Cloning objects and Array

3ds Max provides several techniques for copying or duplicating objects; cloning is the general term for this process. These techniques can be used to clone any selection set.

- Clone
- Shift+Clone
- Snapshot
- Array
- Mirror
- Spacing Tool
- Clone and Align Tool

Shared Features

While each technique has distinct uses and advantages in cloning objects, in most cases the cloning techniques share some similarities in how they work:

- You can apply a transform when you clone. New objects are moved, rotated, or scaled as they are created.
- The transform is relative to the current coordinate system, axis constraint, and transform center.
- When cloning creates new objects, you have the choice of making them copies, instances, or references.

Clone

Using the Clone command on the Edit menu is the easiest method for copying an object in place; no transformation is involved.

Clone creates a copy, instance, or reference of an object.

The Clone command on the Edit menu creates a single copy of your selection. Alternatively, you can clone multiple copies by holding down the Shift key as you move, rotate, or scale your selection. Either method displays the Clone Options dialog.

Clone Options Dialog

Clone creates a copy, instance, or reference of a selected object or set of objects. The Clone command on the Edit menu creates a single copy. You can clone multiple copies by holding down the Shift key as you transform the selection.
To clone an object without transforming it:

1. Select an object, or set of objects.
2. From the Edit menu, choose the Clone command.
   The Clone Options dialog opens.
   **Note** All options are present except Number Of Copies.
3. Change the settings or accept the defaults, and then click OK.

Each new, cloned object occupies the same space as the original. Select a clone by name to move or modify it.

To clone an object with **Scene Explorer**:

**Note** Cloning objects with Scene Explorer requires that the new copies be hierarchical children of an existing object.

1. In Scene Explorer, highlight one or more objects.
2. Do either of the following:
   - Right-click one of the highlighted items and choose Copy Nodes.
   - From the Edit menu, choose Copy Nodes.
3. Do either of the following:
   - Right-click an item and choose Paste Nodes.
   - Highlight an object and from the Edit menu, choose Paste Nodes.
   - The Clone Options dialog opens.
4. Change the settings or accept the defaults, and then click OK.

The copied objects are cloned as children of the highlighted object.

Each new, cloned object occupies the same space as the original. Select a clone by name to move or modify it.

To clone and transform an object:

1. On the main toolbar, click (Move), (Rotate), or (Scale).
2. Select an object, multiple objects, group, or sub-object.
3. Hold down the **Shift** key and drag the selection.
   As you drag your selection, the clone is created, selected, and transformed. The original object is deselected and unaffected by the transform.
4. Change the settings or accept the defaults, and then click OK.
Object group

- **Copy** Places a copy of the selected object at the specified position.
- **Instance** Places an instance of the selected object at the specified position.
- **Reference** Places a reference of the selected object at the specified position.

Controller group

Lets you choose to copy or instance the transform controllers of the original object’s child objects. This option is available only when the selection you are cloning includes two or more hierarchically linked objects.

When cloning non-linked objects, transform controllers are simply copied. Also, when cloning linked objects, the highest-level cloned object’s transform controller is simply copied. This option applies only to the transform controllers of objects at levels below the top of the cloned hierarchy.

- **Copy** Copies the cloned objects' transform controllers.
- **Instance** Instances the cloned objects' transform controllers below the top level of the cloned hierarchy. With instanced transform controllers, you can change the transform animation of one set of linked children, and automatically have the change affect any cloned sets.

This allows you to animate all clones identically with a single animation setup. For example, consider a scene containing three objects named Torso, Thigh, and Calf. The objects are linked hierarchically so that Torso is the parent of Thigh and Thigh is the parent of Calf. Say you select all three objects and then clone them, and choose Clone Options ➤ Controller ➤ Instance. Thereafter, if you transform either Thigh or Calf object, the corresponding object in the other hierarchy is transformed identically, along with any child objects. However, if you transform either Torso object, the other hierarchy is not affected.

Number of Copies

- Specifies the number of copies of the object you want to create. Available only when you Shift+Clone an object.

- Using Shift+Clone to generate multiple copies applies the transform successively to each additional copy. If you Shift+Move an object and specify two copies, the second copy is offset from the first copy by the same distance that the first copy is offset from the original. For Rotate, two copies of the rotated object are created, with the second copy rotated twice as far as the first. For Scale, two copies of the scaled object are created, with the second copy scaled from the first copy by the same percentage that the first copy was scaled from the original.

Name

- Displays the name of the cloned object.

- You can use this field to change the name; additional copies use the same name followed by a three-digit number, starting at 01 and incrementing by one for each copy. So, for instance, if you Shift+Move an object and then specify the name building and two copies, the first copy will be named building and the second will be named building01.

Shift+Clone

Shift+Clone clones an object when you transform it.
You can clone an object as you transform it interactively in the viewport. The process is referred to as **Using Shift+Clone**: the technique of holding down the Shift key while transforming a selected object with the mouse.

Quick and versatile, this technique is probably the one you’ll use most often to duplicate objects. Snap settings give you precise results.

How you set the center and axes for the transforms determines the arrangement of the cloned objects. Depending on the settings, you can create both linear and radial arrays.

You need a working knowledge of transform features to take full advantage of Shift+Clone.

### Using Shift+Clone

Shift+Clone is the primary way to duplicate objects in 3ds Max. You hold down the Shift key and drag during any of the standard transform operations: Move, Rotate, or Scale.

When Maya mode is active, you can’t use Shift+drag to clone an object. In Maya mode, Shift+left-click selects or deselects objects, instead.

**To Shift+Clone an object:**

1. On the main toolbar, click ![Move](Move), ![Rotate](Rotate), or ![Scale](Scale).

2. Select a transform coordinate system and constraints. Each transform carries its own settings. To avoid surprises, always click the transform button first, and then set your transform coordinate system and constraints.

   **Note** You can also use the Transform Gizmo to set axis constraints.

3. Select the object or set of objects you want to clone. The selection can be a single object, multiple objects, a group, or a sub-object selection.

4. Hold down the Shift key and drag the selection to apply the transform.

   As you drag, a clone is created and selected; it is now the object being transformed. The original object is no longer selected and is unaffected by the transform.

When you release the mouse button, the Clone Options dialog appears. Change settings in this dialog or accept the defaults, and then click OK.

Shift+Clone uses the **Clone Options dialog** for any transform you choose.

### Animating Shift+Clone

- You can animate any Shift+Clone operation.
- You can use the **Auto Key button** to animate Shift+clone. However, there are some restrictions.
- When the Auto Key button is on, the transform center defaults to local pivot, and the **Use Center flyout** on the toolbar is unavailable. If you choose one of the other centers and activate Auto Key, the center returns to the local pivot. This means you can’t directly animate about a non-local pivot center with Shift+Rotate and Shift+Scale. For example, you can’t use this method to create clones in an arc or circular array around a common center.

### Using Non-Local Centers
To use a center separate from the object you’re cloning, you can do any of the following:

- Use a dummy object.
- Offset the local pivot.
- Change the default animation center.

### Using a Dummy Object as Center

In this procedure, you use the axis tripod of the dummy object as the center for rotation or scale.

**To use a dummy object as center:**

1. Create a dummy object at the center of rotation or scaling.
2. Link the object or objects you want to clone to the dummy object, which becomes the parent.
3. Select both the dummy and the objects, then transform them with **Shift**+Rotate or **Shift**+Scale.
   - For **Shift**+Rotate, the dummy’s center becomes the pivot.
   - For **Shift**+Scale, the dummy and selected objects scale together toward the center of the dummy.

### Offsetting the Local Pivot

In this procedure, you move the object’s pivot to the center of rotation or scale. This works much like using a dummy object.

**To offset the local pivot:**

1. Select the object whose pivot you wish to move.
2. On the Hierarchy command panel, choose Pivot and then turn on Affect Pivot Only.
3. Move the local pivot of the original object to another location in your scene.
4. On the Hierarchy panel, click Affect Pivot Only again to turn it off.

**Shift**+Rotate or **Shift**+Scale now animates around the offset center. This works with the default setting for local center.

**Note**
Moving the local pivot can adversely affect linking and inverse kinematics. If this is a possibility, consider changing the default axis instead of moving the local pivot.

### To change the default axis while animating:

In this procedure, you set 3ds Max to allow animation of transforms about any center on the Use Center flyout.

1. Choose Customize menu ➤ Preferences and click the Animation tab of the Preference dialog.
2. In the Animate group, turn off Local Center During Animate.

This changes the default and makes all the transform center options available when animating. You can now animate around either the selection or transform coordinate center, as well as local pivot.

**Note**
Changing the default setting animates the rotation you see in viewports as a rotation plus translation, which might not be the effect you wanted.
Cloning objects with Shift+Clone requires transforming them at the same time, by moving, rotating, or scaling them. In some cases, you might want to clone an object without transforming it in any way. The Edit menu Clone command gives you this option, which lets you create only one clone at a time.

To clone objects without transforming:

1. Select the object or objects to clone.
2. Choose Edit menu ➤ Clone. The Clone Options dialog appears. This is the same dialog used with Shift+Clone except that there's no Number Of Copies setting. The Clone command lets you create only one copy.
3. Change settings in this dialog or accept the defaults, and click OK.

Note: The cloned object occupies the exact same space as the original, and is selected when cloning is complete. Use Select By Name to select the original or reselect the clone.

Snapshot

Using an ice-cream cone animated along a path, Snapshot creates a stack of cones.

Snapshot clones an animated object over time. You can create a single clone on any frame, or space multiple clones along the animation path. The spacing is a uniform time interval; it can also be a uniform distance.

Extras toolbar ➤ s (Snapshot), on Array flyout
Tools menu ➤ Snapshot

Choosing Tools ➤ Snapshot opens the Snapshot dialog. This enables you to clone an animated object over time.

Using an ice-cream cone animated along a path, Snapshot creates a stack of cones.

Snapshot spaces the clones equally in time. Adjustments in Track View let you space the clones equally along the path instead (see the second procedure, below).

Like other clone techniques, Snapshot creates copies, instances, or references. You can also choose a mesh option for use with particle systems.
Particle Snapshots

You can clone particle systems as static mesh objects. You can also produce clones of the particles themselves as meshes, when using the Snapshot dialog ➤ Clone Method ➤ Mesh option. This works with all configurations of particle systems, including those using MetaParticles. Usage is the same as with other types of objects.

Procedures

**To clone an object over time:**

1. ![Snapshot icon] Select an object with an animation path.
   Snapshot also shows the effect of any other transform animations, such as rotate or scale as well as parametric modifier animation.
2. Do one of the following:
   - On the Extras toolbar, click ![Snapshot icon], which is on the Array flyout.
   - On the Tools menu, choose Snapshot.
   3ds Max opens the Snapshot dialog.
3. Set parameters on the dialog, and click OK.

**To space clones evenly by distance:**

1. ![Snapshot icon] Select an object with an animated position.
2. Open Track View and find the Position track for the original object.
3. Click ![Assign Controller icon] Assign Controller and check that the track is using a Bezier Position controller. Do one of the following:
4. If the track is already using a Bezier Position controller, proceed to step 4.
5. If the track is not using a Bezier Position controller, change the controller, then proceed to step 4.
6. Select all the transform keys and right-click one of the selected keys to display the Key Info dialog.
7. Click Advanced to expand the dialog.
8. Click Normalize Time.
9. Set Constant Velocity on.
11. 3ds Max opens the Snapshot dialog.
12. Set parameters in the dialog, and click OK.

**Interface**

**Snapshot group**

- **Single** Makes a clone of the geometry of the object at the current frame.
- **Range** Makes clones of the geometry of the object along the trajectory over a range of frames. Specify the range with the From/To settings and the number of clones with the Copies setting.
From/To-Specifies the range of frames to place the cloned object along the trajectory.

Copies-Specifies the number of clones to place along the trajectory. They are evenly distributed over the time period, but not necessarily over the spatial distance along the path.

Clone Method group

- **Copy**Clones copies of the selected object.
- **Instance**Clones instances of the selected object. Not available with particle systems.
- **Reference**Clones references of the selected object. Not available with particle systems.
- **Mesh**Creates mesh geometry out of a particle system. Works with all kinds of particles.

Cloning Objects Over Time with Snapshot

The **Snapshot tool** lets you clone an object along its animation path. You can make a single clone at any frame, or multiple clones spaced over a selected number of frames.

Using **car models animated along paths**, Snapshot creates an image of a collision. Snapshot can also clone a particle system's particles. Snapshot spaces the clones equally in time. Adjustments in Track View let you space the clones equally along the path instead. Like other clone techniques, Snapshot creates copies, instances, or references. You can also choose a mesh option. To clone an object with Snapshot, the object must already be animated. You can use Snapshot from any frame on the path. The Auto Key button has no effect on Snapshot, since Snapshot creates static clones, not animation. This is the general procedure:

**To clone an object with Snapshot:**

1. Select an object with an animation path, or a particle system. The animation can result from applying transforms, controllers, or any combination of effects.
2. On the Extras toolbar ➤ **Array flyout** click (Snapshot), or on the Tools menu, choose Snapshot.
3. 3ds Max opens the Snapshot dialog.
4. **Note**The Array flyout is on the Extras toolbar, which is off by default. You can toggle display of this toolbar by right-clicking an empty spot on the main toolbar and choosing **Axis Constraints** from the Customize Display right-click menu.
5. Set parameters in the dialog, and click OK.

**Array**

A one-dimensional array-**Array** creates repeating design elements: for example, the gondolas of a Ferris wheel, the treads of a spiral stair, or the battlements along a castle wall.

Array gives you precise control over all three transforms and in all three dimensions, including the ability to scale along one or more axes. It is the combination of transforms and dimensions, coupled with different centers, that gives you so many options with a single tool. A spiral stair, for example, would be a
Combination of Move and Rotate around a common center. Another array using Move and Rotate might produce the interlocked links of a chain.

Arraying Objects

Array is a dedicated tool for cloning and precisely transforming and positioning groups of objects in one or more spatial dimensions. For each of the three transforms (move, rotate, and scale), you can specify parameters for individual objects in the array, or for the array as a whole. Many results you can get with Array would be laborious or impossible using Shift+Clone techniques.

A one-dimensional array

Creating an Array

This is the general procedure. For more details, see the topics that follow.

- To create an array:
- Select one or more objects to be in the array.
- Choose a coordinate system and transform center.
- Do either of the following:
  - On the Extras toolbar, click (Array).
  - From the Tools menu, choose Array.

Note: The Array button is on a flyout on the Extras toolbar, which is off by default. You can toggle display of this toolbar by right-clicking an empty spot on the main toolbar and choosing Extras from the Customize Display right-click menu.

1. Set array parameters on this dialog, then click OK. For details on the dialog, see Array.

General Considerations

- When you use the Array tool, keep these points in mind:
- The best way to use Array is with Preview on, so the process is interactive. Preview is off by default, so be sure to turn it on before changing the settings.
- The Array dialog is modeless, so you can navigate the viewport using any standard method while the dialog is open. For example, if the array extends beyond the viewport boundaries (with Preview on), you can pan or zoom the viewport to bring the entire array back into view.
- After creating an array and checking its result, you can undo the array using Edit menu ➤ Undo Create Array or Ctrl+Z. This leaves the original selection set in place.
- After you create an array, object selection moves to the last copy or set of copies in the array. By simply repeating current settings, you create a seamless continuation of the original array.
- Array is relative to the current viewport settings for coordinate system and transform center.
- Axis constraints do not apply, because Array allows you to specify transforms along all axes.
- You can animate array creation. By changing the default Animate preferences setting, you can activate all the transform center buttons, allowing direct animation around either the selection or coordinate center, as well as local pivot. For information about changing the default setting, see the procedure, To change the default axis while animating.
- To make an array of a hierarchically linked object, select all the objects in the hierarchy before you click Array.
Array settings are saved only during the current session, not with the file. Be sure you’ve finished an array before you quit or reset 3ds Max.

Using the Array Dialog

The Array dialog provides two main control areas where you set the important parameters: Array Transformation and Array Dimensions.

You can set parameters in any order, but in practice it’s useful to start with Array Transformation. This creates the basic building block for the larger array, as defined by Array Dimensions.

New

The Array dialog is now modeless, so you can navigate the viewport using any standard method while the dialog is open. For example, if the array extends beyond the viewport boundaries (with Preview on), you can pan or zoom the viewport to bring the entire array back into view.

Array Transformation

This area lists the active coordinate system and transform center. It’s where you set the transforms that define the first row of the array. You decide here on the distance, rotation, or scale of individual elements, and along what axes. You then repeat this row in other dimensions to produce the finished array.

Move, Rotate, and Scale Transforms

- You set Move, Rotate, and Scale parameters along any of the three axes of the current coordinate system.
- Move is set in current units. Use a negative value to create the array in the negative direction of the axis.
- Rotate is set in degrees. Use a negative value to create the array in a clockwise direction around the axis.
- Scale is set as a percentage. 100 percent is full size. Settings below 100 decrease the size, and above 100 increase it.

Incremental and Totals

For each transform, you have the choice of whether to apply the transforms successively to each newly created element in the array or to the overall array. For example, if you set Incremental » X » Move to 120.0 and Array Dimensions » 1D » Count to 3, the result is an array of three objects, each of whose transform centers is 120.0 units apart. However, if you set Totals » X » Move to 120.0 instead, the three elements are spaced 40.0 units apart for a total array length of 120.0 units.

- Click arrows on either side of the transform labels to choose between Incremental or Totals.
Incremental and Totals settings are toggles for each transform. When you set a value on one side, the other side is unavailable. However, the unavailable value updates to show the equivalent setting.

**Incremental:** Parameters set on this side apply to individual objects in the array. Here are examples:
- An Incremental Move X setting of 25 specifies a spacing of 25 units on the X axis between centers of arrayed objects.
- An Incremental Rotate Z setting of 30 specifies a progressive rotation of 30 degrees on the Z axis for each object in the array. In the finished array, each object is rotated 30 degrees farther than the one before it.

**Totals:** Parameters set on this side apply to the overall distance, number or degrees, or percentage scale in the array. Here are examples:
- A Totals Move X setting of 25 specifies a total distance of 25 units on the X axis between the centers of the first and last arrayed objects.
- A Totals Rotate Z setting of 30 specifies a combined rotation of 30 degrees on the Z axis divided equally among every object in the array.

<table>
<thead>
<tr>
<th>Type of Object</th>
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<tbody>
<tr>
<td><strong>Copy</strong>- Creates new array members as copies of the originals.</td>
</tr>
<tr>
<td><strong>Instance</strong>- Creates new array members as instances of the originals.</td>
</tr>
<tr>
<td><strong>Reference</strong>- Creates new array members as references of the originals.</td>
</tr>
</tbody>
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For further information, see [Overview of Copies, Instances, and References](#).

**Array Dimensions**

The Array Dimensions controls determine the number of dimensions used in the array and the spacing between the dimensions.

**Count:** The number of objects, rows, or layers in each dimension.

**1D:** One-dimensional arrays form a single line of objects in 3D space, like a line of columns. 1D Count is the number of objects in a row. Spacing for these objects is defined in the Array Transformation area.

*A one-dimensional array, with 1D Count=6*

**2D:** Two-dimensional arrays form a layer of objects along two dimensions, like the rows of squares on a chess board. 2D Count is the number of rows in the array.
A two-dimensional array, with 1D Count=7 and 2D Count=4

3D: Three-dimensional arrays form multiple layers of objects in 3D space, like neatly stacked boxes. 3D Count is the number of layers in the array.

A three-dimensional array, with 1D Count=10, 2D Count=6, 3D Count=3

Incremental Row Offsets

These parameters become available when you choose a 2D or 3D array. These are distances along any of the three axes of the current coordinate system.

- If you set a Count value for 2D or 3D, but no row offsets, the array is created with overlapping objects. You need to specify at least one offset distance to prevent this.
- If some objects appear to be missing from the array, it is possible that some objects have been created exactly on top of other objects in the array. To determine whether this has occurred, use Select By Name to see the full listing of objects in your scene.

Creating Linear Arrays

A linear array is a series of clones along one or more axes. A linear array can be anything from a line of trees or cars to a stairway, a picket fence, or a length of chain. Any scene requiring repeated objects or shapes is a candidate for a linear array.

Examples of linear arrays

For an explanation of interface terms used here, see Using the Array Dialog. For the basic steps in making an array, see Arraying Objects.

Creating Simple Linear Arrays

The simplest 2D linear array is based on moving a single object along a single axis. These are the basic choices to make on the Array dialog.

Make these choices in the Array Transformation group:

- Use Incremental Move settings where you know the spacing you want between objects.
- Use Totals Move settings when you know the overall space or volume you want the array to occupy.
- For either of these two types of arrays, enter a value for one axis. Leave the other transforms at their default values.

Make these choices in the Array Dimensions group:

- Choose 1D.
- Enter a Count value for the number of objects in the array. The Total In Array field updates to show you the current total of objects in the array you are designing.
- Click OK to create a linear array along the chosen axis, with the number of objects specified by Count.

2D and 3D Linear Arrays
Arrays in 2D and 3D have the same Array Transformation group setup as 1D, with the addition of Incremental Row Offsets settings for moving the additional dimensions apart.

- Set 2D or 3D and enter a Count value.
- If you set 3D, the 2D values also become available. Both Count values are 1 by default, which has the same effect as 1D. Set the 2D and 3D Count values greater than 1 to produce a more complex array.
- Set a nonzero value for at least one Incremental Row Offsets setting for 2D and 3D. Otherwise, there will be no separation between the 1D row and the new clones.

A wide variety of linear arrays are possible. Experiment with moving along all three axes and varying the row offsets in 2D and 3D.

### Using Rotation in Linear Arrays

A linear array with elements rotated about their Y axis.

You can rotate elements in a linear array by applying a Rotate value for a specified axis. When you add rotation to a linear array, the choice of transform center becomes important.

### Using Scale in Linear Arrays

A linear array with progressive scaling.

When you apply a Scale factor, 3ds Max scales each copy from the previous copy. Objects in the array become progressively smaller or larger, as in the illustration.

### Scale and Movement in Nested Arrays

Using only Scale settings and the local pivot of an object produces nested arrays, like Russian dolls, just as it does when you `Shift`+Scale from the local pivot. However, with the Array tool, you can add movement as well. This means you can create increasingly larger or smaller copies and array them at the same time.

### Using Uniform Scaling

By default, all axes are available for scaling. If you turn on Uniform, only the Scale X field is active; the Y and Z fields are unavailable. The X value is applied as uniform scaling on all axes of the arrayed objects.

### Creating Circular and Spiral Arrays

Creating circular and spiral arrays typically involves some combination of moving, scaling, and rotating copies along one or two axes and around a common center. The effects can vary from the uniform radial arrangement of bolts on a wheel hub to the complex geometry of a spiral staircase. You can model many circular patterns with these techniques.

### Using a Common Center
Both circular and spiral arrays require a common center for the arrayed objects. This can be the world center, the center of a custom grid object, or the center of the object group itself. You can also move the pivot point of an individual object and use that as the common center.

### Circular Arrays

A circular array

Circular arrays are similar to linear arrays, but based on rotation around a common center rather than movement along an axis. The following procedure makes a circle of objects on the XY plane of the home grid with the Z axis as the center.

**To create a circular array:**

- On the main toolbar, choose a transform center to become the center of the array. In this case, choose Use Transform Coordinate Center so the center of the grid becomes the array center.
- Select an object and position it at some distance from the center of the grid.
- This distance is the radius of the finished circle.
- On the Extras toolbar, choose (Array) from the Array flyout, or on the Tools menu, choose Array.
- 3ds Max opens the Array dialog.
- **Note** The Array flyout is on the Extras toolbar, which is off by default. You can toggle display of this toolbar by right-clicking the main toolbar and choosing Axis Constraints from the Customize Display right-click menu.
- On the Array dialog, enter 360 in the Totals Rotate Z field.
- This is the total rotation for the array, a complete circle. To create a partial circle, enter a smaller value.
- Choose 1D and enter a Count value (this can be any number) and click OK.
- 3ds Max arrays that number of clones within the total rotational angle you specify.

### Spiral Arrays

A spiral array

The simplest spiral arrays are rotated circular arrays with a movement along the central axis. The same circle is formed, but now the circle rises upward.

If Z is the central axis, enter a value for Incremental Move Z. Each clone is then moved upward this amount as the circle is formed.

**Rotation in Spiral Arrays**

In spiral arrays, the direction of rotation determines the direction of the spiral: which way it winds up or down.

- Enter a positive rotation for a counterclockwise spiral.
- Enter a negative rotation for a clockwise spiral.
Reorienting an Array

- By default, each object, when copied into the array, rotates around its own center to follow the main rotation around the common center. This is controlled by the Re-Orient option.
- To cause objects to maintain their original orientation while being rotated, turn off Re-Orient. In effect, objects remain "facing the same direction" as the original object.

Mirror

Mirroring an object

Mirror produces a symmetrical copy around any combination of axes. There is also a "No Clone" option that performs the mirror operation without copying. The effect is a flip or move of the object to a new orientation. Mirror has an interactive dialog. As you change settings, you see the effect in the active viewport; in other words, a preview of what the mirror will look like. There is also a Mirror modifier that gives you parametric control of the mirror effect.

Mirroring Objects

The Mirror tool uses a dialog that either creates a mirrored clone of a selected object, or mirrors the orientation of the object without creating a clone. You can preview the effects of settings before committing to the operation.

Mirrored Arrays

You can combine the Mirror and Array tools by using them in succession. An entire array can be mirrored, or you can set up mirrored objects before creating an array.

Animating Mirror

When you use Mirror with Auto Key turned on, you see the transition occur as the mirrored object moves into place. For example, a cylinder mirrored to the other side of an axis appears to flatten and reshape itself. The object is, in fact, scaled from 100% to 0% to –100%. This effect is not visible unless the mirror operation is animated.

Mirror Modifier

The Mirror modifier provides a parametric method of mirroring an object or sub-object selection within the modifier stack. You can apply the Mirror modifier to any type of geometry. You can animate the mirror effect by animating the modifier’s gizmo.
Clicking Mirror displays the Mirror dialog, which enables you to move one or more objects while mirroring their orientation.

The Mirror dialog also allows you to mirror the current selection about the center of the current coordinate system. You can create a clone with the mirror dialog at the same time. If you mirror a hierarchical linkage, you have the option to mirror the IK limits.

**Mirroring an object**

The Mirror dialog uses the current reference coordinate system, as reflected in its name. For example, if Reference Coordinate System is set to Local, the dialog is named Mirror: Local Coordinates. There is one exception: If Reference Coordinate System is set to View, Mirror uses Screen coordinates.

As you adjust the various settings in the Mirror dialog, you see the results in the viewports.  

**Procedures**

**To mirror an object:**

- Make any object selection.
- Do one of the following:
  - On the main toolbar, click (Mirror).
  - On the Tools menu, choose Mirror.
- 3ds Max opens the Mirror dialog.
- Set the mirror parameters in the dialog and click OK.
- The active viewport changes to show the effect of each parameter as you set it. When you click OK, 3ds Max creates the choice of mirror that you see previewed.

**To make a clone using mirror:**

1. Make any object selection
2. Do one of the following:
   - On the main toolbar, click (Mirror).
   - On the Tools menu, choose Mirror.
   3ds Max opens the Mirror dialog.
3. In the Clone Selection group, choose Copy, Instance, or Reference.

4. Make any additional settings as desired and then click OK.

**Interface**

**Mirror Axis group**

The mirror axis choices are X, Y, Z, XY, XZ, and YZ. Choose one to specify the direction of mirroring. These are equivalent to the option buttons on the Axis Constraints toolbar.

**Offset**

Specifies the distance of the mirrored object's pivot point from the original object's pivot point.

**Clone Selection group**

Determines the type of copy made by the Mirror function.

- **No Clone** (The default.) Mirrors the selected object without making a copy.
- **Copy** Mirrors a copy of the selected object to the specified position.
- **Instance** Mirrors an instance of the selected object to the specified position.
- **Reference** Mirrors a reference of the selected object to the specified position.

If you animate the mirror operation, mirroring generates a Scale key. If you set Offset to a value other than 0.0, mirroring also generates Position keys.

**Mirror IK Limits**

- Causes the IK constraints to be mirrored (along with the geometry) when you mirror the geometry about a single axis. Turn this off if you don't want the IK constraints to be affected by the mirror command.
- The end effectors used by the IK are not affected by the Mirror command. To successfully mirror an IK hierarchy, first delete the end effectors: Go to the Motion panel ➤ IK Controller Parameters rollout ➤ End Effectors group and, under Position, click the Delete button. After the mirror operation, create the new end effector using the tools on the same panel.

**Spacing Tool**

*The Spacing Tool distributes the vases along the sides of the curved street.*

The Spacing tool distributes along a path defined by a spline or pair of points. You define a path by picking a spline or two points and by setting a number of parameters. You can also specify how the spacing between objects is determined and whether the insertion points of the objects align to the tangent of the spline.
**Using the Spacing Tool**

The Spacing Tool distributes objects based on the current selection along a path defined by a spline or pair of points. The distributed objects can be copies, instances, or references of the current selected object. You define a path by picking a spline or two points and by setting a number of parameters. You can also specify how the spacing between objects is determined and whether the insertion points of the objects align to the tangent of the spline.

The Spacing Tool distributes the vases along the sides of the curved street. The vases are all at the same distance from each other; fewer of them appear on the shorter side.

For details on the Spacing Tool parameters, see Spacing Tool.

**To distribute objects along a path:**

- Select one or more objects to distribute.
- On the Extras menu, choose (Spacing Tool) from the Array flyout, or on the Tools menu, choose Align Spacing Tool.
- Note The Array flyout is on the Extras toolbar, which is off by default. You can toggle display of this toolbar by right-clicking an empty area on the main toolbar and choosing Axis Constraints from the Customize Display right-click menu.
- On the Spacing Tool dialog, click Pick Path or Pick Points to specify a path.
- If you click Pick Path, select a spline from your scene to use as the path.
- If you click Pick Points, click a start point and an end point to define a spline as the path. When you’re finished with the Spacing Tool, 3ds Max deletes this spline.
- From the drop-down list at the bottom of the Parameters group, choose a spacing option.
- The parameters available for Count, Spacing, Start Offset, and End Offset depend on the spacing option you choose.
- Specify the number of objects to distribute by entering a Count value, or by using the spinner.
- Depending on the spacing option you choose, adjust the spacing and offsets.
- In the Context group, choose one of the following:
  - Edges specifies that spacing be determined from the facing edges of each object’s bounding box.
  - Centers specifies that spacing be determined from the center of each object’s bounding box.
- To align the insertion points of the distributed objects to the tangent of the spline, turn on Follow.
- In the Type Of Object group, choose the type of object to output (copy, instance, or reference) and click Apply.

**Clone and Align Tool**

The Clone And Align tool lets you distribute source objects based on the current selection to a second selection of destination objects. For example, you can use Clone And Align to populate several rooms simultaneously with the same furniture arrangement. Similarly, if you import a CAD file that contains 2D symbols that represent chairs in a conference room, you can use Clone And Align to replace the symbols with 3D chair objects en masse.
The Clone And Align tool lets you distribute source objects based on the current selection to a second selection of destination objects. For example, you can populate several rooms simultaneously with the same furniture arrangement. Similarly, if you import a CAD file that contains 2D symbols that represent chairs in a conference room, you can use Clone And Align to replace the symbols with 3D chair objects en masse.

The distributed objects can be copies, instances, or references of the current selected object. You determine the number of clones or clone sets by specifying any number of destination objects. You can also specify position and orientation alignment of the clones on one, two, or three axes, with optional offsets.

You can use any number of source objects and destination objects.

You can pick objects within an XRef scene as destination objects.

With multiple source objects, Clone And Align maintains the positional relationships among the members of each cloned group, aligning the selection center with the destination's pivot.

Procedures

To use the Clone And Align tool:

- Create or load an object or objects to be cloned, as well as one or more destination objects.

- Select the object or objects to be cloned.

- Do one of the following:
  - On the Extras toolbar, click (Clone And Align), which is on the Array flyout.
  - On the Tools menu, choose Align ➤ Clone And Align.

- 3ds Max opens the Clone And Align dialog.

**Note** You can open the Clone And Align dialog before you select the objects to clone.

- Do one of the following:
  - Click Pick once and then click each destination object in turn. Next, click Pick again to turn it off.
  - Click Pick List and then use the Pick Destination Objects dialog to pick all destination objects simultaneously.

- On the Clone Parameters rollout, choose the type of clone, and, if appropriate, how to copy the controller. For details, see Clone Options Dialog.

- Use the Align Parameters rollout settings to specify position, orientation, and scale options.

- At any time, when Pick is off, you can change the source selection in a viewport. This causes the dialog to lose focus; click it again to regain focus and refresh the viewport preview of the clone operation.

- To make the clones permanent, click Apply, and then click Cancel or the close button (X, in upper-right corner) to close the dialog.
The Clone and Align tool takes the form of a non-modal dialog; it remains open while you work in the viewports. While the dialog is active, the results of the current settings appear as a preview in the viewports. Because of the dialog's non-modal nature, you can change the selection of source and destination objects on the fly and see the results immediately in the viewports. When the dialog focus is lost by activating another dialog or clicking in a viewport (that is, its title bar is gray rather than blue), the preview no longer appears in the viewports. To make the cloned objects permanent, click Apply when the dialog is active.

Source and Destination Parameters rollout

Designate source objects by selecting them in a viewport. If you do this with the Clone And Align dialog open, the dialog loses focus; click the dialog to regain focus and update the settings.

Destination Objects [label] - This read-only field shows the number of destination objects. To change this value, use Pick, Pick List, and Clear.

Pick - When on, each object you click in the viewports is added to the list of destination objects. Click again to turn off after picking all destination objects.

To qualify as a valid destination object, an object must:

- not have been designated as a source or destination object.
- be selectable (frozen objects can't be selected).

Pick List - Opens the Pick Destination Objects dialog, which lets you pick all destination objects simultaneously, by name. In the dialog, highlight the destination objects, and then click Pick.

Clear All - Removes all destination objects from the list. Available only when at least one destination object is designated.

Source Objects [label] - This read-only field shows the number of source objects. To change this value, keep the dialog open, make sure Pick is off, and then select source objects in the viewports. When you click the dialog, the field updates.

Link to Destination - Links each clone as a child of its destination object.

Clone Parameters rollout - These settings let you determine the type of clone to create, and, if appropriate, how to copy the controller.

Align Parameters rollout - The Align Position and Align Orientation group names are followed by the current reference coordinate system, in parentheses, which they use as the coordinate system for positioning and aligning the clones. When the View coordinate system is active, alignment uses the World coordinate system.

The Offset parameters always use each destination object's Local coordinate system.
Align Position group

**X/Y/Z Position** - Specifies the axis or axes on which to align the clones' position. Turning on all three options positions each set of clones at the respective destination object's location.

**X/Y/Z Offset** - The distance between the destination object's pivot and the source object's pivot (or source objects' coordinate center). For an Offset value to take effect, the respective Position checkbox must be on.

Align Orientation group

**X/Y/Z Orientation** - Specifies the axis or axes about which to align orientation. Turning on all three options aligns each set of clones' orientation fully with that of the respective destination object.

**X/Y/Z Offset** - The angle by which the source objects are rotated away from the destination object's orientation about each axis. For an Offset value to take effect, the respective Orientation checkbox must be on.

Match Scale group

Use the X Axis, Y Axis, and Z Axis options to match the scale axis values between the source and destination.

This matches only the scale values you'd see in the coordinate display. It does not necessarily cause two objects to be the same size. Matching scale causes no change in size if none of the objects has previously been scaled.

**Reset All Parameters** - Returns all settings in the Align Parameters rollout to their default values.

**Apply** - Generates the clones as permanent objects. After clicking Apply, you can use Clone And Align to generate additional clones, using the results of previous clonings as source or destination objects if you like.

**Cancel** - Aborts the current cloning operation and closes the dialog.