.

There are multiple ways to enter the block creation environment. Many times you can simply double-click on a block. However, if the block has attributes associated with it, double-clicking will instead bring up the attribute editor. Accordingly, there are alternative methods for entering the block creation environment. With a block selected, you can right click and select **Block Editor**. You can also select the block editor from the Block panel located on the Home tab.
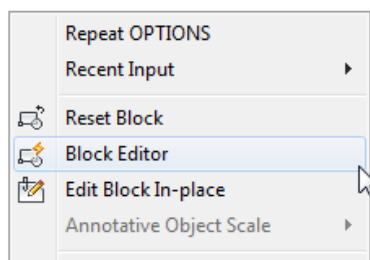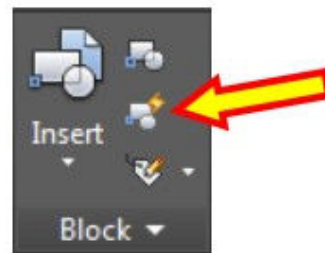
Right Click Menu   Home > Block > Edit

You may already be familiar with the block creation environment; it is the same environment used to create and edit static blocks. The ability to turn static blocks into dynamic blocks comes from the **Block Authoring Palette**. Typically the palette opens by default when you enter the block creation environment. If it has been closed, you can open it by clicking on the **Authoring Palettes** button located in the **Manage** panel on the **Block Editor** contextual tab.
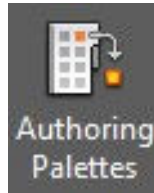
The **Block Authoring Palette** contains four tabs: **Parameters**, **Actions**, **Parameter Sets**, and **Constraints**.
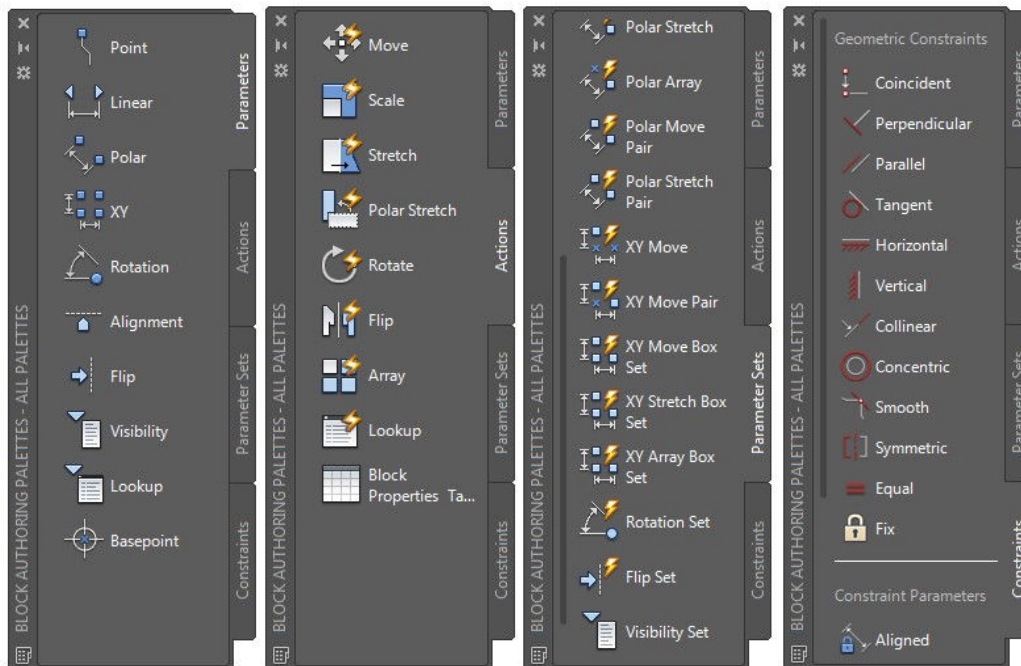
Every dynamic block begins with a Parameter. One example of a parameter is a linear dimension that controls the length of an object.

Most (but not all) dynamic blocks require an Action to go with the Parameter. For example, a block can be stretched or scaled when a linear dimension value is changed.

Parameter Sets allow you to complete the process with a few less clicks; a set is the parameter and action all rolled into one.
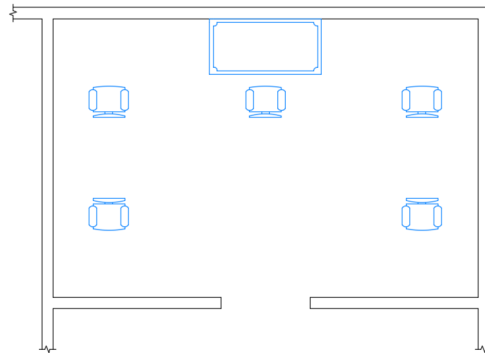
Constraints can be added to a dynamic block to further define what happens to the geometry as the parameters change.

Create Dynamic Blocks with the following abilities: stretch, mirror, array, rotate, align, and multiple insertion points
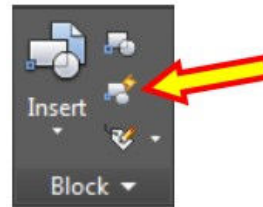
Adding Points to a Block

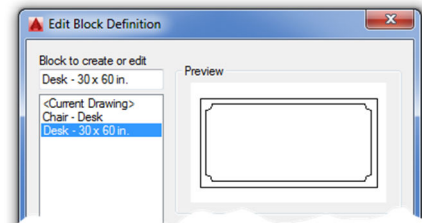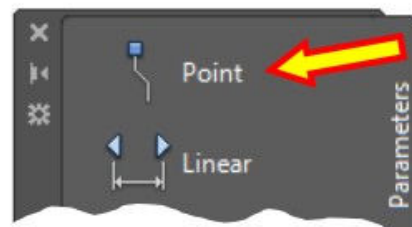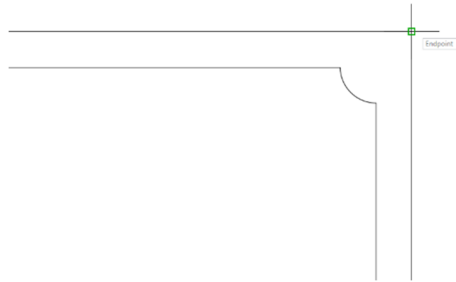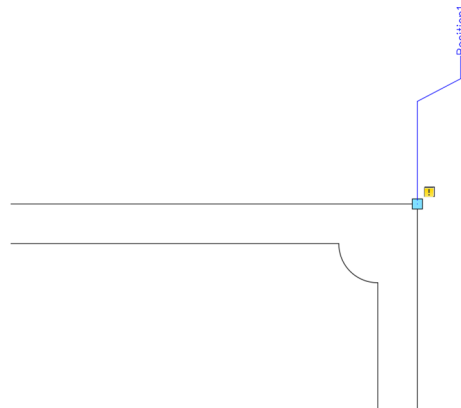| |
|---|
| *In this lesson you will add multiple points to a block so that you can more quickly insert a block by cycling through insertion points.* |
| Open the drawing titled ***Study Hall.dwg***. |
| Enter the Block Editor by double-clicking the block you wish to edit, in this case the desk. Alternatively you can click on **Home>Block>Create Block**. |
| Confirm that the appropriate block is selected, in this case **Desk – 30 x 60 in.** Click **OK**. |
| Select the **Point** Parameter. |

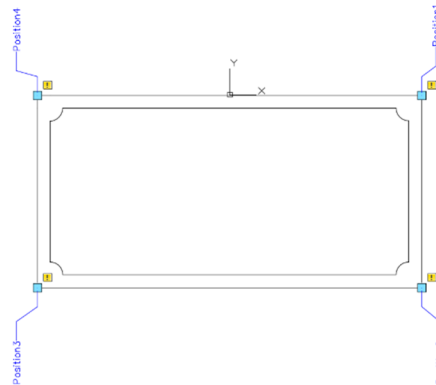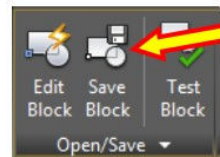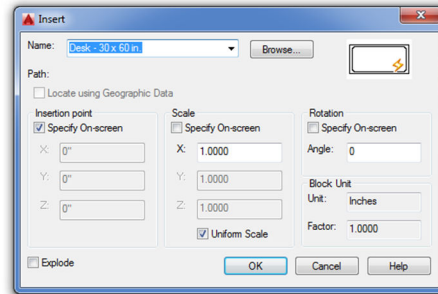|	
Use the Endpoint Snap to select the upper right corner of the desk.	
Click above the selected point to place the **Position 1** label. *The exclamation point means that there has not been an action associated with this parameter. In many cases this problem needs to be solved. For our purposes we can ignore the exclamation point because we will not be adding an action.*	
Repeat the process for the other four corners. For best results continue clockwise from the first point. This will provide a smoother transition between insertion points later when you are inserting the block.	
Click on **Save Block** **Block Editor>Open/Save>Save Block**	
Close the Block Editor **Block Editor>Close>Close Block Editor**	
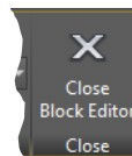
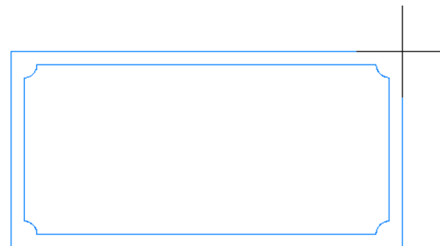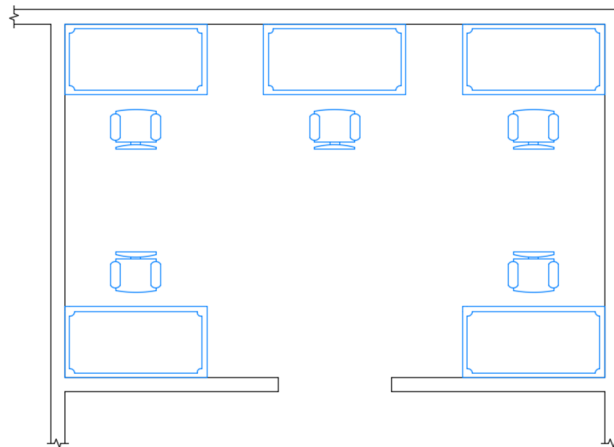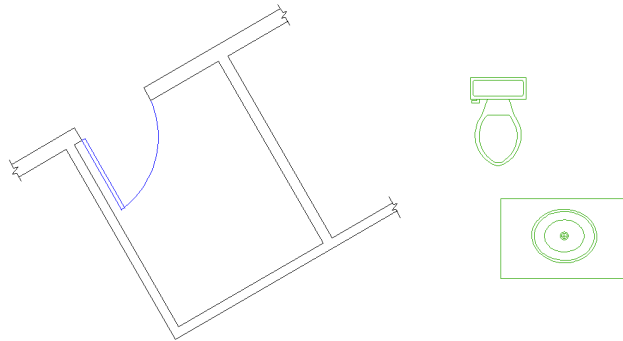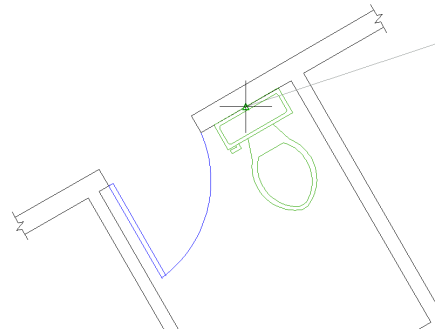|	
Click on **Insert Block**	
Select the **Desk – 30 x 60 in.** block *Notice the lightning bolt in the thumbnail preview. This means that it is a dynamic block!* Click **OK**.	
Press the **<Ctrl>** key to cycle between insertion points	
Continue inserting and cycling through insertion points to complete the Study Hall drawing.	
Save and close the drawing	

Adding the Alignment Grip to a Block

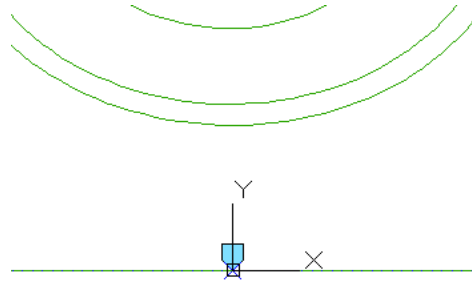| |
|---|
| *In this lesson you will add an alignment grip to a block so that you can effortlessly align a block to existing geometry.* |
| Open the drawing titled ***Half Bath.dwg***. |
| Using the alignment grip on the toilet place the toilet on the midpoint of the wall next to the door. |
| *Next we will edit the **48 x 30 Cabinet with Sink** block so that it also has the ability to align to existing geometry.* |
| Double click on the **48 x 30 Cabinet with Sink** block to enter the Block Editor. |
| Click on the **Alignment** Parameter located on the **Parameters** tab in the **Block Authoring Palette.**

The Alignment tool does not require an action; you will only be adding the parameter. |
| Click on the midpoint of the bottom line of the cabinet. |

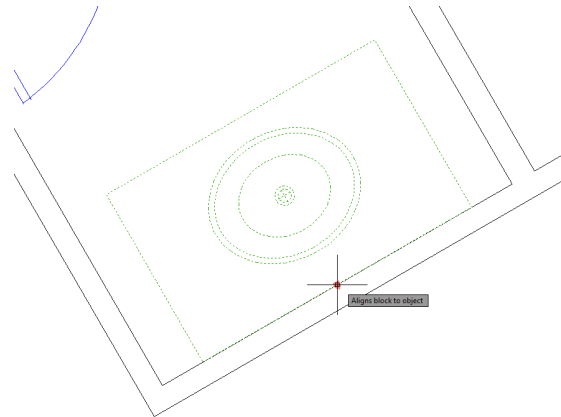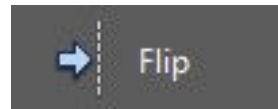|	
This is the original base point of the block and currently displays the UCS icon.	
Click the bottom left endpoint of the cabinet. *We have now defined the edge of alignment. The Alignment grip now displays.* *Notice that it is pointing to the outside of the cabinet. This indicates the direction in which AutoCAD will align this block.*	
Click on **Save Block**. Click **Close Block Editor**.	
Click on the **48 x 30 Cabinet with Sink** block. Use the newly created alignment grip to center the cabinet on the wall opposite from the toilet.	
Save and close the drawing	

Adding the Flip Action to a Block

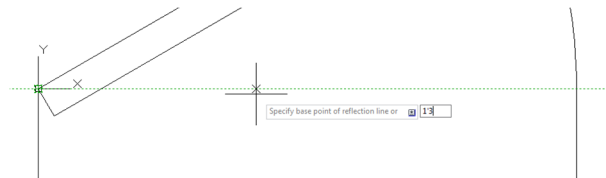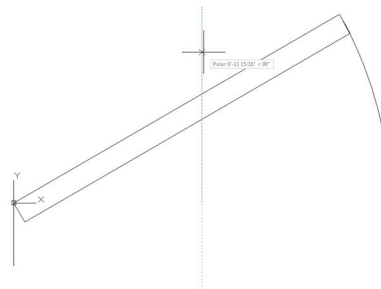| |
|---|
| *In this lesson you will add a Flip grip to a block so that you can quickly mirror it without starting the Mirror command.* |
| Open the drawing titled ***Door.dwg***. |
| Double click on the **Door** block to enter the Block Editor. |
| Click on the **Flip** parameter located on the **Parameters** tab in the **Block Authoring Palette.** |
| Using OTRACK, place the first point 1'-3" to the right of the origin of the block. |
| Place the second point directly above the first. Make sure to use Polar Tracking to achieve a vertical line. *This will act as the mirror axis.* |
| Place the parameter name above the axis. |
| *A warning symbol appears next to the grip because an action needs to be associated with the parameter in order to function.* |

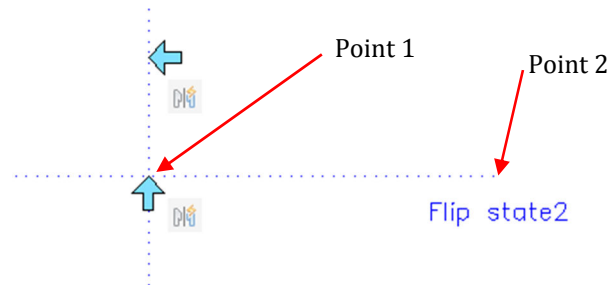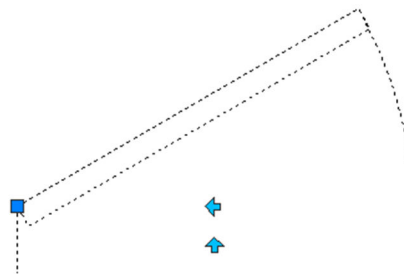|	
Switch to the **Actions** tab in the **Block Authoring Palette.** Click on the **Flip** action.	Flip
You are prompted to select a parameter. Click on the Flip state parameter that was just created.	Flip state1
Next you are prompted to select the objects that will be flipped. Select everything in the block.	
The steps to create the second Flip action are quite similar. When placing the **Flip Parameter** track 3" below the first Flip grip and click to place the first point. The second point will be straight to the right, followed by placing the parameter name. Repeat the steps above to add the flip action.	Point 1 Point 2 Flip state2
Click on **Save Block**. Click **Close Block Editor**.	
Test out the newly created Flip grips!	
Save and close the drawing.	

Adding the Rotation Action to a Block

| |
|---|
| *In this lesson you use the Rotation Parameter Set add the rotation action to a tree. You will see the difference between adding a Paramter Set rather than adding the Parameter and Action separately.* |
| Open the drawing titled **Trees.dwg**. |
| Double click on the **Clump of Trees or Bushes - plan** block to enter the Block Editor. |

Click on **Rotation Set** located on the **Parameter Sets** tab in the **Block Authoring Palette**.	Rotation Set
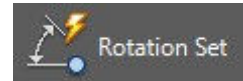
|	
At the **Specify base point** prompt click the origin point or type **0,0**. At the **Specify radius of parameter** prompt click approximately 7'-0" to the right of the first point. *This is where the rotation grip will appear.* At the **Specify default rotation angle** prompt press **Enter** to accept the default rotation angle of **0**.	Point 2 ... Point 1
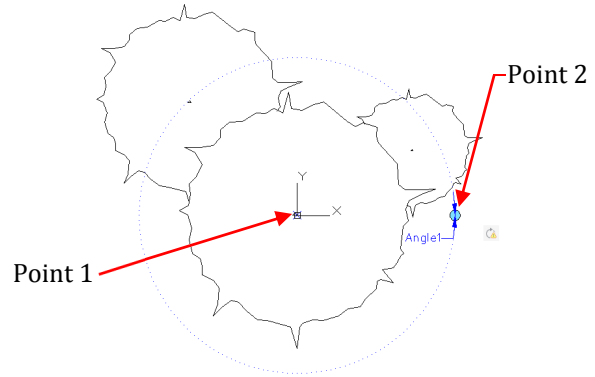
|	
*A **Rotate** action symbol appears. It displays an exclamation because no objects have been associated with the action.* **Right Click** on the symbol and select **Action Selection Set > New Selection Set**. Select all components of the block. Press **Enter**.	Delete · Action Selection Set ▸ New Selection Set / Modify Selection Set · Rename Action · Show All Actions · Hide All Actions
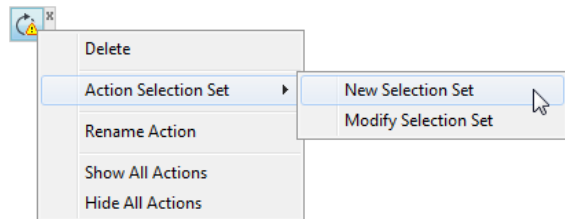
Click on **Save Block**. Click **Close Block Editor**.

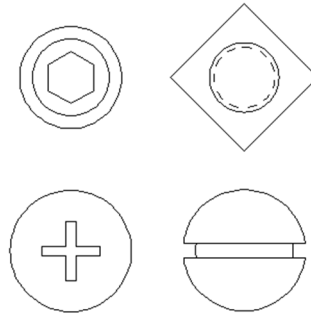|	
Use the newly created **Rotate** grip to rotate the trees.	
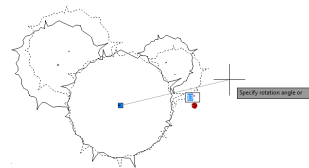
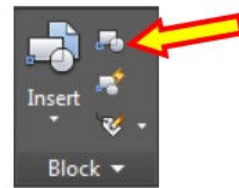| |
|---|
| Save and close the drawing. |

Adding the Visibility Grip to a Block

In this lesson you use the Visibility parameter to combine several blocks into one. A drop-down list will present you with the different views of the block.

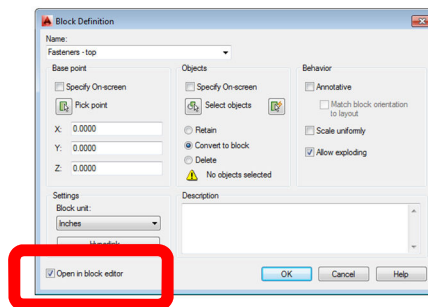|	
Open the drawing titled **Fasteners.dwg**. *The drawing consist of four blocks that each show the top view of a different fastener. You will be combining these into one block that will allow you to choose which one is visible.*	
Click on the **Create** button located on the **Block** panel on the **Home** tab.	
Name the block **Fasteners – top**. Confirm that the base point is set to 0,0,0. Do not select any objects. Click on **Open in block editor**, located in the lower left corner of the dialog box. Click **OK**.	
A message appears indicating that you have not selected any objects for the block. This is okay…Click **Continue**.	
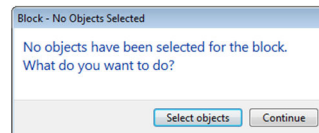
You are now in the block editor…but it is empty. Now it is time to add some fasteners.
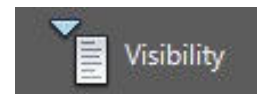
Start the **Insert** command.

Select the **Hex Cap Screw ½ in. -top** block.

Confirm that the Insertion point is 0,0,0 and that it is inserting at full scale, zero rotation.

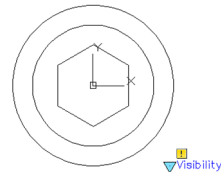Click on **Explode**. *This will prevent nested blocks.*
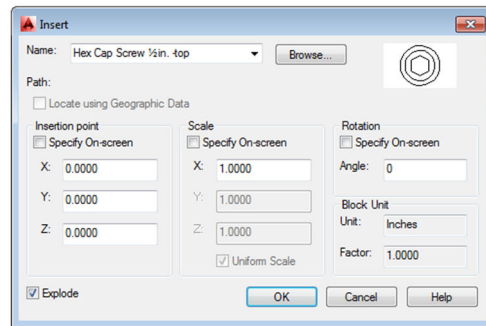
Click on the **Visibility** parameter located on the **Parameters** tab in the **Block Authoring** Palette.

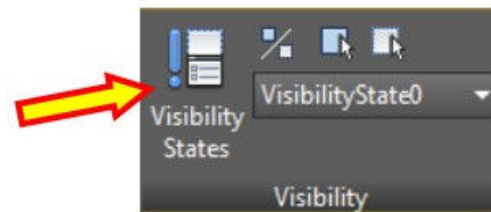
Click to place the parameter near the drawing.

This is where the drop-down grip will appear, allowing you to change the visibility of the block.

There is not an action to associate with the **Visibility** parameter.

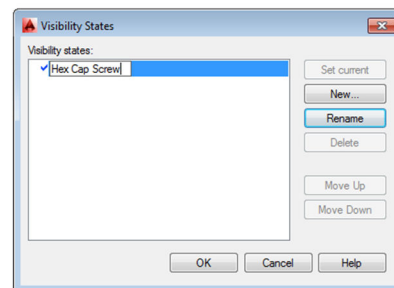*Instead, the **Visibility** panel on the **Block Editor** tab is now available for use.*

Click on **Visibility States**.

Click the **Rename** button.

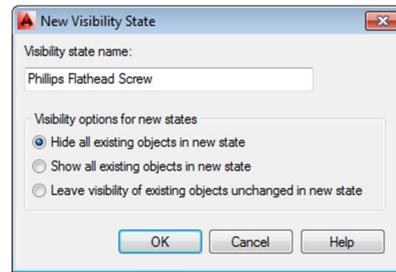Name the Visibility State **Hex Cap Screw**.

Click the **New** button.

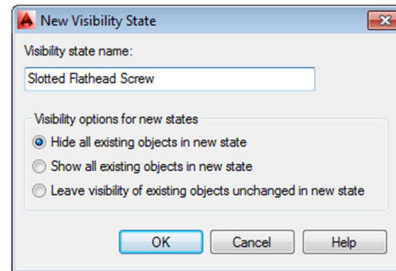|	
Name the new visibility state **Phillips Flathead Screw**. Select the radio button next to **Hide all existing objects in new state**. Click **OK** in both dialog boxes. Once again the screen is blank.	
Insert the block titled **Phillips Flathead Screw ½ in. -top**. Once again confirm that it is inserting full scale and at zero rotation at 0,0,0. Check **Explode** if necessary.	
Click on **Visibility States** located on the **Visibility** panel on the **Block Editor** tab. Click the **New** button in the **Visibility States** dialog box.	
Name the new visibility state **Slotted Flathead Screw**. Confirm that **Hide all existing objects in new state** is selected. Click **OK** in both dialog boxes. Once again the screen is blank.	
Insert the block titled **Slotted Flathead Screw ½ in. -top**. Once again confirm that it is inserting full scale and at zero rotation at 0,0,0. Check **Explode** if necessary.	
Click on **Visibility States** located on the **Visibility** panel on the **Block Editor** tab. Click the **New** button in the **Visibility States** dialog box.	
Name the new visibility state **Square Bolt**. Confirm that **Hide all existing objects in new state** is selected. Click **OK** in both dialog boxes. Once again the screen is blank.	
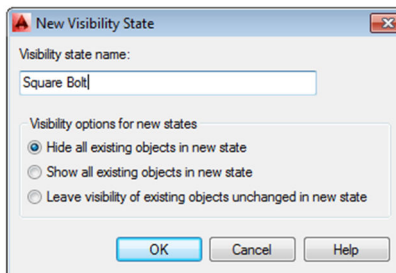
| |
|---|
| Insert the block titled **Square bolt ½ in. -top**. Once again confirm that it is inserting full scale and at zero rotation at 0,0,0. Check **Explode** if necessary. |
| Click on **Save Block**. Click **Close Block Editor**. |
| Insert the newly created block **Fasteners – top** anywhere on-screen.

If necessary select **Specify On-screen** for the **Insertion point**.

If necessary remove the check from **Explode**. |
| Insert the newly created block **Fasteners – top** anywhere on-screen.

Use the drop-down grip to change the visibility to the other fasteners.
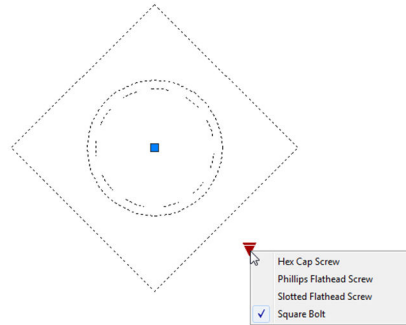
Hex Cap Screw
Phillips Flathead Screw
Slotted Flathead Screw
✓ Square Bolt |
| Save and close the drawing. |

Limit block variations through lists and increments

Adding the Stretch Action to a Block

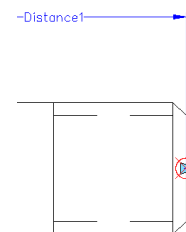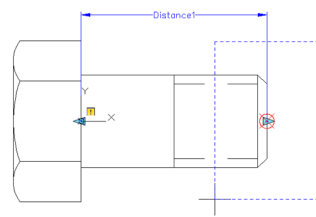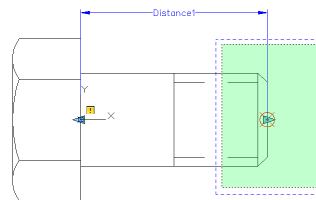| |
|---|
| *In this lesson you use the Linear parameter and Stretch action to create a block that can be quickly stretched. You will also use the List option to limit the allowable values.* |
| Open the drawing titled **Bolt.dwg**. |
| Double click on the **Hex Bolt ½ in. -side** block to enter the Block Editor. |
| Click on the **Linear** parameter located on the **Parameters** tab in the **Block Authoring Palette.** |
| Click on the two midpoints in the order shown in the image to the right.

Click above the drawing to place the Linear parameter.
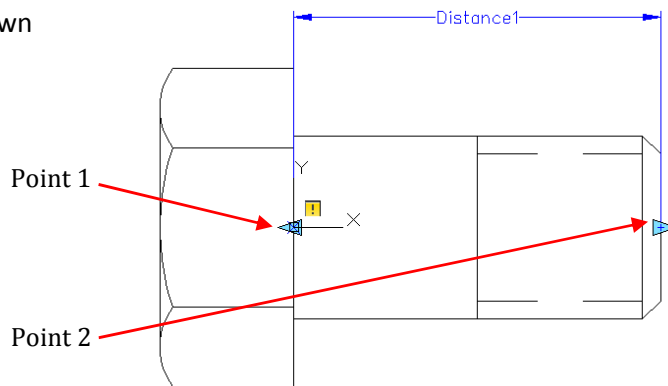
Point 1

Point 2 |
| Click on the **Stretch** action located on the **Actions** tab in the **Block Authoring Palette**. |
| When prompted to **Select parameter**, click anywhere on the **Distance1** Linear parameter that was just created. |
| You are prompted to **Specify parameter point to associate with action**. Click on the right-most point.

This will be where the stretch grip is placed. |

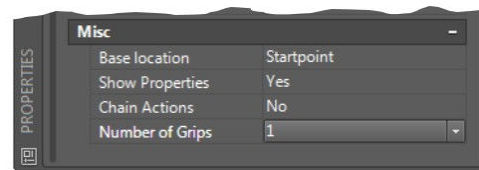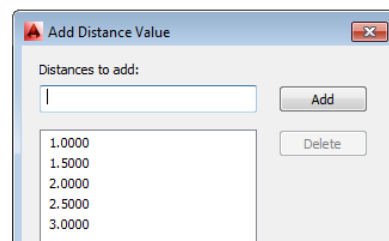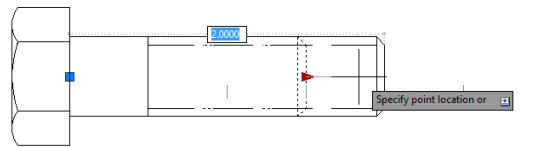|	
When prompted for a stretch frame select the geometry as shown. *This will allow only the threaded portion of the bolt to stretch. Just like when using the **Stretch** command you must select the geometry with a **Crossing** selection by moving right-to-left.*	
Next you are prompted to **Select objects**. Create a crossing selection very similar to the first to select the threaded portion of the bolt to be stretched.	
Now you will limit the lengths that the block can stretch to.	
Select the Linear parameter, then right click and select **Properties.**	
Scroll down to the **Misc** section. Modify **Number of Grips** from **2** to **1**.	
Scroll up slightly to the **Value Set** section. Set the **Dist type** to **List**. In the **Dist value list** row click the **Build** button to open the dialog.	
1.0000 is already set as the current value. Type **1.5** in the **Distances to add:** box, then click **Add**. Repeat the process to add **2**, **2.5**, and **3**. Click **OK**.	
Click on **Save Block**. Click **Close Block Editor**.	

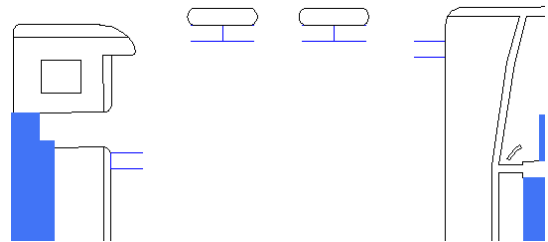|	
Modify the length of the bolt by using the newly created **Stretch** grip.	
Save and close the drawing.	

Adding the Array Action to a Block

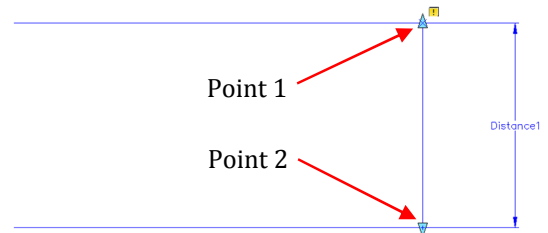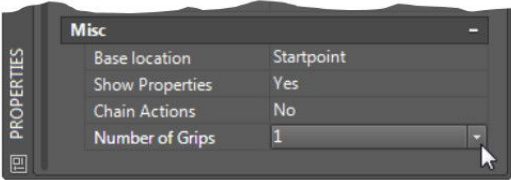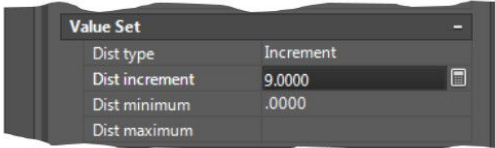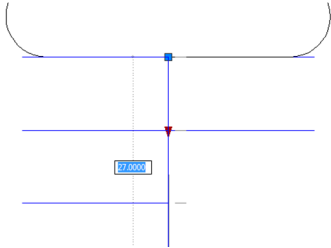|	
In this lesson you use the Linear parameter and Array action to create a parking stall block that can be arrayed quickly. You will also use the Increment option to limit the allowable values.	
Open the drawing titled **Parking Lot.dwg**. *The drawing includes a parking lot with a few copies of the **Parking Stall** block. You will be editing this block to add the array action so that it can be arrayed at a preset increment.*	
Enter the Block Editor by double-clicking on one of the copies of the **Parking Stall** block.	
Click on the **Linear** parameter located on the **Parameters** tab in the **Block Authoring Palette.**	
Click on the upper right corner of the parking stall to place the first point of the parameter. Click on the lower right corner to place the second point. Click to the right to place the **Linear** parameter. *An exclamation point appears above the first point. This indicates that an action needs to be added to the parameter.*	
Click on the **Array** action located on the **Actions** tab in the **Block Authoring Palette.**	

When prompted to **Select parameter**, click anywhere on the **Distance1** Linear parameter that was just created.	Distance1 Select parameter:
Next you are prompted to select the geometry to be arrayed. Select all components of the block. Press **Enter**.	
When prompted for the **Distance Between Columns** enter **9** (the width of the stall in feet). Press **Enter**.	
The exclamation point has disappeared, and an array symbol has taken its place.	
Select the Linear parameter, then right click and select **Properties.**	
Scroll down to the **Misc** section. Modify **Number of Grips** from **2** to **1**.	**Misc** Base location Startpoint Show Properties Yes Chain Actions No Number of Grips 1
Scroll up slightly to the **Value Set** section. Set the **Dist type** to **Increment**. Set the **Dist increment** to **9**.	**Value Set** Dist type Increment Dist increment 9.0000 Dist minimum .0000 Dist maximum
Click on **Save Block**. Click **Close Block Editor**.	
Use the newly created **Array** grip to complete each row of parking stalls.	27.0000
Save and close the drawing.	

Apply constraints and parameters to control block behavior

Implement Block Tables as well as the Lookup Action to quickly select the desired block iteration

Creating a Block List

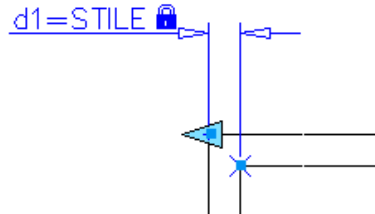| |
|---|
| *In this lesson you use constraints and parameters to limit the ways in which the Window block can change. Next you will create a Block List which will contain the allowable dimensions for the Window block.* |
| Open the drawing titled **Window.dwg**. |
| Double click on the **Double Hung Window** block to enter the Block Editor. |
| Click on **Auto Constrain** located on the **Geometric** panel on the **Block Editor** tab in the Ribbon.

Select all components of the block.

Press **Enter**. |
| Click on **Parameters Manager** located on the **Manage** panel on the **Block Editor** tab in the Ribbon. |
| Click the ☀fx button to create a new user parameter. |
| Name the Parameter **HEIGHT**.

Set the **Expression** to **4'**

Repeat the steps to create the three remaining user parameters as shown to the right. |

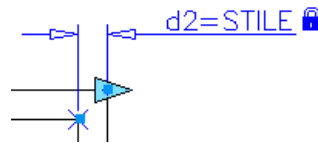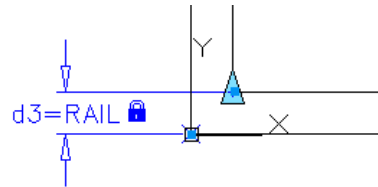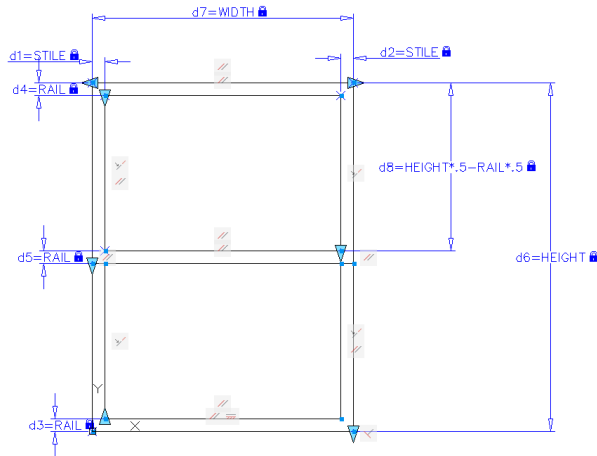|	
Click on the **Horizontal** dimensional constraint located on the **Constraints** tab in the **Block Authoring** Palette.	
Select the two endpoints on the **upper left** corner of the window. Click to place the parameter. Type **STILE** for the value.	
Repeat the process for the **upper right** corner of the window.	
Click on the **Vertical** dimensional constraint located on the **Constraints** tab in the **Block Authoring** Palette.	
Select the two endpoints on the **lower left** corner of the window. Click to place the parameter. Type **RAIL** for the value.	
Repeat the process for the **upper left** corner of the window as well as the meeting rail in the middle of the window.	
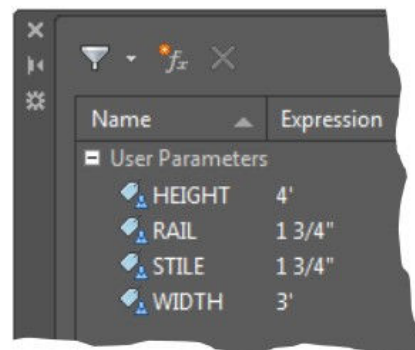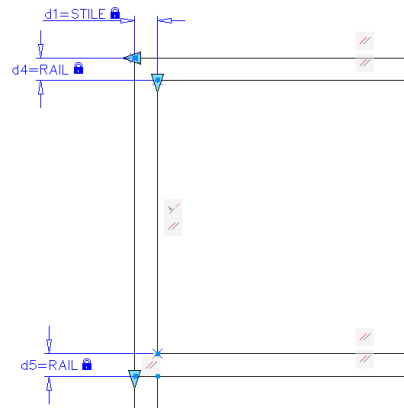
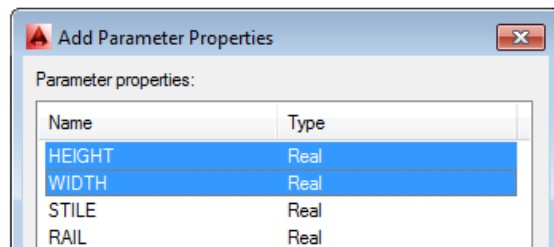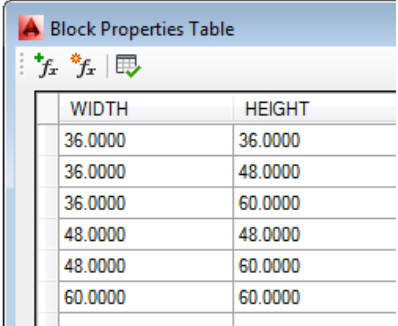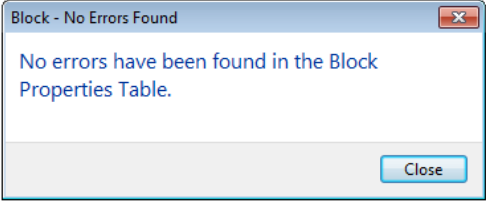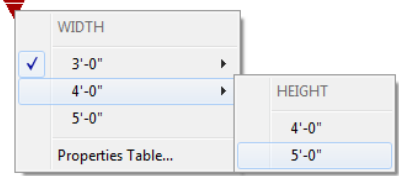|	
Add a **Vertical** dimensional constraint to the overall height of the window. Set the value to **HEIGHT**. Add a **Horizontal** dimensional constraint to the overall width of the window. Set the value to **WIDTH**. Add a **Vertical** dimensional constraint from the top of the window to the top of the meeting rail. Set the value to **HEIGHT*.5-RAIL*.5**	
Click on **Block Table** located on the **Dimensional** panel on the **Block Editor** tab in the Ribbon.	
Click below the window. *This is where the grip will appear*.	
At the **Enter number of grips** prompt press **Enter** to accept **1**.	
Click f_x to add the properties that will appear in the table.	
Select **HEIGHT**, press **Ctrl** and also select **WIDTH**. Click **OK**.	
Click and drag the **WIDTH** column header to the left of **HEIGHT** so that it is first.	

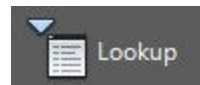|	
Edit the table to display the values shown to the right.	
Click Block properties must match a row in the table.	
Click to Audit the table for errors. Click **Close**.	
Click **OK** to exit the **Block Properties Table** dialog box.	
Click on **Save Block**. Click **Close Block Editor**.	
Use the newly created drop-down grip to switch between multiple window configurations.	

Adding the Lookup Action to a Block

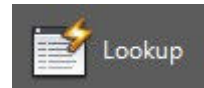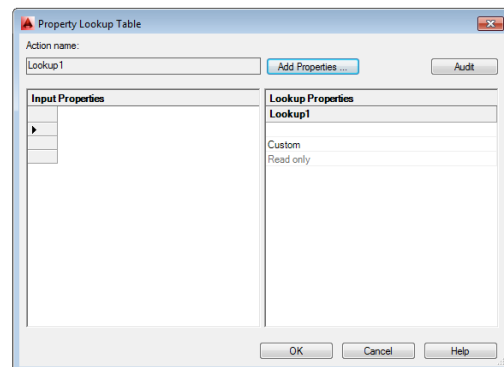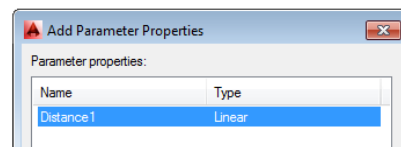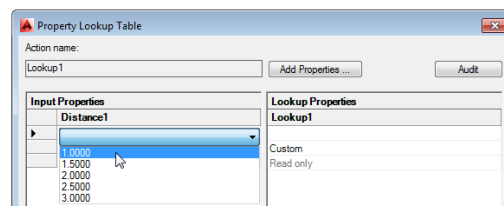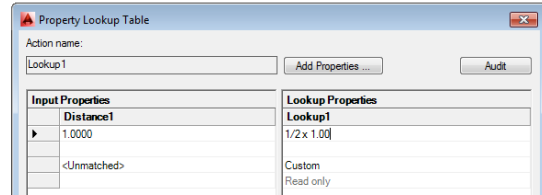| |
|---|
| *In this lesson you use the Lookup action to create a drop-down list that allows the user to choose a block variation by name.* |
| Open the drawing titled **Bolt - Complete.dwg**. |
| Double click on the **Hex Bolt ½ in. -side** block to enter the Block Editor. |
| Click on the **Lookup** parameter located on the **Parameters** tab in the **Block Authoring Palette**. |
| Place the parameter in the location where you would like the drop-down arrow to appear. |
| Click on the **Lookup** action located on the **Actions** tab in the **Block Authoring Palette**. |
| When prompted to **Select parameter**, click anywhere on the **Lookup1** parameter that was just created. |
| The **Property Lookup Table** is displayed. Click on **Add Properties…** |
| The **Add Parameter Properties** dialog box is displayed. Only one parameter exists in this block. Confirm that **Distance1** is selected and click **OK**. |
| Click in the first blank row under **Input Properties Distance1**. Select **1.0000** from the value list. |

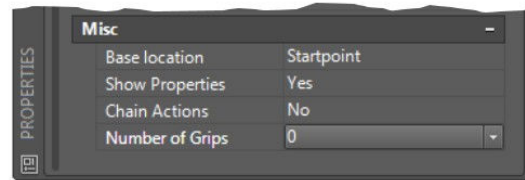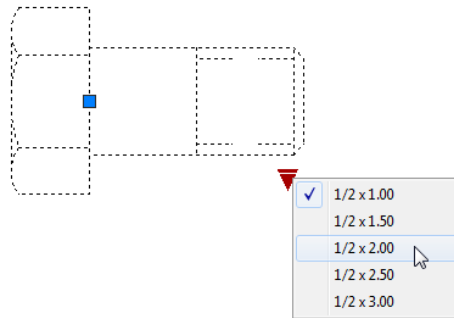|	
Click in the first blank row under **Lookup Properties Lookup1** and type **1/2 x 1.00** *This is the text that will be displayed when the drop-down arrow is selected.*	
Repeat the steps for the remaining values as shown in the image to the right. Click **OK**.	
Select the Linear parameter, then right click and select **Properties.** Scroll down to the **Misc** section. Set **Number of Grips** to **0**.	
Click on **Save Block**. Click **Close Block Editor**.	
Select the bolt and use the drop-down list to switch between different configurations of the block.	
Save and close the drawing.	