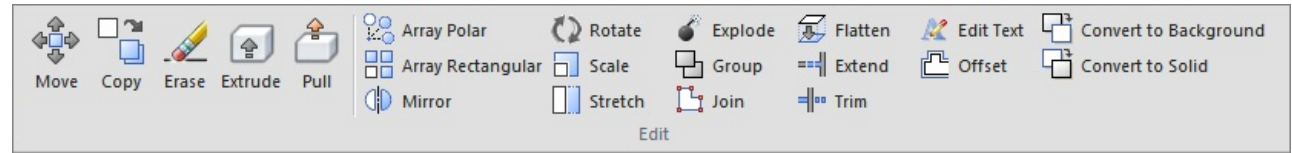


Chapter 6 - Modify

Ease of modification is a critical factor when modeling lighting systems. This is partly due to the complexity of the overall architectural design process (project phases and revisions for example) and the fact that lighting design is largely a matter of *iterative* process and analysis. The initially constructed *model* and the final design are rarely one and the same.

The **Modify** *tab* of the **Ribbonbar** contains commands to alter the current *model*.

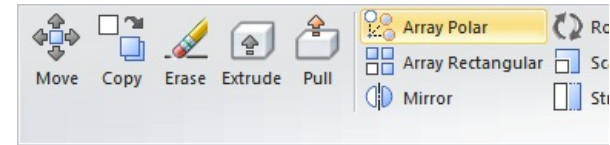


This chapter will introduce the concepts and commands used in Visual to permit modification of lighting designs. Discussion of the **Copy**, **Extrude**, **Pull**, **Array Polar**, **Array Rectangular**, **Mirror**, and **Offset** are commands can be found in Constructing by Reference.

6.1 Array Polar

The **Array Polar** command applies to all object types and is used to create multiple copies of all selected objects in columns (x-direction), rows (y-direction), and/or levels (z-direction). The most common use of the **Array Polar** command is with **Solid Objects** since they are most often placed in such **Arrays** to *models* circular, spherical, and cylindrical objects.

The **Array Polar** command can be found on the **Modify tab** of the **Ribbonbar**.

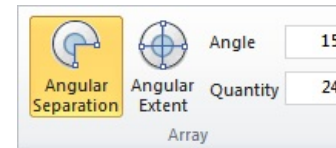


To **Array Polar** objects, left-click the object(s) to be used as the basis for the **Array** with the selection box or use a selection window to select a set of objects. Right-click to complete the selection process of base objects.

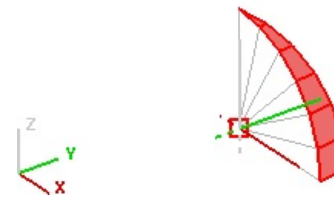
See [Selecting Objects](#) for information on object selection methods.



Spacing information for **Arrayed** objects must be provided in the **Properties tab**. **Angular Separation** spaces newly created objects at the angle specified and creates a total quantity (including the original object) also as specified. Positive angles yield clockwise arrays; negative angles yields counterclockwise arrays. See below for information on **Angular Extent**.

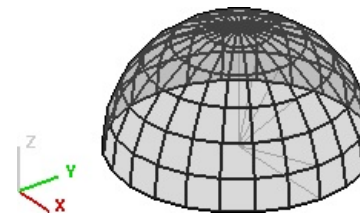


Specify a **Base Point** with the mouse, keyboard, or **Object Snap**.



After selecting the **Base Point** for the **Array**, Visual automatically completes the command.

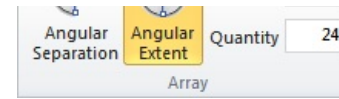
At right, 24 objects are arrayed in a polar fashion 15° apart as is shown in the [Properties tab](#) input boxes above.



Angular Extent allows the user to define how many objects are created (including the original object) and then specify the total angular extent to fill with objects. The



process is the same as before: select objects, specify a **Base Point**, and Visual automatically completes the command.

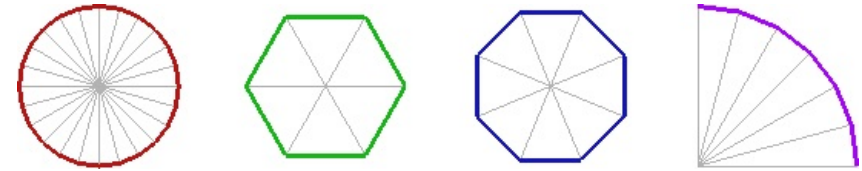


Two examples that create a full faceted circle (*polygon*) are warranted to illustrate the difference between the angular options. Once the radial lines are arrayed, the faceted circle is drawn with the **Polyline** command:

Angular Extent option: an angle of 360 is specified, and the number of objects to use to fill that angle is chosen. A quantity of 24 yields 15° wedges that might be the base of the hemisphere shown above, 6 yields a hexagon, and 8 yields an octagon.

Angular Separation option : the inputs left to right in the examples are 15° angle and quantity of 24. 60° angle and quantity of 6, or 45° of angle and quantity of 8. At far right, 15° and quantity of 7 yields 90° of arc.

[Angular Separation] X [Quantity] = [Angular Extent] e.g. 15 X 24 = 360 as above.

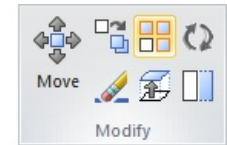
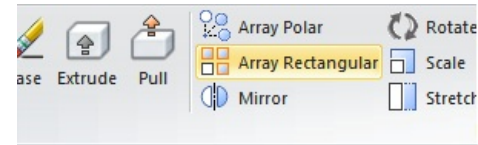


Like many commands, **Array Polar** can be used on **Luminaires**, **Background Objects**, **Solid Objects**, and **Calculation Zones**.

6.2 Array Rectangular

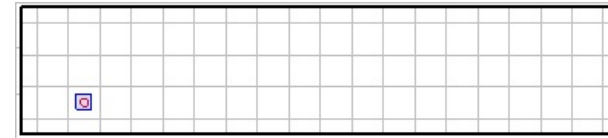
The **Array Rectangular** command applies to all object types and is used to create multiple copies of all selected objects in columns (x-direction), rows (y-direction), and/or levels (z-direction). The most common use of the **Array Rectangular** command is with **Luminaire Objects** since they are most often placed in such **Arrays** in reality.

The **Array Rectangular** command can be found on the **Modify tab** and the **Home tab** of the **Ribbonbar**.



To **Array Rectangular** objects, left-click the object(s) to be used as the basis for the **Array** with the selection box or use a selection window to select a set of objects. Right-click to complete the selection process of base objects.

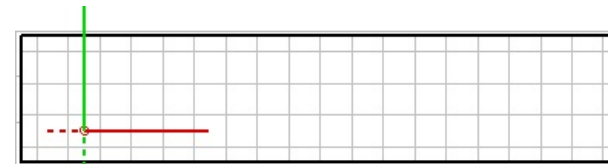
See [Selecting Objects](#) for information on object selection methods.



Spacing information for **Arrayed** objects must be provided in the **Properties tab**. **Array By Spacing** spaces newly created objects at the distance specified. The limits of the **Array** are specified with the mouse; defined by the **Base Point** and **Destination Point**. See below for information on **Array By Quantity**.

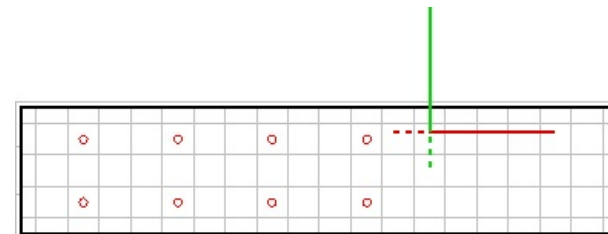


Specify a **Base Point** with the mouse, keyboard, or **Object Snap**.

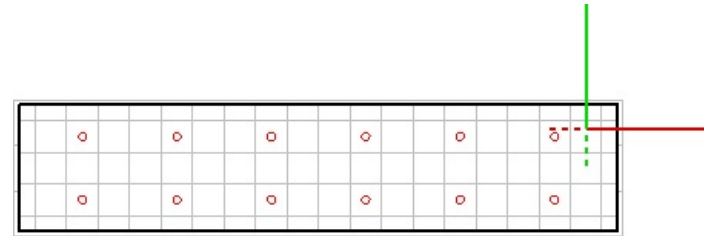


After selection of a **Base Point**, movement of the mouse **crosshairs** within the **Design Environment** will display a graphical representation of the selected objects as they will be arrayed with the specified spacing to aid in the proper selection of a **Destination Point**.

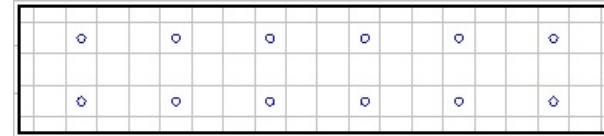
In the example at right, **Luminaire Objects** are pre-spaced at 6ft in the x-direction and 4ft in the y-direction. The **crosshairs** indicate the current extent of the **Array**.



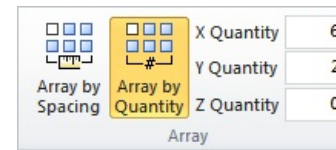
Select a **Destination Point** with the mouse, keyboard, or **Object Snap**.



After selecting the **Destination Point**, Visual automatically completes the command.

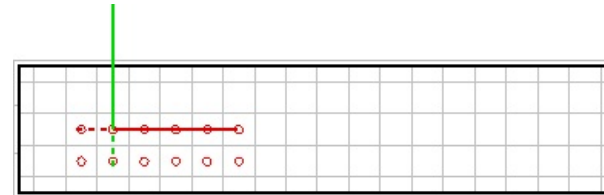


Array By Quantity allows the user to define how many objects are created and then specify the X, Y, and/or Z-spacing with the mouse, keyboard or **Object Snap**.

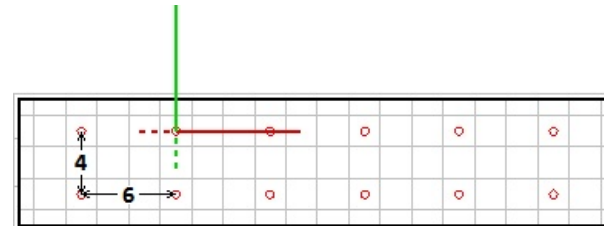


As before, moving the mouse in the **Array By Quantity** mode illustrates how the columns and rows would be placed if the mouse was clicked in that location with the quantity fixed and the spacing variable with mouse movement.

For example, at right, the mouse has been moved 2x2 and the 6 columns and 2 rows are shown more compact than is likely desired.



Select a **Destination Point** that defines the X, Y, and/or Z-spacing with the mouse, keyboard or **Object Snap**. For example, specifying a quantity of X=6 and Y=2 and then using the mouse to specify **Base Point** and **Destination Point** 6x4 apart yields the same **Array** as was shown above.

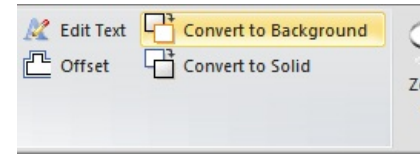


Like many commands, **Array Rectangular** can be used on **Luminaires**, **Background Objects**, **Solid Objects**, and **Calculation Zones**.

6.3 Convert To Background

Solid Objects can be converted to **Background Objects**.

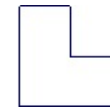
The **Convert To Background** command can be found on the **Modify** *tab* of the **Ribbonbar**.



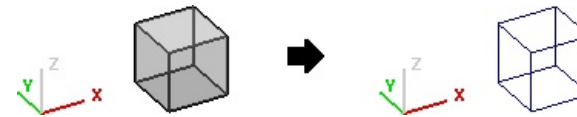
To **Convert To Background**, select the **Solid Object** to be converted by left-clicking the object or using a window selection method.



Right-click the mouse or press *Enter* to end the command and make the conversion. The new **Background Object(s)** will reside on the same **Layer** as the original **Solid Object(s)**.



Grouped Solid Objects (**Rooms**, **Structures**, etc) can be converted in bulk by clicking the **Group**. Individual **Polygons** will be created since there is not an analog to "group" **Background Objects**.



See [Convert To Solid](#) for the opposite functionality.

6.4 Convert To Solid

Background Objects can be converted to **Solid Objects**.

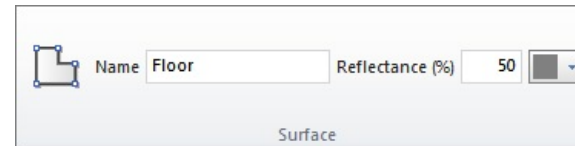
The **Convert To Solid** command can be found on the **Modify** *tab* of the **Ribbonbar**.



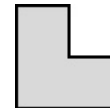
To **Convert To Solid**, select the **Background Object** to be converted by left-clicking the object or using a window selection method.



Before or after object selection, a **Name** can be assigned in the **Properties** *tab*. Additionally, a **Color** and **Reflectance** can be chosen (see [Using the Color Dialog](#)) just as would be the case when using the Individual Construction methods.



Right-click the mouse or press *Enter* to end the command and make the conversion. The new **Solid Object(s)** will reside on the same **Layer** as the original **Background Object(s)**.

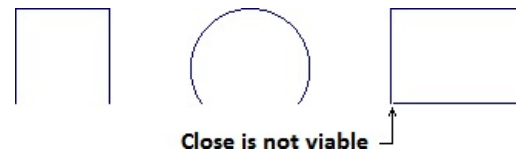


Grouped Background Objects can be converted in bulk. All converted objects will be assigned the same **Name**, **Color**, and **Reflectance** as chosen in the **Properties** *tab*. Individual **Solid Objects** will be created and will not be made a **Group**.



It should be clear that only closed *planar* polygons can be converted to **Solid Objects**. Visual will validate the selection by effectively ignoring the object selection if it cannot be converted.

It is routinely the case that objects appear to be a closed *polygon*. If they are closed, they will be converted. If they are not converted, they are simply not closed regardless of the appearance. The user must apply [Trim](#) and [Extend](#) to provide a single *vertex* for Visual to use.

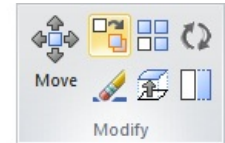
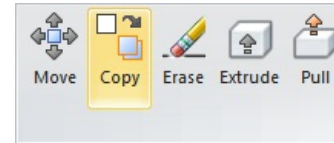


See [Convert To Background](#) for the opposite functionality.

6.5 Copy

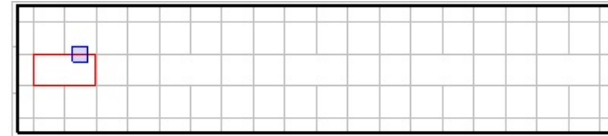
The **Copy** command applies to all object types and is used to create single or multiple copies of all selected objects.

The **Copy** command can be found on the **Modify** *tab* and the **Home** *tab* of the **Ribbonbar**.

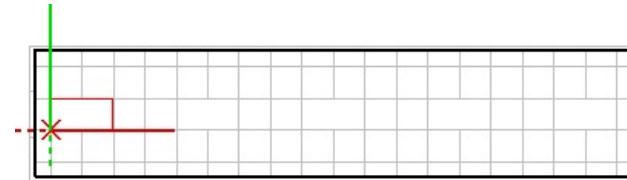


To **Copy** objects, left-click the object(s) you want to **Copy** with the selection box or use a selection window to select a set of objects. Right-click to complete the selection process of base objects.

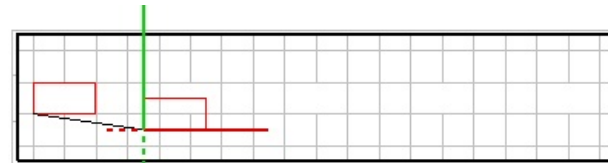
See [Selecting Objects](#) for information on object selection methods.



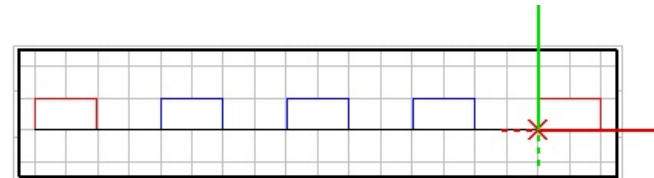
Specify a **Base Point** with the mouse, keyboard, or **Object Snap**.



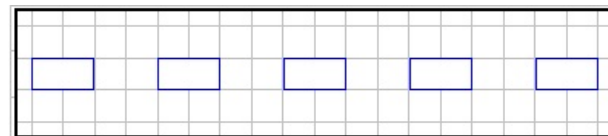
After selection of a **Base Point**, movement of the mouse *crosshairs* within the **Design Environment** will display a graphical representation of the selected objects as they are being translated to aid in the proper selection of a **Destination Point**.



Select a **Destination Point** with the mouse, keyboard, or **Object Snap**. Select additional **Destination Points** for each additional **Copy** you want to create. At right, note that the base object is highlighted in red (the system **Selection Color**) and newly created *luminaires* are shown in the **Color** assigned to them.



To complete the **Copy** command right-click the mouse or press *Enter*.

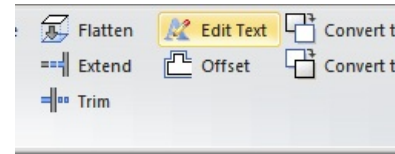


Copy can be used on *Luminaires*, **Background Objects**, **Solid Objects**, and **Calculation Zones**.

6.6 Edit Text

Text placed in Visual (created natively or by **Import**) can be edited with the **Text Editor**.

The **Edit Text** command can be found on the **Modify** *tab* of the **Ribbonbar**.



To **Edit Text**, left-click to select the **Text** to be edited.

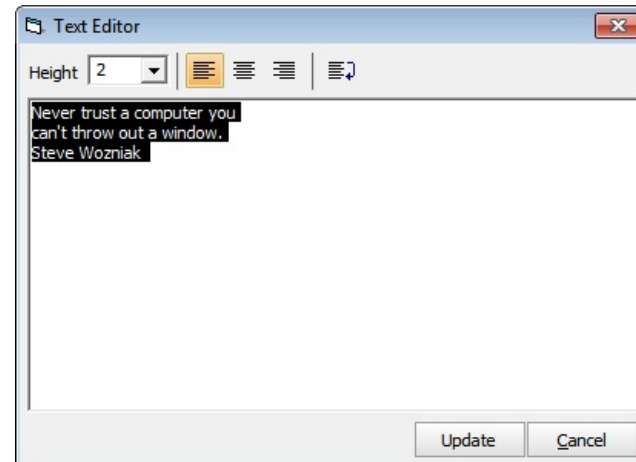
```
Never trust a computer you  
can't throw out a window.  
Steve Wozniak
```

The **Text Editor** is immediately initiated. Unlike other **Modify** commands, the object will not be highlighted in the **Design Environment**.

The selected **Text** is shown in the **Text Editor** and changes to **Height**, **Alignment**, and **Wrapping** can be made just as when the **Text** was originally created.

The orientation of the **Text** cannot be modified after the **Text Editor** is closed. See [Rotate](#) for information on changing the angle of the **Text**.

The **Color** of **Text** is modified with [Properties](#) based on **Layer** selection and object parameters as was the case during **Text** creation.



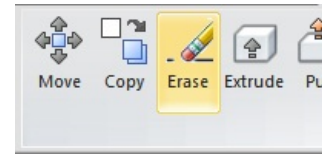
Click **Update** to apply the changes and exit the **Text Editor**. Clicking **Cancel** ignores changes and closes the *dialog*.

```
Reading computer manuals without the hardware is as  
frustrating as reading manuals without the software.  
Arthur C. Clarke
```

6.7 Erase

The **Erase** command removes objects from the lighting *model*.

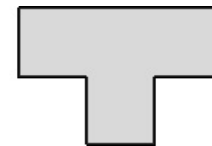
The **Erase** command can be found on the **Modify** *tab* and the **Home** *tab* of the **Ribbonbar**.



To **Erase** one or more objects, select the objects by left-clicking or selecting multiple objects with a window selection method.



Right-click or press *Enter* to end the command.



Erase applies to all object types.

6.8 Explode

The **Explode** command allows connected objects to be un-**Grouped** (for **Solid Objects**) or un-**Joined** (for **Background Objects**). Objects like **Rooms**, **Structures**, and **Polygons** are pre-connected upon construction. It may be desirable to break this connection to **Erase** or otherwise modify one of the sub-objects.

The **Explode** command can be found on the **Modify** tab of the **Ribbonbar**.



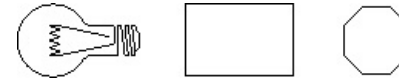
To **Explode** an object, select the object(s) to be **Exploded** by left-clicking or using a window selection method.



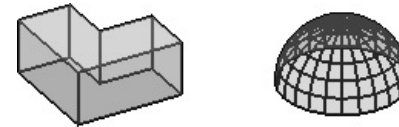
Right-click to end object selection and **Explode** the objects. In most cases, the explosion will not be immediately obvious. At right, note that a single surface of the **Solid Object Room** and the long sides of a **Background Rectangle** can be individually selected, whereas above, prior to the explosion, the entire **Room** and **Rectangle** were selected with a single left-click on each.



The **Background Objects: Polylines, Rectangles, and Polygons** can be **Exploded**.



The **Solid Objects: Room, Structure, and Grouped** objects can be **Exploded**.



See [Group](#) and [Join](#) for methods of connecting objects.

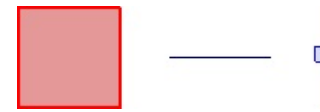
6.9 Extend

The **Extend** command increases the length of a **Line** or **Polyline** (not **Arcs**) to meet or touch the selected **Base Object**.

The **Extend** command can be found on the **Modify tab** of the **Ribbonbar**.

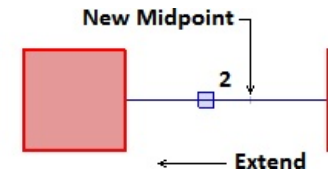
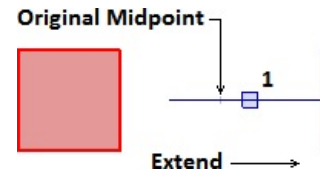


To **Extend** one or more **Base Objects**, left-click or use a window selection method to choose the **Boundary Edges** or object(s) to extend to. Right-click or press **Enter** to end object selection. Two **Boundary Edges** are selected at right; a **Solid Object** square and a **Background Line**.



Left-click each object to be **Extended** to the **Boundary Edge(s)**. It is necessary to left-click on the half of the object nearest the **Boundary Edge**.

After each click, Visual **Extends** the object.



Right-click or press **Enter** to end the command.

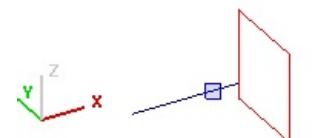


Extend operates on objects based on the current view. i.e. an object at $Z=0$ can be **Extended** to an object at $Z+1$ when viewed in the **Plan View**, even if the objects don't mathematically intersect. This functionality can be an advantage when constructing advanced geometries when used in N, S, E, or W views. At right, a line is extended to a vertical **Solid Object**.



Important Note:

Extending in isometric views can yield unsatisfactory results if **Boundary Edges** objects are not in the same *plane* as the **Extended** object. At top right, the **Plan View** and **South view** of two objects are shown; a line and a square. The common assumption is that the **Line** will be **Extended** to the center of the square when in an isometric view. This is not the way the command functions. At bottom, the **Line** is **Extended** in **SW View**, and when viewed in **Plan View**, the results are not likely what was intended.



Extend operates only on **Background Objects**. **Arcs** cannot be **Extended**. **Solid Objects** can be used as **Boundary Edges**.

6.10 Extrude

Extrude is a term that describes the process of "stretching" a *linear* or *planar* object linearly into a (in most cases) third dimension to create a 3-D **Solid Object** from it. See the [Pull](#) command for a more graphical and WYSIWYG method of extruding.

Extrude is a powerful tool for modeling **Solid Objects** because extruded shapes are commonly found in modern architecture. At right, some examples of extruded shapes are shown. The original *planar* object is shaded and the arrows indicate the direction of extrusion.

Any existing **Solid Object** may be **Extruded**. Select the **Extrude** command from the **Modify** *tab* of the **Ribbonbar**. The **Properties** *tab* will appear allowing for entry of command parameters.

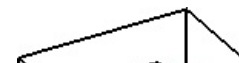
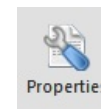
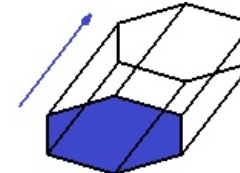
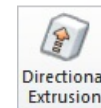
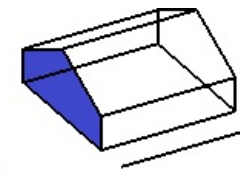
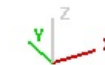
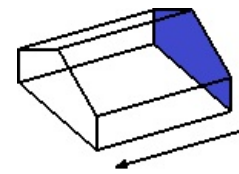
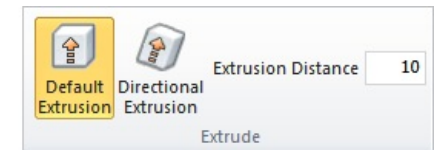
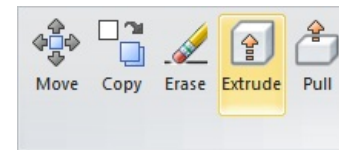
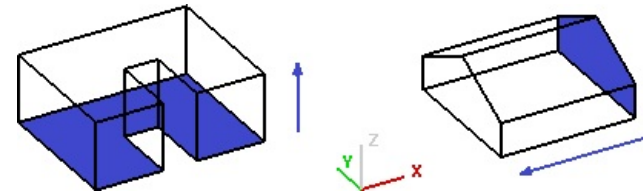
An **Extrusion Distance** must be entered. The default direction of **Extrusion** is perpendicular to the *plane* of the **Solid Object**, in the direction nearest the point of view.

To extrude in the opposite direction, specify a negative **Extrusion Distance**.

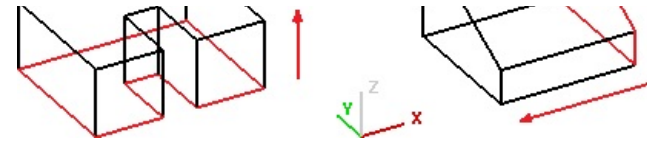
When **Directional Extrusion** is chosen, the **Command Line** will prompt for the base and destination points of a *vector* to establish the direction of **Extrusion**. In terms of the graphics above and at right, the base would correspond to the tail of the arrow and the destination would correspond to the head. The exact location of the chosen base and destination points is irrelevant as they only serve to indicate a direction. The base and destination points may be entered manually as well. For example, a *base point* of (0,0,0) combined with a *destination point* of (1,0,1) would result in the extrusion at right, which is in the X-Z *plane* at an angle of 45°.

The result of **Extrusion** is a single **Solid Object** having the same **Reflectance** value (taken from the original *planar* object) on all surfaces. Should varying **Reflectance** values need to be assigned, this can be accomplished by editing the **Reflectance** values by using the [Properties](#) command. The **Grouped Solid Object** can also be [Exploded](#) into its component **Solids**.

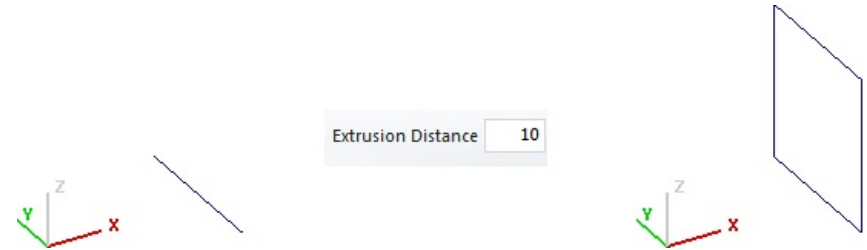
Extruding Background Objects follows a similar methodology as **Solid Objects**. Select the object to be **Extruded**, specify the extrusion distance in the



[Properties tab](#), and right-click or press *Enter* to end the command.



Lines can be **Extruded** to make **Rectangles**.

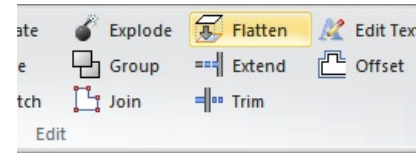


Note that the **Extrusion** process is the core of the behavior when executing the **Room** and **Structure** commands. Review [Rooms and Structures](#) before deciding to construct a **Solid Object** and **Extrude** it; i.e. constructing a **Room** or **Structure** may be a quicker process.

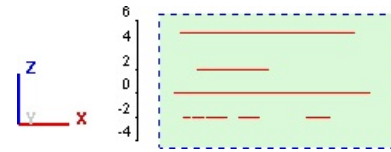
6.11 Flatten

The **Flatten** command changes the *Z-coordinate* of selected **Background Objects** to zero. This is very useful when importing *CAD* files to use as reference for a design since various heights of objects that are not germane to the project can exist.

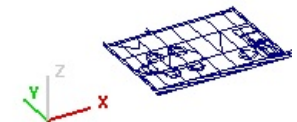
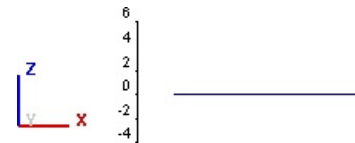
The **Flatten** command can be found on the **Modify** *tab* of the **Ribbonbar**.



To **Flatten** objects, select the desired objects by left-clicking or with a window selection method. "All" is useful in this case; see [Selecting Objects](#). Note the first graphic at right is an elevation view of the X-Z *plane*.



Right-click or press *Enter* to end the command and the objects are changed to have $Z = 0$. Note the first graphic at right is an elevation view of the X-Z *plane* and that all objects now have a *Z-coordinate* of "0".

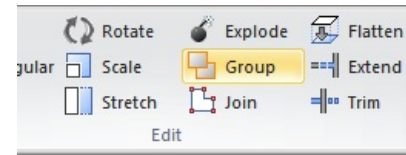


Flatten only operates on **Background Objects**.

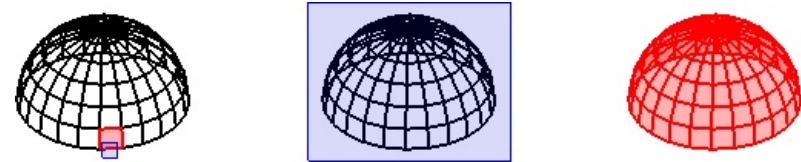
6.12 Group

The **Group** command allows **Solid Objects** to be connected. This can allow for collective editing of **Properties**, use of **Modify** commands, or in complex projects, a cleaner *model*.

The **Group** command can be found on the **Modify** *tab* of the **Ribbonbar**.



To **Group** objects, select the desired objects by left-clicking or using a window selection method.



Right-click the mouse or press *Enter* to end object selection and automatically complete the command.

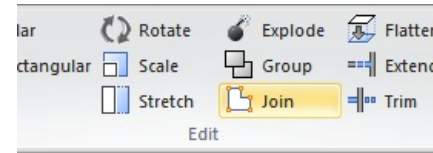


The **Group** command only applies to **Solid Objects**. See [Join](#) for the analog command for **Background Objects**.

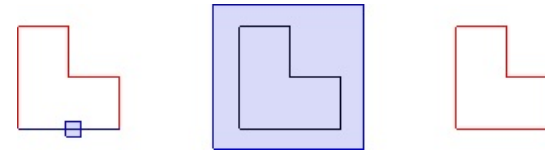
6.13 Join

The **Join** command allows **Background Line** and **Polylines** to be connected. This can allow for collective editing of **Properties**, use of **Modify** commands, or in complex projects, a cleaner *model*.

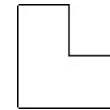
The **Join** command can be found on the **Modify tab** of the **Ribbonbar**.



To **Join** objects, select the desired objects by left-clicking or using a window selection method.



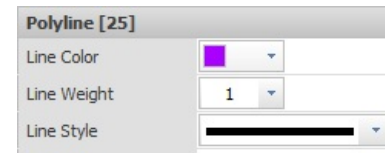
Right-click the mouse or press *Enter* to end object selection and automatically complete the command.



Lines or **Polylines** must touch and cannot cross at *vertices*. The level of **Zoom** may indicate a viable *vertex* when one does not actually exist. The command will not change the length of base objects; **Extend** and **Trim** must be used to "clean up" the base objects.



Objects of different **Color** and **Line Width** will be made the **Color** and **Line Width** of the object with the highest **Polyline Number**. The number of any **Polyline** can be found with the **Properties** command. After **Joining**, the resultant **Polyline** can be modified with **Properties** if desired.



The **Join** command only applies to **Background Objects**. See **Group** for the analog command for **Solid Objects**.

6.14 Mirror

The **Mirror** command applies to all object types and is used to produce a **Mirror** image of selected items.

The **Mirror** command can be found on the **Modify** tab of the **Ribbonbar**.



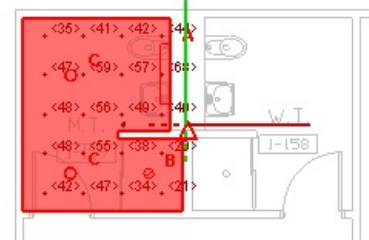
Select the objects to be **Mirrored** by left-clicking or with a window selection. Right-click or press *Enter* to complete the selection process.

See [Selecting Objects](#) for information on object selection methods.

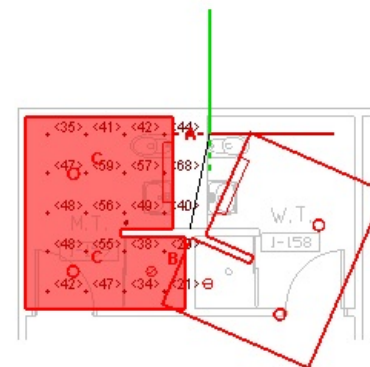


Mirroring occurs about a **Mirror Line** that must be user-specified. The mouse is normally used for this, but keyboard and **Object Snap** input are also accepted. Left-click to establish the first coordinate about which mirroring will occur.

In the example at right, it is known that the restrooms are symmetric and then the midpoint of a line between walls can be used as the **Base Point** to mirror the **Luminaires**, **Solid Objects**, and **Calculation Zones**.

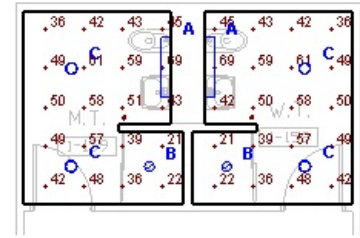


As the mouse crosshairs are moved, an implied **Mirror Line** will be drawn from the **Base Point** to the mouse cursor, and the **Mirrored** objects are temporarily shown to assist in proper **Mirror Line** input.



Specify the second point of the **Mirror Line** with the mouse, keyboard, or **Object Snap**. Visual completes the command after the complete specification of the **Mirror Line**.

Use of **Orthogonal Mode** is often an advantage since architecture is often parallel to the *Cartesian* axes. Similarly, using the keyboard to specify "@1<90" also yields the result at right.

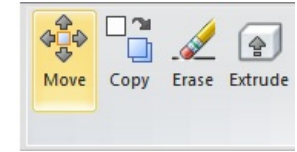
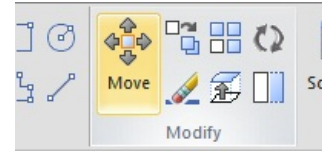


Mirror can be used on **Luminaires**, **Background Objects**, **Solid Objects**, and **Calculation Zones**.

6.15 Move

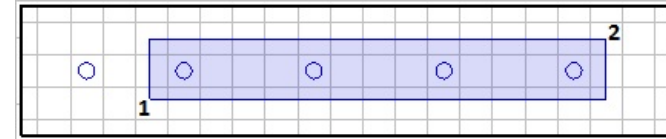
The **Move** command is used to uniformly translate selected objects in the **Design Environment**.

The **Move** command can be found on the **Modify tab** and the **Home tab** of the **Ribbonbar**.

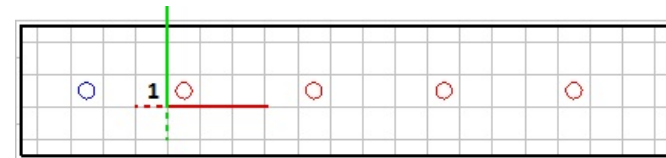


To **Move** one or more objects, Left-click on the object you want to **Move** with the selection box or use a selection window to select a set of objects.

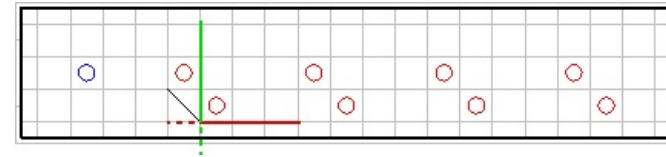
Right-click or press *Enter* to end object selection.



Select a **Base Point** with the mouse, keyboard, or **Object Snap**.

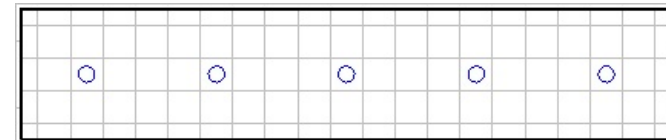


After selection of a **Base Point**, movement of the mouse within the **Design Environment** will display a graphical representation of the selected objects as they are being translated to aid in the proper selection of a **Destination Point**.



Select a **Destination Point** with the mouse, keyboard, or **Object Snap**.

Visual automatically ends the command and **Moves** the object(s).

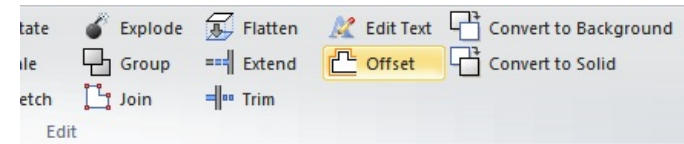


The **Move** command applies to all object types.

6.16 Offset

The **Offset** command creates a **Background Object** similar to the base **Background Object** but applies non-*linear* scaling to change the shape accordingly.

The **Offset** command can be found on the **Modify** *tab* of the **Ribbonbar**.



To **Offset** an object, select the base object by left-clicking with the mouse. Right-click the mouse or press *Enter* to end object selection.

Offset operates on multiple objects but because results can be confusing, it is recommended that **Offsets** be applied to one object at a time.

Select the **Base Point** with the mouse, keyboard, or **Object Snap**.

The **Base Point** can be positioned anywhere related to where the **Offset** is desired; it does not have to be on the side of the object where the new object will be created. The **Base Point** defines the first end of a direction *vector* that tells Visual how to make the **Offset**.

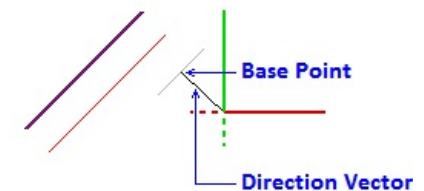
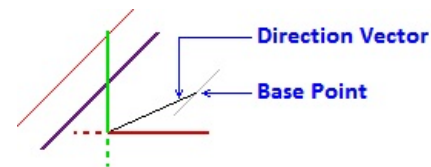
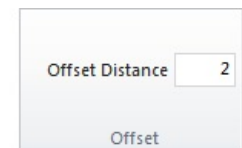
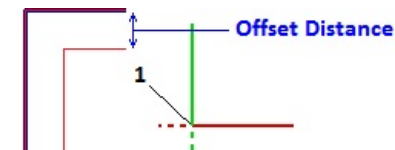
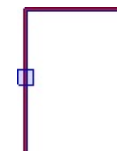
The **Offset Distance** must be specified in the **Properties** *tab* of the **Ribbonbar**.

The **Offset** of the object is made parallel to the base object.

Moving the mouse after selection of the **Base Point** shows the implied **Offset** in red. The direction of the offset is based on an imaginary line (shown in gray at right) drawn parallel to the base object. This imaginary line is not drawn in Visual.

Moving to one side or the other of the imaginary line changes the directional *vector* and causes Visual to move the **Offset** object from one side to the other of the base object.

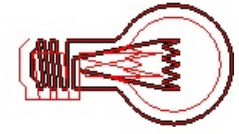
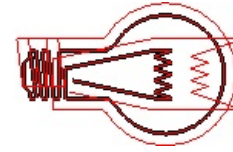
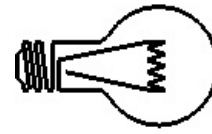
Select the second point of the direction *vector*. Visual automatically ends the command, creating the new object(s). The new **Background Object** is created with the same properties as the base object; **Color** and **Width** are preserved. [Properties](#) can be modified if necessary.



For multi-segment **Background Objects**, the behavior of the direction *vector* is often non-*linear* and complex as can be seen at right. It is recommended that the implied *drawing* feature inherent to the command be used to determine if the **Offset** is desirable and/or where the **Offset** object will be created.

Polylines may need to be [Exploded](#) and/or [Joined](#) prior to **Offsetting** to create the desired result.

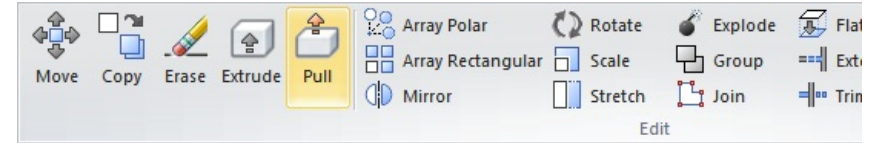
Offset only applies to **Background** objects.



6.17 Pull

The **Pull** command is effectively the same as the [Extrude](#) command with the exception that the **Extrusion/Pull** distance is specified with the mouse, the keyboard or **Object Snap**. **Pull** only operates on **Solid Objects**.

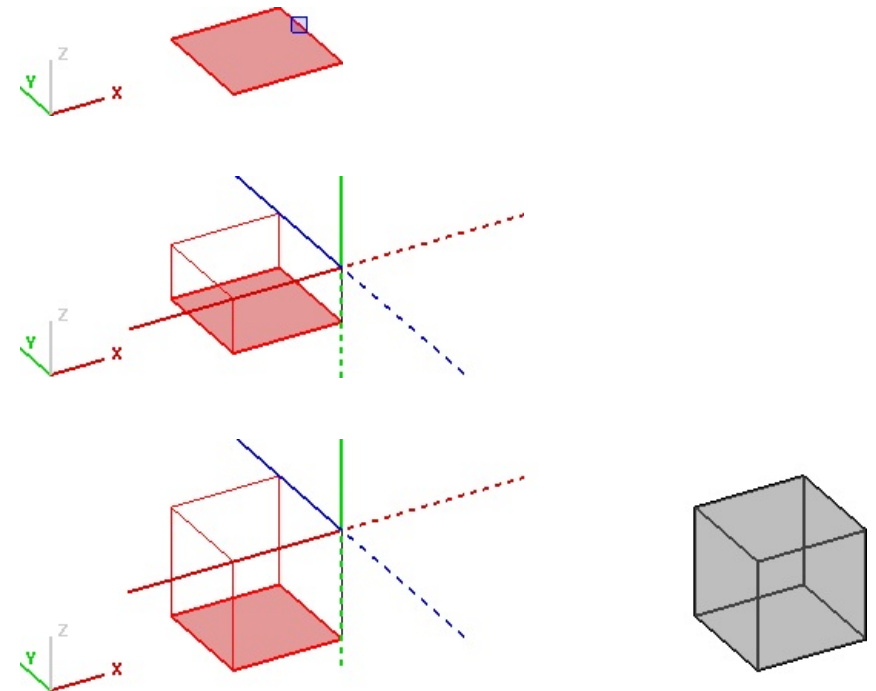
The **Pull** command is found on the **Modify** *tab* of the **Ribbonbar**.



To use the **Pull** command, select the objects to be manipulated by left-clicking. Right-click or press *Enter* to proceed.

Visual will automatically begin **Pulling** the object by attaching the farthest extent to the mouse *crosshairs*. Note that **Pulling** only occurs perpendicular to the *plane* of the **Solid Object** chosen, with the positive direction of **Pull** being in the direction of the **Surface Normal**. Moving the mouse shows the implied **Pulled** shape.

Left-click the mouse to choose the desired distance. Note that keyboard input is valid in that a distance can be input; to **Pull** 10 units, enter "10" at the command line. Input of direction information via the "<angle" method is not valid.

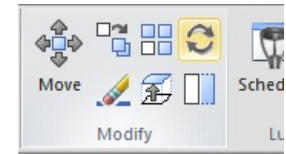
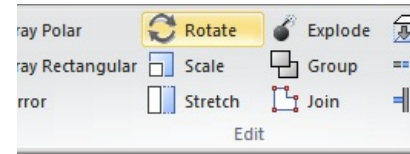


Pull only applies to **Background Objects** and **Solid Objects**.

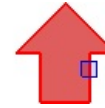
6.18 Rotate

The **Rotate** command imparts an angular displacement to objects parallel to one of the *Cartesian planes*. Rotation occurs only in the **Active Plane**.

The **Rotate** command can be found on the **Modify tab** and the **Home tab** of the **Ribbonbar**.



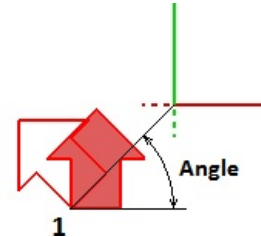
To **Rotate** one or more objects, select the objects by left-clicking or selecting multiple objects with a window selection method.



Select the **Base Point** for rotation with the mouse, keyboard, or **Object Snap**. Right-click or press *Enter* to end object selection.



Movement of the mouse in the command shows the implied rotation of the selected objects. 0° is the X-axis if rotated in the X-Y or X-Z *planes* and the Y-axis if rotated in the Y-Z *plane*.

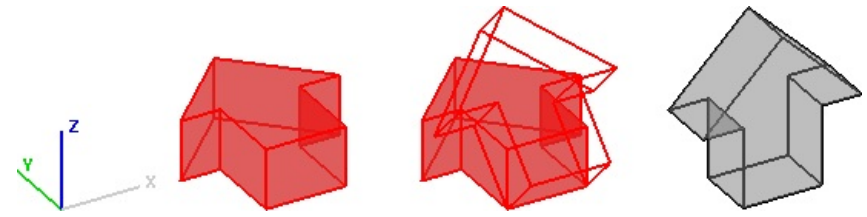


Specify the angle to **Rotate** with the mouse, keyboard, or **Object Snap**. The command will be automatically completed after the angle is specified with a left-click. Specification with the keyboard at the **Command Line** requires a right-click or pressing *Enter* to end the command.

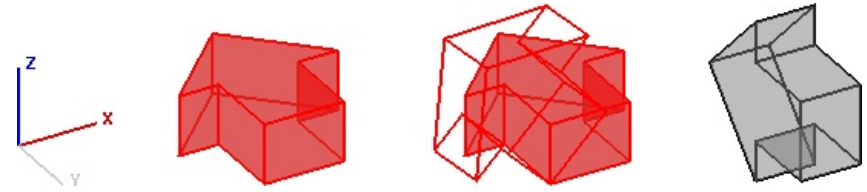
Using **Orthogonal Mode** and the mouse, 90° rotations can be ensured without having to rationalize clockwise or counterclockwise when viewed in 3-D.



To **Rotate** an object vertically, simply choose the desired **Active Plane**, and repeat the steps above. Since rotation can only be applied parallel to a *Cartesian plane*, the exact (X,Y,Z) location of the **Active Plane** is not important. At right, rotation occurs in the Y-Z *plane*, or in other words, the rotation occurs about the X-axis.



As an additional example, the same 3-D arrow is rotated at right in the X-Z *plane*, or in other words, the rotation occurs about the Y-axis.

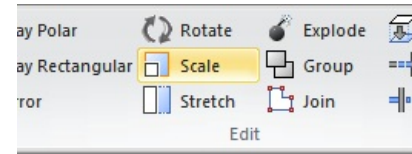


Rotate applies to all object types.

6.19 Scale

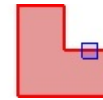
The **Scale** command changes the size of objects based on the application of one or more factors to the (X,Y,Z) *coordinates*.

The **Scale** command can be found on the **Modify** *tab* of the **Ribbonbar**.



To **Scale** one or more objects, left-click or select objects with a window selection method.

Right-click or press *Enter* to end object selection.



Select a **Base Point** with the mouse, keyboard, or **Object Snap**. See below for detailed information and examples.

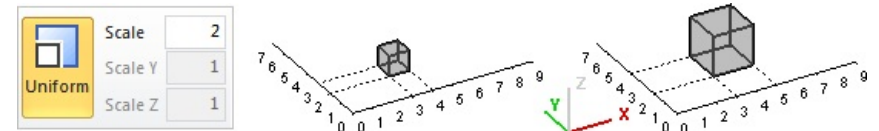
Selection of the **Base Point** automatically completes the command.



A **Scale Factor** must be specified in the **Properties** *tab*. The factor can be any decimal value and is applied as would be expected; e.g. a **Scale Factor** of 2 would make objects twice their original size and 0.5 would result in half size.

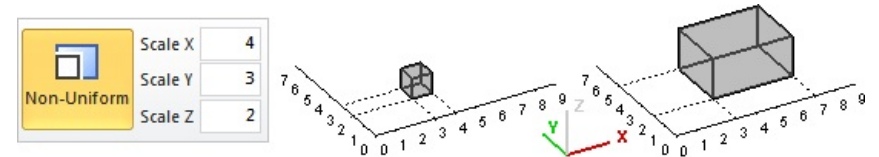
The **Uniform** option (the default) for **Scale Factor** applies a single factor to the X, Y, and Z dimensions.

For example, at right a 1x1x1 cube becomes 2x2x2.



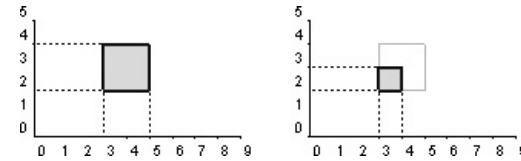
The **Non-Uniform** option for **Scale Factor** applies a separate factor to each of the X, Y, and Z dimensions as specified in the individual **Properties** *tab* fields.

For example, at right, a 1x1x1 cube becomes 4x3x2.

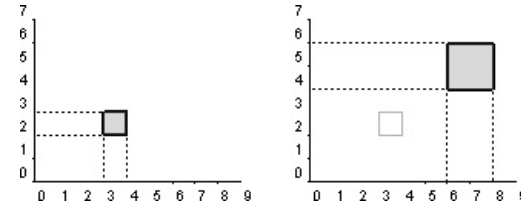


Selection of the **Base Point** may cause a translation of the source object(s) with an increase or decrease in size:

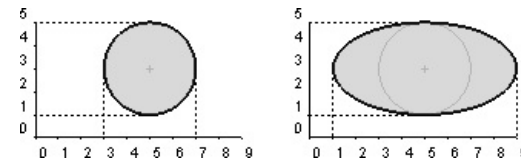
1. Selecting a **Base Point** at the corner of an object changes the size but doesn't cause a translation (a movement in the X, Y, and/or Z-direction). For example, with a **Uniform Scale Factor** of 0.5, a 2x2 square is reduced to a 1x1 square and the lower-left corner (being the **Base Point**) remains in the same location.



2. Selecting a **Base Point** at (0,0,0) changes the size and translates the object by the same factor(s). For example, with a **Uniform Scale Factor** of 2, a 1x1 square located at (3,2,0) would be moved to (6,4,0) and would become 2x2 in dimension.



3. **Non-Uniform Scaling** of a **Solid** or **Background Circle** yields an ellipse. For example, a 2x2 **Circle** with **Scale Factors** of 2, 1, and 1 respectively yields an ellipse with a major axis of 4 and a minor axis of 2. The **Base Point** here is the center of the **Circle**.



Mathematically, the equations applied when scaling are shown at right.

$$x_{new} = [Scale\ Factor]_x \times (x_{old} - x_{BasePoint}) + x_{BasePoint}$$

$$y_{new} = [Scale\ Factor]_y \times (y_{old} - y_{BasePoint}) + y_{BasePoint}$$

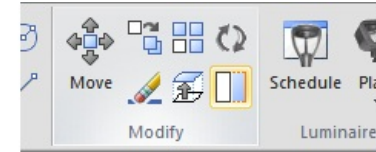
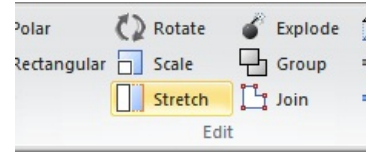
$$z_{new} = [Scale\ Factor]_z \times (z_{old} - z_{BasePoint}) + z_{BasePoint}$$

The **Scale** command applies to **Background Objects**, **Solid Objects**, and **Calculation Zones**. **Luminaires** cannot be scaled but their location can be scaled if, for instance, a **CAD Import** file was misjudged to be drawn in feet and it was really inches, a 1/12 **Scale Factor** could be applied to the entire lighting model to correct the error.

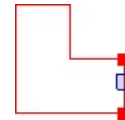
6.20 Stretch

The **Stretch** command changes the size or shape of objects non-proportionally. **Stretch** will effectively move the selected objects and then alter the adjoining objects.

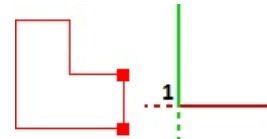
The **Stretch** command can be found on the **Modify tab** and the **Home tab** of the **Ribbonbar**.



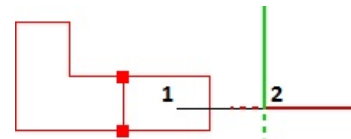
To **Stretch** an object, left-click the object(s). A selection should be made to fully select the object(s) that will remain the same shape. The process could be thought of as "stretching the connectors to keep the base objects attached as they are moved."



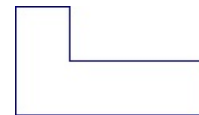
Select a **Base Point** with the mouse, keyboard, or **Object Snap**. This is the first end of a direction **vector** that will define the amount and direction of **Stretch**. Normally, a selection would be made on the object with the mouse. Once an object is selected, the **vertices** will be highlighted. Multiple left-clicks will select multiple objects. Right-click the mouse or press Enter to end object selection.



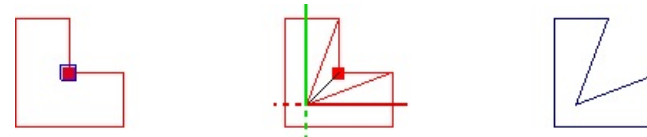
Moving the mouse in the command shows the implied change to the base objects, so the result can be verified before ending the command.



Select the end of the direction **vector** (**Destination Point**) with the mouse, keyboard, or **Object Snap** and the command is automatically completed.

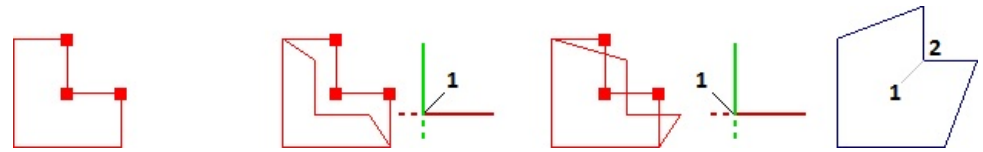


If the initial object selection is made at a **vertex**, behavior changes slightly. The **vertex** will be moved and the abutting edges will be changed to suit that selection. Note that only one **vertex** is highlighted. (This is the same methodology as before except the base object is a zero-length line.)

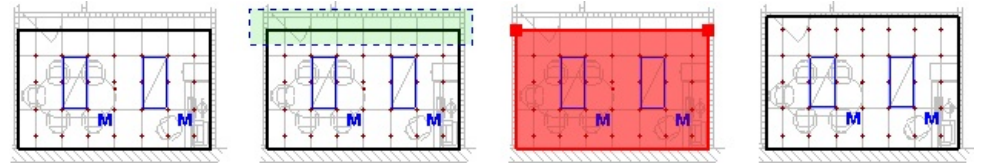


Two examples illustrating behavior and usefulness:

1. Multiple edges are selected, the mouse is moved to two positions, and the final selection is made. Note that the selected objects do not change. The objects adjacent to the selected objects morph to make the new shape.



2. A change has been made to a small office to increase the size by one foot in width and a new *CAD* file has been **Imported**. (This can be seen at right in the **Background** objects that are uneditable.) The appropriate edges are selected with a crossing window method; including the **Calculation Zone**. Finally, the new design is ready to be calculated after the changes have been applied.

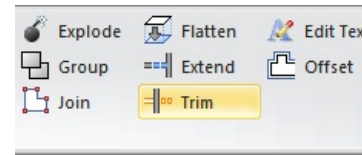


The **Stretch** command applies to all objects except *Luminaires*.

6.21 Trim

The **Trim** command decreases the length of any **Background Object** (Lines, Polylines, Circles, and Arcs) to meet the selected **Base Object** or **Boundary Edge**.

The **Trim** command can be found on the **Modify tab** of the **Ribbonbar**.



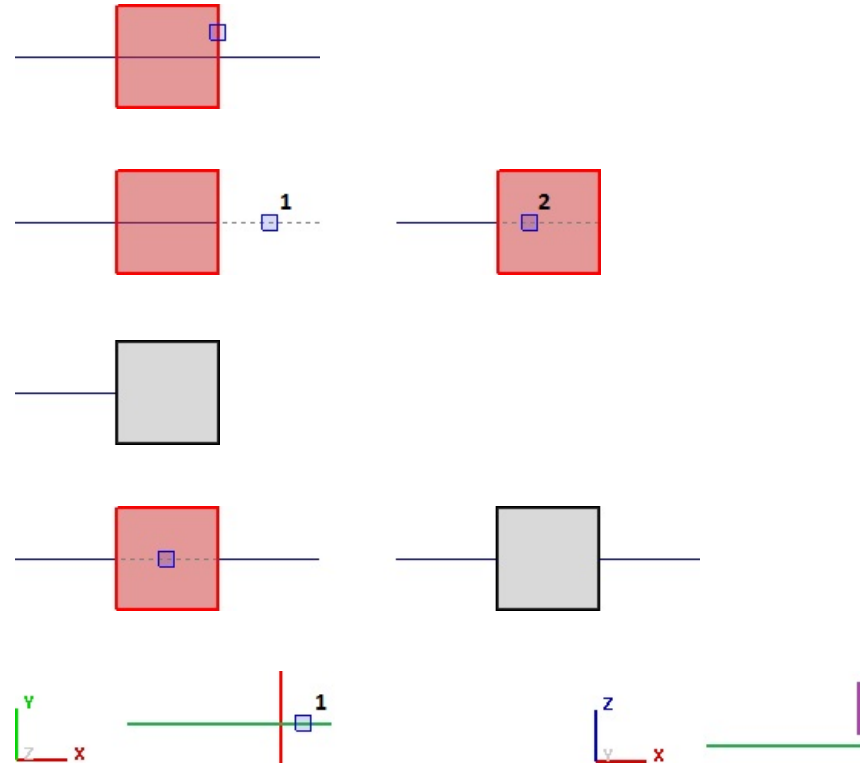
To **Trim** one or more **Base Objects**, left-click or use a window selection method to choose the **Boundary Edges** or object(s) to extend to. Right-click or press *Enter* to end object selection.

Left-click each object to be **Trimmed** to the **Boundary Edge(s)**. It is necessary to left-click on the half of the object nearest the **Boundary Edge**. After each click, Visual **Trims** the object. At right, the previous **Line** is shown dashed along with the clicked location.

Right-click or press *Enter* to end the command.

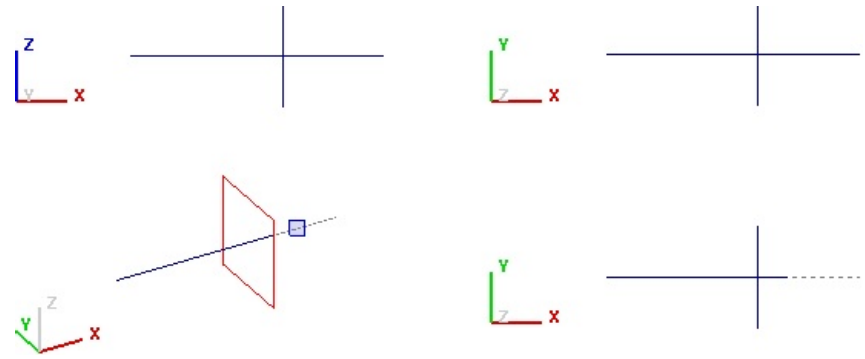
Trim can also remove the included portion of the **Trimmed** object. The segment bounded by the **Boundary Edges** will be removed wherever it may be. At right, the previous **Line** is shown dashed along with the clicked location.

Trim operates on objects based on the current view. i.e. an object at Z=0 can be **Trimmed** to an object at Z+1 when viewed in the **Plan View**, even if the objects don't mathematically intersect. This functionality can be an advantage when constructing advanced geometries when used in N, S, E, or W views.



Important Note:

Trimming in isometric views can yield unsatisfactory results if **Boundary Edge** objects are not in the same *plane* as the **Trimmed** object. At top right, the **Plan View** and **South** view of two objects are shown. The common assumption is that the **Line** will be **Trimmed** to the center of the square. This is not the way the command functions. At bottom, the **Line** is **Trimmed** in **SW View**, and when viewed in **Plan View**, the results are not likely what was intended.



Trim operates only on **Background Objects**. **Solid Objects** can be used as **Boundary Edges**.