

## AGENDA:

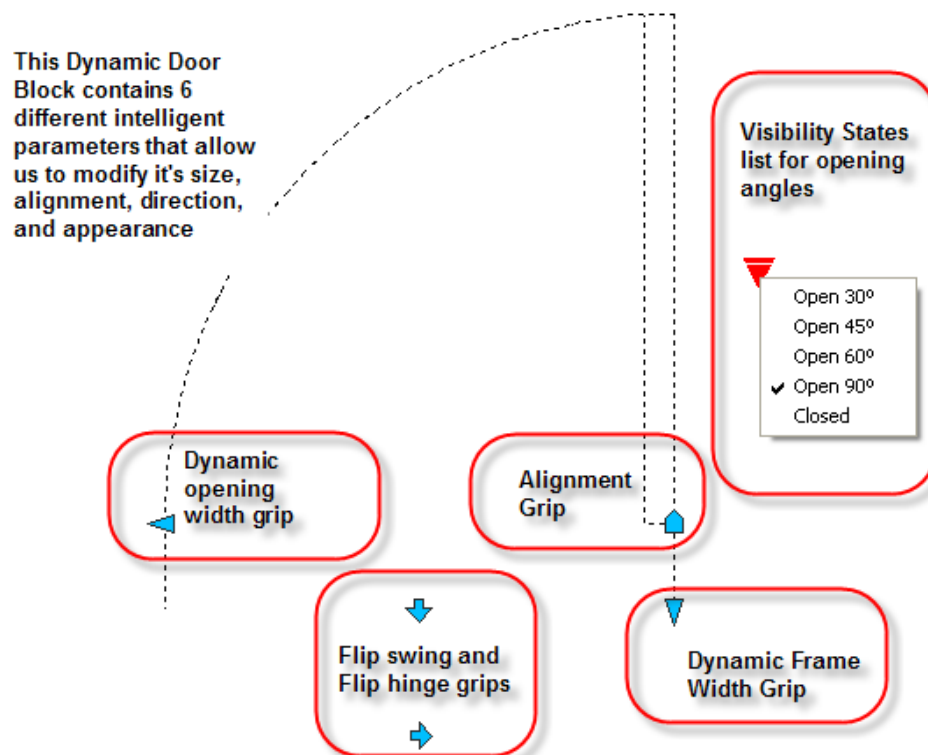
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1. Dynamic Blocks Overview
2. Process for Creating Dynamic Blocks
3. The Block Editor
4. Adding Dynamic Elements with Actions and Parameters

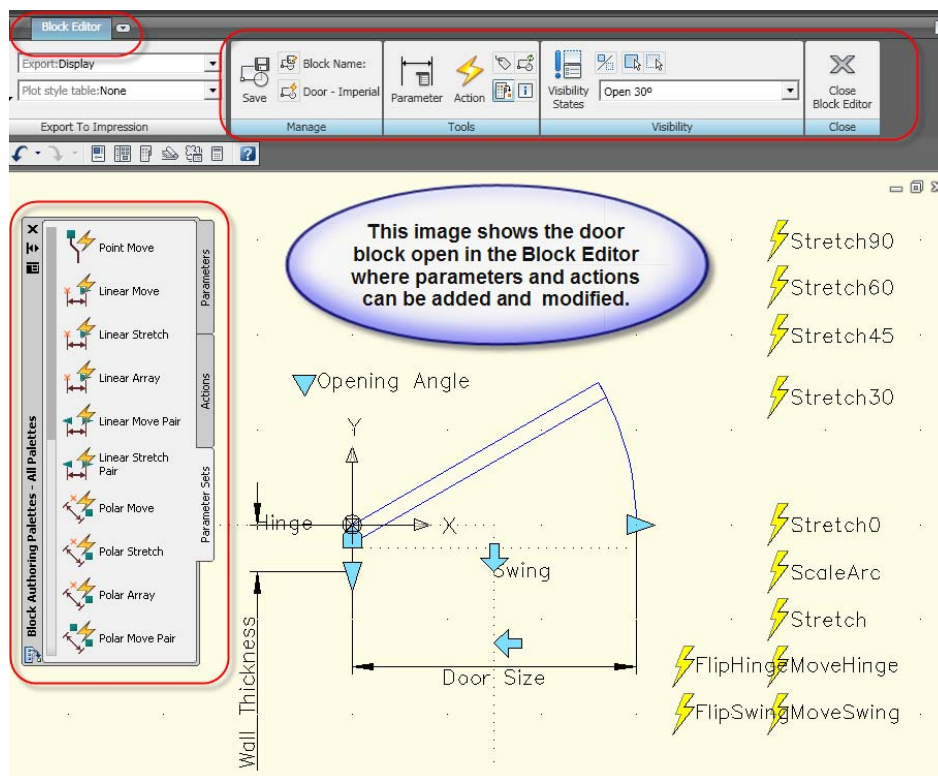
## Dynamic Blocks

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- A block definition can contain elements that add dynamic behavior to the block. You add these elements to the block in the Block Editor. When you add dynamic behavior to a block, you add flexibility and intelligence to the geometry.



- When you insert a block reference with dynamic behavior in a drawing, you can manipulate the geometry of the block reference through custom grips or custom properties, depending on how the block was defined. For example, if you insert a door block reference in a drawing, you might need to change the size of the door while you're editing the drawing. If the block is dynamic and defined to have an adjustable size, you can change the size of the door simply by dragging the custom grip or by specifying a different size in the Properties palette. You might also need to change the open angle of the door. The door block might also contain an alignment grip, which allows you to align the door block reference easily to other geometry in the drawing.



- You add dynamic behavior to new or existing block definitions by adding parameters and actions to the block in the Block Editor. For a block to be dynamic, you must add at least one parameter. You then add an action and associate the action with the parameter. The types of parameters and actions you add to the block definition define how the block reference will work in a drawing.

- The Block Editor is a special authoring area where you add the elements that make a block dynamic. You can create a block from scratch, or you can add dynamic behavior to an existing block definition. You can also create geometry, just as you would in the drawing area.
- **Parameters** define custom properties for the dynamic block by specifying positions, distances, and angles for geometry in the block.
- **Actions** define how the geometry of a dynamic block reference will move or change when the block reference is manipulated in a drawing. When you add actions to the block, you must associate them with parameters and usually geometry.
- When you add a parameter to a block definition, custom grips and properties are automatically added to the block. You use these custom grips and properties to manipulate the block reference in the drawing.

### Process for Creating Dynamic Blocks

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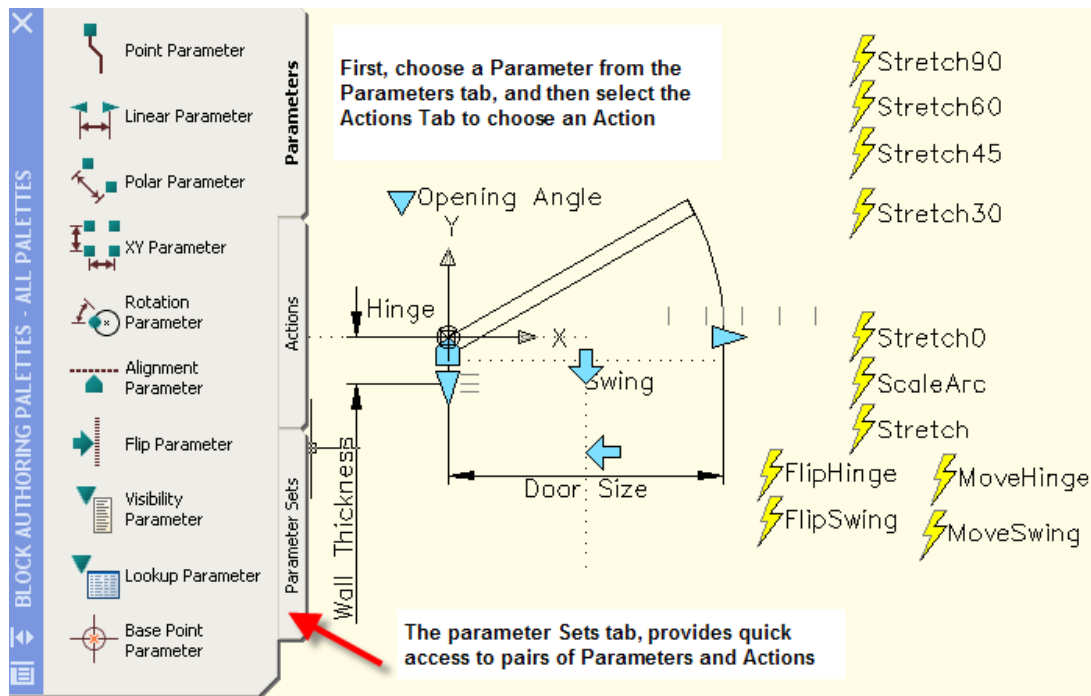
- To create quality dynamic blocks, so you get the results you expect, it is recommended that you follow the steps in the following process. This process will help you author dynamic blocks effectively.
  - **Plan the Contents** - Before you create a dynamic block, you should know what it will look like and how it will be used in a drawing. Decide which objects within the block will change or move when the dynamic block reference is manipulated. Furthermore, decide how these objects will change. For example, you might create a dynamic block that can be resized. In addition, when the block reference is resized, additional geometry may be displayed. These factors determine the types of parameters and actions you add to the block definition, and how you make the parameters, actions, and geometry work together.

- **Draw the Geometry** - You can draw the geometry for your dynamic block in the drawing area or the Block Editor. You can also use existing geometry in a drawing or an existing block definition.
- **Understand how the block elements will work together** - Before you add parameters and actions to your block definition, understand their dependencies on each other and on the geometry within the block. When you add an action to the block definition, you will need to associate the action with a parameter and a selection set of geometry. This creates a dependency. When you add multiple parameters and actions to a dynamic block reference, you will need to set up the correct dependencies in order for the block reference to function properly in a drawing.
- **Add Parameters** - Add the appropriate parameters to the dynamic block definition, following the prompts on the command line. You can also use the Parameter Sets tab of the Block Authoring Palettes to add a parameter and an associated action at the same time.
- **Add Actions** - Add the appropriate actions to the dynamic block definition. Follow the prompts on the command line, making sure to associate the actions with the correct parameters and geometry
- **Define how the Dynamic Block reference will be manipulated** - You can specify how the dynamic block reference will be manipulated in the drawing. You can manipulate a dynamic block reference through custom grips and custom properties. When you create a dynamic block definition, you define what grips are displayed and how they edit the dynamic block reference. You also specify whether or not custom properties for the block will be shown in the Properties palette and whether or not these properties can be changed through the palette or through custom grips.

- **Save the dynamic block and then try it in a drawing** - Save the dynamic block definition and exit the Block Editor. Insert the dynamic block reference in a drawing and test the block's functionality

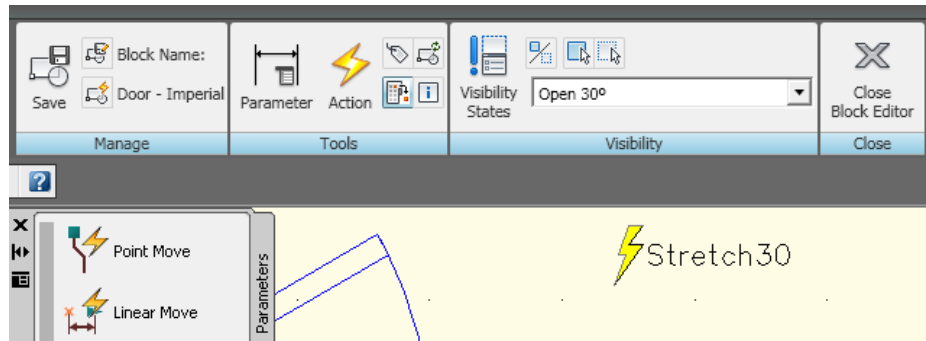
## The Block Editor

- The Block Editor is a special authoring area for creating block definitions and adding dynamic behavior. The Block Editor provides special Authoring palettes. These palettes provide quick access to block authoring tools.



- In addition to the Block Authoring palettes, the Block Editor provides a drawing area in which you can draw and edit geometry as you would in the program's main drawing area. You can specify the background color for the Block Editor drawing area.
- You can use the Block Editor to edit or add dynamic behavior to block definitions that exist in the current drawing. You can also use it to create new block definitions.











- In the Block Editor, a special Ribbon tab is displayed above the drawing area. The tab contains 4 panels , shows the name of the block definition currently being edited and provides tools to do the following:
  - Save the block definition, Add a parameter, Add an action, Define attributes, Close the Block Editor and Manage visibility states.



- You can select any parameter, grip, action, or geometric object in the Block Editor to view its properties in the Properties palette. When you work in the Block Editor, the command line should be displayed. The command line displays prompts for nearly all aspects of creating dynamic blocks.
- The Block Editor has three block authoring palettes: Parameters, Actions, and Parameter Sets. The Block Authoring Palettes window is displayed only in the Block Editor. Use these palettes to add parameters and actions to your dynamic block definition.
- **Parameters**, actions, and their relationships (dependencies) are displayed in different ways in the Block Editor. You can specify settings for some of these elements.
- In the Block Editor, most parameters look like dimensions. If you create a value set (a range or list of values) for a parameter, tick marks are shown at the locations of those values.
- An action displays its name and icon (a lightning bolt) in the Block Editor. You can specify the text size and color for actions in the Block Editor.
- When you select a parameter, grip, or action in the Block Editor, its associated objects, or dependencies, are highlighted. This is called dependency highlighting.

## Adding Dynamic Block Elements

- You add dynamic elements to a block definition in the Block Editor. In addition to geometry, a dynamic block generally includes one or more parameters and one or more actions.
- Parameters** and **Actions** are displayed only in the Block Editor. When you insert a dynamic block reference in a drawing, the parameters and actions contained in the dynamic block definition are not displayed.
- When you add a parameter to a dynamic block definition, grips are added to key points of the parameter. Key points are the parts of a parameter that you use to manipulate the block reference. For example, a linear parameter has key points at its base point and end point. You can manipulate the parameter distance from either key point.
- The type of parameter that you add to a dynamic block determines the type of grips that are added. Each type of parameter supports only certain types of actions. The following table shows the relationship among parameters, grips, and actions.







Parameter Type	Grip Type		Actions You Can Associate with a Parameter
Point		Standard	Move, Stretch
Linear		Linear	Move, Scale, Stretch, Array
Polar		Standard	Move, Scale, Stretch, Polar Stretch, Array,
XY		Standard	Move, Scale, Stretch, Array
Rotation		Rotation	Rotate
Flip		Flip	Flip
Alignment		Alignment	None (The action is implied and contained within the parameter.)
Visibility		Lookup	None (The action is implied and controlled by visibility states.)
Lookup		Lookup	Lookup
Base		Standard	None

- Actions** define how the geometry of a dynamic block reference will move or change when the custom properties of a block reference are manipulated in a drawing. A dynamic block usually contains at least one action.

- In general, when you add an action to a dynamic block definition, you must associate the action with a parameter, a key point on the parameter, and geometry. A key point is the point on a parameter that drives its associated action when edited. The geometry associated with an action is called the selection set.
- You can assign more than one action to the same parameter and geometry. However, you should not assign two or more of the same type of actions to the same key point on a parameter if both actions affect the same geometry. This can result in unexpected behavior in the block reference.
- Use the **Parameter Sets** tab on the Block Authoring palette to add commonly paired parameters and actions to your dynamic block definition.
- You add a parameter set to your block the same way you add a parameter. The action included in the parameter set is automatically added to your block definition and associated with the added parameter. You must then associate a selection set (geometry) with each action.
- When you first add a parameter set to your dynamic block definition, a yellow alert icon is displayed next to each action. This indicates that you need to associate a selection set with each action.
- When you add a parameter to a dynamic block definition, custom grips associated with key points of the parameter are automatically added to the block. In a drawing, you can use these custom grips to manipulate the geometry of a dynamic block reference.
- All parameters (except the alignment parameter, which always displays one grip) have a property called Number of Grips. When you select a parameter in the Block Editor, the Number of Grips property is displayed in the Properties palette. This property allows you to specify, from a preset list, the number of grips you want to display for the parameter.
- If you specify that a parameter has 0 grips, you can still edit the dynamic block reference through the Properties palette (if the block is defined that way).

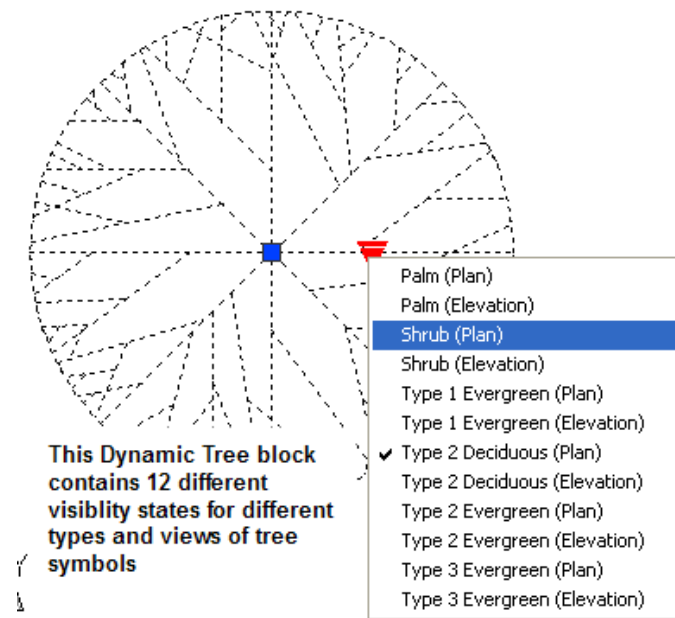
## LECTURE NOTES: CLASS 10

- Grips are automatically added at key points on the parameter. You can reposition a grip anywhere in the block space relative to its associated key point on the parameter. When you reposition a grip, it is still tied to the key point with which it is associated. No matter where the grip is shown in the block reference, it will still manipulate the key point with which it is associated. If you move or change the key point of the parameter, the grip's position relative to the key point is maintained. Because you use grips to manipulate dynamic block references in a drawing, you should make sure that each grip is placed in a logical location. If a grip is not in a logical place, the behavior may not be what is expected.
- The type of parameter you add to the dynamic block definition determines the type of grips that are added to the block. These grips give visual clues as to how the block reference can be manipulated in a drawing. The following table details the types of grips used in dynamic blocks, what they look like, and the parameters with which they are associated.

Grip Type		How the Grip Can Be Manipulated in a Drawing	Associated Parameters
Standard		Within a plane in any direction	Base, Point, Polar, and XY
Linear		Back and forth in a defined direction or along an axis	Linear
Rotation		Around an axis	Rotation
Flip		Click to flip the dynamic block reference	Flip
Alignment		Within a plane in any direction; when moved over an object, triggers the block reference to align with the object	Alignment
Lookup		Click to display a list of items	Visibility, Lookup

- You can use **visibility states** to make geometry visible or invisible in a dynamic block. One block can have any number of visibility states.
- Using visibility states is a powerful way to create a block that has many different graphical representations. You can easily change a block reference that has different visibility states without having to find a different one to insert in your drawing.

- After you combine the geometry in the Block Editor, you add a visibility parameter. You add only one visibility parameter to a dynamic block definition. You do not associate any actions with a visibility parameter.



- You can then create and name a different visibility state for each symbol. You can make particular geometry visible or invisible for each state.
- The visibility parameter includes a **lookup grip**. This grip is always displayed in a block reference that contains visibility states. When you click the grip in the block reference, a drop-down list of all the visibility states in the block reference is displayed. When you select one of the states from the list, the geometry that is visible for that state is displayed in the drawing.
- In the Block Editor, you can specify properties for a parameter in a dynamic block definition. Some of these properties can be displayed as custom properties for the dynamic block reference when it is in a drawing. These properties are displayed under Custom in the Properties palette.

- In the Block Editor, you can specify **parameter labels**. When you select the dynamic block reference in a drawing, these properties are shown under Custom in the Properties palette. It is good practice to specify unique parameter labels within the block.
- Depending on the parameters used in the dynamic block definition, other parameter properties may be listed under Custom in the Properties palette when you select the dynamic block reference in a drawing. For example, a polar parameter has an angle property that displays in the Properties palette. Depending on how the dynamic block is defined, these properties might display values such as size, angle, and position for a selected block reference
- You can specify a defined value set for linear, polar, XY, and rotation parameters.
- A value set is a range or list of values specified for a parameter. These values can be displayed for the block reference as a drop-down list next to the parameter label under Custom in the Properties palette. When you define a value set for a parameter, the parameter is limited to these values when the block reference is manipulated in a drawing. For example, if you define a linear parameter in a block that represents a window to have a value set of 20, 40, and 60, the window can only be stretched to 20, 40, or 60 units.

## Assignment Drawing – Dynamic Blocks

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- In the following drawing exercises, you will learn how to create Dynamic Blocks from existing blocks and also from scratch. You will experiment with Parameters, Actions, Parameter Sets, and Visibility States.
1. Referring to the drawing file pages for lesson 10, Create the assignment drawing as shown. Start the file with the CADD2-B2 template file. Save the file as CADD2-5\_Your Name. Switch to model space, set the units to Architectural and the limits to 40',20'.
  2. Create a layer called A-Furn and make it current. Set its color to 35 and it's lineweight to .25mm.
  3. Open the Block Editor from the Tools Menu. In the Edit Block Definition dialog box, enter the name Book Shelf and pick OK.
  4. In the Block Editor, create a rectangle 24 inches long by 12 inches in height, starting at 0,0.
  5. From the Parameters tab of the Block Authoring Palette, select Linear Parameter and then pick the two endpoints of the rectangle as if you were adding a dimension. Choose a location below the rectangle again as if you were dimensioning.
  6. Select the Actions tab of the Block Authoring Palette and choose a Stretch Action. At the command line, AutoCAD prompts you to select a Parameter. Pick the Distance parameter.
  7. AutoCAD is now prompting you to specify a parameter point to associate with the action. If you move your mouse over the two blue grips at either end of the rectangle you should see a red node appear. Pick the grip point at the right side.
  8. The next prompt is for a stretch frame. Pick two points that encompass one end of the rectangle as if you were going to stretch it. The direction or order of the selected points is not crucial as it is with the regular stretch command.

9. After defining the stretch frame, you need to select the rectangle and hit enter. Pick a point below and to the right of the rectangle to specify a location for the Action. This will only be visible when editing the block.
10. The yellow alert icon at the left indicates that one of the stretch grips does not yet have an action associated with it. If you only want to be able to stretch the book case in one direction, you can ignore the alert. If you want to be able to stretch the length in both directions, you need to add a second stretch action. Before adding more actions, test the block. From the Block Editor tool bar, choose Close Block Editor and save the block as you exit and return to the main drawing viewport.
11. Insert the Book Shelf block. Pick the block to view its grips. The regular blue square grip allows you to move the block. Pick the arrow grip at the right side and try stretching it. You can pick and drag to resize the length of the bookcase. Notice that when the grip is selected, you can see the length of the block being displayed. If you type in a value and then hit enter you can set the length of the book shelf to a specific value such as 36, 42, 48, etc.
12. Try picking the stretch grip at the left side. Because we did not add an action to this grip, dragging it or typing in a value does not have any effect on the symbol but only relocates the grip. Stretch the grip to the left, about 12 units from the symbol.
13. Pick the right grip and type in a value of 60. Notice that the distance is between the two stretch grips and is not reflecting the actual length of the bookcase. We need to either add a second stretch action to this grip or remove the grip from the parameter.
14. Pick the book shelf, right click and choose Properties. In the Properties Palette, you will see a "Custom" section at the bottom, with a single property called Distance. Try typing a new value in the distance field. Notice that the bookshelf changes size, but it is still measuring the distance between the two stretch grips instead of along the book shelf's actual length.
15. Double click the book shelf and then pick ok to open it in the Block Editor. We could add a second stretch action to be able to stretch the book case in both directions or we can simply eliminate the grip at the left side.

16. Select the Distance parameter, right-click and choose Properties. Under the Property Labels section, change the Distance label from the default "Distance" to the more descriptive "Width". Under the Value Set heading, change the Dist Type from None to Increment. Set the Dist Increment to 6, the Dist Minimum to 12 and the Dist Maximum to 60. This will restrict the stretch action to 6" increments from 12 to 60 inches. Under the Misc. heading, change the Number of Grips to 1.
17. Close the Properties Palette and then exit the Block Editor. Save the changes as you exit to update the existing block.
18. Pick the block and try manipulating the remaining stretch grip. It should restrict the stretch action to 6" increments between 12 and 60 inches. With the bookshelf selected access the Properties Palette and look in the custom area. You now have a property called Width. Try modifying its value to 27 or 33 to see that it will round off your number to closest allowable 6 inch increment.
19. Double click the block and open it in the Block Editor again. This time we'll add a Parameter set called Linear Stretch that is preset to use a linear parameter, and a stretch action with a single grip. We will define this parameter as Depth and use it to change the depth of the book shelf in 2 inch increments from 8 to 16 inches.
20. Choose the Parameter Sets tab from the Block Authoring Palette and pick Linear Stretch. Choose a start point at the lower left corner of the bookcase, an endpoint at the upper left corner, and a label location a short distance to the left. Notice that a single stretch action has already been applied.
21. Double-click the stretch action, define a stretch frame around the top half of the rectangle and then select the rectangle to complete the parameter.
22. Select the parameter, right-click and choose Properties. Change the Distance Label to "Depth" and under Value Set change the Dist Type to Increment. Use an increment of 2 inches, a minimum of 8 and a maximum of 16.

23. Close the Block Editor and test the block behavior both with grip edits and through the custom properties listed on the Properties Palette.
24. We will now add an Alignment parameter so that when we add the block it will automatically align itself so its length will be parallel to a selected wall object.
25. Open the Book Shelf in the Block Editor. From the Parameters tab, choose Alignment Parameter and then pick the midpoint along the bottom of the bookshelf. When prompted for the alignment direction, choose the bottom left endpoint. Select the cross that appears at the middle of the alignment parameter to display its grips. Pick the middle grip and grip stretch (move) the parameter 1.5" below the bottom of the rectangle. This will ensure that the bookshelf will be inserted with a 1.5" gap between itself and the adjacent wall. (If you want the unit to appear built-in or attached to the wall, leave the alignment parameter directly on the edge of the book shelf.
26. Save the block definition and exit the Block Editor. Draw a few lines to indicate the walls of a floor plan. Include a couple of randomly angled walls in the sketch. Try inserting the block. In the insert block dialog box, clear the "specify rotation on screen" option if it is selected. As you insert the block you will notice that it is not initially aligning with the walls.
27. After inserting the block, if you select the alignment grip and stretch the position of the block to another wall, you will see the alignment action start to work. It did not work at the time of insertion because the default base insertion point of the block is at the lower left corner of the unit and the alignment parameter is offset from its midpoint.
28. Double click to open the block in the Block Editor once again. In the parameters tab, choose "Base Point Parameter" and then snap to the Node of the alignment parameter. Save the definition and exit the Block Editor. Try inserting the block again along any of the walls you sketched for testing.

29. We will now experiment with Visibility states and the Linear Array parameter set. Open the bookshelf in the Block Editor and from the Parameters tab, choose Visibility Parameter. Pick a location for the parameter near the other parameters. Double click the parameter to open the Visibility States manager.
30. Pick VisibilityState0 and rename it to Bookshelf\_Plan. Pick New, and create a second visibility state called Bookshelf\_Elevation. Under visibility options choose to "Hide all existing objects" and pick OK.
31. Ensure that the Elevation state has a checkmark by it indicating it is current, and choose OK. The only graphic visible is the Base Parameter. You need to create an elevation view of the Bookshelf unit, with its base midpoint aligned with the Base Parameter.
32. Draw a rectangle, 24" wide by 28" tall. Offset it .75" to the inside and then explode the inside rectangle. Extend the inside vertical lines to the top and bottom edges. Move the inside line along the base up by 2.5" and then offset it .75" towards the top. Copy this horizontal pair of lines up 12" toward the top. Check the dimensions to ensure the distances match the elevation view on the handout. Move the entire set of lines so that the midpoint of the bottom edge aligns with the Node of the Base point parameter.
33. From the Parameter Sets tab, choose Linear stretch and add a parameter to define the width of the bookcase. You will need to call this one Width Front instead of Width as you have already used the Width label in the plan view of this block. Use the same increments that used in the Plan view definition.
34. Add a second Linear Stretch parameter set to define the height of the book shelf. When you define the stretch frame do not include the middle shelf. Set the distance type to increment with an increment of 12", a minimum distance of 24 and a maximum distance of 72.
35. Save the definition and close the Block Editor. Insert the block or select an existing block to see the new visibility state lookup list. Pick the visibility grip and select the elevation state that you just defined. Try modifying the width and the height of the book shelf. It should work well but it would be nice if more shelves were added as the height increases.

36. Open the block in the Block Editor. Double click the Visibility parameter and set the elevation visibility state current. A linear array parameter set can help us define the shelf copy behaviour. Since we already have the linear stretch we can add an Array action.
37. From the Actions tab choose Array. Select the Height parameter and then pick the middle shelf. Specify 12" as the "column distance". (Column is the term used regardless of the direction in which you are copying the items.)
38. Save the definition and exit the Block Editor. Display an elevation of the bookshelf block and try adjusting its height. A new shelf should be added whenever the height increases by one foot. If the shelf is not aligning properly, review your construction dimensions.
39. Open the Design Centre and browse to your block library of doors and windows. Drag and drop a 24" window into the current drawing. Zoom in on the window and double click it to open it in the block editor. Add a linear stretch parameter set that defines the width of the opening.
40. Add a second linear stretch between the edge of the frame and the insertion point at the exterior face. (Autotrack from the frame and the sill extension line to define the second parameter point). When prompted to select objects, choose the lines that define the frame, glass, and sash. Label this parameter "Ext\_Offset".
41. Add a third linear stretch similar to the Ext\_Offset but this time used to move the interior sill component (stool). Label this parameter Int\_Offset. A single "offset" parameter would actually allow you to use the block in any width of wall, but using two gives you the added option of moving the window back and forth anywhere in that width.
42. Switch to Layout space and complete the views as shown. Add the drawing title from the annotation tab of the Tool Palettes. It is a Dynamic block with attributes. Insert your own titleblock attributes that you completed as part of your fourth assignment.
43. Draw the dimensions as shown on the handout, complete the titleblock info and the drawing titles and then save and close your file. This assignment is due for evaluation by the end of class 12.