

# Draw Symbols Using Basic CAD Commands

**Unit:** Graphic Agility

**Problem Area:** Computer Applications: CAD (2D Drafting Techniques)

**Lesson:** Draw Symbols Using Basic CAD Commands

- **Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

- 1 Create typical symbols used in CAD drawings.**
- 2 Create and modify drawing blocks of CAD symbols.**
- 3 Add and use dynamic elements and attributes in CAD blocks.**

- **List of Resources.** The following resources may be useful in teaching this lesson:

Abbott, Dan. *AutoCAD: Secrets Every Designer Should Know*. Sybex, 2007.

Aubin, Paul F. *Mastering AutoCAD Architecture 2008*, 6th ed. Autodesk Press, 2007.

Finkelstein, Ellen. *AutoCAD 2008 and AutoCAD LT 2008 Bible*. Wiley, 2007.

Grabowski, Ralph. *The Illustrated AutoCAD 2008 Quick Reference*. Autodesk Press, 2007.

Watson, David. *CAD Tutor Tutorials: 1996–2007*. Accessed on April 2, 2008. <<http://www.cadtutor.net>>.



## ■ **List of Equipment, Tools, Supplies, and Facilities**

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

## ■ **Terms.** The following terms are presented in this lesson (shown in bold italics):

- attribute
- attribute prompt
- base point
- block
- block authoring palettes
- block editor
- block (symbol) library
- dynamic block
- explode
- insert
- nested object
- symbols
- wblock

## ■ **Interest Approach.** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situation. A possible approach is included here.

*Furniture symbols are commonly found and used in CAD drawings. Have each student pick a different piece of furniture in the room and sketch it in plan. Then have them draw the plan in CAD, label it with attributes, and add dynamic features. In this way, the students are collectively creating a block library that the whole class can share.*

# SUMMARY OF CONTENT AND TEACHING STRATEGIES

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**Objective 1:** Create typical symbols used in CAD drawings.

**Anticipated Problem:** How do I draw common symbols to use in my drawings?

- I. Lines, circles, and polylines can be used to create **symbols**; these are representations of items commonly used in drawings. Symbols are inserted into drawings as blocks. (Blocks will be discussed later in this lesson.)
  - A. Symbols may be comprised of objects drawn on several layers with various colors, linetypes, and lineweight properties.
  - B. A circle (for furniture labels) or a square (for room name labels) may be created that contain the alphanumeric value assigned to the said symbol.

*Use VM–A to reinforce the concepts in this objective. Ask students how or why symbols are generally used. Lead into a discussion of CAD drawings and symbols.*

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**Objective 2:** Create and modify drawing blocks of CAD symbols.

**Anticipated Problem:** How are blocks created and modified in CAD?

- II. Create a block
  - A. A **block** is one or more objects combined to create a single object. A collection of blocks in one single drawing is called a **block (symbol) library**.
    1. Blocks can be used to reduce a drawing's file size.
    2. Blocks can be used to update all the insertions of a particular block quickly. For example, the designer may have a block composed of a square with a text object in the center that has been used and inserted several times. If the text value is M but needs to be modified to S, the block can be redefined with the correct letter. After the value is redefined, the several block insertions are updated concurrently. This saves a lot of editing time.
  - B. Two commands are used to create a block.
    1. After typing “block” on the keyboard, the designer is asked to select objects to be included in a single object in addition to the base point and behavior. **Base point** is the point where the object will be inserted into a drawing; it is typically located at a corner. Choosing a base point is crucial. If the designer fails to choose a base point, the object will be difficult to find in the drawing window. This method creates the block within the drawing.

2. Another option is to type “wblock” on the keyboard. “**Wblock**” stands for “write block” and is an easy way to create selected objects from the current drawing as a new drawing to be used in other files. This method asks the designer to select a base point and the objects to be blocked. In this case a path (in which to save the new drawing file) would also need to be selected.
- C. To **insert** or re-use a block, the designer must go to the Insert pull-down menu and select Block. The insert dialog box pops up and asks where to locate the desired block. The designer must specify the location, scale, and rotation before clicking on OK. The chosen block will be inserted at the base point selected when the block was created.
- D. The **block editor** allows the designer to modify a block. The block editor can be accessed by double clicking on the block that needs to be revised. When designers are in the block editor, the screen will be light yellow.
  1. To **explode** a block refers to breaking the block into component objects. To modify one or more objects within a block separately, the block can be exploded, which grants the designer access to nested objects.
  2. A **nested object** is a block reference that contains other blocks and objects. Using a nested object can simplify the organization of a complex block definition. Nested blocks make it easier to redefine a block. For example, a large block may be composed of lots of objects, but one object changes color occasionally. Without redefining the large block each time the object in question changes color, the designer can create a small block consisting of the one object and insert it as a nested block in the large block. Then, when it is necessary to change the object’s color, it can be redefined in the small block and will be automatically updated in the large block. It is important to note that, in this example, the large block will reflect the new color of the nested object, but the large block does not have to be redefined.

Use VM–B to show students options to create blocks. Use LS–A to allow students to practice creating and modifying blocks with attributes.

### **Objective 3:** Add and use dynamic elements and attributes in CAD blocks.

**Anticipated Problem:** How do I add dynamic elements and attributes to a block?

#### III. Adding dynamic elements and attributes to a block

- A. A **dynamic block** is a block that has flexibility. By adding dynamic elements, the designer can adjust the block in place, as necessary, rather than searching for another block to insert or editing an existing block.
  1. Dynamic elements are added in the block editor.
  2. Dynamic blocks are used for door or window blocks (where sizes will differ). For example, a dynamic door block could change from 3 feet in width to 2 feet and 8 inches in width.

3. **Block authoring palettes** are tool palettes that allow the designer to add actions and parameters to dynamic block definitions.
- B. An **attribute** is an object included in a block definition to store alphanumeric data.
  1. Attribute values can be predefined or specified when a block is inserted.
  2. Attribute data can be extracted from a drawing and inserted into external files using the ATTDEF command.
  3. When a block is inserted with an attribute value that is undefined, the **attribute prompt** will appear in the drawing window. The attribute prompt window is the location to enter the alphanumeric text necessary for labeling the block.

Use VM–C to illustrate the CAD block editor interface and LS–B to create and use dynamic blocks.

- **Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used in the review/summary.
- **Application.** Use the included visual masters and lab sheets to apply the information presented in the lesson.
- **Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

## ■ **Answers to Sample Test:**

### Part One: Matching

1. f
2. d
3. a
4. g
5. b
6. e
7. c

### Part Two: Short Answer

1. The two commands used to create a block are “block” and “wblock.”
  - ◆ The block command combines one or more objects to create a single object. Blocks allow reuse of objects in the same drawing. When creating a block, the designer will be asked to specify the base point, objects, and behavior.

- ◆ Wblock allows the designer to create a new drawing file from certain objects in the existing drawing and to use them in other drawings. (Access this by typing “wblock” on the keyboard). When creating a wblock, the designer will be asked to select the objects and a base point in addition to the path where the file should be stored.
- 2. Two ways to modify a block are to use the “explode” command or to use the “block editor.”
  - ◆ Explode: Explode breaks a compound object into component objects. If you need to modify one or more objects within a block separately, use this command. When you are finished with the changes, you can use the “block” command to redefine the new block.
  - ◆ Block editor: Double-click on the block to be modified to access the block editor. Once block editor is open, you can make changes, save the changes, and then click to close the block editor. All blocks in the drawing with the same name will be updated.
- 3. Dynamic elements are blocks with flexibility; these adjust a block, while in place in a drawing, without using the block editor or looking for another block to insert.
  - ◆ Dynamic blocks are used for door or window blocks (where sizes will differ). For example, you could have a dynamic door block that could change from 3 feet in width to 2 feet and 8 inches in width.
  - ◆ Dynamic blocks are added in the block editor. The block authoring palettes contain tools to add actions and parameters to dynamic block definitions.

### Part Three: Completion

1. symbol
2. base point
3. insert
4. block authoring palettes
5. wblock
6. block editor



# Draw Symbols Using Basic CAD Commands

## ► Part One: Matching

**Instructions:** Match the term with the correct definition.

- |                     |                           |
|---------------------|---------------------------|
| a. dynamic element  | e. explode                |
| b. nested object    | f. block                  |
| c. attribute prompt | g. block (symbol) library |
| d. attribute        |                           |

- \_\_\_\_\_ 1. Objects that are combined to create a single object
- \_\_\_\_\_ 2. An object included in a block definition to store alphanumeric data
- \_\_\_\_\_ 3. A block that has flexibility
- \_\_\_\_\_ 4. A collection of blocks in one single drawing
- \_\_\_\_\_ 5. A block reference that contains other blocks and objects
- \_\_\_\_\_ 6. A command that breaks a block into component objects
- \_\_\_\_\_ 7. The text string that is displayed when a block with an undefined attribute value is inserted

## ► Part Two: Short Answer

**Instructions:** Complete the following.

- 1. Describe the two ways to create a block and how the two ways differ.



2. Briefly describe the two ways to modify a block.

3. Describe dynamic elements, their usefulness, and how they are added to a block.

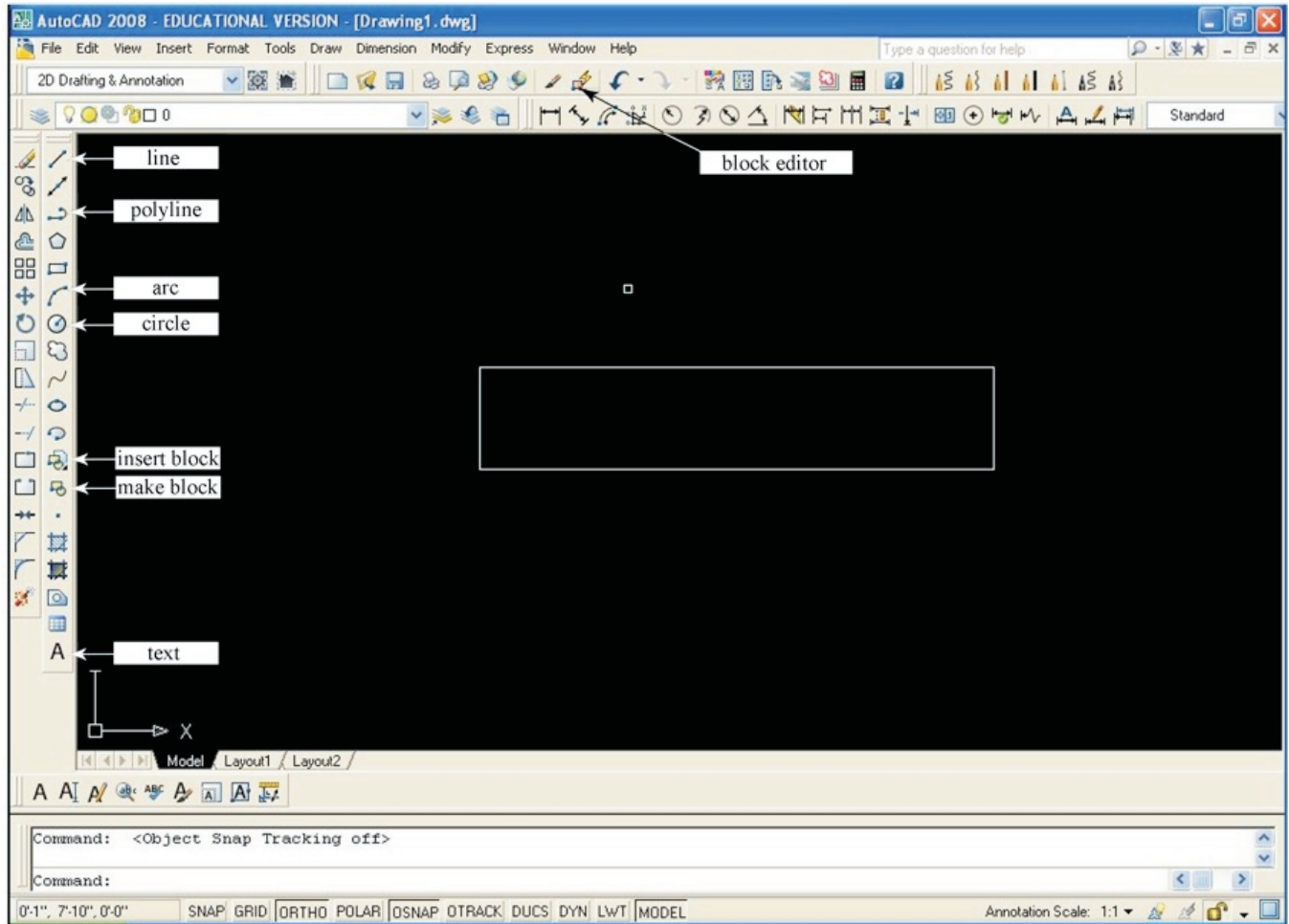
### ► **Part Three: Completion**

**Instructions:** Provide the word or words to complete the following statements.

1. A(n) \_\_\_\_\_ is a representation of an item commonly used in drawings and can be inserted as blocks.
2. When creating a block, you select a(n) \_\_\_\_\_ or a position on the object where the block will be inserted.
3. When you \_\_\_\_\_ a block, you create a block reference and specify its location, scale, and rotation.
4. In the block editor, \_\_\_\_\_ are used to add actions and parameters to dynamic block definitions.
5. The CAD command \_\_\_\_\_ allows the designer to save selected objects from a current drawing to use in other files.
6. The CAD command “explode” and the \_\_\_\_\_ modify existing blocks.

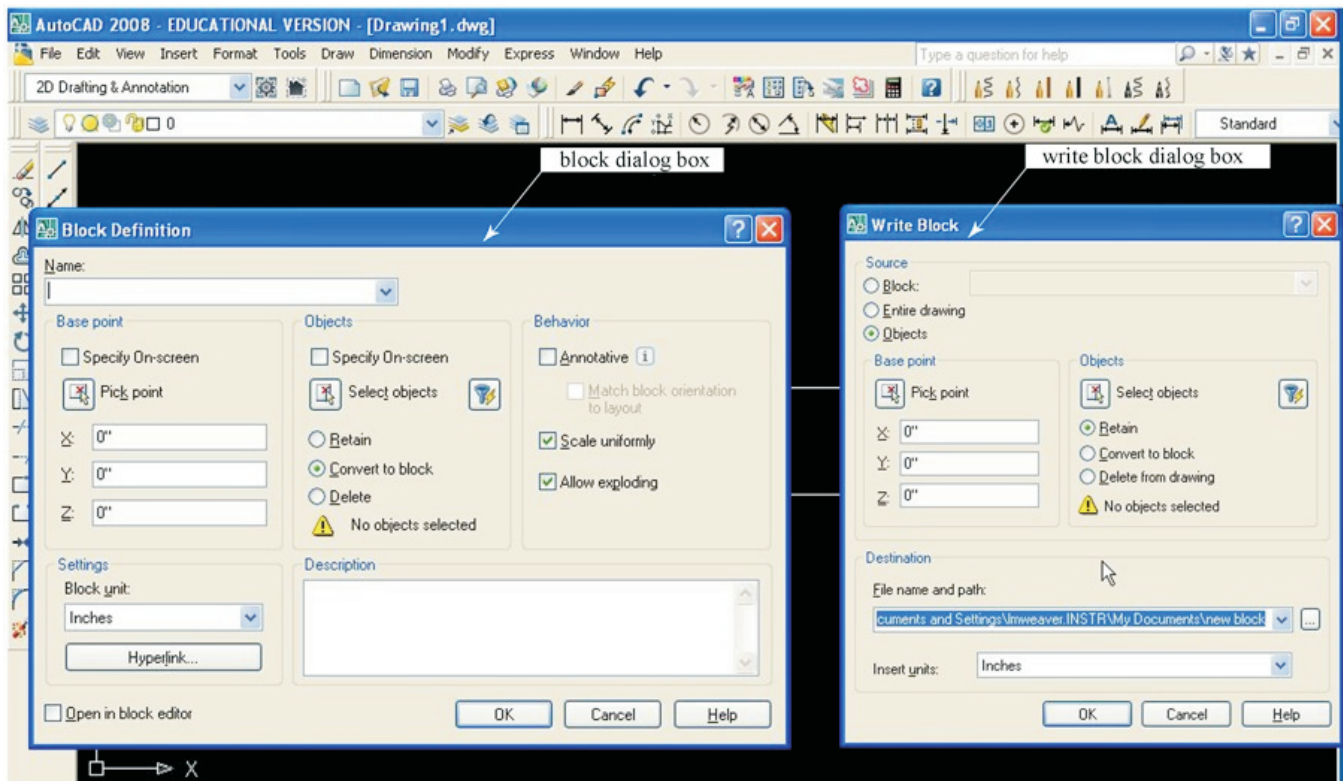


# TYPICAL TOOLS TO CREATE CAD SYMBOLS



(Microsoft product screen shot reprinted with permission from Microsoft Corporation)

# BLOCK AND WRITE BLOCK DIALOG BOXES



(Microsoft product screen shot reprinted with permission from Microsoft Corporation)

The “block” command creates a block within your drawing.

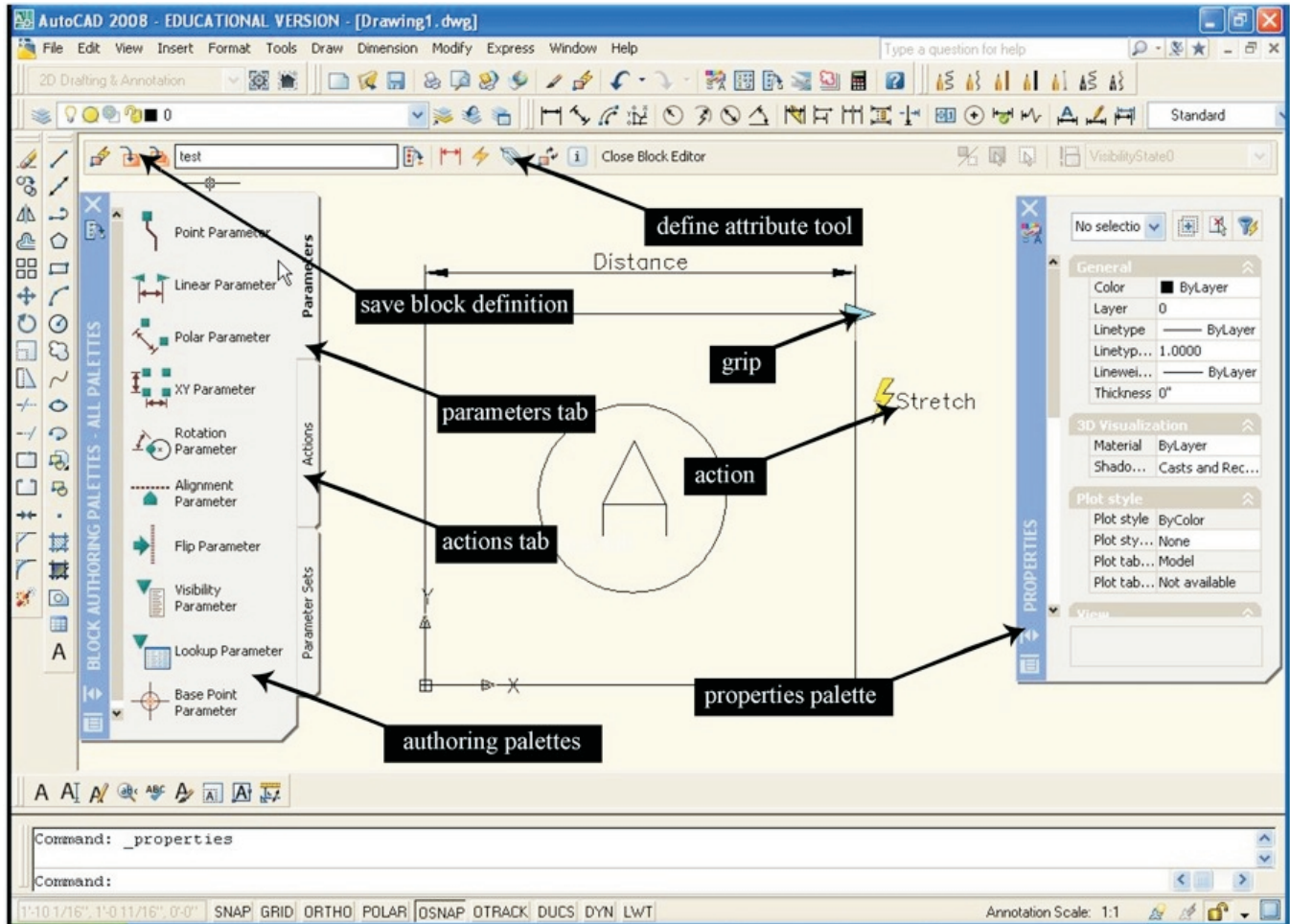
- ◆ Step 1: Type “block” on the keyboard.
- ◆ Step 2: Name the block.
- ◆ Step 3: Pick the base point (the location where the block will be inserted).

- ◆ Step 4: Select all of the objects that you would like to be included in the block.
- ◆ Step 5: Make sure “convert to block” is checked.
- ◆ Step 6: Make sure “scale uniformly” and “allow exploding” are checked.
- ◆ Step 7: Click OK. The objects are now one object or a block.

The “wblock” command creates a new drawing.

- ◆ Step 1: Pick a base point (the location where the block will be inserted)
- ◆ Step 2: Select the objects you would like to be included in the block.
- ◆ Step 3: Choose a file name for your new drawing and the location where it will be stored.
- ◆ Step 4: You now have a block as a new .dwg file.

# THE BLOCK EDITOR INTERFACE



(Microsoft product screen shot reprinted with permission from Microsoft Corporation)

# Create Symbols and Build a Block Library

## Purpose

The purpose of this activity is to create symbols to build a block library that can be used in future drawings and assignments.

## Objectives

1. Create symbols to become a block.
2. Modify a block.
3. Create and use a block (symbol) library.
4. Create a block that uses attributes.

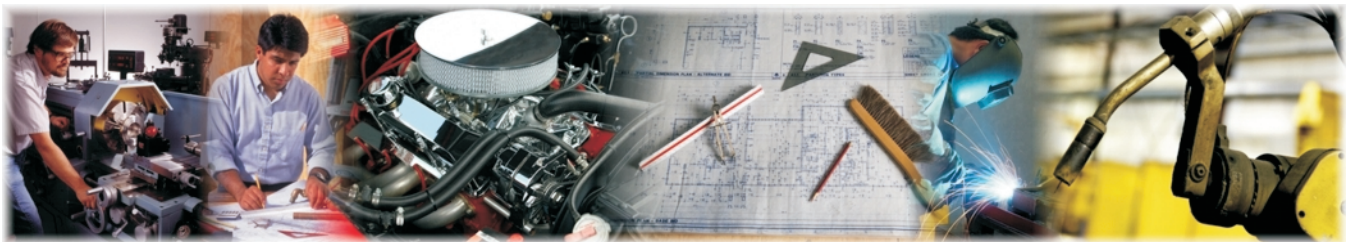
## Materials

- ◆ lab sheet
- ◆ computer with CAD software installed

## Procedure

To create a block:

1. Create a sketch of the plan of a piece of furniture (e.g., a chair, cabinet, or desk) in the classroom. Note all of the dimensions necessary to complete the drawing in CAD.
2. Open a new drawing, and type “units” on the keyboard. This brings up the units dialog box; change the format to “architectural” and the precision to  $\frac{1}{4}$ ".
3. Draw the plan with line, arc, and polyline commands. Create a circle in the middle of the plan that will be used to contain the label for that specific block.





4. After the drawing is completed and the plan looks appropriate, type “wblock” on the keyboard. The block definition dialog box comes up. Name the block whatever your piece is called (e.g., desk chair or 36" desk).
5. Select the objects you wish to turn into a block, and make sure that “convert to block” is selected. Choose the base point; this is usually the lower left-hand corner of your object. Click OK. Notice that the objects you created are now viewed as one. As a result, the objects can be moved, copied, and selected as one object. This is a block.

To modify a block:

6. Next, modify the block to include an attribute. Double-click on the block you just created to bring up the block editor. Here you can make any necessary changes to the objects that comprise the block.
7. Add an attribute in the center of the circle you drew to label the block. While in the block editor, type “att” for attribute. The attribute definition dialog box comes up.
8. In the tag box, type “A.” In the prompt box, type “label.” In the default box, type “A.” This means that when we insert this block, it will ask you what you want the label to be. You can enter any value; however, if you press Enter, it will become an A value.
9. Make sure the annotative box is checked, and click OK. Make sure the “A” tag is exactly in the center of the circle you made. If it is not, move it there now. Click the save block definition icon at the upper left of the screen. Then click the close block editor button. You should now be back in model space and in your drawing window.
10. Go to the Insert pull-down menu. Then go to Block. Browse for the block that you named in Step 3. Make sure the insertion point is set to “specify on screen.” The scale will default to 1, and the rotation angle will default to zero. Click OK.
11. Place the mouse crosshairs where you would like to insert the block in your drawing and click. The block will be placed from the lower left-hand corner (base point) to the center of the mouse crosshairs.
12. Next, the attribute prompt will ask you to type the text for the attribute you set up. Type “B.” Now, you should have your block on the screen with a label of “B.”

To make a block library:

13. Define as many blocks as you wish. Then give the drawing a name appropriate for a block library. For example, if you were making blocks for bathroom equipment, you might name the drawing “bathroom blocks.” Because the building blocks are to be shared, use the “wblock” command to make separate drawings to save on a shared drive to build a “Collective Furniture Library.”

# Create and Use Dynamic Blocks

## Purpose

The purpose of this activity is to create and use dynamic blocks.

## Objectives

1. Create a dynamic block using the block editor.
2. Alter block parameters in place.

## Materials

- ◆ lab sheet
- ◆ computer with CAD software installed

## Procedure

Add dynamic elements and alter block parameters:

1. Open the drawing of the block you created in LS-A. Now, you will add dynamic elements to the block.
2. One dynamic element is the stretching of a block. Let's assume that you are creating a door block. Some doors are 3' 0" and some are 2' 6" wide. Using dynamic blocks, it is possible to have one block that can change from 3' 0" wide to 2' 6" wide without using the block editor or redefining the block.
3. Double-click on the block to go into block editor. Make sure the block authoring palettes are on by clicking on the icon to the immediate right of the block name displayed at the top of the block editor.
4. On the Parameters tab, select Linear parameter. Then select the start and end point of the door width.





5. Select Linear parameter, right-click, and then click Grip display. Change the grip to 1.
6. To define specific sizes for the width of the block, select the linear parameter. In the Properties dialog box (Modify pull-down menu then Properties) under value set, click the box next to dist type, and select list. Click the box next to dist value list, and then click the "[...]" button." In the "add distance values dialog box," add the list of values for the width of the block you have drawn.
7. On the actions tab, select "stretch action." Next, select the linear parameter. Then select the parameter point that displays the grip. Define the stretch frame, and then select the objects to stretch and move. Click to place the action. A lightning bolt with the word "stretch" near it will appear.
8. Click the "save block definition button" on the block editor toolbar, and close the block editor.
9. Go to insert, and find your block. You can now change the width to any of those you set up by holding down the grip and dragging your mouse.