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THE UNIVERSITY of NOTTINGHAM

Graphics Guide

A summary of graphical equipment and software likely to be available to computer users at the University of Nottingham

www.nottingham.ac.uk/is/
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Contents

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1. Introduction

There is a very wide range of programs available which use computers to display pictures and print them. This Guide summarises equipment and software likely to be available to people at the University of Nottingham, and attempts to guide you to what is most likely to fulfil your requirements.

The Guide does not describe any software in detail, but references are given to manuals and other sources of information. These should always be consulted by anyone planning to use a particular piece of software.

It is a guide to software specifically designed for the production of graphics. If you are producing a document with some limited graphics content, it may be worth investigating the graphical capabilities within the document preparation system of your choice before considering any specialised graphics package. Section 5 in this guide: *Graphics in documents* discusses how pictures from specialised graphics packages can be imported into document preparation systems.

1.1 Support and advice

Within this document you will find references to the following:

IS: Information Services: the unit that manages provision of these services across the University.

CCC: Cripps Computing Centre: the pair of buildings (North and South) on the University Park campus that accommodate some IS staff, particularly those involved in providing computing services.

ISCRA: Information Services Computing Resource Area: areas managed by IS, providing public-access facilities for members of the University.

Wherever a Helpline is referred to, please contact the relevant one:

- student-IT-helpline@nottingham.ac.uk ext 13333†
- staff-IT-helpline@nottingham.ac.uk ext 16677†.

Information about all IS services and facilities is available from URL www.nottingham.ac.uk/is

1.2 Computer graphics applications

Two major uses of Computer Graphics are to present data in pictorial form, and to draw diagrams or figures. Software designed to present information is often called *Presentation Graphics*, and is used to prepare reports or perhaps overheads for publication and presentation. Often these packages will include the capability to draw diagrams and incorporate images, but they are not designed specifically for the production of serious artwork.

Software which has a greater range of options for manipulation and presentation of data, probably with more technical and scientific uses in mind, might be termed *Data Presentation* software.

For *Graphic Design* applications, there are specialised painting and drawing packages.

Examples of output from each category are shown in Figure 1. The categories themselves are further discussed in Section 3. Strict classification of software can be difficult, however, as features will overlap.

† These are extensions at University Park, so a prefix may be needed e.g. 73 from QMC or City Hospital, or (0115) 95 if you are calling from outside the University telephone system.

There is also software for more specialised applications. For example:

- Computer Aided Design (CAD) packages for sophisticated drawing and design.
- Visualisation software for interactive analysis of data by computer graphics.
- Image processing to enhance or extract data from pictures.

In addition, there are programs which are useful for particular tasks. These are *utilities* and do such things as display particular graphics formats, or convert them to other formats.

1.3 Making a choice

In deciding what equipment and software to use to produce your computer graphics, a number of things may need to be considered. These include:

- What sort of graphics are to be produced? Does the task come under the general heading of presentation graphics, data presentation, painting or drawing, or something more specialised? See Section 3 for a list of software in each category.
- Do you want to use a self-contained software "package", or use libraries of graphics routines called from your own program (usually written in Fortran or C)? Most packages have some form of graphical user interface to allow easy choice of options via a pointing device (usually a mouse). This may be considered a major advantage. Such an interface also allows interactive placing of graphical objects, or freehand painting and drawing. On the other hand, programming may allow greater flexibility in certain situations.
- What output is required? Is a high resolution screen required?
- Is hardcopy required? Even if this is not immediately necessary, will it be required eventually? Does it need to be in colour? Do you want to produce transparencies? Will the output need to be photocopied? Will the hardcopy need to go in a document, and need A4 paper?
- Will the picture be incorporated into any other package, for example wordprocessing/document preparation package? If so, you must consider in what format the graphics software can produce output, and ensure that this can be imported into the wordprocessing or other package.

The equipment (i.e. computer) you wish/have to use may also influence your decision. However, it is probably better to spend a little time familiarising yourself with a new computer system rather than putting up with unsuitable software on a familiar system. See the IS web-site at **Services>Applications Software** and click on **Graphical/Multimedia** for details of supported platforms and output capabilities for each software application.

See the IS web-site at **Services>Computers & Peripherals** for details of input and output facilities in ISCRAs.

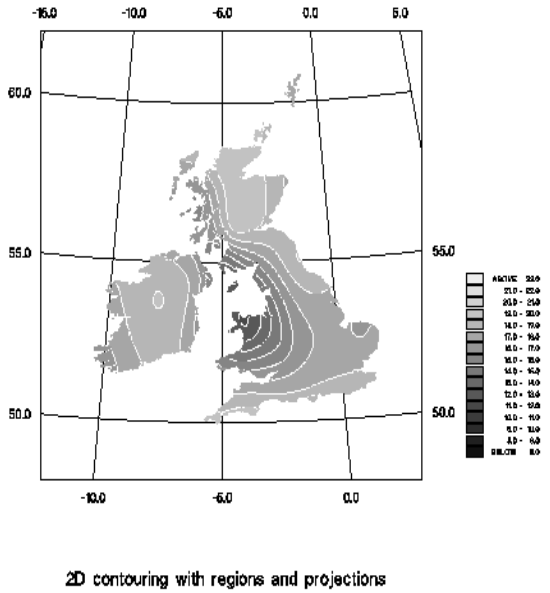

Figure 1a) — Data Presentation

The University of Nottingham

Figure 1b) — Graphic Design

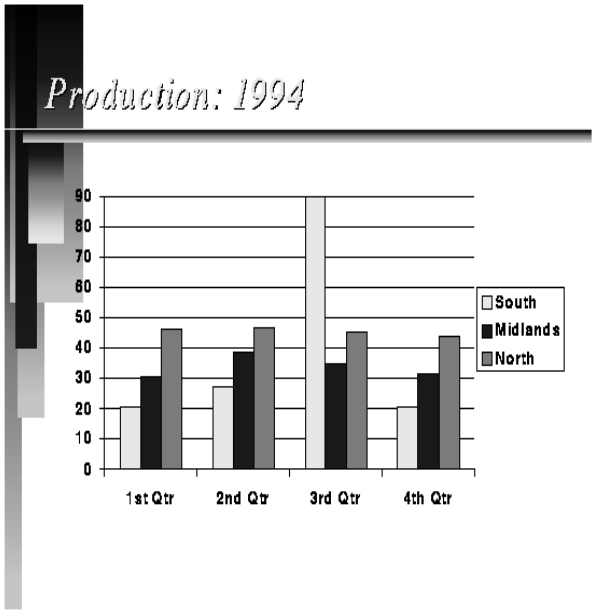

Figure 1c) — Presentation Graphics

Figure 1 — Examples of Categories of Graphical Output

2. Computer graphics fundamentals

2.1 Screen displays

A picture displayed on a conventional computer screen is made from a large number of small rectangles of the same size, called “pixels”, each having a colour (or intensity) associated with them. These pixels cover the screen, making up the display. The number of pixels is the screen resolution; typical values are up to 1024×768 for a superVGA PC screen or 1280×1024 for a Sun monitor. The number of colours available varies but is usually in the range 256–several million. Greyscale and monochrome screens are also still used. In Figure 2 the enlarged section clearly shows the rectangular pixels making up the picture.

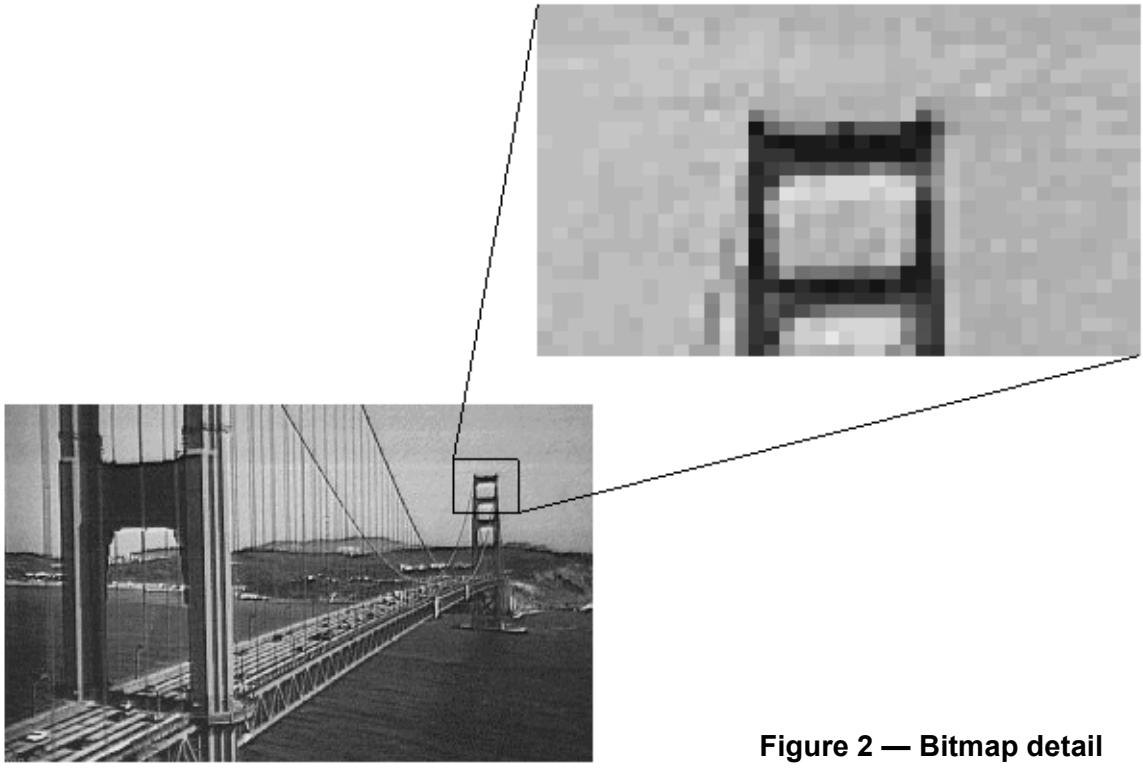

Figure 2 — Bitmap detail

Computer graphics programs may store their pictures as pixel maps, more often called a bitmap. This will have a certain size (number of pixels up, and number of pixels across the screen), and a specified position on the screen. Alternatively, a picture may be described in terms of objects such as lines and rectangles and circles. The size of objects may be specified in fractions of the screen, or in actual mm or inch coordinates. When the picture is sent to the screen, a “driver” routine converts this data to pixel values on the display.

To display pictures on the screen, a graphics program must have access to the correct driver for that screen. In many cases the screen driver is located within a “Graphical User Interface” (GUI) such as Microsoft Windows on PCs, or X windows on Unix workstations. With this system, the graphics program uses a standard Windows or X window driver, and the GUI runs on the workstation, converting the graphics output from the program to pixel values on the screen.

If there is no GUI, as is the case with DOS applications on PCs, or when using simple terminals to access a central system, the driver must reside within the graphics program. It can be seen that there are definite advantages to the GUI

approach, since it allows standardisation across equipment, so long as the same GUI is used. They are also usually easier to use. The disadvantage is that an extra process has to run to provide the GUI, reducing the performance of the terminal, PC etc. However, most modern equipment can run GUIs with a perfectly satisfactory performance for most applications.

2.2 Graphics files

Graphics programs may store their pictures on disk as bitmaps or as objects, or maybe a combination of both. A package may have its own format to store its pictures efficiently, but certain "standard" formats have emerged to allow the transfer of pictures between packages. Examples of well-used bitmap formats are PCX, TIF, GIF and JPEG. Examples of object graphics files are CGM, encapsulated PostScript (EPS) and HPGL. EPS can include bitmap sections as well.

Which format is most useful depends on what is to be done to the file. For image processing, the picture is best represented as a bitmap. For editing a diagram, it would be best to have the picture described in terms of objects. Bitmaps are a straightforward way to store pictures on a computer. The disadvantage is that the resolution of the picture is fixed by the bitmap size. A bitmap of size 300×200, for example, might be displayed on a super-VGA screen capable of 1024×768 resolution. If one screen pixel is used for each image pixel, a rather small picture results. If an attempt is made to enlarge the picture to fill the screen, each image pixel will have to fill several screen pixels. The rectangular pixels in the picture then become rather obvious, as they are in the enlarged section in Figure 2. On the other hand, if a bitmap of a size larger than the screen resolution is fitted to the screen, some of the picture information will obviously have to be lost, resulting in a very poor quality display.

Many graphics files produced by modern systems are of fairly high resolution, matching the high resolution computer screens now available. These files are consequently of a substantial size, requiring significant amounts of memory and disk space for display and storage. If hardcopy is to be produced, the printer must have sufficient memory to cope with the file, and large files will take a significant time to process and print. This issue should be considered, especially if it is intended to produce a document with a significant graphics content. It is wise to test printing of (sample) graphics files in advance of the final document being printed.

Using objects, the full resolution of the device can be used, and the picture can be displayed at any size, without such obvious degradation in quality. The problem with this approach is the difficulty of encoding pictures, especially photographic images, as simple objects.

Conversion programs are readily available to convert between standard formats (see Section 3.4.11 *Utilities*), but converting a bitmap to an object description is very difficult and requires special software. Programs which convert to PostScript from a bitmap will generally use the PostScript internal image format, for instance.

2.3 3D Graphics

Graphics applications which require 3 dimensional views of objects or scenes are considerably more complex than 2 dimensional applications. A 2D image can represent a 3 dimensional scene, for example in a photograph, but this image is static, representing only one view out of an infinite range of possibilities. Several modern computer graphics applications require interaction with objects or scenes, for instance in the areas of 3D modelling, 3D CAD, and visualisation of complex data of 3 or more dimensions. This

interaction requires a representation of the 3D scene to be stored in the computer, rather than a 2D image or bitmap. A 2D image of the scene can be calculated, based on a selected viewpoint, and sent to the screen display. This process of "rendering" a 3D scene to a 2D image may be quite demanding in computing resources, depending on how complex the scene is. In interactive graphics applications, the viewpoint may be altered by a pointing device, or keyboard, or the scene itself may be animated in some way. This will require the rendering process to be performed several times per second if anything like a realistic impression of motion is to be achieved. Some computer systems have specialised hardware to manage the rendering process, and these systems have a considerable advantage over those which rely on the main processor to do the necessary calculations.

2.4 Printing and plotting

There is a very wide variety of devices available for the production of hardcopy from computer graphics software. All the various types may be placed into one of two categories, vector or raster devices. Vector plotters understand how to draw lines between specified points, and there may be a choice of pen colour available. Most devices are raster based, however, like the computer screen. They assign a colour (black or white on monochrome devices) to each pixel on the paper. Resolution is often better than screen resolutions, but the number of colours is often limited to 8. To give a bigger range of colours (or give greyscale on monochrome devices) a technique called "dithering" is used. This combines different coloured dots in a set pattern to give the illusion of a new colour. In this way the printer can represent more colours, but this is at the cost of resolution since more than one printer pixel is needed to represent a picture pixel. This is why a colour print may look poor compared to a screen display, even though the stated resolution of the printer is higher than the screen.

For a printer to produce a picture it must be sent data that it can understand. This data is generally produced by a routine, accessible to the graphics software, called a "driver". If the software is to print a picture successfully it must use the appropriate driver for the intended printer. Individual makes of printer may have their own languages which only they understand, but there are two languages, PostScript and HPGL, which have become very widespread. Perhaps the more important of these is PostScript. Many printer manufacturers produce versions of their printers which understand this language. Also, most modern software produces PostScript as an output option. Even if a printer is not directly connected to the computer system on which you are running a computer graphics application, it may be possible to save the picture in a PostScript file, transfer it to a computer which does have a PostScript printer attached, and so print it there.

2.5 Use of colour

Before producing output in colour it is worth bearing some or all of the following points in mind:

- Some people have difficulty distinguishing certain colours, in particular red/green colour-blindness is relatively common (some people have difficulty distinguishing colours at all).
- If you are producing a document that is likely to be subjected to any form of monochrome reproduction, for example photocopying or microfilming, colour alone will not be sufficient to distinguish lines, objects or other areas.
- If you are designing graphics principally for screen display, you should bear in mind that certain colour combinations can cause an apparent "flicker" on the screen. Also, you should design with the lowest likely screen resolution that may be used in mind.

The following is extracted from BS4821, the last sentence can usefully be applied also to overhead projector slides and poster displays:

> *"If the use of colour is essential in the text or illustration of a thesis, the author should choose a method of production that facilitates the reproduction of colour. Because copies for consultation are generally issued on microfilm, any page that contains colour should be headed 'Original in colour', so that the reader will be aware that some information may have been lost in copying. In the production of graphs, maps and diagrams, hatching or broken lines, which will reproduce in monochrome, should be considered as an alternative to colour or used in addition to it."*

3. Graphics applications

3.1 Presentation graphics

These programs are designed to produce high quality output principally for presentations on projectors, either via hardcopy transparency or directly from a computer. They generally include some capability for the production of simple charts from data, such as line, pie, or bar charts. They also allow the import of pictures from other graphics programs, via graphics files, and some drawing capability.

Most graphics programs can print to a transparency, suitable for a presentation, but it is the presentation graphics packages that have facilities such as common backgrounds, and direct display to a screen projection facility (assuming appropriate hardware is available) to give a "professional" feel to the presentation.

The Presentation Graphics package provided on PC systems managed by IS is Powerpoint, part of the Microsoft Office suite.

3.2 Data presentation

There are a number of packages designed specifically for the presentation of data in graphical forms. Most can draw simple charts, as well as contour or surface plots of 3 or 4 dimensional data. As well as graphics packages, subroutine libraries are available in some systems for maximum flexibility.

Interactive packages

The main interactive packages provided on IS systems are:

- Gsharp is the most powerful data presentation system we make available. It is available on the UNIX service (granby) and PC workstations.
- Harvard Chart XL can produce a wide range of graph types, and has some data manipulation facilities, but is less capable than Gsharp. It is available on PCs.
- Gnuplot is a fairly simple program, allowing plotting of 2D graphs and 3D surfaces from data or mathematical expressions. It is available on both PC and UNIX platforms.
- Grace can produce high-quality, 2-D graphs. It is available on the UNIX service (granby and cropwell).

Subroutine libraries

- The Toolmaster libraries, (formerly known as UNIRAS) have the most comprehensive facilities. These are available on Unix and PC systems and can be called from Fortran or C programs.
- Simpleplot, NAG Graphics and PGPLOT are libraries of routines callable from Fortran, available only on the Unix system.

Other software may have data presentation facilities, although this may not be the major function. For instance, SAS and SPSS are very large packages for data analysis, and have data presentation facilities. Some software systems are powerful enough to allow interactive analysis of large data sets by visual means; this is often termed "visualisation", see Section 3.4 *Specialised and advanced graphics* for more details.

3.3 Drawing and painting

It is possible to draw or paint by computer, producing effects similar to what might be produced on paper with pencils or paints.

Drawing packages generally store and manipulate their pictures using objects, painting packages use pixels (see Section 2 *Computer graphics fundamentals*).

It is possible to edit imported pictures, perhaps derived from a scanner, as well as create totally new pictures. You should check whether any copyright

protection exists for a picture, and obtain copyright clearance if necessary, before using it in any work of your own.

N.B. A computer package can make these packages easy to use, but the quality of output will always depend on the skills of the user.
Software available on IS systems is as follows:

- xfig is a simple drawing package available on the UNIX service on the granby server and Sun workstations.
- xpaint is a painting program available on the UNIX service on the granby server and Sun workstations.
- The GIMP (GNU Image Manipulation Program) is a sophisticated system for image manipulation and painting. It is available on PCs and Unix platforms (granby and SGI).

Other software may be available in some departments, e.g. Adobe Photoshop for image manipulation and painting (GIMP has similar features, see above), and Autodesk Animator Pro and 3D studio for drawings and animations. However, these packages are not available on IS systems.

Other applications require specialised software, often with sophisticated drawing capabilities, see Section 3.4 *Specialised and advanced graphics*.

3.4 Specialised and advanced graphics

Some software uses computer graphics extensively for applications in specialised areas. In some cases, this software is not as widely accessible as the more commonly used applications.

3.4.1 3D Modelling

Construction and manipulation of realistic 3D scenes is very demanding on computer technology. The Ray Tracing software discussed elsewhere in these pages can construct such scenes, as can PC packages such as Auto Desk 3D Studio, but manipulating these scenes in real time may require workstations with specialised graphics hardware. IS facilities include SGI workstations, with AC3D and Cosmoworlds modelling packages, and Inventor and Performer 3D graphics libraries.

3.4.2 Chemical structure diagrams

The University's main collections of software for drawing chemical structure diagrams are on computers owned by the departments of Chemistry and Pharmacy. The software used is on PCs and AppleMacs, for example *ChemWindow* for PC, *ChemDraw* and *ChemIntosh* for AppleMacs. Anyone interested in using such software, especially those from departments outside those mentioned above, should contact the relevant Helpline (see Section 1.1).

3.4.3 Computer Aided Design (CAD)

CAD at the University is mainly used for engineering design applications, and the main collection of CAD software is installed in the Faculty of Engineering's CAD studio in the Pope building. *AutoCAD* is the main system, available on PCs. Other CAD software packages are used in various departments on campus, and the relevant Helpline (see Section 1.1) can give advice on the availability and suitability of these.

3.4.4 Geographic Information Systems (GIS)

The University has licenses for ARC/INFO and ARCVIEW. ARC/INFO is one of the most comprehensive GIS systems available. ARCVIEW is a GIS and mapping system which is easier to use than ARC/INFO. ARC/INFO and ARCVIEW are available for UNIX and PC platforms. Anyone wishing to use the software should contact the relevant Helpline (see Section 1.1).

3.4.5 Graphical User Interfaces (GUIs)

The GUI is increasingly the preferred way of interacting with computers, and most modern applications have such an interface, whether on PC or UNIX via X windows. Programmers can design their own interfaces if they have a knowledge of the windowing system, and several tools exist to help in such a task. IS staff will not undertake major projects in windows programming on behalf of others, but can give general advice to people considering such projects.

3.4.6 Image processing

The University has a licence for *ERDAS Imagine*, which is a geographic imaging suite particularly suitable for processing remotely sensed data, for example from satellite.

Anyone interested in this software should contact the relevant Helpline (see Section 1.1).

3.4.7 Mathematical plotting

Some mathematical software incorporates facilities for the graphical display of mathematical calculations such as curves, surfaces and contours, but they may not be suitable for all types of data presentation. *Maple*, which is available on the UNIX service as well as on the public NetWare PC service, and *Matlab*, which is available on the UNIX server Granby, both have extensive graphics capabilities particularly suited for the display for their own results.

The NAG Graphics Library, although a library of Fortran general graphics routines, may be used in particular to display results produced by calling the NAG Fortran Library.

3.4.8 Ray tracing

Given a geometric model of an environment, including light sources, ray tracing allows the production of realistic pictures. *Rayshade* is a general purpose ray tracing program. *Radiance* can produce a map of spectral radiance values, and has more serious applications in design and architecture. Both these programs are available on the central UNIX service.

3.4.9 Virtual reality

Virtual Reality applications typically involve the simulation of an environment, and also provide a means to interact with objects within the environment. This may require specialised hardware, such as immersive headsets and data gloves, as well as high performance graphics. Various schools are involved in research projects using virtual reality (for example, the Communications Research Group in Computer Science & IT[†], VIRART[‡] in MMMEM).

3.4.10 Visualisation

The ability to process data quickly in a graphical environment can allow interactive analysis of data by eye. This is sometimes termed "visualisation", and is desirable when large amounts of data need processing. Section 3.2 *Data presentation* mentions some programs that have capabilities in this area.

More advanced systems exist, such as IDL, which is used by a number of research groups on campus, and AVS/Express, which has been used by researchers here. For more information, please contact the relevant Helpline (see Section 1.1).

† www.crg.cs.nott.ac.uk

‡ Virtual Reality Applications Research Team — www.virart.nottingham.ac.uk

3.4.11 Utilities

There are many small programs available that do useful tasks such as viewing and processing graphics files. Processing may include conversion of formats, perhaps to allow printing, or resizing or cropping. A selection of those available on systems managed by IS is given below. They may be documented in *man* pages on UNIX systems, or will have online help facilities.

Viewing PostScript	• **Ghostview**/**Ghostscript** (PC/Windows, Unix via X)
Printing PostScript	• **queueoutput**, **qo** (UNIX) • **Ghostview** (PC/Windows)
Viewing and processing bitmaps	• **xv** (Unix via X) • **netpbm** (Unix)
Grab screen/window	• **xv** (Unix via X) • **xwd** (Unix via X) • Print Screen (PC with Windows)
Converting image files to/from movie files	• **mediaconvert** (SGI systems)

4. Graphics hardware

4.1 Display hardware

There are a number of different sorts of display available for computer graphics, and different methods to get graphics onto them. Most of the displays will be in one of the following categories: graphics terminal, X terminal, PC workstation or multi-user workstation. The choice of which to use may be constrained by the software that is to be used, and what type of display is actually available.

Graphics terminals are devices dedicated to display graphics under the control of a central computer. They have no capability to run software independently of another system. An example is a Tektronix terminal. In recent years, the use of terminals has declined in favour of workstations.

PC workstations give a very wide range of options to display computer graphics. They can use software on the PC or a network server to display graphics on the screen. They often use Microsoft Windows as the user interface. In addition, other programs, such as Exceed, can run on the PC which allow it to act like ("emulate") a graphics terminal such as an X terminal. This allows the PC to access central systems via a network, and use graphics software on them to display pictures on the PC screen.

IS provide networked PC workstations in all our public-access areas (ISCRAs). They can be used to access PC software on the public NetWare service, and they can be used as terminals to access network host systems (for which a username is required on the host system). For details of the use of these PCs and the public servers, please see document IS1016:*Using IT facilities at the University of Nottingham*.

Multi-user workstations run a multi-user operating system such as UNIX and usually use the X windows user-interface, which is a very widely-used standard in computer Graphical User Interfaces (GUIs). Using this interface, it is possible to open a number of "windows" which are simultaneously displayed on the screen. Each window may represent a running process, or program. It is possible to access a number of different host systems, for instance, and have each use its own window. A very wide range of software is available to display on X window devices. These devices can be colour, greyscale or monochrome and have a variety of screen resolutions.

We provide a number of Sun and Silicon Graphics workstations. These can be found in the CAD studio in the Engineering Faculty (Pope building). To use these workstations, your username must be created on the central Unix service. Please see documents IS1016:*Using IT facilities at the University of Nottingham* and IS1301:*Getting started on the Unix service* for further information if necessary.

X terminals are devices which use the X window user interface, but are under the control of a central system.

4.2 Hardcopy devices

A very wide variety of printers and plotters exists to give hardcopy from computer graphics software, of which IS offer a number of different types. Alternative equipment may be available in your department in addition to these central resources. The device types made available here are discussed below.

Please see also Information Services web pages at **Services>Computers & Peripherals>Printers & Scanners**

Laser printers are good for shaded areas or drawing lines. We provide Hewlett Packard laser printers which are located in or nearby ISCRAs on all campuses. The printers are monochrome, but can produce greyscale shading from appropriate software; and most accept PostScript. The usual size of output is A4. After an initial allocation of free printing, output is chargeable; it can be collected from operations staff in the appropriate location or by prepayment and self-collection. There is more information on the URL quoted above.

Ink jet colour printers are for use when colour is necessary. We provide Hewlett Packard inkjet printers in the CCC South building and in some other areas. A4 transparencies and A3 paper are available in some areas. Output is chargeable, and can be collected from operations staff in the appropriate location. There is more information on the IS web-site as quoted above.

4.3 Scanners

A scanner can produce a computer graphics file from a photograph or other document so that this may be input to a graphics program, displayed on a screen or imported into a document. The scanned image can be edited, to refine or modify it if necessary, via "painting" software; see Section 3.3.

We provide Hewlett Packard scanners which produce quite acceptable results. The pictures can be saved as PCX, TIF or EPS files.

4.4 Digitising

A digitiser is used to obtain sets of coordinates from a picture, typically a map, so that a representation of the picture can be constructed on the computer in terms of objects (lines and polygons, for example). We provide no digitising equipment, but other departments may be able to provide equipment for use by arrangement. Please consult the relevant Helpline (see Section 1.1) for advice.

5. Graphics in documents

People often want to include pictures generated by a computer graphics application into documents such as reports and papers. With modern systems, it should be possible to do this without resorting to physical cutting and pasting of pictures. Word processors and other document preparation systems allow pictures to be included in one way or another, though the methods of doing this, and the ease with which it can be done, may vary considerably.

5.1 Considerations

When choosing a system to use, consideration of the format which the picture is stored in is important. Obviously, this must match one of the formats acceptable to the wordprocessor or document preparation system. It is also worth considering whether any changes may need to be made to the picture once it is in the document, such as cropping or rotating. The facilities offered vary considerably between software. Also, can the document be printed on a printer supported by the system? It may well be possible to convert a bitmap format such as TIF to a format which can be printed on any printer that the system/wordprocessor supports. It is likely that an Encapsulated PostScript file, on the other hand, can be printed only on a PostScript printer.

You should not assume that a scanner will always be able to give you a perfect result, nor that a printer will be able to reproduce a clear enough image. If you wish to incorporate very finely detailed photographs in a document such as a thesis, it may still be preferable to bind in the photographs themselves. Always check first with a typical example before investing time and effort.

If you are producing a document that may require photocopying, check first that the photocopier is capable of a faithful reproduction of your scanned image. It is possible to produce quite acceptable masters off a printer, particularly those working at resolutions of 600dpi (dots per inch) and upwards, but often a photocopier will not be able to repeat the fine gradations of the greyscale.

Please also note the comments on copyright in Section 3.3, and the comments on the user of colour in Section 2.5.

The major wordprocessing and document preparation systems made generally available here are MS Word and LaTeX. Word can accept many bitmap formats including BMP, GIF, PCX, TIF and EPS files. LaTeX can accept EPS files. Some software can output simple graphics in LaTeX formats, an example is **xfig**.

6. Further information

This document is a basic guide to graphics systems available at the University of Nottingham. In such a large and fast moving field it is inevitable that it will be less than comprehensive, and certain sections may become out of date fairly quickly. There are other sources of information that should be consulted by anyone using computer graphics facilities.

If you need further information on any of the facilities mentioned below, please consult the relevant Helpline (see Section 1.1).

Email distribution lists

An important mail server, hosting a number of graphics-related discussion lists, is the National Academic Mailing List Service or JISCmail. For information on using this resource, please see **www.jiscmail.ac.uk/**
The distribution lists at JISCmail of interest to computer graphics users include

AVS-users	*for discussion of*	Gsharp & AVS/Express
chest-arc-info		arc-info
chest-imagine		ERDAS imagine
visualisation-tools		visualisation

Newsgroups

A local newsgroup, called **nott.graphics**, has been set up for discussion of graphics related topics. In addition, many national and international newsgroups exist for the discussion of specific software and systems. **comp.graphics.visualisation**, for example, discusses matters relating to computer visualisation; **comp.graphics.gnuplot** discusses issues related to the gnuplot package.

World Wide Web pages

More information about most of the software mentioned in this Guide can be found through the *Software applications* section of the IS web pages via **IS>Services>Applications Software>Graphical & Multimedia**
— there are numerous links to web sites authored by software suppliers and user-groups, as well as local information.

6.1 References

[1] IS1016:*Using IT facilities at the University of Nottingham*

[2] IS1301: *Getting started on the Unix service*

These documents may be examined in the CCC South Building and in the University Libraries. Copies may be obtained from most IS service points. If you have difficulties obtaining them, please contact the relevant helpline:

- student-IT-helpline@nottingham.ac.uk ext 13333†
- staff-IT-helpline@nottingham.ac.uk ext 16677†.

Information about all IS services and facilities is available from URL **www.nottingham.ac.uk/is**

† These are extensions at University Park, so a prefix may be needed e.g. 73 from QMC or City Hospital, or (0115) 95 if you are calling from outside the University telephone system.

Comment Sheet

To: Documentation feedback
CCC South Building
University of NottinghamNG7 2RD

ISD Publication: **Graphics Guide**

This Guide is intended to provide information on graphical hardware and software facilities available at the University of Nottingham.

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