

Computers in the Graphics industries

2D CAD, 3D CAD and DTP

The development of computers in recent years has dramatically changed the ways in which graphics are produced – for example **Desktop Publishing (DTP)** has transformed the way in which books and magazines are produced and published. **Computer Aided Draughting/ Design (CAD)** has greatly increased the power of the engineer, architect and graphic designer in developing and producing a range of work associated with their disciplines.

While there are many areas covered within this series of notes, you should remember the main advantages and disadvantages using computers within graphics brings to the user.

More specific advantages and disadvantages are discussed in each area, however.

These **core points** are generally the same across all areas, and it is very likely you shall be asked them in your final exam:

General advantages of using computer-based graphics:

- Items of work can be easily edited and modified.
- Work can be sent quickly anywhere in the world via the internet.
- Work can be easily and quickly stored.
- Money can be saved on labour and production costs.

General disadvantages of using computer-based graphics

- Computers can fall victim to viruses or system failure.
- It can be easier to steal electronic files than hard copies.
- The initial cost of buying, installing and training staff to use the software can be high.

Because Graphic Communication is essentially a **practical subject**—as a student you are usually **doing** something—the best way to learn is in this manner. You have had experience in using most of the features in this section.

The parts of the course within these notes in which you can learn by doing are labelled with this icon:



This is the best way to learn, and there is more chance of you understanding and remembering the material for your final exam.

However, there are some areas in which this is impossible in a school—usually due to financial constraints and similar reasons. For example, quality 3D printers are very expensive (£40000 and upwards) and obviously out of the reach of a school budget.

YouTube videos are a very effective way of seeing a process, technology or equipment in action, and give a more realistic account than written descriptions ever can. If you go to YouTube and type the search term you can see a wide and comprehensive range of these technologies in action. Within these notes such items are labelled with this icon:



If you are interested in reading further articles about some sections, a search of Wikipedia is also useful. These parts have been labelled with this icon:



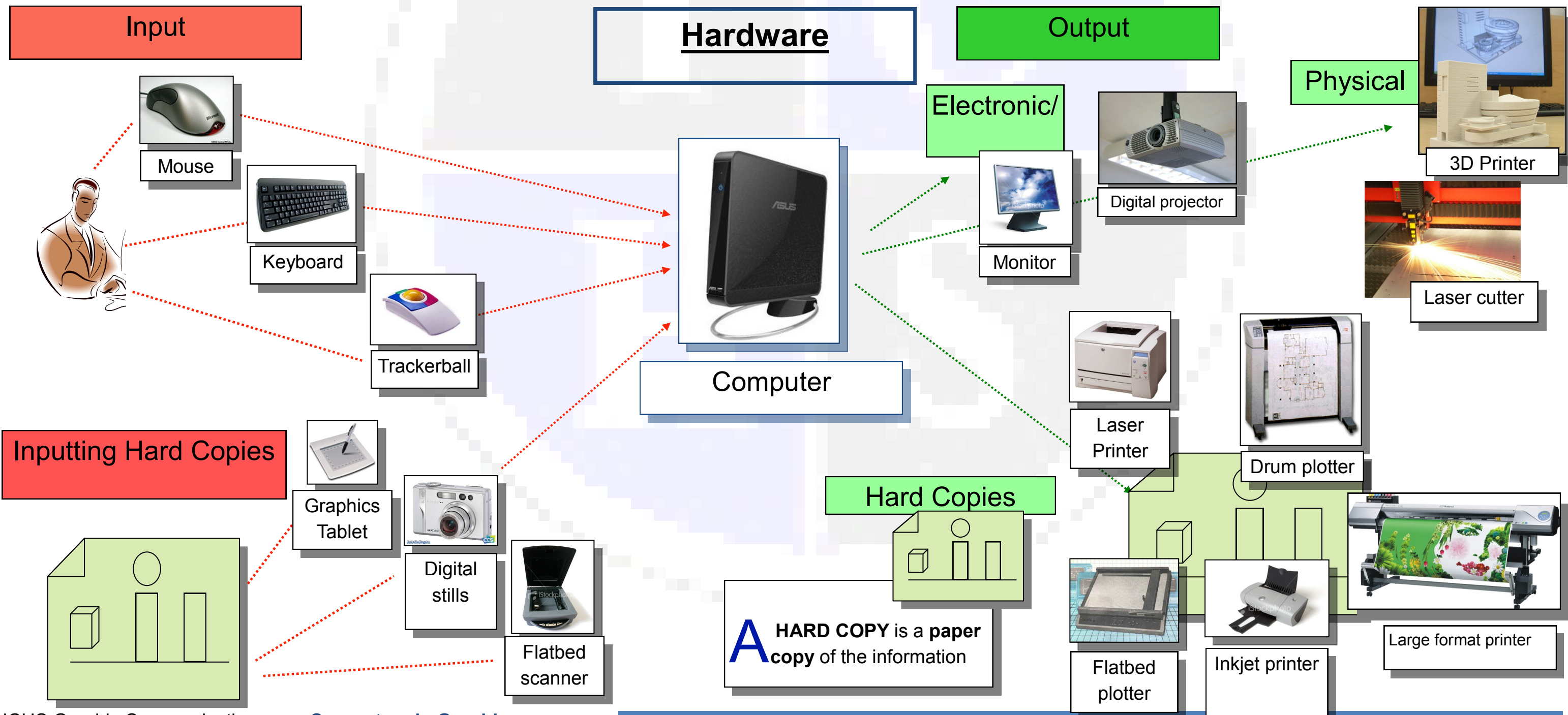
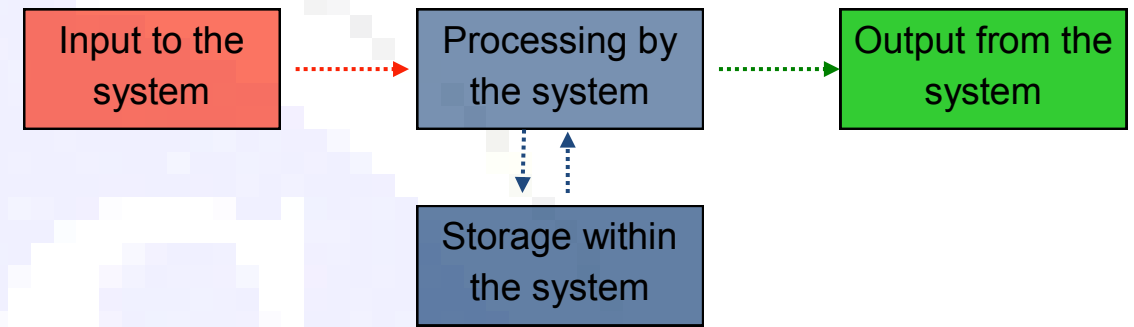
The role of the computer in graphics

Hardware and software

Computers use a combination of **hardware** and **software** to perform tasks. Hardware is the name given to the physical parts of the system such as keyboard, monitor and printer. Software is the name given to programs which interact with the hardware, enabling the computer to perform its tasks.

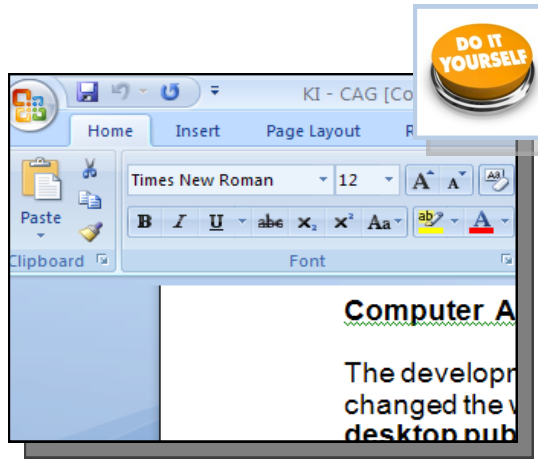


Information is **INPUT** into the computer via various forms of **HARDWARE**, the computer **PROCESSES** this information using **SOFTWARE** and the results are **OUTPUT** using **HARDWARE**.

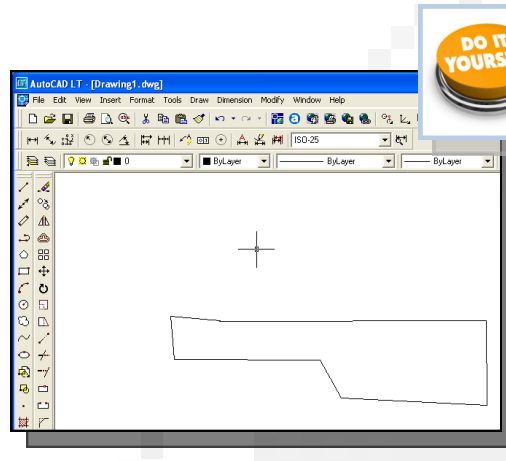


Software

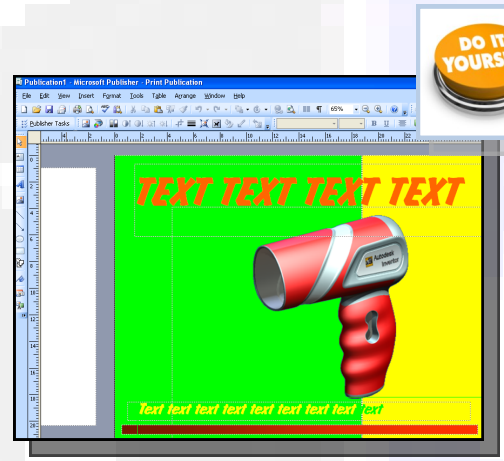
Software—the programs which allow the computer to do what you want it to—cover a huge range of functions. Most are dedicated to a particular role, but some programs have more than one feature—for example Inventor has a computer illustration feature: **Inventor Studio**. A comprehensive list is given on this page:



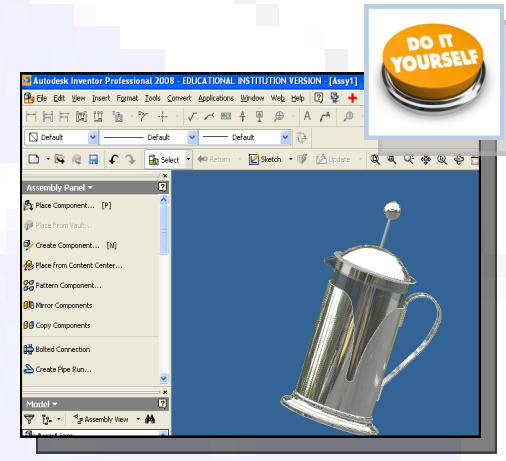
Word processing package e.g. Microsoft Word. This would be used to produce letters which only contain text.



Computer Aided Drawing (CAD) package e.g. Auto-Cad. This would be used to produce detailed technical drawings of some component.



Desk Top Publishing (DTP) package e.g. Microsoft Publisher. This is used to produce a mixture of text and graphics, for example a magazine.



3D Modelling package e.g. Inventor. This is used to produce realistic 3D models of components, allowing changes to be made easily.



Illustration and Presentation package e.g. Inventor Studio. This would be used to colour and render an object or environment.



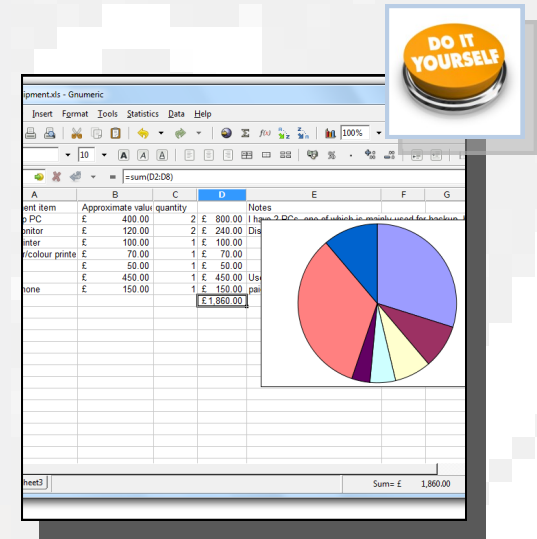
Website building software
These allow the rapid creation of websites, and packages range in sophistication.



Video editing software
This software enables the user to professionally edit pre-recorded videos.



Vector drawing
High quality vector drawings can be quickly produced. There are many free programs available.



Spread sheets
Spread sheet programs usually have a feature which lets the user represent the data graphically.



Photo editing software
These packages allows the manipulation of previously taken images.

2D CAD



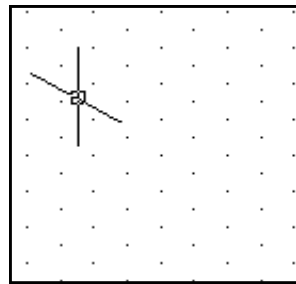
2D CAD can basically be considered as being a computer version of a manual drawing board and is used extensively in the architectural, engineering and construction industries. It also forms the basis for producing 3D models. By applying on-screen commands the user can quickly, easily and accurately produce high-quality 2D drawings of the required format.

2D CAD packages bring several advantages to the process. In addition to increased **SPEED** and **ACCURACY** of production, the drawings can be easily **EDITED, STORED** and **TRANSFERRED** immediately around the world via the internet. 2D CAD also provides the user with several features which are unique to this medium:

Grid

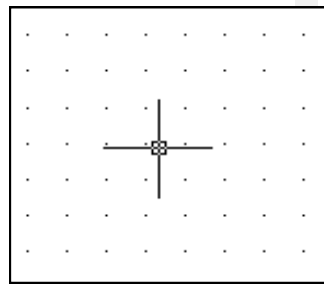
By applying a grid template to the drawing, the user can 'Snap to grid' - this means that each point and line on the drawing is joined to a pre-determined format. The size and style of the grid can be set before drawing and this allows greater accuracy and speed of production. It can be compared with the drawing instruments used with the manual drawing board such as the rule, set squares and T-squares.

Isometric



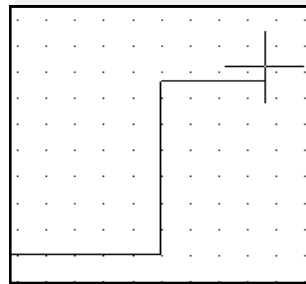
Displays a 30° grid on screen which makes isometric drawing easier and more accurate.

Ortho grid



Displays a grid on the screen to any desired spacing. This makes orthographic drawing easier and more accurate.

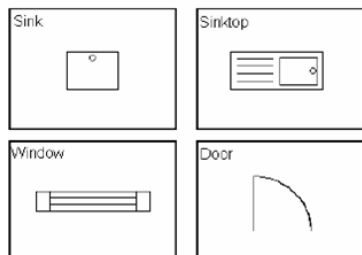
Ortho



Restricts the movement of the cursor to horizontal and vertical movement only. This makes orthographic projection

Library of parts

This allows the user to insert previously drawn and saved parts into a new drawing. The advantage of this feature is that each part is **UNIFORM** (BSI symbols, etc.) and does not have to be redrawn each time it is required. The library feature allows newly drawn parts to be saved for future use and multiple users can add to and access the library.



Some disadvantages with CAD...

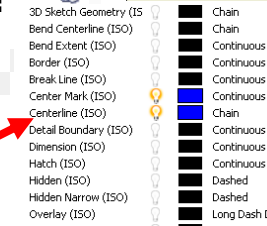
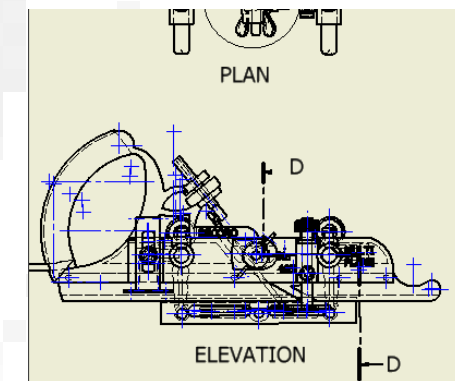
Using CAD as a software package involves some of the risks associated with any computer systems, such as:

- The initial cost of a computer system is high, as is the cost of retraining staff that are used to producing drawings by traditional methods.
- It takes time to convert existing paper drawings over to an electronic format, although **scanners** can help with this.
- Loss of material can occur due to computer viruses and power failures.
- Possible theft of materials is more common with a CAD system.

Layers

A CAD drawing is made up of individual 'layers', with each layer providing a different line type or 'element' of the drawing. This allows that layer to be isolated and edited/applied to the drawing. For example, within a large floor plan the electrical, plumbing or heating systems can be displayed individually so allowing that information to be easily available to the individual required without the drawing becoming 'cluttered' with excess detail.

Layer Name	On	Color	Line Type	Line Weight	Scale by Line ...	Plot
3D Sketch Geometry (IS)	On	Black	Chain	0.25 mm		On
Bend Centerline (ISO)	On	Black	Chain	0.25 mm		On
Bend Extent (ISO)	On	Black	Continuous	0.50 mm		On
Border (ISO)	On	Black	Continuous	0.70 mm		On
Break Line (ISO)	On	Black	Continuous	0.50 mm		On
Center Mark (ISO)	On	Blue	Continuous	0.25 mm		On
Centerline (ISO)	On	Blue	Chain	0.25 mm		On
Detail Boundary (ISO)	On	Black	Continuous	0.25 mm		On
Dimension (ISO)	On	Black	Continuous	0.25 mm		On
Hatch (ISO)	On	Black	Continuous	0.18 mm		On



All the layers in the CAD drawing have now been turned off, apart the centre lines. This can be done with any layer in the drawing.

The main CAD commands

These CAD commands are taken from 2D Auto-CAD, but all can be used within the **sketching** mode of 3D Modelling packages, including Inventor. They are all designed to make the drawing of material as easy and efficient as possible for the user.

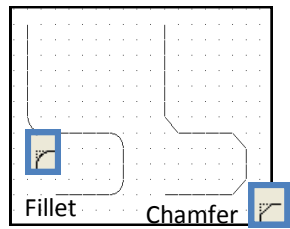
Trim, extend and break

trim Trims the end off a line

extend Makes a line longer

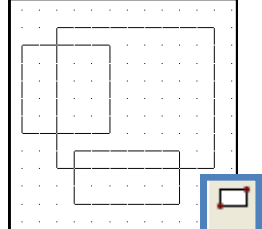
break Removes a section from the middle of a line

Fillet and chamfer



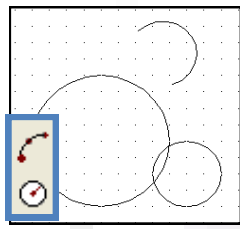
Rounds (fillets) corners;
Angles (chamfers) corners

Rectangle/box



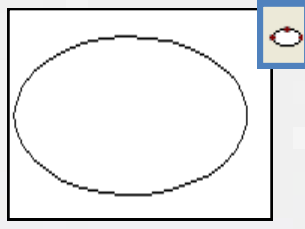
Draws squares and rectangles accurately and quickly

Circle and arc



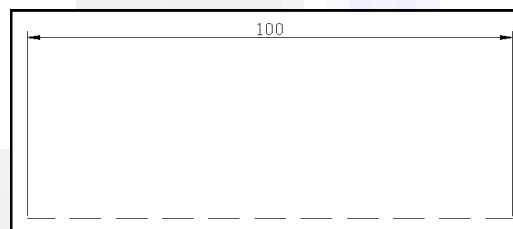
Draws circles and arcs accurately and quickly

Ellipse



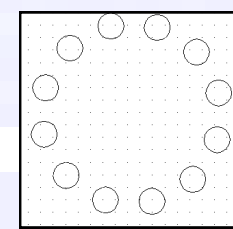
Draws circles and arcs accurately and quickly

Dimension



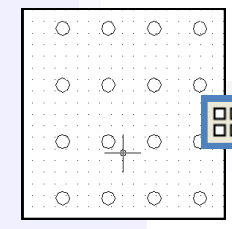
Automatically measures then dimensions chosen parts of a drawing.

Ring Array



Creates a circular arrangement from copied objects.

Box Array



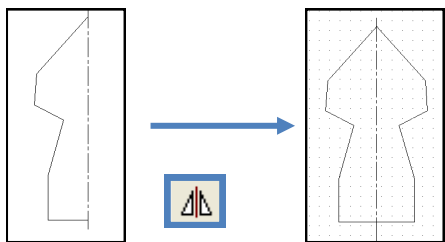
Creates a rectangular arrangement from copied objects.

Text



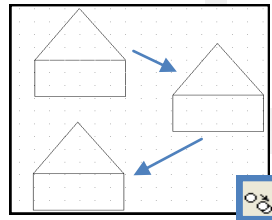
Allows text to be entered in a variety of fonts and sizes

Mirror



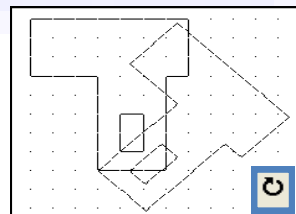
Creates a mirror image copy of an object

Copy



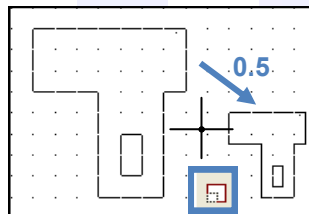
Copies and positions without having

Rotate



Turns an object to any angle required.

Scale

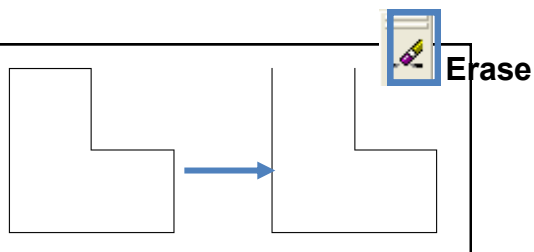


This changes the sizes of objects.

Line types

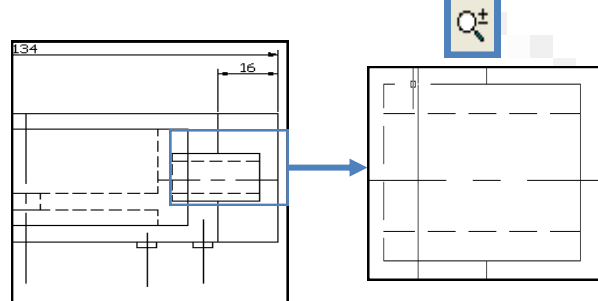
Linetype	Appearance	Description
ByLayer	————	
ByBlock	————	
CENTER2	— · — · — ·	Center (.5x)
Continuous	————	Continuous
HIDDEN2	- - - - -	Hidden (.5x)

Allows any BSI line types to be used in the drawing.



Erases selected lines or areas from a drawing

Zoom



Enlarges view so that small details appear bigger and are easier to work on.

Layers

Name	On	Freeze...	L...	Color	Linetype	Lineweight
0				250	Continuous	— Default
Centre Line				250	CENTER2	— 0.15 mm
Defpoints				250	Continuous	— Default
Dimension				250	Continuous	— 0.15 mm
Hidden Line				250	HIDDEN2	— 0.15 mm
SMART-Redline				250	Continuous	— 0.15 mm

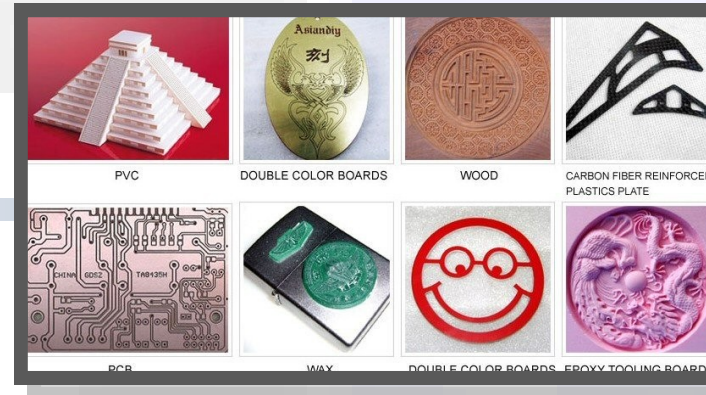
Allows a complex drawing to be built up in several layers to make it easier to work on.

3D CAD

3D CAD—also known as 3D modelling - allows the user to produce virtual models based on sketches produced within the package or imported 2D CAD drawings. 3D modelling has several uses within industry:

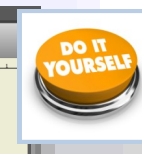
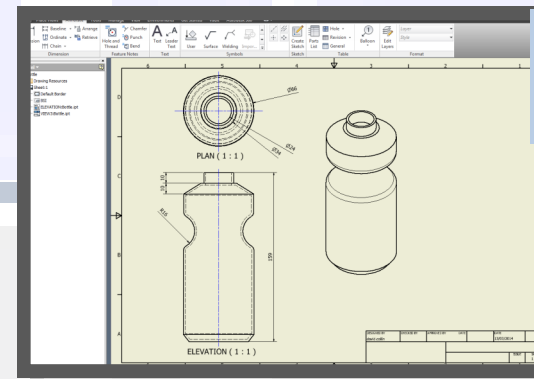
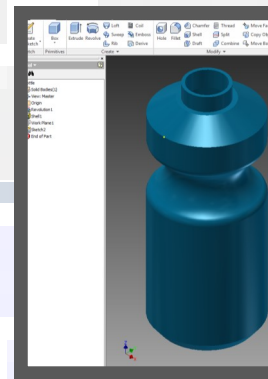
Manufacturing

Prototype 'models' of a design can be produced on the software and 'tested' via features in the program. This can be to simulate different areas of stress on the design or how it would react in various real-life situations. Computer Aided Manufacture (CAM) allows Computer Numerically Controlled (CNC) machines to produce physical parts. A result of this development over the years has been the replacement of many human workers with this automated system.



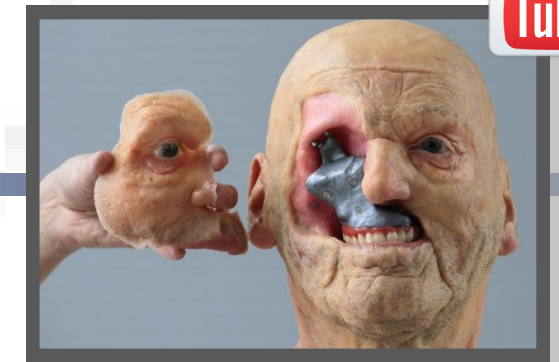
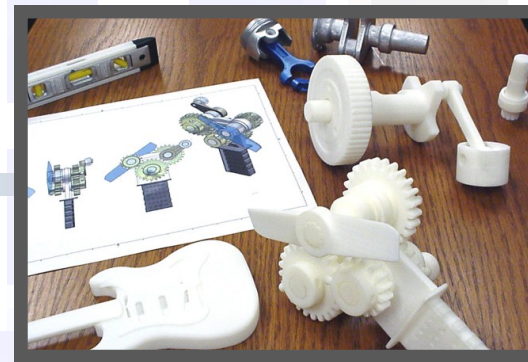
Production Drawings

2D CAD production drawings can be very quickly and accurately obtained from the 3D model. This can make it easier to produce these drawings than using manual methods or 2D CAD. Alterations to the model automatically update the 2D production drawing.



3D Printing

The 3D models can be exported as standard tessellation language (STL) files to 3D printers and produced as physical prototypes. This allows basic models to be produced to provide a hand-held, tangible version of the design from the computer. The advantages of this are that the designer or customer can get a 'feel' of how the design shall exist in real-life, in a way that the computer version cannot do, no matter how sophisticated the software is.



Simulation

This allows the creation of required situations for training, testing design/ materials and predicting future events. This is generally cheaper than 'real-life' and safer too.



3D Illustration

This improves the visual appearance of a 3D model, and some packages allow the user to interact and animate with the design. Most CAD packages have illustration features imbedded within them—ie Inventor Studio—but there are 'stand alone' products available which are solely devoted to the task.

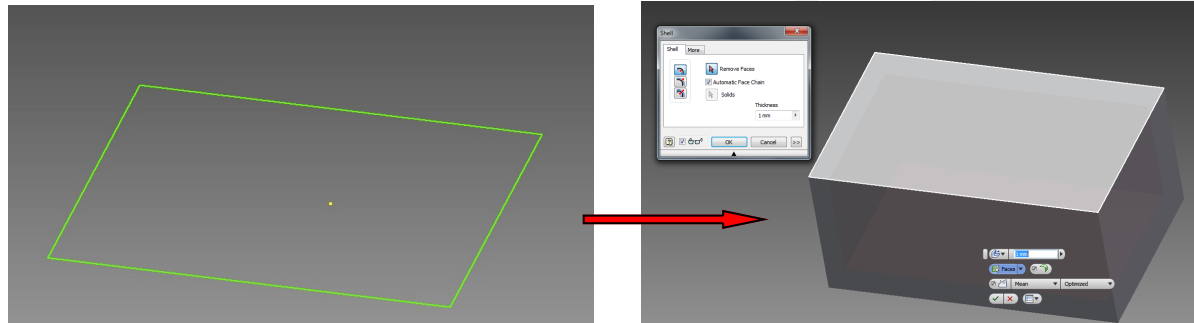
3D CAD (2)

3D Modelling

3D modelling is a method of drawing objects on a computer and enables the user to manipulate them and view them from any angle. They are also easily sent to other users around the world via the internet. This development over the years has greatly benefitted design and manufacture as development time and costs have been reduced. This has had an impact on traditional manufacturing roles, although there has been a rapid demand for skilled CAD operators.

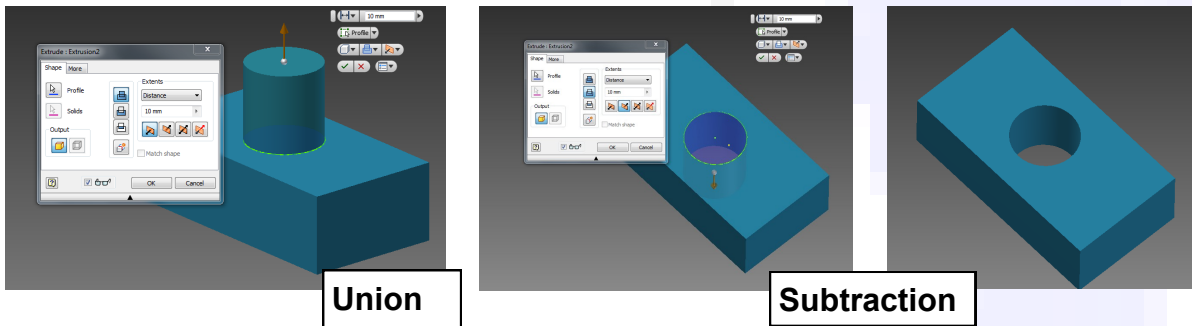
There are many 3D modelling packages available, but most adopt the same set of core tools or features:

Extrude



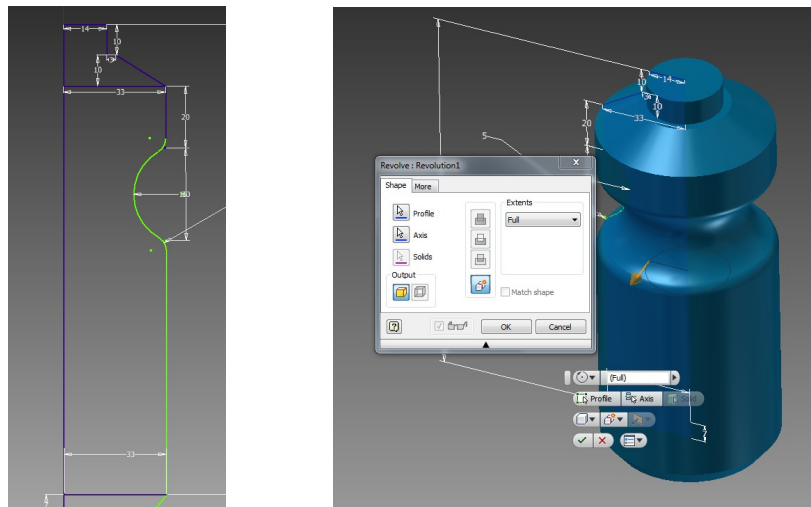
This is the most basic feature in 3D modelling. It allows the user to give another dimension to the initial 2D sketch by adding a specified amount of 'material' at 90° to the

Union and Subtraction



Union and **Subtraction** are effects the extrusion feature has on an existing solid. This is generated in the same way by a sketch, but a different option is chosen.

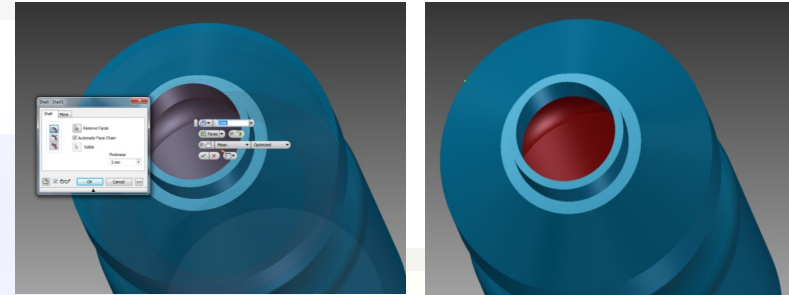
Solid Revolve



This feature allows the user to produce 3D models based on a profile sketch which is a symmetrical half of the final model. It is particularly useful for cylindrically-based objects such as bottles, glasses and other forms which would prove very time consuming, complicated and inaccurate to construct with the **extrude** feature.

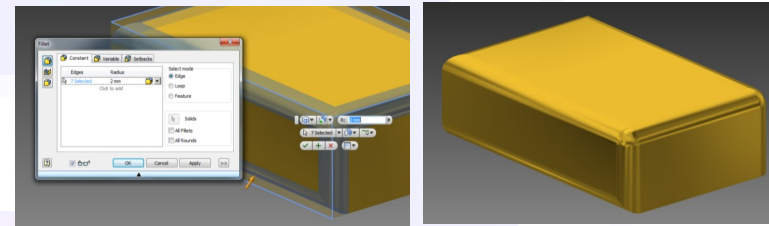


Shell



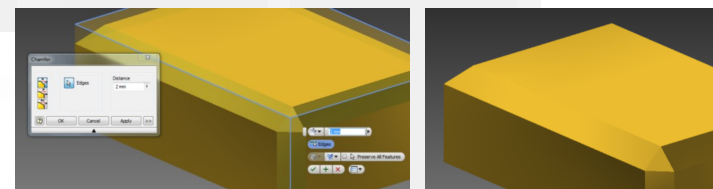
Shell provides the user with the ability to 'hollow out' the model. This is a quick and accurate method of changing a 'solid' model.

Fillet



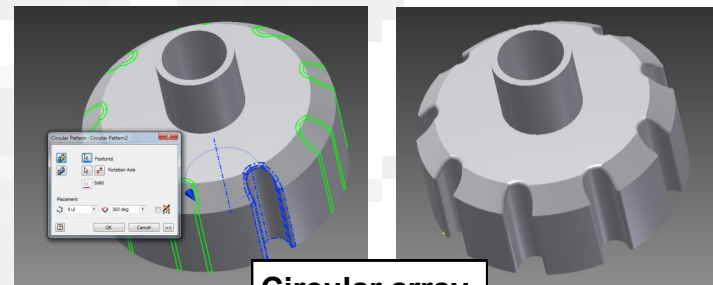
This edit allows the 'sharp' 90° edges of a model to be rounded according to a designated radius.

Chamfer

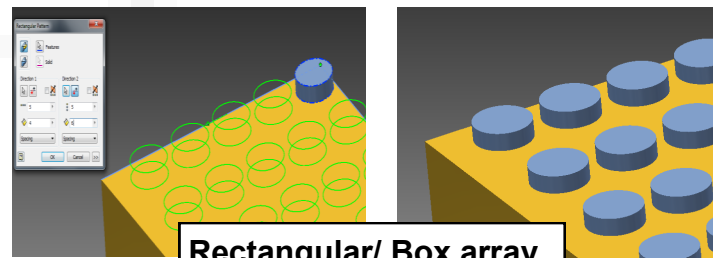


This edit creates an angled face to the 90° edges of the solid.

Array



Circular array



Rectangular/ Box array

The **array** feature allows the user to create a pattern based on a feature, or the initial sketch. This produces an accurate pattern very quickly. There are two kinds of array—**circular** and **rectangular/ box**.

3D CAD (3)

Simulation

The rapid development and improvement in computer processing power and graphics over the years has enabled different scenarios to be realistically produced within the computer environment for a range of functions.

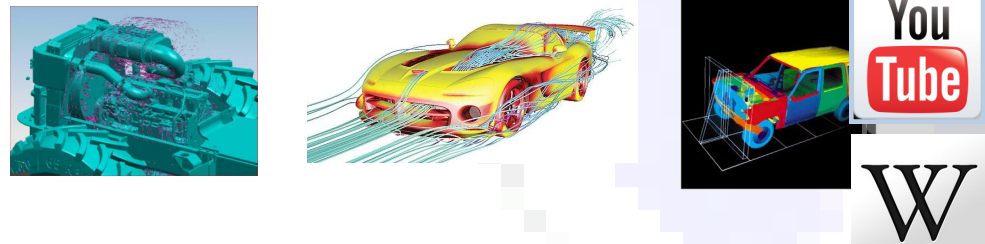


Training

Flight simulators are perhaps one of the most common uses for simulation. This allows the trainee to be subjected to a range of different scenarios and their performance monitored and recorded. This is obviously a lot safer than flying an actual plane, and saves a huge amount of money in training costs, fuel and parts. Many other training programmes can be simulated such as extreme driving, sailing and space flight.

Testing

Products can be tested for stress, momentum response and material properties before production using computer simulation. This saves greatly on production costs and products can easily be altered or 'tweaked' based on results before physical models are produced.



Predictive

The software converts complicated data into a visual form which anyone can easily understand. Weather patterns are the most common uses of this form of prediction, but other uses are animal migration, volcanic eruptions and volcanic activity.

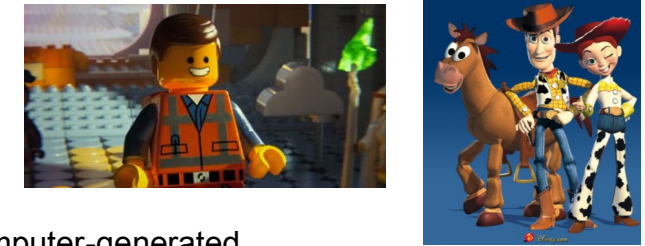


Illustration

Films and Animation

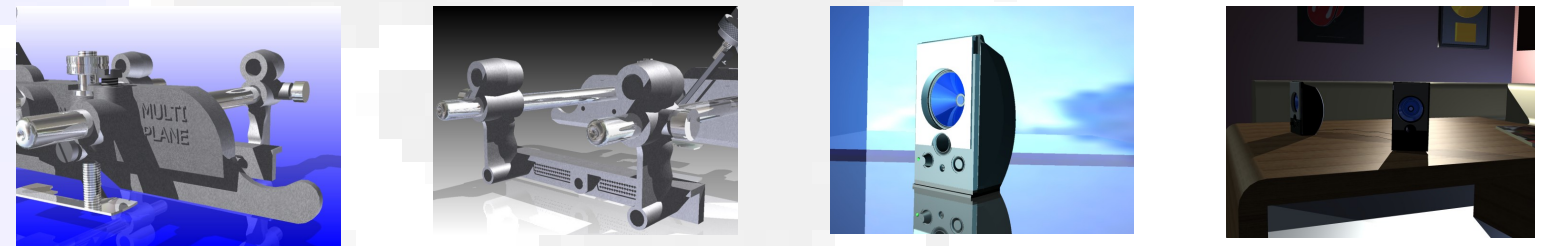
Toystory (1995) was the first feature film made exclusively from computer-generated imagery (CGI). Since then, they have become ever more ambitious and advanced. This format brings several advantages to film production, as the producers have often unlimited scope for more scenes—often the imagination is the only limitation to what can be achieved.

Scenes can be continually recreated until the producers are satisfied, and there is no need for a full film crew and actors to be kept on standby. This results in huge savings in production costs, although CGI films still involve great expense.



Product Visualisation

This involves rendering a 3D model to enhance its appearance and make it appear more realistic and attractive. Materials and lighting effects can be added and this rendered image can be used for promotional purposes within DTP documents.



Video

Video games use 3D models which have been created, rendered and incorporated in a program to make them interact with each other and user input.



A more in-depth description of computer Illustration is provided on the following page



Computer Illustration

Computer illustration—or computer-generated imagery (CGI) - is the term given to producing or enhancing graphics with computers.

Rapid advances in technology have enabled this area of the graphics industry to generally dominate over manual methods. The internet, software and processing capabilities of computers have dramatically increased the possibilities within this area.

The fundamental purpose of promotional graphics is to capture the public's attention, and the computer illustrator is integral to this as they have the knowledge and skills to make the graphics eye catching and attractive.

Computer illustration involves 2D or 3D CAD, and often crosses over between both. A computer illustrator not only needs to have CAD skills, but must also understand design elements and principles, colour theory and DTP techniques.

Computer illustrators work in a range of industries, such as:

- Website building
- Sign writing
- Architecture
- Advertising
- Graphic design
- Video games
- Film and TV production

Resolution

Images on a screen or printout are made up of an array of dots; the greater the amount of dots in an area means the picture quality is better and sharper. A greater number of dots means the image has a higher **resolution** than one with less. This is either known as **pixels per inch (PPI)** or **dots per inch (DPI)**. There are two form of computer graphics: **vector** and **raster**.

- Vector graphics are produced by a pre-determined mathematical equation, so resolution is constant regardless of the size of image.
- Raster graphics are constructed by allocating each pixel a colour. This can result in the image becoming 'pixelated' if it is enlarged greatly.

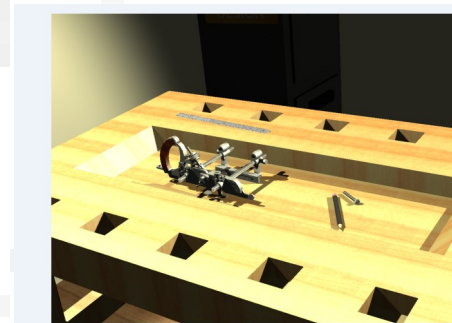
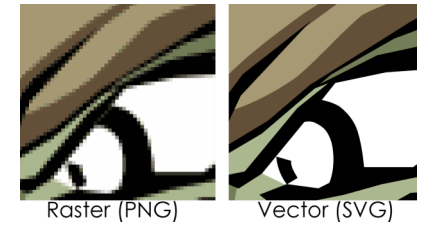
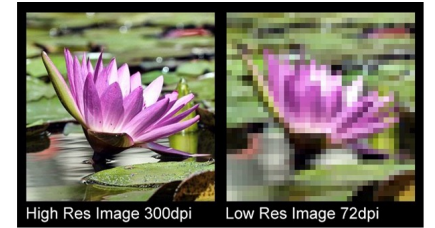
3D illustration

With the rapid development of 3D modelling, great advantages have been provided to engineers, architects and designer. Basic models can be effectively 'brought to life' by a range of features within the software. Most 3D modelling programs have an in-built package to enable illustration—i.e. Inventor Studio—but there are many 'dedicated' packages which can provide even greater depth to illustration. Several core features are applied to a basic model or scene to make it attractive and realistic:

- **Materials:** metals, plastic and wood effects can be added to the model to give it different appearances.
- **Lights:** there are two basic types of light used to illuminate a model or scene. **Global illumination** lights up the whole scene, **Focused illumination** involves individual lights pointing at specific parts of the display—like spotlights.
- **Reflections:** these are used to add further realism to the illustration, and bounce light and surface details to other parts of the model or scene.
- **Shadows:** usually a 'follow on' effect from applying light to the display, it adds further realism to the illustration. The more focused illumination involved, the more shadows.
- **Texture:** added to material to give it further life-like qualities. It could involve characteristics such as a 'rough' look such as knurled metal.

2D illustration

2D illustration is used for a variety of purposes such as producing backgrounds for DTP displays, decals for 3D models and manipulating images. As with all aspects of computer graphics, they give the user the advantage of being able to easily edit them, send them via email and store easily. **Microsoft Paint** is a simple package for this form of illustration, but there are many more powerful free programs available.



Gradient and radial fill

Desktop Publishing (DTP)



Desktop Publishing (DTP) enables the production of magazines, newspapers, books, promotional literature etc. to be created on a desktop computer or laptop. The **publishing industry** creates these documents and the physical paper documents are produced by the **printing industry**. The design is the result of the work of the **graphic designer**.

Benefits of DTP to the Graphic Designer

Graphic designers nowadays operate on a very flexible basis— work can be produced anywhere and any time using modern technology and sent to the office via the internet.

Modern DTP packages allow exciting and imaginative displays to be very quickly and easily created. The main benefits DTP software brings to the graphic designer are:

- It is simple to make modifications to images such as colour, shape and formatting.
- Further modifications to the design can easily be implemented on behalf of the editor or client.
- The grid structure templates within DTP software enables designs to be created accurately and quickly.
- Design proposals can be sent to the editor or client electronically to save time. Their responses can be returned this way.
- The graphic designer can work from home. This saves travel costs and environmental impact of their journey.

Benefits of DTP to the graphics industries

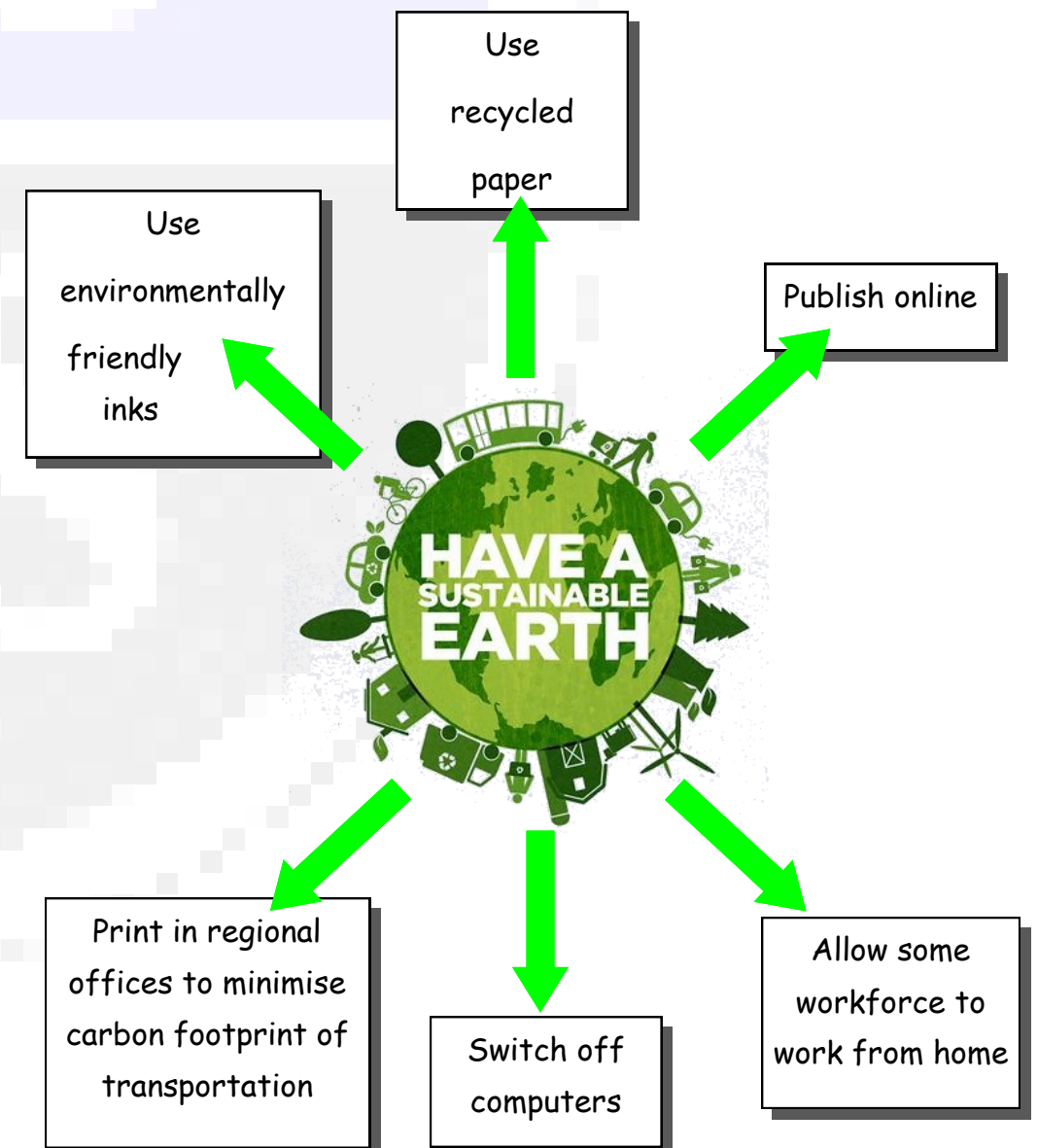
As there is great competition among newspapers and magazines in the market and the circulation of most printed newspapers is declining, DTP provides many advantages to the industry:

- Proposals and final editions with full designs and images can be sent quickly electronically. These can then be forwarded onto the printer in this way.
- News reports can be sent from anywhere in the world email.
- The time it takes to design and publish a document is greatly reduced. Modifications can easily be made by the editor and sent to printer.
- Common features within a publication can be quickly produced via templates such as footers, running headers etc.

Benefits of modern printing methods to society

The advent of modern methods has had a major impact on the printing industry. Traditional methods were very labour intensive and large numbers of people were employed in various roles such as print-setters, labourers and engineers. The amount of semi-skilled workers has been reduced, although there is now great demand for highly skilled operators as more reliance is placed on computer controlled design and production. The new technology has also had an effect on the industry's environmental impact:

- Modern printing methods are more energy efficient than previous means.
- Many publications provide an electronic or online edition. This reduces the amount of paper and ink required
- Most publications use paper which can be 100% recycled as a result of modern printing technology.
- Modern inks are more environmentally friendly and less quantity is required. Inks are now based on vegetable oil rather than on petro-chemicals.
- The quantity of paper and inks required is digitally controlled. This reduces waste.





Bleed

This main image bleeds off the printing area and through the margin. This creates an informal feel to the page.

Colour fill

Contrast and harmony can be achieved by formatting the text box appropriately. These two text boxes use a blue/ grey fill which harmonises with the main picture, but contrasts with reds used in the headers.

Column rule

This column rule gives this page a more formal look, and separates these two sections.

Reverse

The body text colour is black. The text of the subheading has been reversed, and the box filled with a darker colour. This creates contrast and gives the page interest.

Header

This is called a **running header**, and appears on every section of the magazine.

SPECIAL FEATURE



Declaring war on the 'dull' music scene....

KASABIAN

Headline

The headline introduces the article. In this case, the bold fonts create emphasis, and the reverse text on the blue/ grey fill gives it visual impact.

Drop capital

This larger first letter signifies the start of the article. The use of reverse also attracts interest.

Margin

Margin—the space at the side and bottom of the page where there is no text or graphic.

Kasabian burst on to the British music scene in 2004 with the release of their eponymous debut album. Disgusted with the clean living 'non' antics of the current groups of the time—Coldplay, Keane, etc.—they vowed to bring back some of the excitement and glamour that had been sorely missing. They have since gone from

strength to strength, becoming the major attraction at festivals over the years. As guitarist Serge says: "Oasis have gone. We are the biggest band in Britain now. Kasabian are to headline the Isle of Wight and Rockness festivals."

Excitement...what it is all about

The song "Vlad the Impaler" was released as a free download for a period of 4 days, as a preview for the album. The promo video for "Vlad the Impaler" stars Noel Fielding of *The Mighty Boosh*. The album's first official single was the track "Fire", which was released on 1 June 2009, and the song "Where Did All the Love Go?" was released as the second official single. The third single "Underdog" was used in the movie *Takers* (2010).

On 14 June 2009, *West Ryder Pauper Lunatic Asylum* reached number one in the UK top 40 charts, spending two weeks there. *West Ryder Pauper Lunatic Asylum* was shortlisted for the 2009 Mercury Prize, and was named 'Best Album' at the 2009 Q Awards. The band won "Best Group" at the 2010 Brit Awards. At the 2010 Q Awards the band won the "Best Act In The World Today".

The song "Fire" was used as the Barclays Premier League theme song for

Lead singer Tom explains the Kasabian philosophy

Where do you prefer to perform?

Scotland—the crowds are always up for it and go mental.



Lead singer Tom

Why do you hate some other bands' boring attitudes?

All rock bands have a responsibility to live the life of a rock star—who wants to hear about Chris Martin's vegan diet or the Fratellis going to bed early? People want an escape from the grinding routine of life, and we'll give them that.



Favourite festival?

T in



Heading

This introduces a separate section of the article.

Tilt

This image is tilted, which catches the reader's attention. It creates a modern feel, which will appeal to the youthful target market.

Caption

Gives information about the image.

Sub-headings

These break up the large section of body text. The use of the accent colour produces a visual rhythm.

Column

Columns are used to restrict the length of the lines of text, making them easier to read. They also produce a visual structure to the page.

Gutter

This separates columns, and helps to de-clutter the page.

Text wrap

As it suggests, the text wraps around the image.

Cropped image

This is an image with the background removed. It creates a more interesting shape.



Text/Typeface/Font

There are different ways of organizing text which are used globally. This is referred to **justification** or **alignment**.

Aligned Left

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Aligned Right

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Justified

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Centered

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Copy/cut/paste

When you take an image/piece of text etc. and copy it from one place to another. Cut is when you delete something from its original location and paste it somewhere else.

Shortcuts: Ctrl C / Ctrl X / Ctrl C

Handles

Handles are the parts which appear when you select an image. By moving these you can manipulate the image in many ways i.e. changing the size or rotating an image.



Colour Fill

This is when you take a shape with an outline and fill it in with a colour this is shown in the images below.



Before col-

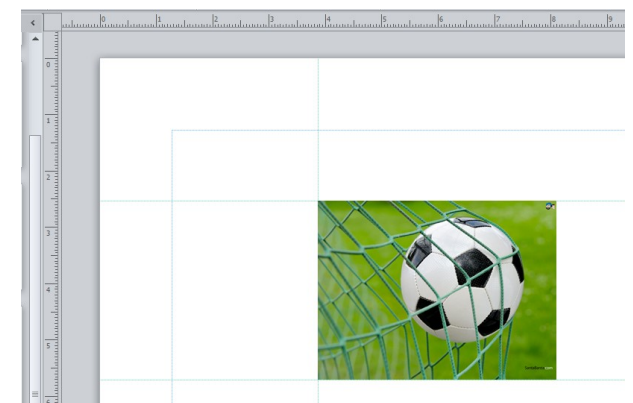


After colour

Guidelines

Guidelines are guides which you access via your rulers on your page. They act as a guideline for aligning images/text etc.

You can select **Snap to Guidelines** which will allow your image to automatically jump to meet with guidelines you have positioned on the page





Cropping

Cropping is a tool which allows you to delete unwanted parts of an image. You can crop an image by pulling in the sides or by cropping around the outline of the shape as shown in the second cropped image



Original image



Cropped Image



Cropped Image

Rotate

Rotate is when an image is rotated like the beach ball shown in the second image. You can rotate an image/text to any specific angle you wish



Original image



Rotated image

Transparency

When you make an image/text/ block of colour etc. 'see-through' so that you can see anything positioned behind



Desktop Publishing techniques

Desktop Publishing

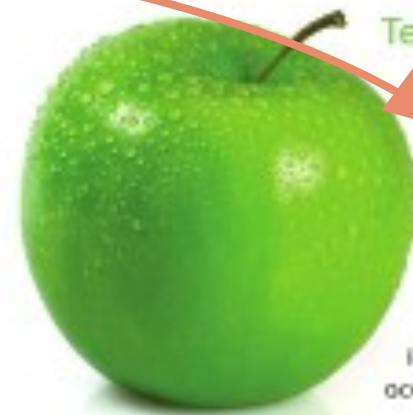
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Text Wrap

When you alter text to wrap around an image or shape



Text Wrap

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Drop Shadow

When you make an image/text/ block of colour etc. 'see-through' so that you can see anything positioned behind

Drop Shadow

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