



## AutoCAD 2007

What They Haven't Told You about Dynamic Blocks!

Paul Oakley

S1-1

### Course Summary:

Discover flexibility and intelligence within the blocks you use every day, and realize an increase in efficiency and productivity. If you haven't yet learned to leverage the full power of Dynamic Blocks, this is the place you want to be. In this course, we will guide you through the full scope of mastering Dynamic Blocks, including how to manipulate the geometry in a dynamic block reference through custom grips or custom properties. The steps you learn will revolutionize your understanding and use of blocks and block libraries!

### Instructor:

Paul is Director of Oakley-CAD Services Ltd and has 20 years experience in the AEC industry. He worked as both an architect and CAD manager for major Architectural practices such as Broadway Malyan and PRP Architects before starting his own CAD management consultancy specialising in CAD management, bespoke AutoCAD and ADT training courses. Paul chairs the technical forum for the ADT Community group and has been involved in various BIM initiatives, such as Teamwork and more recently Avanti.



## Introduction

Blocks have been a part of AutoCAD for nearly 20 years and during the majority of this time there have not been many changes to the initial concept. The initial use of blocks allowed file sizes to be kept to a minimum and the only method of manipulating blocks was by swapping one block for another via the command line. To change a block the *explode* command had to be used and the block recreated. The alternative was the use of *Wblocks* where each block is stored in its own drawing and reinserted from that drawing for each update.

Since AutoCAD 2004 there have been a number of improvements to blocks. This includes the introduction of tool palettes, blocks *edit in place* and updates to block attributes with field text.

The release of AutoCAD 2006 saw the introduction of Dynamic blocks. For the first time block geometry has the ability to change whilst still remaining as a block. The possible power of Dynamic blocks is awesome with the ability of basic geometry to actually be as flexible as object technology. Through this session we will look at how to create Dynamic blocks and the various methods of doing this. Initially we will review the Block Editor, which as with most new software has its own language and phraseology that goes with it.

The majority of the session will be spent looking at an exercise called "the Dynamic Door Project" where we will take a simple door block and see how many features of dynamic blocks we can add to it. Finally we will look at the do's and don'ts of Dynamic Blocks, plus some advanced manipulation techniques.

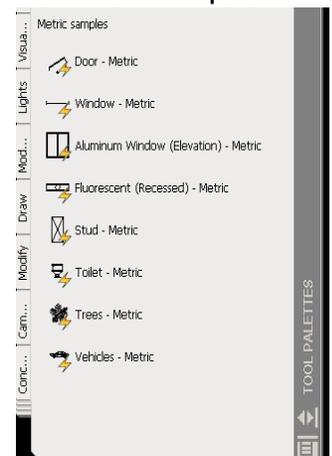
## What are Dynamic Blocks?

Dynamic blocks create the functionality of object technology within AutoCAD block geometry by the use of grips. Dynamic blocks can *scale*, *stretch*, *mirror* and have different *visible states* yet whilst still remaining as a block. They can also have multiple insertion points and can align themselves with existing geometry when being placed within a drawing. All this provides the power of having multiple blocks within a single block reference by providing custom properties that can be used to manipulate the block.

## Use of Dynamic Blocks

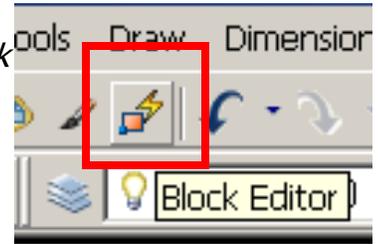
Dynamic blocks have a lightning symbol to differentiate them from other blocks. This can be viewed on the Tool palette or when the block is inserted. If a block has multiple insertion points then the use of the Control Key will allow you to toggle through the various insertion points.

There is a number of sample blocks provided within AutoCAD, which provide content to highlight how Dynamic blocks can be used. The illustrated Architectural palette gives a variety of blocks. It is worth inserting a few of these and playing with the grips to see how they respond.



# The Block Editor

Autodesk have created a new block development environment called the *Block Editor*. This is used to both create and edit Dynamic Blocks. The *Block Editor* as with all Autodesk features has various methods of access. These are:



Keyboard command is *BEDIT* or shortcut key is using the *BE* Alias

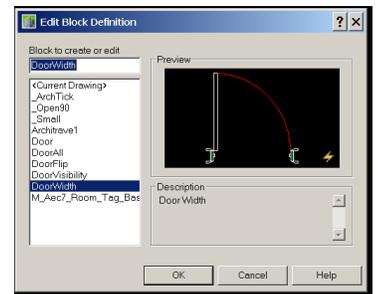
The TOOLS pull down menu to access the *BLOCK EDITOR*

The *BLOCK EDITOR* tool on the STANDARD toolbar

Right click on any block and select the *BLOCK EDITOR* command

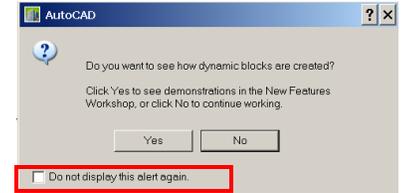
Be careful not to confuse the *BLOCK EDITOR* with the *EDIT BLOCK IN PLACE* command.

Tip: Double click on any block to bring up the Edit Block Definition dialog. Select the Block name to edit or add a name for a new block and open the *BLOCK EDITOR*. Setting the *BLOCKEDITLOCK* system variable to 1 can disable this.



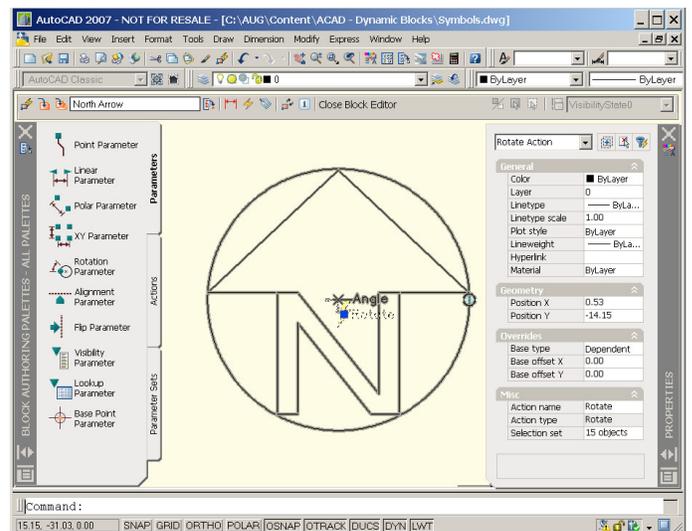
## The Block Editor Environment

When you first enter the *Block Editor Environment* a New features dialog is presented. If you are new to dynamic blocks it is worth taking the step-by-step guide and seeing what is available. If you no longer wish to see this dialog tick the *Do not display this alert* again box.



The *Block Editor Environment* has its own specific Tool Palette called the *Block Authoring Palettes* plus a *Block Editor Toolbar* again specific to this environment.

Dynamic blocks work through a series of objects called Parameters and Actions which are applied either to the block or AutoCAD geometry within the block. All the Parameters and Actions within the Block Editor Environment can be edited through the Properties Palettes as with any AutoCAD entity.



## The Block Editor Toolbar



The Block Editor toolbar provides a specific list of tools for creating and editing Dynamic blocks. The Visibility state tools are not available (shown gray) until a *Visibility Parameter* is added to the Block.

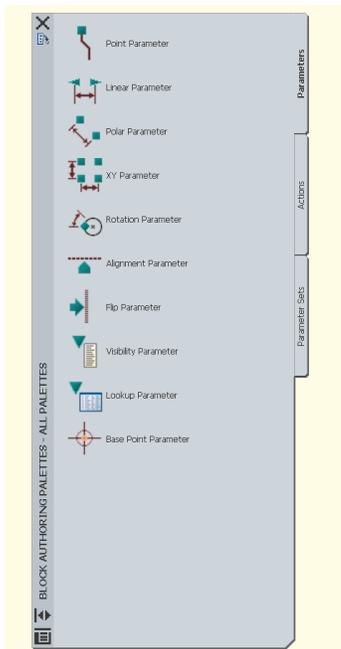
	<b>Edit or Create Block Definition</b>	Opens the Edit Block Definition dialog box that allows you to create or select a block definition to be modified.
	<b>Save Block Definition</b>	Saves changes made to the current block definition
	<b>Save Block As</b>	Saves the block with a new name to create a new dynamic block
<input type="text" value="North Arrow"/>	<b>Block Definition Name</b>	Displays the name of the current block
	<b>Authoring Palettes</b>	Turns the Block Authoring Palettes on and off
	<b>Parameter (_BPARAMETER)</b>	Adds a Parameter via the <code>_BPARAMETER</code> command
	<b>Action (_BACTION)</b>	Adds an Action via the <code>_BACTION</code> command
	<b>Define Attribute</b>	Opens the Attribute Definition dialog box. Attributes can then be added in the normal manner for blocks.
	<b>Update Parameter and Action Text Size</b>	Regens the Block Editor and adjusts the display text size of Parameters and Actions.
	<b>Learn About Dynamic Blocks</b>	Opens the New Features Workshop dialog box and displays the Dynamic Blocks topic.
<input type="button" value="Close Block Editor"/>	<b>Close Block Editor</b>	Closes the Block Editor with a prompt to save changes.

The Visibility area of the Toolbar becomes active when a Visibility Parameter is added.

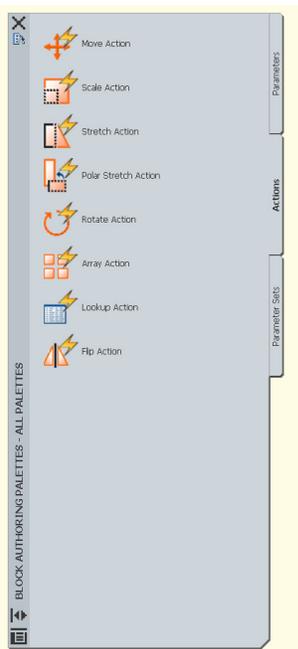
	<b>Visibility Mode</b>	Toggles the visibility of geometry (BVMODE). 0=only visible geometry in the current visibility state will be seen. 1=all geometry in the current visibility state will be seen, but invisible geometry will be gray.
	<b>Make Visible</b>	Makes selected geometry visible in the current visibility state.
	<b>Make Invisible</b>	Makes selected geometry invisible in the current visibility state.
	<b>Manage Visibility States</b>	Opens the Visibility States dialog box so you can manage visibility states.
	<b>Visibility States</b>	Lets you select the current visibility state from a dropdown

Within the *BLOCK EDITOR* is a separate Tool palette called the *Authoring Palette* that is only used specifically for editing Dynamic blocks. This has the following three tabs:

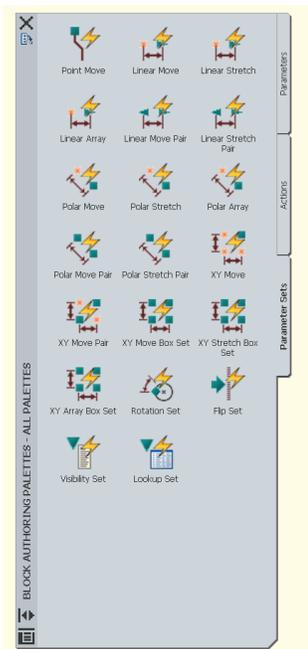
Parameter



Action



Parameter Sets



## Parameters, Actions and Parameter sets

"Parameters define custom properties and specify positions, distances, and angles for the geometry in the block.

Actions define how the geometry of a dynamic block reference will move or change when a block is modified. When you add Actions to the block, you must associate them with Parameters and the AutoCAD geometry."

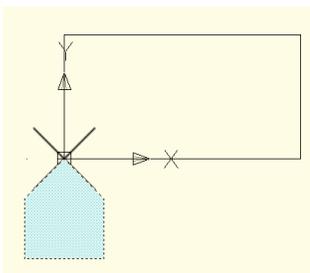
For a block to be Dynamic it must be assigned a Parameter. Most Parameters also need to have an Action applied. However, there are a few Parameters that do not require any Actions, such as an Alignment, Point and Visibility Parameter. Parameters defined what is going to happen to the block and provides the necessary grips. By using the Parameter grips you will generally invoke an Action. Sometimes the grips are used to invoke many Actions.

Parameter Sets let you apply both the Parameters and the Actions in one command. Both Parameters and Actions are Autodesk geometry that can be manipulated via the properties dialogue. These properties can be named to define the custom Action that will be invoked.

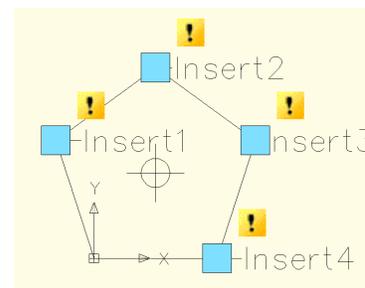
E.g. changing the terminology on a Flip Parameter in the Parameter properties dialog from 'Flipped (Flipped / Not Flipped)' to 'Handed (Left / Right)'.

### Basic Parameters

By adding various insertion Parameters or an Alignment Parameter to an existing block we can immediately enhance it's functionality. Alignment Parameters will automatically pick up the rotation of any adjoining geometry and will save rotate and move commands after insertion. Multiple Insertion points can be added to a block and the Control key used when inserting the block to toggle through the various insertion point options. Only one Base point can be added to each block and no Actions can be applied to this Parameter. Multiple Point Parameters can be added and certain Actions such as Move or Stretch then applied to these points.



Alignment Parameter



Base Point and Multiple Insertion Points Parameters

### Adding Dynamic Blocks to Toolbars

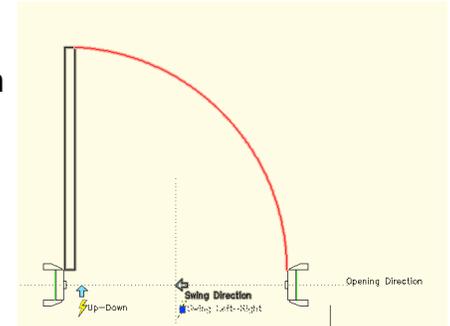
As with standard blocks Dynamic blocks can be added to Toolbars from a saved drawing. Select the block and the hold down the Mouse Right click to drag the block onto your Tool Palette. Right click the block and then edit the properties such as the insertion Layer as required.

## Dynamic Door Project

In order to understand the various abilities of Dynamic blocks the following exercise uses a door block and will increase its functionality by adding various Parameters and Actions and see how they can work.

### Adding a Flip Parameter Set

A Flip Parameter Set is the easiest method of applying both a Flip Parameter and a Flip Action. Open the Block Editor by right clicking on the block and selecting Block Editor. This bypasses the BEDIT box, as AutoCAD knows which block you wish to edit. Add the Flip Parameter Set from the Parameter Set Palette and place this on the mid point of the door swing. Rename the Flip Parameter to "Swing Direction", the base state label to "Left Swing" and the Flipped base State Label to "Right Swing".



Select the Flip Action and renamed to "Swing left – right". Select the door and the swing object and add to the Flip Action.

The same principles of adding a Flip Parameter Set can then be applied to allow the door to open into or out of the room. It is usual to also include the doorframe or at least the doorstep in this situation, as this needs to flip with the door.

### Adding a Linear Parameter

In order to be able to change the width of the door a Linear Parameter is required. Naming the Parameter to something understandable is good practice such as "Door Width". Because we want the Door to always stretch in one direction the No. of Grips property should be set to 1.

In order for the doorframe to move we now need to add a Stretch Action to the door. When adding the Stretch Action AutoCAD will request that you select the associated Parameter, which will be the Door Width Parameter. Create the stretch box and add the frame objects. When selecting a Stretch Action the objects associated with this action will be highlighted. In order for the Door to also change size a Scale Action also need to be applied to scale the Doorframe and the swing.

Linear Parameters have various options associated with them that are available via the properties dialog. One of the properties of the Linear Parameter is the Dist Type. This has three options

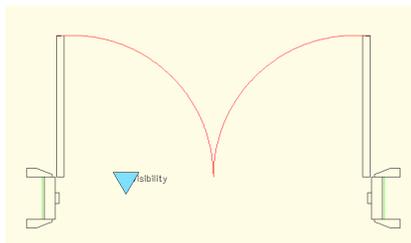
- **None** – The width can be changed to any distance require. A further minimum and maximum setting can be applied.
- **Increment** – Specific increment distances can be applied and also a further minimum and maximum setting can be applied
- **List** – A specific set of distances can be added to a list for Users to then select

## Adding A Look up Table

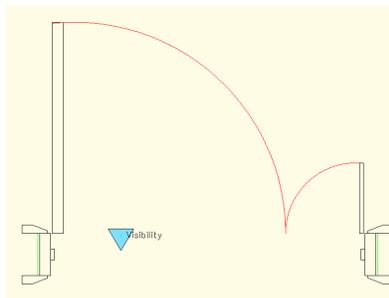
A look up table is a useful device for assigning specific sizes and geometry to a Dynamic block by using the Parameters that have already been defined within that block. If the Linear Parameter has been set to provide Door Widths of specific sizes then the Door Width Properties can be added to the Lookup Table and Lookup Property names given to them. By using the Allow Reverse Lookup within the table then the Geometry and size of the block can be driven by the Lookup grip.

## Adding A Visibility Parameter

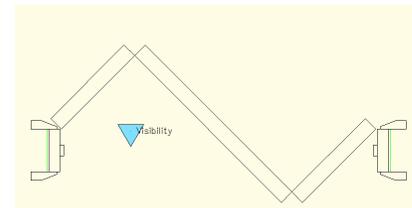
One of the most powerful of the Parameters provided is the Visibility Parameter. This does not require an Action to be assigned to it but instead has a series of Visibility states that can be turned on or off. This allows for one Dynamic Block to hold the geometry of many traditional blocks and therefore reduce your block Libraries. Our Door Example has various swing Visibility States created for it with different AutoCAD Geometry, such as:



Double Door



Door + a Half



Folding Door

For each Visibility State not only can AutoCAD Geometry been made visible or not, but this can also apply to other Parameters and Actions. This allows a Flip Parameter to be added to a Single Door visibility state, but not included within a double door, where the left / right swing is irrelevant.

## Adding Attributes to Dynamic Blocks

The ability to add attributes as fields reading properties provides a powerful tool for scheduling your Dynamic Blocks. Most fields have been exposed with the BLOCKPLACEHOLDER but the results are also not always as assumed.

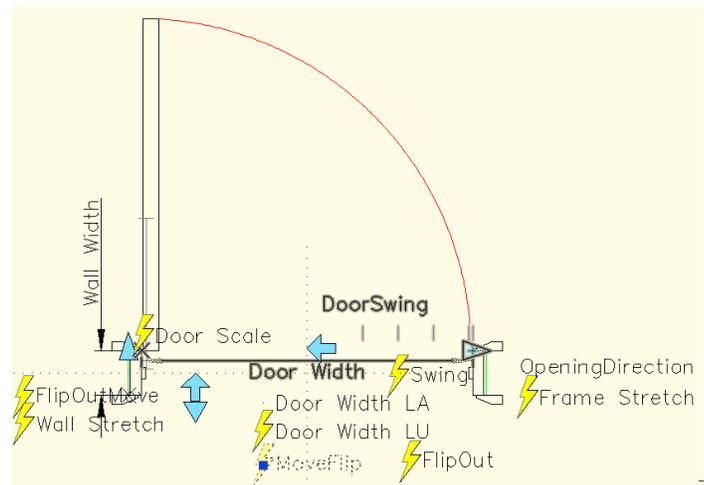
Remember to use the ATTSYNC command after Attributes have been updated to refresh the existing blocks in the drawing.

**Note** - Having added a Flip Parameter Set to our Dynamic Block and named the Base State Label to "Left Swing" the expectation is that "Left Swing" would be the default result for the attribute as is the case in the properties dialog. Unfortunately the response is 0, which just reveals that it is a Boolean data type with a 0 / 1 result.

## Adding Multiple Parameters and Actions

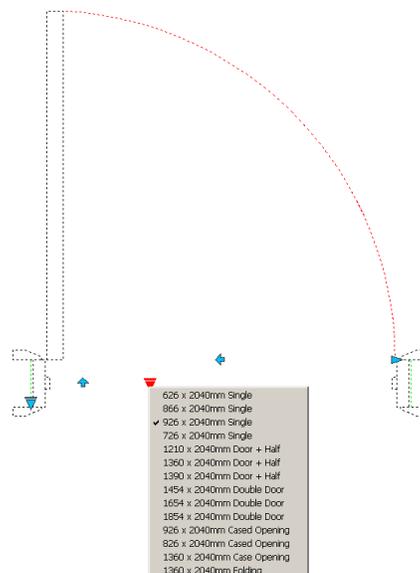
It is not always obvious when adding various Parameters to a Dynamic Block what the final outcome will be. It takes careful planning and consideration of what the various Parameters and Action are intended to do. The use of a Flip Parameter Set and a Linear Parameter has been discussed with the Door block. However, the Flip Parameter was placed at the midpoint of the door, but as the door size changes via the Linear Parameter (Door Width) the Flip Parameter would no longer be in the middle. A resolution for this is to add an additional Move Action to the Door Width Parameter. As the Door width Parameter only wants to stay in the middle of the door then a Distance Multiplier of 0.5 needs to be added. The same should be carried out for the Opening Direction Flip to ensure this always stays in the middle no matter how wide the wall is.

The Move Action called "MoveFlip" is associated with the Linear Parameter Called Door Width. This will move the Flip Parameter called "DoorSwing" half the distance of the Door Width Parameter due to the Distance Multiplier of 0.5.



By using the various Parameters and Actions together a powerful Dynamic block can be created to enhance your productivity. This Door example uses a look up table, which will change both the Width and Display of the Door by selecting from the list. Grips to flip the door to the appropriate swing have also been included.

This could be developed further with attributes being added reading the data from the Lookup tables to allow scheduling of the Dynamic blocks by AutoCAD Tables.



## Other Parameters and Actions

### The Array Action

The use of Linear Parameters to drive stretch, scale and move actions have been shown through the Dynamic Door Project. Another action that is useful to link to the Linear Parameter is the Array Action. This provides the opportunity to add additional objects as the length of an object is increased. This could be an extra chair being added to a table or as this example shows additional bricks being added as the wall extends.

To create a dynamic brick wall a simple brick is drawn with lines for the mortar. The hatching for the bricks is then added. Create a block and then open the Block Editor.

Add a Linear Parameter called Courses and set the Distance Type to be Increment. Set the Increments to be 75. Add an Array Action and call this Brick Count. Add this to the Courses Parameter and set the Array Column Offset to be 75. Add the geometry to the Array Action Selection Set and save the Block.

Now use the array grip to extend the block.

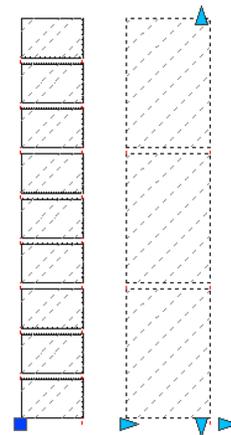
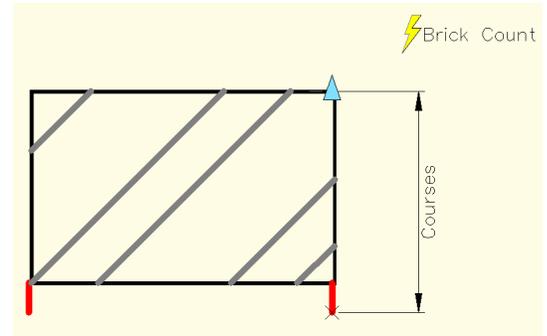
By adding a series of Linear Parameters for component such as the wall cavity and the Blockwork width will provide further functionality. This can be improved further by using a lookup table, which drives both the width for the Cavity and width for the Concrete Blockwork.

A Flip Parameter could also be incorporated as well as wall ties to every other block course using another array. The productivity gains from creating these types of Dynamic blocks for detailing

### Other Parameters

Polar Parameters differ from Linear Parameters in that the angle as well as the distance can change.

XY Parameters shows the difference in the X and Y direction from the base point of the Parameter. This is displayed as two dimensions in the Block Editor.



100mm Block 50mm Cavity
100mm Block 75mm Cavity
100mm Block 100mm Cavity
125mm Block 50mm Cavity
125mm Block 75mm Cavity
125mm Block 100mm Cavity
140mm Block 50mm Cavity
✓ 140mm Block 75mm Cavity
140mm Block 100mm Cavity



## Does and Don'ts.

### Dynamic Blocks Tips

Don't attempt to edit Dynamic Blocks using the Block, Edit Block In place or Explode commands.

Dynamic Blocks do not support Z plane work and therefore do not work with 3 Dimensional objects. Although AutoCAD2007 Solids can be grip edited they do not support the stretch command and cannot be changed in Dynamic Blocks.

To update attributes within a Dynamic block a *REGEN* is required. Remember to use the *ATTSYNC* command to update Dynamic blocks after editing Attributes within the Block Editor. On occasions even the *ATTSYNC* command does not work and it may be required to reinsert the block.

Attributes will read from Field codes but if you type in the Properties Dialog the field code value will be lost and will not update from then on.

Don't use standard AutoCAD commands such as Mirror, Rotate, Scale or Stretch on Dynamic Blocks. This is particularly true if you are scheduling attributes such as handing or rotation. A mirrored block usually has the Scale X property set to -1.

If Associated Hatch is added to Blocks it may not respond as predicted, particularly if there are a number of Actions associated with it. An example of this is the hatch in a Block Wall. It may require both Parameters to be carried out to update the Hatch.

Chaining Parameters to Actions can be enabled via the Properties dialog of the Parameter

Test Dynamic Blocks to Destructing pulling each grip in various orders to ensure it behaves as expected.

### Dynamic Block Editing Tips

Each Action has its own Action Selection Set. If you select the Action the selection set (objects linked to it) will be highlighted. To change this right click and Use either the *New Selection Set* option or *Modify Existing Selection Set*.

Check through the various property dialogs for each Action and see what the various changes can do.

### Dynamic Block Tips for ADT Users

Don't add ADT or any other object to your Dynamic blocks. Also don't try adding Dynamic blocks into ADT Multi-view blocks unless you want to see ADT vanish with a single click.

In ADT the use of the *Select Similar* command can be used to check Dynamic Blocks that have the same properties.

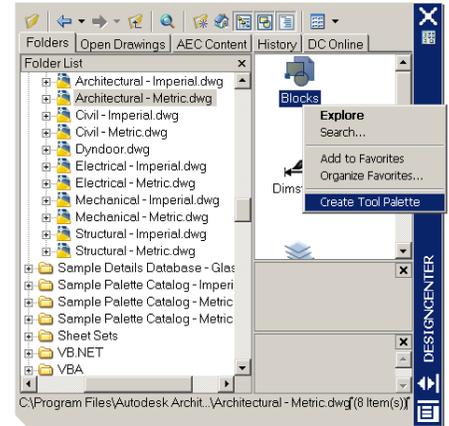
The COPYBLOCK AND ASSIGN function does not work with Dynamic Blocks.



## Updating your Existing block Libraries

The changes in the way the Design Centre and blocks work, mean that it is no longer necessary to have individual blocks stored in a single drawing. The ability to quickly update all your blocks into Dynamic Blocks by adding multiple insertion points, an alignment parameter and a flip parameter could quickly increase productivity.

Design Centre allows Palettes to be quickly created by using the right click on any Drawing Block icon and using the Create Palette command. It is best practice to purge your block drawings to get rid of any anonymous blocks that are not required.



## Palette Properties

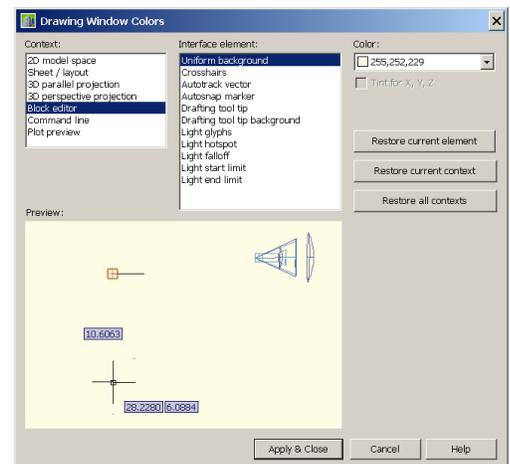
Multiple Tools can be selected on the Palettes and Properties changed in a single click for items such as Layer, Color, Etc.. Insertion Properties such as options for *Rotation*, *Scale* and whether the block should be *Exploded* upon insertion are also available.

## Block Authoring Palettes.

The path to the Block Authoring Palettes is stored under the Options / File / Authoring Palette File Location dialog. The Palettes can be customized to add your own specific requirements. It is recommended that default Palettes are not altered but add your own custom palettes.

## Block Editor Variables

There are a series of system variables relating to the Block Editor Environment. Most of these are available under the Options / Display / Colors dialog. Then choose the Block Editor options illustrated and the various settings are made available. Alternatively the lists of System Variables available via the command line are illustrated in the following table.



## Dynamic Block System Variables

BACTIONCOLOR

### What they do.....

Sets the text color of actions in the Block Editor

BAUTHORPALETTE

Opens the Block Authoring Palettes window in the Block Editor



BAUTHORPALETTECLOSE	Closes the Block Authoring Palettes window in the Block Editor
BCLOSE	Closes the Block Editor.
BCYCLEORDER	Changes the cycling order of grips for a Dynamic Block reference
BEDIT	Opens the Edit Block Definition dialog box and then the Block Editor
-BEDIT	Opens the Edit Block Definition dialog box and then the Block Editor (command line)
BGRIPOBJCOLOR	Sets the color of grips in the Block Editor
BGRIPOBJSIZE	Sets the display size of custom grips in the Block Editor relative to the screen display
BGRIPSET	Creates deletes or resets grips associated with a parameter
BLOCKEDITLOCK	Prevents opening of the Block Editor and editing of Dynamic Blocks definitions. Set it to 1. By doing this when you double click on a block it will open the REFEDIT feature rather than the Block Editor. By default in AutoCAD 2007 the BLOCKEDITLOCK is set to 0. This prevents users from editing Dynamic Blocks
BLOCKEDITOR	Reflects whether or not the Block Editor is open.
BPARAMETERCOLOR	Sets the colour of <i>Parameters</i> in the Block Editor.
BPARAMETERFONT	Sets the font used for <i>Parameters</i> and <i>Actions</i> in the Block Editor.
BPARAMETERSIZE	Sets the size of parameter text and features in the Block Editor relative to the screen display.
BSAVE	Saves the current block definition
BSAVEAS	Saves a copy of the current block definition with a new name
BTMARKDISPLAY	Controls whether or not value set markers are displayed.
GRIPDYNCOLOR	Controls the colour of custom grips for Dynamic Blocks.
INSUNITS	Specifies a drawing-units value for automatic scaling of block images or xrefs inserted into or attached to a drawing.
RESETBLOCK	Resets one or more Dynamic Block references to the default values of the block definition