This is an introduction to using ‘Graphite’ software. It is not exhaustive, but
will give you an overview of the tools you will use most, and other important
issues and techniques. It is intended to be used in addition to introductory
lectures and not as an alternative.

It deals only with the process of ‘drawing’ linework. The process of
dimensioning will be dealt with in an associated document.

Drafting Assistant

Graphite uses an extremely useful drawing aid called a ‘drafting assistant’. In
summary, the drafting assistant displays the position of the cursor whenever it
is on, or near a line entity.

The following images demonstrate a range of information displayed by the
drafting assistant.
Icon Design

The icons have been designed to give you a hint to their function and method of input. This has been done by including ‘dots’ on the icons in the position you are required to ‘click’ to input data.

For instance, the ‘single line’ tool icon shows ‘dots’ at the beginning and end of the line. This is where you are required to click to create a line of this type.

Circles are drawn in a number of ways, and again, the icons give you a clue to how they are used. A ‘centre point’ circle is drawn starting with the centre point, then any point on the circumference, whereas a ‘two point’ circle is created with two opposite points on the circumference.

In addition to the icon detail, you are also prompted by the text in the top left hand corner of the drawing area ‘top line hints’. As you can see below, when the ‘centre point’ circle tool is selected, you are advised that next you need to “pick centre” of circle.

Extended Functionality

In addition to the ‘top line hints’ informing you what action the software expects next, extended tool functionality is also indicated here.

For instance, by pressing the shift or option keys on a ‘Mac’ or the shift and Ctrl keys on a PC while using a particular tool will change or enhance the way a specific tool works. The way that the relevant keys extend functionality is indicated in the ‘top line hints’.

Note: Macs and PCs use different keys to add additional functionality. The relevant keys are noted in the same screen position, but take care when switching between platforms as it may be a bit confusing at first.
Preferences

Before you start drawing, it is useful to set your own ‘preferences’ for using the software. Someone may have been using the computer before you and changed the interface to the way they prefer it.

You change preferences at; Layout-Preferences

The preferences which are most important are **Snap** and **Units**

**Snap** refers to the distance from a feature (line, endpoint, quadrant etc), at which the cursor ‘jumps’ or **Snaps** to that feature. This helps the alignment of elements on your drawing, but needs to be set appropriately to be effective. My preference is a snap distance of 3 pixels. The system defaults to 12 pixels.

It is useful to try different ‘snap’ distances to find your own preference.
Input your preferred snap distance in the Hit Radius box. The other boxes are for amending more advanced functionality so leave these on the default settings.

Both **Units** and **Precision** are set in the Units box. Always set units to millimeters (mm). Don't assume that this has already been set, as Graphite is an American software and defaults to Inches. Also, make sure there is a tick in the ‘**Leading 0** and **Trailing 0**’ boxes.

**Notes**

ALWAYS draw full size in Graphite, even if your component will eventually be printed out at a smaller size. This ensures that you can dimension your part ‘automatically’. If you need to scale your part to fit onto a particular page size you can do this later.

Be conscious of the dimensions of the components you are drawing. Try and use whole numbers or sensible decimals where possible. For instance, overall dimensions should be 100.00 not 100.563. It is important that you are aware, and in control of the dimensions you are using to construct your drawing, as these will be used for final ‘automatic’ dimensioning.
Cursor Tools

1 Select Cursor

This is the cursor tool you will use most often. You simply click on the entity you want to select for it to become ‘active’.

*Extended Functionality* - Remember, there are relevant keys (e.g. shift, option, Ctrl etc) which extend the functionality of a selected tool.

2 Tracer

The tracer tool allow you to select a closed region with one click. For example if you need to crosshatch an area, or change a line weight etc, this tool is useful. Simply click inside the region you want to select, and the tool will select all the line entities that define the region.
Drawing Tools

Line Tools

There are 2 ways to create a single line with this tool. Either ‘click’ at the start and end points of your line, or ‘click and hold’ at the start point, drag your line into position, then release at the end point.

Following your second click (or release), a dialogue box automatically becomes active. This allows an exact dimension for the line to be input. In addition to line length, you can also set the angle of the line. This is done by pressing the TAB key immediately after inputting the line length. This will activate the angle dialogue box for input.

Only press the return key after inputting both line length AND angle otherwise you will not be able to input the angle in this way.

Parallel Line Tool

Place the cursor on the line to be duplicated. ‘Click and drag’ the cursor in the direction you want the new line to appear. Release when the line is approximately in the right position. When you release, a dialogue box automatically becomes active for you to type in the exact dimension for the parallel line offset.

You must input the line offset amount immediately after releasing the mouse button. Once you press return the opportunity to input data is lost.
Construction Lines

A construction line is a dotted red line that can be drawn in any position. They are useful when starting a drawing to outline the overall sizes and extremities of your drawing. In addition, construction lines are the best way to align edges and details between different views.

There isn’t a specific tool for drawing construction lines, instead, you can draw a construction line using almost any of the drawing tools. To change the original tool function to draw a construction line press the ‘apple’ key on a ‘mac’ and the ‘ctl’ and ‘shift’ keys in combination on a PC.

You can tell when the tool is in ‘construction line’ mode as the screen icon changes.

Creating a Construction Line

To draw a construction line, select any one of the line tools, then press the appropriate keys to change to ‘construction line’ mode.

To create a horizontal construction line, ‘click and hold’ the mouse button, then scroll the mouse horizontally either left or right. The scrolling action doesn’t have to be fast, but should be as straight as you can make it. The construction line is created when you release the mouse button.

To create a vertical construction line, repeat the process above, but this time scroll vertically with the mouse.

Construction lines act like most other lines and can be ‘snapped to’, used with parallel line tool etc.
Arc Tools

These arc tools are useful for ‘sketching in’ lines during the process of design development. However, there are some limitations if they are not used carefully.

To use the center point arc tool, first pick the center of the arc to be created. Then select two points that are on or near the circumference of the arc to be drawn. The first point you select on the circumference (the second point selected) will define the radius of the arc to be drawn.

*Remember* - Graphite will tell you what action it expects next, (where you need to ‘click’) so remember to look at the text in the top left hand corner.

Three Point Arc Tool

To use the three point arc tool, simply select (click on) three points through which the arc will be drawn. The drafting assistant will help you align your selected points.

Tangent Point Arc Tool

To use the center point arc tool, first pick the center of the arc to be created. Then select two points that are on the circumference of the arc to be drawn. The first point you select on the circumference (the second point selected) will define the radius of the arc to be drawn.
Circle Tools

There are 2 ways to create a circle this tool. Either click at the centre and a point on the circumference of your line, or click and hold at the centre point the release at circumference point.

Following your second click, or release, a dialogue box automatically becomes active. This allows you to input an exact dimension for the diameter of the circle you have just drawn. (see below).

Only press the return key after inputting the diameter otherwise you will not be able to input the dimension in this way.

Two Point Circle Tool

There are 2 ways to create a circle with this tool. Either click at two separate points on the proposed circumference of your line, or click on one point and hold and drag to construct a circle.

Following your second click, or release, a dialogue box automatically becomes active. This allows you to input an exact dimension for the diameter of the circle, although this will be in the form of a horizontal distance between the two selected points (dX), or vertical distance between the points (dY).

Only press the return key after inputting the diameter otherwise you will not be able to input the dimension in this way.
Centre Point Ellipse Tool

To create an ellipse with this tool, ‘click’ on the centre point of the intended geometry, then click on a point at the corner of the notional rectangle inside which the ellipse will be drawn. It is sometimes useful to actually draw a rectangle inside which to create your ellipse.

As with many of the drawing tools in Graphite, the red dots on the tool icon, and the top line hints, describe where you are expected to click next to draw your intended geometry.
Rectangle Tool

There are 2 ways to create a square or rectangle this tool. Either click at one corner of the rectangle, then click again at the diagonally opposite corner, or ‘click and hold’, then drag the cursor to form the rectangle, releasing to complete the shape.

Following your second click (or release), a dialogue box automatically becomes active. This allows you to input an exact dimension for the width \(W\) of the rectangle you have just drawn.  

Press the tab key to then activate the height \(H\) dialogue box, immediately after inputting the width dimension. Only press the return key after inputting BOTH dimensions otherwise you will not be able to input the dimensions in this way.
To add text to your drawing, select the text tool, then ‘click and drag’ a text box into which the text will be created. However tall you draw the text box it will automatically resize to the correct height for one line of text (at the text size already set). The width of the text box will remain as initially created.

Once the text box has been created, you can start typing right away. Additional lines are created automatically when required.
Drawing Tools

Radius Tools

20  Fillet Tool

To create a radius between two lines, click on each of the two lines in turn, close the position of the radius to be created. As with many other tools, following the final click, a dialogue box becomes active. You must input your preferred radius into this box immediately. Do not press return or you will not be able to input data in this way.

Alternatively, you can input your desired radius immediately after selecting the radius tool. The radius will be created with this value. You will still have the opportunity to change the radius following the selection of the second line.

22  3 Entity Fillet Tool

This tool creates a full radius between 3 line entities. They may be straight or curved lines, and need not intersect.

Simply select (click on) each line in turn and following the last selection the radius is created. There is no opportunity to change the radius using this tool, as there is only one possible value for the constructed radius between the 3 lines.
Trim Tools

Before you select many of the trim tools, you must first define the area to which you want to trim. You do this by selecting the line entities that describe your intended trim region.

After selecting the lines defining the trim region, select your preferred trim tool, in this case ‘simple trim’. Then, simply click on the part of the line entity you want to remove (trim).

The relimit tool is used in the same way as the simple trim tool, except that you click on the part of the line entity you want to keep (not trim).

The segment tool divides (splits) a line into a number of pieces. The line will be split wherever there is an active line entity defining the trim region.

The line can be split into any number of pieces

This tool allows you to quickly create a ‘corner’ with two separate lines. Click on each of the line entities near the end of the line closest to the point of intersection. Following your second click, both lines will be extended or trimmed to their point of intersection.

This tool works with straight lines or curves, although Graphite sometimes has a problem extending trimmed ellipses. This seems to be a quirk with the software and not a problem with the geometry.
Modify Tools

First, select the elements to be moved. This can include both whole lines and endpoints. Then select the move tool.

Then, as with most graphite tools, a dialogue box appears for you to input data. The distance moved is in the form of a horizontal distance between the start and end positions (dX), and/or a vertical distance between start and end positions (dY), see below.

Only press the return key after inputting both dX and dY otherwise you will not be able to input data in this way.

Rotate Tool

First, select the elements to be rotated, then select the rotate tool.

After selecting the rotate tool a dialogue box will appear. Select (click on) the point about which the lines are to be rotated (pivot point).

Then input the angle (into the dialogue box) by which the line entities are to be rotated, before pressing return.
Drawing Tools

Modify Tools

**Scale Tool**

First, select the elements to be scaled. This can include any number of line entities.

Following selection of the scale tool, select (click on) the point about which the geometry is to be scaled (the anchor point).

Then, input the scale to be applied (2 will double the size of the geometry, 0.5 will half it).

**Mirror Tool**

First, select the elements to be mirrored, then select the mirror tool.

You must then select (click on) two points which define the line about which the geometry will be mirrored. The geometry will be mirrored following the second mouse click.

If this is a horizontal line or a vertical line the drafting assistant will help you line up the mirror plane. If the geometry is to be mirrored across an angled plane, it is easier to first draw a line of the correct angle for mirroring. You can then ‘click on’ this line in 2 places to define it as the mirror plane.

**Extended Functionality** - Remember, there are relevant keys (e.g. shift, option, Ctrl etc) which extend the functionality of a selected tool.

You are also able to keep the original and ‘add’ the mirrored copy by extending the functionality of the mirror tool. Check the ‘top line hints’ for the appropriate keys on both Macs and PCs.
Refining your drawing - additional functions

Changing line thickness (line weight)

The way you assign line thicknesses can dramatically effect the appearance of your CAD illustration. You should aim to use an effective combination of thick and thin lines.

You select line weights at; **Pen-Weight**

The purpose your drawing is being put to, will effect which line weights you choose. For instance, a CAD specification drawing should use ‘British Standard’ line weights, whereas a concept illustration will use line weights to improve the visual quality of the drawing.

It is important to experiment with a variety of line weights until you find a combination which works for you.
Printing your drawing

Sizing your drawing for print

Before you try and print, it is important to correctly set the scale of the drawing relative to the page size you have chosen, and to ensure the drawing is positioned in the correct area for printing. The following sections will explain how to achieve this.

Scale

You set drawing scale at; **Layout - Drawing Size**. The following menu box will appear. Input your preferred scale into the dialogue box marked **Drawing Scale**

![Drawing Size Menu](image)

The relevant ‘British Standard’ suggests drawing scales of 1:1 (full size) and 10:1, 5:1, 2:1 for enlarging, and 1:2, 1:5, 1:10 for reducing, however 4:1 and 1:4 seems acceptable to industry. DO NOT use odd scales like 2.5:1 etc, even in order to size the drawing better on the page. Choose the closest recommended scale. Any drawings with very large or small scales, should use multiples of 2 and 5 for the scaling value, e.g. 20:1, 50:1, 100:1 or 1:20, 1:50, 1:100 etc.

By setting the drawing scale first, you ensure that any subsequent dimensions, arrowheads, and any additional text is sized correctly from the outset to ensure they can be arranged appropriately on the page.
When you activate the drawing size menu, (Layout-Drawing Size) a page outline appears (this outline is sometimes positioned off screen so is not visible). The outline shows the area that will be printed, and is the paper size and orientation that has been set in the ‘Page Setup’ menu. You need to position this outline over the linework you want to print.

A quick way to do this is by selecting ‘Fit’ on the ‘Drawing Size’ menu. Graphite will then fit your drawing to the page, maximising the drawing size. It is important then to change the drawing scale to the nearest recommended one.

By selecting ‘Always Display Page Bounds’ the page outline always remains visible, although it cannot be moved without activating the ‘Drawing Size’ menu.

Once your drawing is fitted to the page, print in the usual way.
Document Feedback

Suggested Additions and Amendments

Having used this document, please note below any amendments or additions you think would be benefit its clarity and ease of use, and return to Steve Bailey.

Thank You.

Name:

Document:

Feedback: