

[Stephen Peter, S.Peter@unsw.edu.au](mailto:S.Peter@unsw.edu.au)

This tutorial has been prepared for architecture students at the Faculty of the Built Environment studying AutoCAD. It has been placed on the Web to facilitate access by those students and because I believe others may find the material of use!

Note that throughout this document I am using the character "↵" to symbolise the [Enter] and [spacebar] keys.

Stephen Peter, 17 July 2000 (8 October 1998).

Introduction

The drawing used for this tutorial comes from Clark R. and M.Pause, "Precedents in Architecture", VNR 1985, page 135.

In this tutorial you will learn how to edit graphics(!) and about setting model space limits. You will draw a simple plan based on Frank Lloyd Wright's 1956 (New York) Guggenheim Museum.

Please note that the dimensions used in this tutorial are neither accurate nor correct! I don't have access to an accurately dimensioned drawing of the building so I've guessed the dimensions...

Starting AutoCAD

On my computer, the bottom-left coordinate was 0,0,0 and the top-right coordinate was 514,296,0.

Start AutoCAD, and then move the cursor to the bottom left of the screen, you will note the coordinates (on the status line) go down to near 0,0. In the version I am using the drawing limits are set to the size (in millimetres) of an A3 sheet of paper (420,297).

Setting the Limits and Units

It is normal when using AutoCAD to draw objects full size, so it's usually necessary to reset the drawing limits to (about) the size of the object being drawn (or in the case of a building the building's site). Type:



*Alternatively, select **Format - Drawing Limits** and then type the numbers shown.*

```
limits ↵
0,0 ↵
50000,50000 ↵
```

This sets the drawing "size" to 50x50 metres.

If the coordinates in the status area didn't change to no decimal places, move the mouse!

Next we need to get rid of the 4 decimal points! Select "**Format - Units...**", AutoCAD will display the "**Drawing Units**" dialog. Make sure *Decimal* is selected in the **Units** section and *Decimal Degrees* in the **Angles** section, then in Unit's **Precision**, click on the down arrow beside "0.0000" and select "0", and finally select "OK".

Zoom All 
Zoom Window 
Z is the alias (shortcut) for **ZOOM**.
Remember that [**space**] is the same as ↵.

This sets the "model space" dimensions. To reset the drawing view to the whole of the (empty) drawing, select the zoom-all icon, which is hiding under the zoom-window icon (on the standard toolbar) - hold the button down and then rest of the zoom toolbar is displayed (or type:


Z [space] A [space]).

Move the cursor around now and note that the coordinates are now bigger numbers!

Let the Drawing Begin!!


This shows us the "drawing area".

Firstly draw a rectangle from 0,0 to 50000,50000, you should remember how to do that from the first tutorial!

Circle 
"c" is the alias for CIRCLE.

Then draw a circle, centred at 30000,24000 with a 6000 radius. Select **circle** (or type: **c ↵**), then type:

30000 , 24000 ↵ *the circle centre*
6000 ↵ *the circle radius*

Centre snap 

To get AutoCAD to display the Object Snap Modes toolbar, select "Toolbars" from the "View" menu and then select "**Object Snap**".

Next you will draw another circle, with the same centre, but with a 9500 radius. Press: ↵ to "recall" the last command. Select the **centre** snap mode (or type: **CEN↵**), then pick the first circle (**NOT** the centre of the circle), then type:

9500 ↵ *the circle radius*

Draw the Building "Wing"


Hopefully you remember how!!

Next draw a rectangle from the centre of the circles to 39500,33500.

Hint: use a relative coordinate @1500,9500.

Once you have done that draw another rectangle to the right of the last, start at 39500,24000 and make the rectangle 1500x9500.

You might find the following section easier if you turn object snapping ON (make sure "OSNAP" is IN in the status area).

Endpoint Snap 

Midpoint Snap 

Now you will draw an arc on the end of the last rectangle (see figure 1). Select **Draw - Arc - Start-Center-End**, then select the Endpoint snap mode (or type: **END ↵**) and select the bottom-right of the last rectangle. For the centre point of the Arc, select the Midpoint Snap Mode (or type: **MID ↵**) and select the middle of the right edge of the last rectangle. For the end of the Arc, select the Endpoint Snap Mode and select the top-right of the rectangle.

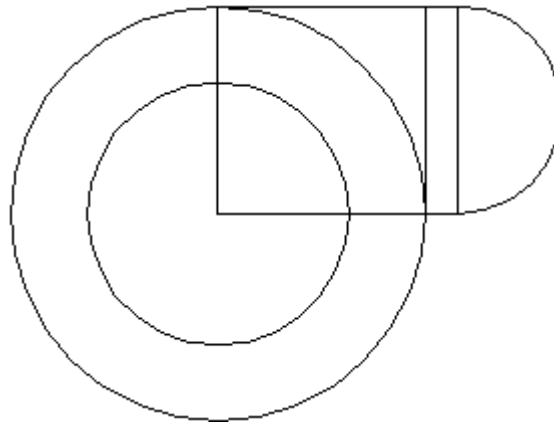



Figure 1 Showing the location of the ARC.

Save the drawing


Save  Save the drawing: select the **save** icon (or type: **QSAVE** +↵), if you are prompted for a drawing name, select the appropriate Drive and Directory and type a drawing name (for example: **TUT2**) and select "OK".

Copy & Rotate the Building Wing

The array command is used to copy one or more objects in either a rectangular or circular pattern and when a circular pattern is used the objects can be rotated; it can be an incredibly powerful command.

Now we want to copy & rotate the two rectangles and the arc (3 times), AutoCAD provides the array command to achieve this.

Select **Modify - Array**, AutoCAD will prompt for the objects to be selected: click below and to the left of the bottom-left corner of the **left rectangle** and then move the mouse until the selection rectangle encloses the **two rectangles and the arc** - then click the mouse button (3 objects should be selected). Then press +↵ to end the selection process.

Centre snap 
*After selecting the Centre snap mode, pick the circle **NOT** the centre!*

AutoCAD will then prompt for the type of Array - rectangular or polar, type: **P**+↵ for polar. Then use the Centre snap mode to select the centre of the circles. Then type:

4+↵ *the number of items (including the existing item)*
 +↵ *accept 360 degrees*
 +↵ *accept "rotate as copied"*

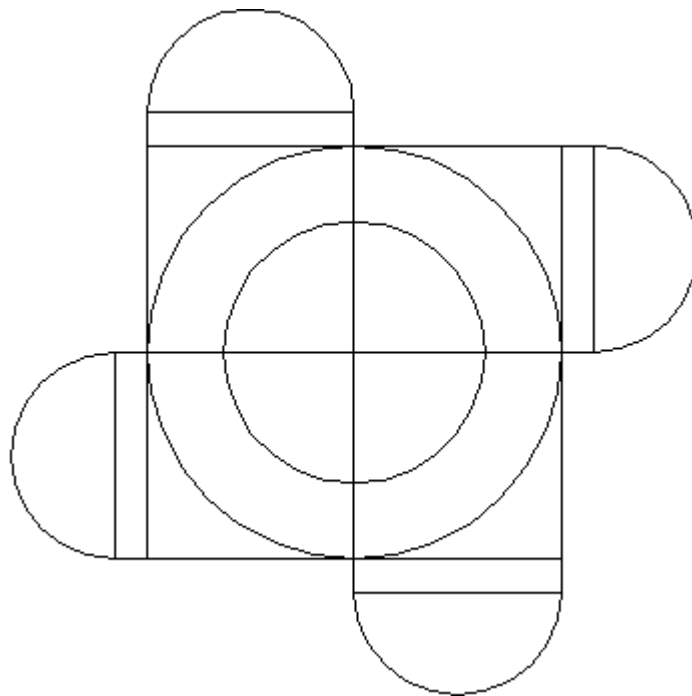



Figure 2 Drawing with all four building "wings" in place.

Exploding Objects!

For convenience, in the following section, I'll talk of the "top-right wing" and the "bottom-right wing". By the "top-right wing" I mean the first rectangles and arc that you drew, and the "bottom-right wing" is the rectangles and arc in the bottom-right corner!!


*Explode  Be aware that explode does not appear to do anything! It doesn't say - "yes, I've done that" and the display doesn't change, but AutoCAD **will** display an error message if it failed to explode the objects.*

Now we need to erase some of the lines we've drawn. When the rectangle command is used the rectangle that is drawn is a "polyline" which means that all the lines that make up the object are *joined together*, the lines must be "*exploded*" before any parts of the rectangle can be erased.

Select **explode** from the modify toolbar (or type **x+↵** which is the alias for "explode") select both the rectangles in the "top-right corner" and then press **↵**. If AutoCAD doesn't display any error messages then the explode command worked!

Erasing Objects

We need to delete some extraneous lines from the drawing...

*Erase  Select **erase** from the modify toolbar (or type: **e+↵**). Click on the right edge of the inner rectangle (from the "top-right" corner), and press **↵**. AutoCAD should automatically redraw the area around the erased line.*

Now we erase the other line there! An alternate way to delete is to click on the object to be deleted and then press the keyboard's "Delete" key. Click on the line in the same place and press "Delete".

To test your understanding: explode the two rectangles in the "bottom-right wing" and the erase all the "inner" lines (see figure 3).

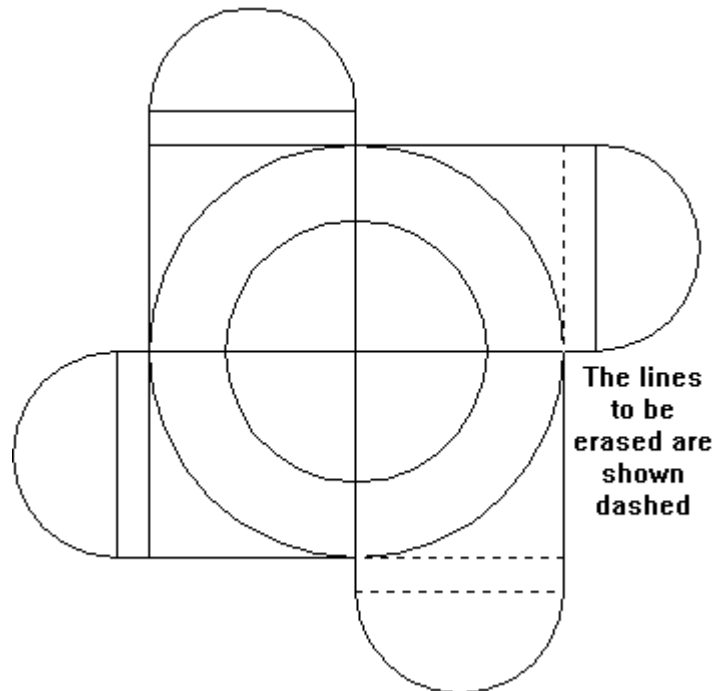



Figure 3 Lines to be erased.

Stretching Your Wings

Now you need to stretch the "bottom-left wing" and then remove the inner lines.

Stretch  The "C" tells AutoCAD that you want a "crossing" window. The normal selection window selects only those objects wholly within the section window. A crossing selection window selects objects that are **wholly** or **partly** within the selection window.

A useful short-cut to know is that if you draw a selection rectangle left-to-right (in the positive X direction) AutoCAD interprets it as a "window" selection; but if you draw the selection rectangle right-to-left AutoCAD interprets it as a "crossing" selection.
[Tip thanks to Jack Barton]

Select **stretch** (or type: **s**↵ which is the alias for stretch). Type **c**↵ and then draw a selection window around the arc and **through** the small rectangle (see figure 4), press ↵ to terminate the selection process, click with left mouse button near the selected objects, and type: **@-10000,0** ↵ (this is the "stretch distance"). If that worked the building wing should stretch 10 metres (to the left).

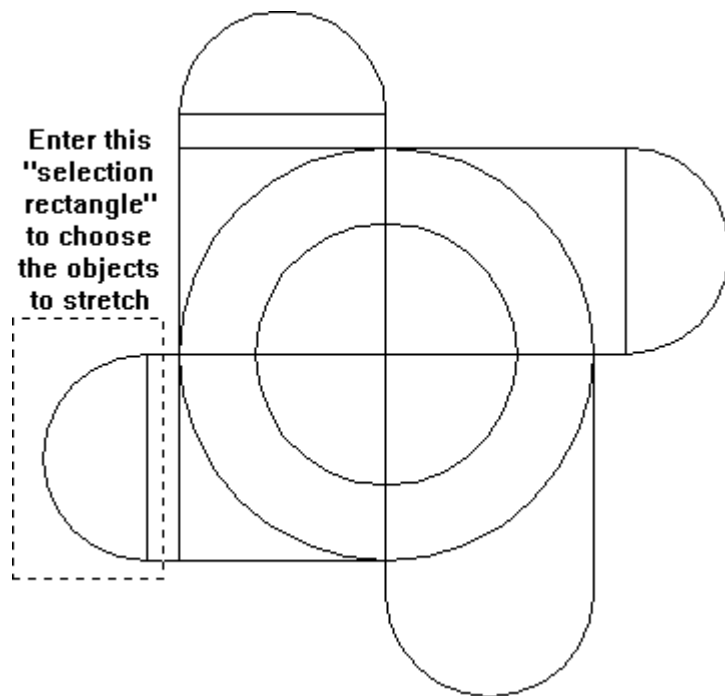
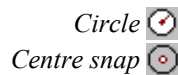


Figure 4 Stretch selection rectangle.

Explode both the rectangles in the "bottom-left wing" and erase the vertical lines, except the line from the centre of the circles.

One Last Circle...



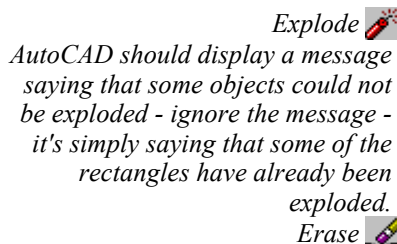
The last object to add is a circle inside the arc of the "bottom-left wing". Select **circle** (or type: **c** ↵). Select the Center snap mode (or type: **CEN** ↵) and click on the arc; then type **3600** ↵ (the circle's radius).

It's always worth saving your work regularly!

Select **save** (or press Ctrl-S).

More Explosions and Deletions....

The drawing is basically complete, all that needs to be done is to change some of the line-types!



AutoCAD should display a message saying that some objects could not be exploded - ignore the message - it's simply saying that some of the rectangles have already been exploded.

Select: **explode** from the modify toolbar (or type **x**↵), select all the rectangles at the centre of the original circles (use a crossing selection window), and then press ↵.

There are 8 lines going to the centre (4 are "covered" by the others). You need to erase 4 of them, select **erase** from the modify toolbar (or type: **E**↵), then click on each of the four lines and finally press ↵.

You should now be able to see the lines that were under the lines you erased!

Changing Line Types

Before changing some of the lines to *dashed* lines, we need to load the linetype(!). Select **Format - Linetype...**, then select "**Load...**". AutoCAD will display a list of linetypes, select "**Hidden**" (you will need to scroll through the list!), then select "OK", then select "OK" again to dismiss the "Select Linetype" dialog box.

Select the 4 lines going to the circle centre and the arcs in the "top-left" and "top-right" wings (see figure 5), then select **Modify - Properties...**. A dialog with the properties of the selected objects is displayed. Change the Linetype to **HIDDEN** and the Linetype Scale to **75** and dismiss the dialog.

The objects should be redrawn using *dashed* lines (see figure 5).

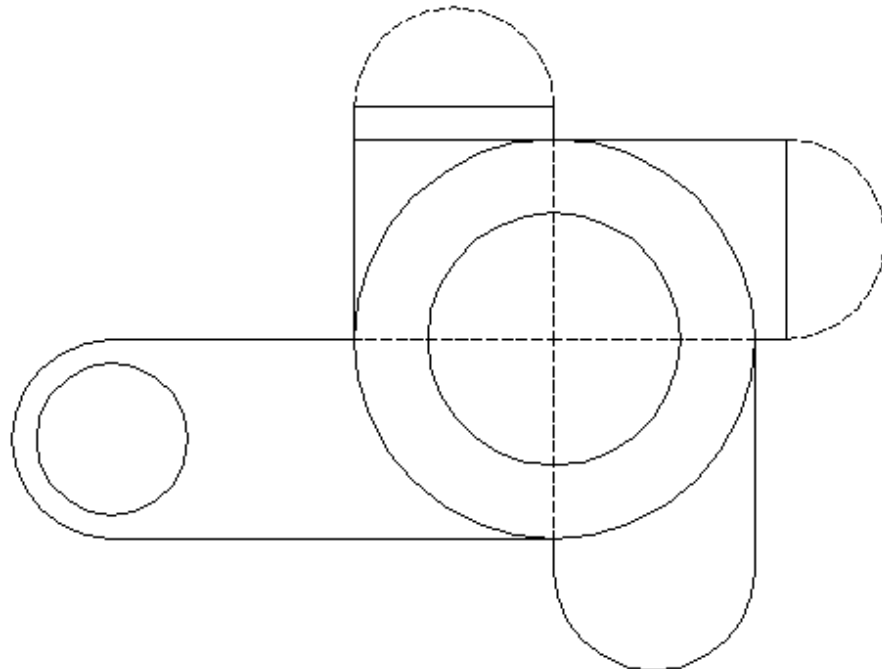


Figure 5 Finished form study of Wright's Guggenheim Museum

The End!

That's all for tutorial two!

Save your drawing and then exit AutoCAD.

Remember to log off before leaving.

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Page Contact : [Stephen Peter](#)
Email : s.peter@unsw.edu.au