

Computer Basics for Health Practitioners 1996

A C Lynn Zelmer
Editor

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Preface

When *Computer Basics for Health Practitioners 1993* was published we had hopes of producing an annual publication containing both Primers—basic computer information specifically for health practitioners—and Case Studies of Australian practice. Although the 1993 edition was an instant success, and went through three printings, time constraints and other commitments have delayed the production of subsequent issues.

While much of the information in the 1993 publication has remained current and useful, healthcare information technology (IT) has changed considerably in the interval. Internet use and the World Wide Web, for example, have become dominant IT strategies, and many institutions have shifted from stand-alone desktop systems to networked computing using distributed or client-server models.

Early in 1996 the AHIA(QLD) Executive *decreed* that there would be a new edition in time for HISA's (Health Informatics Society of Australia) next Annual Conference—HIC '96. Unable to duck a directive when there were no options, I somewhat reluctantly agreed (I was in the midst of completing a major interactive multimedia CD-ROM project and was going to be in Singapore for several weeks at the most critical time) and the production of *Computer Basics for Health Practitioners 1996* went into high gear.

Unfortunately, preparing good case studies requires significantly more time than was available in our production schedule, thus this edition contains only Primers. The case studies will hopefully not be abandoned; it is my intention to include them in a special issue of *Informatics in Healthcare Australia*, the HISA magazine, late in 1997. Practitioners with potential case study materials are requested to contact me at the address on the inside front cover for further details.

Primers provide basic information for novices, not 'Dummies'

I am quite concerned about the image many novice computer users receive through such book titles as 'Internet for Dummies'. While many people are computer illiterate, or Internet illiterate, etc., illiteracy does not equate to stupidity. Furthermore, equating illiteracy with stupidity perpetuates the myth that IT is the domain of the priesthood—IT professionals—and its temple—a restricted access computer centre.

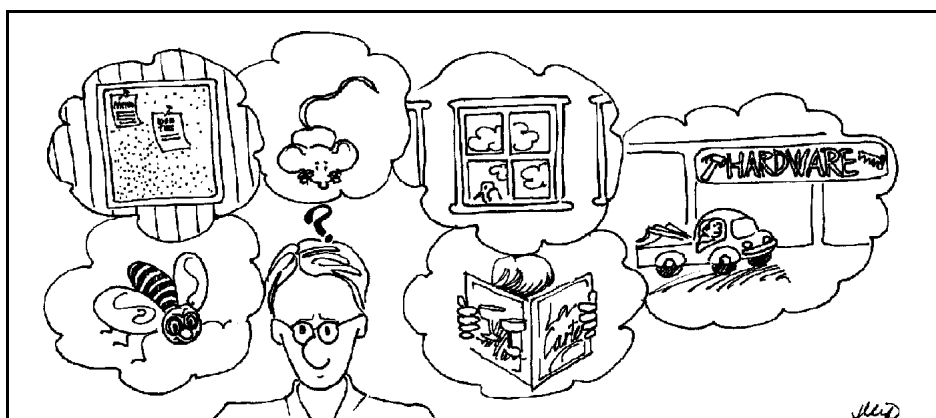
The truth is far different, as many organisations are discovering to their benefit. The BHP Blackwater coal mine in Central Queensland, for example, does not have either a computer centre or a hierarchy of computer professionals, although most of the professional staff use computers in their work. Instead, an IT service coordinator ensures that everyone is able to perform their jobs effectively using the available IT resources. Such a service orientation completely changes the role of the IT professional and requires understanding that training in the use of the technology is critical to proper job performance.

Often the key to effective use is selecting appropriate training for each task. Hospital-based informatics nurses or GPs looking for a new patient records system, for example, do not need to know how to program in C/C++. They may need to know about the information system life cycle, etc., but their main input will come from knowing how the health system works. 'Horses for courses', the Aussie mantra goes, and this is seldom more evident than

with IT. Effective IT implementation requires teamwork and the variety of skills brought to the task by team members with different backgrounds.

Hopefully, that is the orientation of this publication as well. The authors recognise that whether the use of IT is central to your work, or merely a peripheral interest, you need an appropriate understanding of the technology to use it effectively. *Computer Basics for Health Practitioners 1996* provides basic information about selected technologies; there are many places to get additional/more specific information for your own setting including:

- the IT specialists in your institution—encourage them to speak in plain English, avoiding jargon; and do likewise, it will make both your jobs much easier;
- TAFE and university IT specialists and programs—CQU, for example, has specialised IT degree programs oriented towards health professionals: Bachelor of Health (Health Information and Management), Graduate Diploma and Master of Health Administration and Information Systems, as well as providing consultancy services;
- your local Health Informatics Association educational meetings and workshops, conferences such as HISA's annual national HIC, discussions about specific problems with vendors of hardware and software products and systems, and vendor workshops (eg. 1-5 day workshops on using specific products such as Macromedia Director or Java); and
- reading—single topic books are often out-of-date before they are printed but trade magazines and the weekly IT sections of your newspaper have a surprising amount of current information.



Successful Computer Use

‘I have only anecdotal evidence but four years spent training people to operate word processors have left me with the distinct impression that those who have the most difficulty are the ones who want rigid lists of procedures to follow in every eventuality.

‘... the successful users probably just remember roughly what sort of procedure is needed, then either look up the details or press buttons and see what happens.

‘Eventually, of course, what works gets “hard-wired” into our brains for things we do a lot, but we certainly don't memorise long sequences of action right off.’

Rosemary Rodd, *Playing by the Rules*, New Scientist, 30/6/90, p. 54.

Organisation of the Primers

The Primers are organised into six sections:

- **Computer Acquisition and Use**

Choosing a computer system is not simply a matter of talking with a vendor and checking your bank balance—you need to know how you are going to use the system, then go about the selection process in an organised manner. Likewise, you will not be able to use all functions of the computer from day one—you will need to start with one or two critical (to your work) applications and learn the basics of their use before continuing on to a more advanced level. This section provides a selection procedure and introduces several common applications.

- **The Net**

The Internet and its related networks and tools are the single fastest growing area of computer use and look like continuing to grow almost exponentially. This section introduces network terminology and explains basic network oriented tools and activities.

- **Computer Security**

Healthcare institutions are the custodians of patient/client data which must be handled in a responsible manner to maintain the trust of patients/clients and to ensure that we are working with accurate and up-to-date information. This section introduces issues, tools, and techniques for developing secure systems.

- **Educational Applications**

Desktop publishing may be the answer to your need for patient education materials. Multimedia is being touted as the answer to all training and information presentation needs, hypermedia as a tool for navigating through the information jungle. This section explains the tools, some techniques, and some constraints.

- **Beyond the Basics**

Recognising that some topics will be beyond the novice, this section provides more advanced information on information systems, selecting a system, managing your system, and some suggestions for further study.

- **Glossary of Basic Terminology**

Dozens of terms explained in [hopefully] plain English.

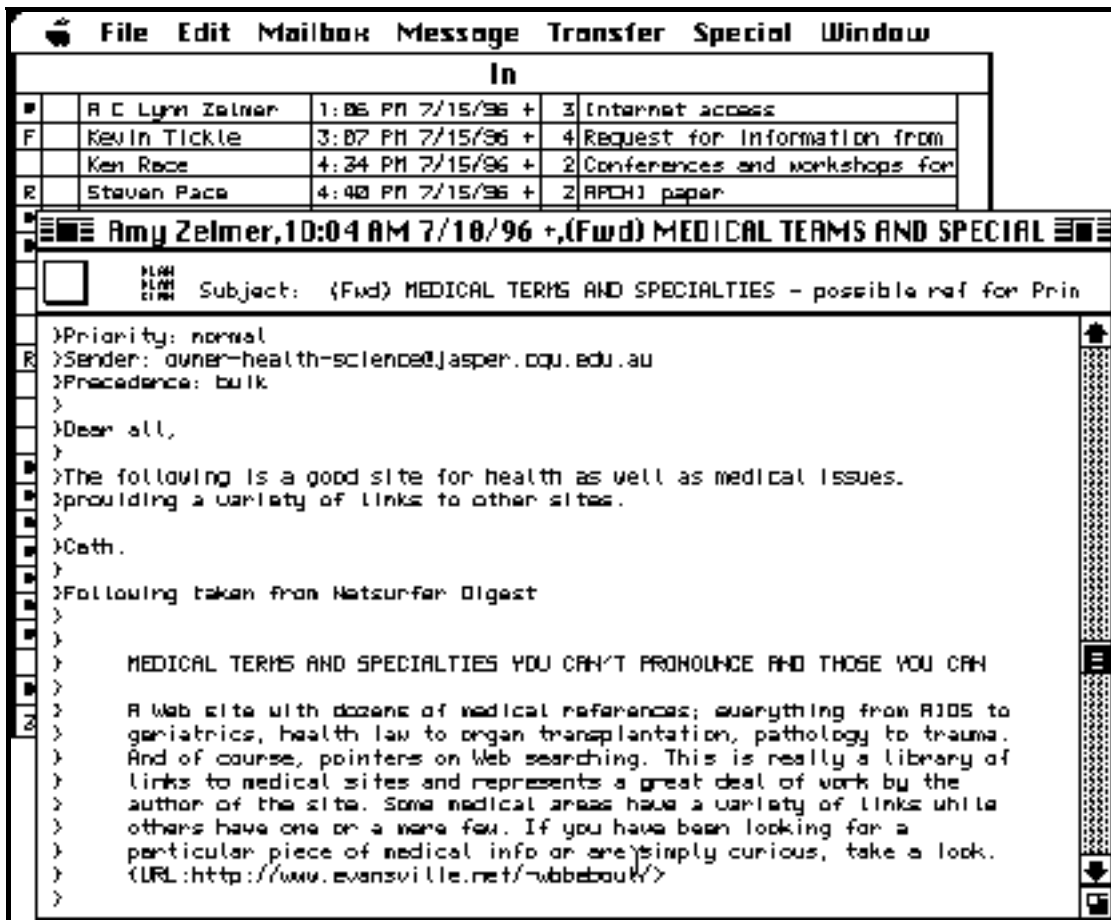
The assistance of many individuals is gratefully acknowledged in the preparation of this publication; the errors are my own. I could try blaming them on the distractions of work (and fine foods) in Singapore, where I did most of the final editing, but the reality is more mundane—long hours of editing, competing priorities, and the impossibility of keeping up with the fastest changing technologies in human history.

Your comments on the use of these Primers are welcome.



Editor

p.s. If you want to see information technology being used in healthcare, particularly telemedicine, then look to the regional centres and rural Australia. Practitioners in these areas seem to have a lot more incentive to experiment with the technologies than those in capital cities.



Electronic mail (e-mail), one of the easiest to use and most widespread of the computer-based communication tools. E-mail applications (clients) are available for almost every computer platform as they are inherently text-based. See the Primer Internet Tools for details.



Computer Acquisition and Use

Buying a new computer, or upgrading an old one, should follow the same process that you would use for any other major purchase, and the purchase should receive the same care and research before you decide to act.

Operating the system takes similar care and planning.

No computer system is cheap, even if the price is a bargain.

In a business setting (and hospitals, general practices, and clinics are business enterprises in this context) the cost of the computer itself, the hardware, accounts for roughly half of the initial cost.

The software, the programs which provide the applications that make the computer useful, account for the other half.

In addition, it will cost roughly one quarter of the initial capital cost, per year, to maintain the computer. This includes paper and other supplies, maintenance, software upgrades, insurance, etc., but does not include electricity, air conditioning, communication and similar operating costs.

Training to use the system will cost about the same as the initial capital expenditure but is spread over several years.

Prior to the introduction of Windows, training costs for Intel platform-based computers (IBM/PC-DOS) and similar command oriented computer systems were at least twice that as for Macintosh computers with their GUI (graphical user interface). One reason for this is the greater consistency of use across application programs—most Macintosh programs operate the same way and command menus, with similar commands, are located in the same place for each application.

The following Primers start with tips on selecting systems and applications, followed by general applications. Information on the care of your system is found in Beyond the Basics.

Buying Your First (Personal) Computer

This Primer provides some tips for first time computer purchasers. Read it in conjunction with the next two Primers, Choosing the Solution and General Practice Computing, and the Terminology Primer.

- **Set a realistic dollar limit for your computer purchase.**

Setting a budget limit ensures that you don't end up with something you cannot afford.

- **Make a list of problems to be solved with the computer.**

Unless you are purchasing the computer as a status symbol, you should tailor the purchase to your needs. This requires defining those needs.

- **Quantify the tasks involved in these problems.**

For example, identifying how many patient records you will store, as well as the amount of information in each record, will help you define how fast the computer will need to be and how much storage will be required. The tasks need to be quantified over time as well.

- **Prioritise your list of tasks.**

Some tasks/functions would be nice to be done, others are essential. A priority list will help decide whether it would merely be nice or absolutely essential to have a network connection, backup tape drive, etc.

- **Look to the future!**

Talk to people who have used computers for similar work in the past. How did their needs and priorities change over time? Read the computer literature and specialised publication in your own area of expertise. What do your colleagues use/recommend?

Computers and computer software, like cars and other consumer goods, come in a range of prices and capabilities from a variety of manufacturers and suppliers. In Australia we are fortunate in that we can obtain both world known brand name products and local or regionally manufactured low cost entry-level products. While some imported brands have a significant markup over their US price, most are available locally at approximately the same price (US price plus exchange rate) as in their home market.

You Get What You Pay For...

You can always find a computer or software product at a lower price; ensure that any purchase you make meets your productivity and quality needs... and comes from a reputable source.

While cost does not always reflect quality, it is often a good indicator.

Ensure that your source is honest and ethical. While some hard drives, for example, come with software products already installed, these products are not always legal and continued use could cause complications.

What kind of software?

Assuming that your tasks can and should be done by computer, the type of computer purchased should depend upon your finding software that will allow you to effectively do these tasks on the computer.

- The software to be used may have been specified for you.

While you may find that corporate policies mandate the use of specific software, the choice of platforms may still be open if the software is available on several different platforms.

- Software should never be purchased without a 'test drive'.
Insist on trying the software yourself on a sample of your own work before you make a decision. The software choice should determine what type of computer you require. Take your time to make a wise choice.
Look at the various software alternatives for ease of use, flexibility, dependability and cost. In general, choose the least expensive option that meets your needs and fits your style of working.
- Applications software may have special memory or other requirements.
Note that while software may run under the minimum requirements, the preferred requirements are almost always required to run properly.
Your budget and list of priorities will indicate whether you should, or can, go beyond the minimum system that will meet your needs.

What kind of computer?

All computers are obsolete once you have taken them out of the store and the newest, flashiest computer may not be the best solution for your needs. [It is also true that the first release of both hardware and software products often seem 'bug' ridden.]

As a new computer buyer you want to get the computer that will best meet your needs within the budget you have available.

- What type of computer and accessories are required to run the software of your choice?
- Can you afford this choice, or do you need to make a compromise?
- Must your computer be a desktop model or will a portable be preferable?
- Are the manufacturer and local vendor reliable? What do other customers say about the vendor?
- What kind of service is available? Does the vendor provide assistance with software installation, maintenance during and after the warranty?

Portable Computers

A fully functional portable computer can cost little more than a comparable desktop unit and it is possible to have a portable computer system (battery powered computer and printer, modem, hard drive, and cables to connect to a projector for display purposes) that fits into a slim briefcase with enough room to spare for business papers and a fresh shirt.

Many users need computers with very large screens, extra peripherals, etc. However, I have difficulty understanding why individuals select a desktop computer over a portable computer for general use.

If you want a computer light enough to carry in your briefcase for word processing, spreadsheet and file management tasks, look at the wide range of notebook class computers. Remember that while Macintosh computers can read and write DOS/Windows disks, and many Mac applications can read/write DOS/Windows file formats, the reverse is not always true.

Form Factors—Laptop, Notebook, and Handheld

It isn't likely that many users would choose to use a handheld computer as their only computer. It may be possible to touch type on a tiny keyboard but the small size, limited storage and the lack of standard applications restrict handheld computers to a niche market. Within two of those niche markets, however—data collection by community nurses and recording patient data by hospital staff—the handheld computer is well accepted.

'Laptop' and 'notebook' defined different sizes of computer as recently as 2 years ago; the terms seem now to be used interchangeably for any small computer of textbook or smaller size.

Don't hold your breath on the prices for the most functional brand name units, though; a Pentium or Power PC colour unit capable of working on light weight batteries with eight hours or more between changes is likely to be twice as expensive as a comparable brand name desktop unit.

**Your ideal system obviously depends upon your unique needs—
and will change as the technology changes.**

- Purchase quality. A good local vendor and service support (perhaps worldwide) becomes more critical as your computer becomes smaller.
- Test the keyboard and screen under *your* normal working conditions. If the keyboard is too small to allow you to type comfortably, and/or you cannot view the screen properly, you will never be happy with the machine. Also, look at how to connect a mouse and other peripherals.
- Bright, fast screens take lots of power (affecting battery life) but are useable under a wider variety of work situations. You must be able to easily see the cursor under normal working conditions—it often seems to disappear on slower LCD screens, particularly when moved quickly.
- The computer isn't the only weight! Many 'extra' pieces are required for working on the road (computer, power pack, power cord, mouse, modem and cables, carry case, etc.).
- Look at battery use and the cost of extra power packs. Consider buying two power packs, one for the office and another for home, rather than extra batteries.
- Many portable computers operate on 110 or 220 volts AC at 50 or 60 Hz and only need a plug adaptor to operate almost anywhere in the world. Note that the 'shaver' outlets in aeroplanes or overseas hotels cannot operate a computer.
- Many users will want to connect their portable computer into the same local area network (LAN) as their desktop computer. LAN adaptors, smaller than a pack of cigarettes, provide an external connection, as do infra-red and PCMCIA card LAN, modem cards, and docking stations.
- Portable computers are very theft prone; get a security cable and a lock for regular use—then use them!

Portable Computers—Ergonomics and Convenience

Your portable computer will only become an indispensable part of your daily life if it is properly designed and constructed.

- The screen must be adjustable for use in your normal working environment, whether that is flying on an aeroplane or working out in the Aussie sun from the back of a Ute.
- The keyboard must be easy to use, preferably with a comfortable edge to rest your hands on. A built-in pointing device is critical. The consensus is that the pointing device needs to be in the centre of the keyboard or just below the space bar—micro joysticks and trackballs are both popular with users.
- The computer must run cool. Few portable computers have a cooling fan, thus all the heat generated must be dispersed in other ways, often through the bottom of the computer. Try to avoid buying a computer that will be too warm to use on your lap—if it gets that hot it will also likely have other heat related problems.

General Practice Computing

with Dr Peter Adkins

For information system purposes, most General Practices are simply small businesses, albeit with a specialised focus.

- The practice employs a number of staff requiring personnel and associated financial management records.
- The practice maintains both short and long term records (patient and personnel records) in addition to billing records.
- The practice purchases supplies, other materials, and outside services, and needs to keep records of these transactions.
- The practice has a continuing need for access to up-to-date information relevant to the unique requirements of its clientele and staff.
- The practice is required to maintain a certain level of records for taxation and other government requirements.
- The practice has a requirement for staff training and a need for patient/client education.

This Primer provides a brief look at selecting computer systems to maintain the required records and access information sources. The operation of such a computer system is also briefly examined (see also Primers such as Security Guidelines—Small Systems, Information Systems and Choosing the Solution).

Integrated Information Needs

It is important to look at the information needs of any business as a *system* rather than as isolated functions. For example, in a general practice it is ridiculous for the receptionist to have to enter the patient's name and other identifiers into two separate systems to retrieve personal (medical) and financial records. In an integrated system the patient's name/identifiers would only have to be entered once.

This doesn't mean that all of the functions in a system have to be supplied by a single vendor, although that sometimes provides a more functional system. It does mean that data types and codes must be consistent from function to function, and the system must have adequate controls (data locking, levels of security, etc.) so that shared access to data files is possible and information/queries can easily be transferred from function to function.

An information system for a general practitioner is an integrated collection of records and tools necessary for the proper functioning of the practice in a form that is accurate, secure from tampering or disaster, easy to use and appropriate to the needs of the individuals operating/using the practice.

Know your needs and select a system accordingly.

Financial Records and Practice Management

Financial records in a general practice include accounts receivable and payable and salary records. Some practitioners bill the government or an insurance fund direct while others work on a cash only basis, however, the resulting financial records are not unique to medical practices.

If an accounting package had sufficient capacity for the volume of your business, could accommodate the variety of accounts required, and would generate a coded patient bill to indicate the type of procedure performed, *and* you were sufficiently computer literate, almost any good accounting system could be used. Since general-purpose financial systems are available

for most computer platforms, this means that almost any computer could meet the accounting needs of one or more GPs.

Unfortunately an off-the-shelf accounting package often only answers some of your needs. An integrated practice management system, on the other hand, could maintain all of your records. Then you could, for example, enter procedure codes and have the system automatically generate a bill. When the fee schedule requires changing, all that would be required is to change a single data file for the system to generate bills using the new figures.

- It should be obvious that a system designed for a large practice might not be useful in a small practice, and vice versa.
- You also need to be aware of the requirements, legal or otherwise, for maintaining audit trails or other special functions.

Practice management systems are available from a variety of commercial and professional sources (usually written by colleagues for their own practice). Many commercial systems are only available as a 'turn key' system whereby the vendor supplies both hardware and software in a single package. This has the advantage that one vendor is responsible for all aspects of the systems, including on-going maintenance, but has the disadvantage that it may not integrate well with any other technology you may be currently using or wish to adopt later.

Ensure that you see the system in operation in a practice similar to your own before purchasing such a system, and that it will both provide the services you require and work with the systems you use—including any required forms (scripts, etc.).

Patient Records

Almost invariably, medical/health information systems are designed around the financial requirements of the institution. Unfortunately this may mean that the non-financial aspects of the system are less well designed, and may even be totally non-functional.

A good patient record system ensures that you have only one record for any patient and that all data entered is reasonable. It should also be easy to use, have functionality appropriate to your needs and be reasonably priced. It should also provide a secure working environment, both in terms of the data and the hardware/software itself.

Archival facilities, and the ability to quickly recover records from the archives, is very important with patient records. Both financial and patient records must be maintained for a statutory number of years. The practitioner must determine how long every category of information must be kept, in what form, and where.

A good practice management system will include a patient records module, however, patient record systems are also available separately.

Networks and Data Communications

Normally the staff in a general practice will want to share at least some access to data records, even if only to avoid duplicating information. The general practitioner, for example, will normally want to see the patient's clinical records, the receptionist will need to access the same patient's demographic data and the accounts clerk will have to update the patient's financial records.

If all the information was contained on a computer system with only a single access point everyone would have to go to that point to access the records. This is obviously inefficient.

The solution is to provide multiple (networked) access to a single database. A multi-user computer with several terminals, perhaps with PCs as the terminals, is one possibility; alternatively, several computers could be linked through a network to a database located on a common file server.

Increasingly health professionals require access to databases and other off-site information systems. Computers can access other computer systems through direct connections (dedicated telephone lines or higher capacity lines such as ISDN) or via a modem. A modem is simply an electronic device that converts digital data streams from the computer into a form which can be transmitted on the telephone lines. A compatible modem is required at each end of the connection—the second one converts the data stream back into digital format. Encryption, converting the data into a more secure form which is not easily read by an unintended audience, can be accomplished at the same time.

Some general practitioners use a modem connection to link with a local hospital, or even a financial service bureau which maintains their financial records. Others use the computer for ordering supplies, electronic mail, exchanging messages with colleagues using the computer, or for accessing medical databases such as MedLine. (See the *Net Primers* for more details).

Telemedicine

Telemedicine is the use of telecommunications in medicine/healthcare and includes everything from a rural patient having a consultation with a capital-city specialist via electronic mail or videoconference to the electronic transfer of x-rays or other medical information.

As satellites, cable television, and similar high capacity (broadband) distribution technologies become more widespread it may be possible to conduct most clinical and other healthcare activities via a remote link. Obvious problems still to be overcome are both social and technical—patient/clinician acceptance of the technologies, privacy, security, and technical quality (colour, image fidelity, and resolution).

Staff and Patient Education

Materials on poisons, drug education, etc., are available via modem, or increasingly, on CD-ROM for local use. These materials, and purpose designed educational programs and databases, are valuable for both staff and patient education.

This use will increase the load on the computer system, and probably require additional levels of security, but may have significant benefits to your practice—particularly in health promotion.

Data Security

The difficulties inherent in protecting patient data from unauthorised access is one of the reasons cited by practitioners for their reluctance to install a computerised information system.

In a recent article medical practitioners stated that the reason why they didn't worry about similar unauthorised access to a manual system was that 'doctors' handwriting is so bad that no one can read the paper record' and the records cannot be found anyways because 'so many records are lost [misfiled]' once they are entered into a hospital record system.

The literature suggests that there are two reasons for this negative response to computerisation. First, people often believe that computerising the records will make them more accessible to outside agencies—government 'snoops' and quality control bodies in particular. Second, computer users are, in general, quite fearful of being made to look incompetent through their use of computers.

Identifying and changing these attitudes will be part of the implementation strategies required when computerising.

All users of the system have the right to know that:

- data records are accurate and up-to-date;
- only authorised individuals have access to their records; and
- records will not be destroyed in the event of a disaster.

Accuracy of Records: Record accuracy is a function of the accuracy of the information entered into a system—manual or computerised:

- the staff collecting and entering the data must be properly trained,
- the data collection process (interviews, tests, etc., and their associated records) must be appropriate and functional,
- the data must be accurately entered into the record system, and
- the data must be double checked to ensure that what is entered is the same as what is intended

Data Checks: A properly designed system will have some built-in automatic data checks, but they will only be partly successful in ensuring accuracy. For example, while it is quite possible to ensure that a newborn baby's weight is within a standard range, the computer cannot prevent an incorrect but theoretically valid weight being entered.

Up-to-Date: Keeping the computerised records up-to-date requires the same thought as the manual records. Staff must be responsible enough to inform the personnel office when they move, for example, and normal office routines must be designed to solicit changes in patient data, even when the data for most patients doesn't change.

Access: Locked computer rooms, passwords, unique user identifiers, and data encryption are the normal methods of ensuring that unauthorised persons do not access large computer systems. These systems usually also have a hierarchy of access levels on a 'need to know basis'.

There are two problems with such a system for the general practitioner. First, smaller computer systems often lack appropriate security facilities—except for physically locking up the whole system and controlling access to every terminal, connected computer, modem, phone line, etc., any reasonably computer literate individual can access the system.

Second, someone needs to be able to maintain the system. Larger systems depend upon the assumed professional ethics of their computer system operators to prevent the disclosure of information gained as part of the work. Control may be harder when the system operator is a 'junior', college student or similar non-professional, and more often than not, is a part time support person.

Preventing Disasters: A properly designed information system will have procedures for backing up the data on a regular basis. This will usually require additional hardware as well as magnetic or other media (tapes, diskettes) for storing the backup copies. (See the *Security Tips* Primers)

The duplicate copies should never be stored in the same place as the original data. Large installations will have an off-site vault or other safe storage facility. Small installations might simply keep duplicate copies in a second location, typically the home of one of the staff members.

Remember that physical security is just as important for the duplicates as for the original. Therefore it might be reasonable to purchase a small fireproof safe for the home of the staff member storing the backup data.

If your data is important enough to require security procedures, backup copies (including paper copies) require equal security.

Disaster prevention includes the use of power conditioners and uninterruptible power supplies, as well as emergency power systems. Anti-theft locking systems, air conditioners, fire alarm and fire control systems, etc., must also be considered.

Selecting a System/Vendor

There is a whole industry built up around selecting a computer system and its vendor. A variety of books and other support materials also exist, including several Primers in this book. Since the computer industry generally operates on the principle of *caveat emptor*, it is your responsibility to know what you need before you approach any vendors (or consultants).

In brief, selecting a system requires that you identify and quantify your needs before you make a decision. 'Needs' are different from 'wants'—and the newest and flashiest might not be the most appropriate.

Once you know your needs you can talk to vendors and users of installed systems to obtain information on all the systems that appear to meet or exceed your needs and make a choice based on some combination of:

- required, desired, and optional features,
- requirement for, or availability of, extra support (eg. need for special graphics cards or touch screens, vendor training available),
- industry standards,
- integration with other facilities,
- need for and/or ease of modification,
- upgrade path/costs,
- level of staff available to operate, or additional staff requirements to use/maintain,
- perceived learning curve before use,
- availability of local support and service,
- reputation of product/vendor (including availability of source code or repair parts in the event of vendor failure), and
- cost to purchase, operate (including training costs), maintain (repair) and replace.

Special purpose computer systems for general practitioners are available from a number of vendors. One consideration when looking at such a system, or indeed any system, is whether the vendor requires you to purchase the whole system from the same source. Your computer system becomes much more expensive if you have to discard your current system (computers, printers, network and modem facilities, and sometimes even your office furniture) because the vendor supplies a total package solution.

In the final analysis cost should never be the most important consideration. The cost of the data itself, and its replacement, is *always* greater than the cost of the computer system. In addition, every computer system purchaser, the general practitioner included, will find that security of data, vendor reputation and support (short term and long term), and ease of use will all be more important than the initial cost. If you can determine the relative costs of these items you will have a more accurate indication of the true long term costs of a system, and thus have a better basis for evaluating a potential system.

Staff Training

Fear of the unknown, and a reluctance to make a fool of yourself, is quite rational and very common among new computer users.

Over the lifetime of an information system it will probably cost more to train staff to maintain and use the system than it did to purchase the system. This training must take into account people's fears and address attitude changes as well as more technical operating skills.

Implementing/Operating the System

Even if you live/work in a major centre and the vendor installs your system, someone must maintain it on a daily basis. This means that someone in your practice must become very computer literate, able to both operate the system under normal conditions and to identify and solve problems when they occur.

You will likely lose considerable productivity during the installation process. It is recommended, for example, that both new and old (including manual) systems be operated in parallel for one full cycle, normally a year for financial systems, to ensure that there aren't any problems with the new system. This takes extra time and work.

At the very least, the new system will disrupt established procedures and may require a total rethink of others. Procedures (and personnel identified) to resolve problems will avoid totally disrupting the practice.

Also recognise that your needs change over time. A system that was perfectly adequate when designed will require updating as these needs change. Such changes could be as simple as a change in fee or taxation schedules, or as complex as the installation of a new function, or the vendor's discontinuation of support for your hardware or software.

Managing Change

The computerisation of your practice is a major change project, comparable to changing practice partners or physically moving the practice. Here are some change management tips from the literature and personal experience:

Anticipate failure: Structure the change so that the participants learn from mistakes. Everyone involved, but most particularly your clients/patients must be protected from any unexpected consequences of the project.

Goals must be explicit: Without indicators of success or failure the project has a high risk of either floundering or producing an unusable system.

Projects require more resources than expected: There are many types of resource required: leadership, time, funding, staff training; solutions to people problems, team communications, etc.

Quality control: the project manager needs to constantly focus on objectives and ensure that they are being met in a timely, appropriate and effective manner.

<p style="text-align: center;">Plan for change.</p>
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<p>The wise project leader (general practitioner) plans for change and is able to adapt when it occurs.</p>

Using New Software

Installing a new software package, whether for evaluation or general use, is relatively simple. Many software packages come with their own installation programs—you simply run the INSTALL program and indicate where you want the program files to be stored.

Unfortunately, installing the software is only half of the problem. You also need to be able to use the software. This Primer provides some hints on what to do when you purchase a new software package.

When You Purchase a New Software Package

- Gather together everything that you need to use the product—program diskettes/CDs (copies, not the originals, in the case of diskettes), documentation, tutorials, blank formatted data diskettes, a suitable computer for running the program, etc.

Most programs describe the required equipment (including memory requirements, etc.) in either the introductory section (often called ‘Getting Started’) or an appendix on ‘Installation’.

- Read the written documentation.

Most software packages contain updated documentation and tutorials on disk. Some have on-line documentation which removes the need to fully read the written documentation.

- Start up the computer, follow the instructions for installing the software, then restart your computer.

Most programs now have installation programs that will semi-automatically copy the program onto your computer, asking you for the information required to ‘configure’ the program for the special environment of your computer.

You should be able to install the program and start up the program to display the opening menu or copyright notice. If you can't, re-read the documentation, looking for special hardware or memory requirements.

- Fill out the software registration forms and record the serial number and other registration details in a safe location.
- Start with the tutorial if there is one, otherwise try running the software.

Next, try using the software to solve a sample problem. For example, if you were testing a new word processor, you might try typing in a two page report and print it out on your printer.

As part of this process, use the ‘help’ and other aids. Refer to the documentation as required.

<p style="text-align: center;">Have Fun!</p>

Using a new piece of software should be an exploration, an adventure, not a chore.

- Make notes on any problems that you find and how you solved them, what you find useful about the program as well as what you think the program should have been able to do. See the Software Evaluation Record on the next page for a sample recording pro forma.
- Go back and re-read the documentation to find out why you were not able to do any of the above steps. Rework your sample project when you find out where you were inefficient in your use.

Software Evaluation Record

Product Name/Version:

Source/Cost:

Requirements:

Description/Intended Use:

Installation Notes:

Usage Notes and Problems:

Comments:

Evaluator/Date:

Installation Tips

- Set the copy protection (open the small slider in one corner of the diskette) on the diskettes that you are using. Make a duplicate (backup) copy of any diskettes before using them and work from the duplicates.
- Make a copy of your AUTOEXEC.BAT, CONFIG.SYS, and WIN.INI files (SYSTEM files on a Macintosh, the equivalent on other computers) before you install a new piece of software. Keep track of changes to these files in any event, but installing some products automatically changes some of these files; you need to have a copy of the original files in case you need to revert to a previous state. Ask your colleagues or your system/network manager for help as required.
- Check program and other diskettes for known viruses before installing new software. Purchasing software from reliable vendors or publishers is your best protection, although no source is 100% reliable. Commercial anti-viral software is available from computer vendors and shareware versions can be downloaded from the Internet. New viruses appear regularly, requiring frequent updating of anti-viral software.

Computer viruses can be beaten...

The two best defences against viruses are to always use legal copies of software (buy your software from a reputable dealer and register it with the software developer/distributor) and check your drives/files using regularly updated virus protection software.

- Put new applications into their own sub-directory or folder, not the root or main directory.
- Read the installation documentation before attempting any new software installation, re-read when you encounter problems.
- If you still have problems, call the vendor, distributor or developer, particularly if your computer cannot read one or more of the diskettes.

See the Primer Security Guidelines—Small Systems for additional tips.

The Basic Applications

Word and list management were the original desktop computer functions, but it was number management through the spreadsheet which put computers onto business desktops. Presentation software, which turns the computer into a page turner for OHPs, is a recent addition to the basic office suite, along with e-mail and Internet access tools.

Increasingly these tools are sold in a package of work-alike applications which make transferring data from one application to another very easy.

Selecting the application

The number of vendors of basic applications has decreased dramatically in the last few years. Microsoft Office (a suite of word processing, database, spreadsheet, and presentation software), for example, dominates the desktop market on both the Windows and Macintosh platforms, although there is more competition in the entry-level market.

Unfortunately, packages such as Microsoft Office require a fast computer with a large amount of random access memory (RAM) and hard disk space and most users find them so complex that they seldom use more than a small percentage of the available functions, wasting both the potential and resources. Most users, for example, appreciate spell checking but seldom use a thesaurus and almost never use the presentation software.

- Decide what your needs are (needs, not fanciful wishes),
- Look at the range of tools to determine their capabilities and ease of use,
- Try each choice with activities (documents, reports, etc.) similar to what you intend to be preparing and your own hardware configuration, and

Don't depend upon a vendor demo... try the software yourself!

- Make a choice based on logic.

The newest and fanciest software is not necessarily the best product for your needs!

If you have special needs—if, for example, you will be using a lot of illustrations, you should probably choose your graphics or other special tools before settling on the basic tools. For example, knowing what type of files will be need to be imported will aid you in selecting a word processor.

Word Processing

Word processing involves the use of computer software to manipulate words, sentences and paragraphs to create documents. A word processor (word processing program) is a tool that enables a general purpose computer to mimic a typewriter. It has several advantages over the familiar typewriter:

- a document may be saved for later changes, and is easily changed—portions of a document can easily be deleted, copied or moved to a different part of the document (cut and paste);
- spelling can be checked [semi-]automatically;
- special features such as automatic page numbering, automatic footnote placement, etc., are available;
- graphic material can easily be included with the text; and
- style changes—paragraph indentation, spacing, fonts and sizes, etc.—can be applied to portions of the text file to simplify preparing the document.

Producing long reports is where the word processor really comes into its own. A typewritten document must be laboriously retyped every time an error is found (and there are always errors to be found), but with a word processor the source file is corrected and a new copy printed within minutes. [Really long reports may need a page layout program.]

Spell Checkers Do NOT Understand

As the following example shows, spell checkers can only determine whether a word is spelled correctly, not that it is used correctly.

The fare man with the read hair through his Czech over their.

Word processed documents can also be linked to a database containing information on patients, clients, students, etc. This allows the system to automatically generate letters or memos when some specified condition has been reached—four weeks after the last examination, for example, or who have not returned for a smear or blood pressure check

Some database systems, such as the clinical record systems being promoted for maintaining patient records in a doctor's surgery, have word processing functions built-in.

Each tool has a purpose...

Desk Top Publishing (DTP): The process which allows a computer user to produce print-like output using standard computer tools. A typical system uses either a text formatter, word processor or a page layout program to format the text and illustrations, and either an ink jet or a laser printer to produce a medium quality (300 dpi) master copy for duplicating.

Editor: A basic computer tool, used extensively by computer programmers, to prepare a computer file. As with a typewriter, the user must usually do all the formatting (tabs, spacing, etc.).

Page Layout Program: A computer tool, often called a desk-top publisher, which formats text and illustrations according to desired page characteristics. Professional publications usually employ page layout programs to produce high resolution (1200+ dpi) imagesetter files. These files are then processed by a commercial printer.

Text Formatter: A computer tool that processes a text file, usually containing special formatting commands as well as the desired text itself, to yield a printed copy that has been formatted according to the embedded commands. Mathematicians and medical researchers, for example, use TeX and its variants for their documents.

Word Processor: a computer tool which enables the user to enter and save text, retrieve and modify the text, and print the text onto paper using a selected format.

WYSIWYG: 'What You See Is What You Get', the concept that the printed output will look exactly like what you see on the screen, subject only to the differences in resolution of the screen and the printer. [See *Text Formatter*]

Word Processing Tips

- The word processor is NOT a typewriter. With a word processor you should continue to type as the letters reach the end of the line; it will automatically 'wrap' your text to the new line as appropriate. The <RETURN> key is only used to end a paragraph.

A single space (the <SPACE> bar is at the bottom of the keyboard) between sentences improves appearance (typists used to leave 2 spaces, this is too much with proportional spaced fonts).

- Type in your text with the display unjustified (all lines even on the left but ragged on the right). This allows you to spot errors more easily and is usually easier to read than a justified line.

Avoid lines of ALL CAPS and underlines. Use bold and *italics* instead for better appearance and readability.

- Type your text in without worrying about how the final product will look. You can fix the paragraph indentation, underlining, etc., when you have finished entering your text.
- Save your work often. If you save your work every 10-20 minutes you will minimise the amount of work lost when a problem occurs. Use different names for different versions of your work.
- Ensure that the word processor page is the same size as the paper that you are using. An Imperial (or American) size page is usually 8 1/2 x 11 inches, while a Metric A4 size sheet is 8 x 11.5 or 11.66 inches.
- Each printer brand is somewhat unique. Ensure that the printer being used will print your text properly and that you are using the correct printer 'drivers'. This is particularly important when you have selected a type font that differs from the printer's built-in fonts.
- Word processors usually save their text in a proprietary format. Good word processors now have the ability to convert text from one proprietary format to another without losing the special characters and formatting (type styles and sizes, etc.) information.

Maintain Lists with a Database

A database manager is a computer program which allows you to manipulate lists—almost any kind of list—in the same way that you manipulate words with a word processor and numbers with a spreadsheet package.

Database managers are perhaps the most useful of all the general purpose tools available on the computer; some computer systems exist only to host one or more databases, and ease of access to on-line databases is one of the reasons for the current popularity of the World Wide Web.

While we can prepare lists using a word processor, they cannot be manipulated as easily as with a database manager. Many spreadsheet programs permit the user to sort and rearrange information, but again, they do not have the flexibility of a good database manager, particularly with regard to preparing reports from the data.

A database manager allows you to:

- build and maintain a list;
- sort the information into any specific order;
- query the database to find the answer to questions;
- and output the result in a variety of report formats.

There are many kinds of lists (databases), ranging from a simple list of names and telephone numbers to the massive files maintained by the tax authorities or a municipal utility.

With the database manager we use the term 'file' to mean the collection of data we are using (this can include various computers files, including definition, data and index files). The information for one individual is contained in a 'record' (often displayed as a row in a matrix) and each discrete piece of information is labelled as a 'field' (displayed as columns in a matrix).

The computer can store numerical and coded information more economically than it can store text characters. Thus fields are commonly defined by the type of information that they contain. Special field types include text, numeric, date and logical.

Common Database Terminology

Each database type has advantages and disadvantages, particularly when storing or searching for information. It is much quicker to find an item, for example, in an indexed file than in one that doesn't have an index.

Fixed Length versus Variable Length Records: A database system with a fixed length record allocates the same amount of space for each field regardless of content. A 20 character fixed length SURNAME field would store 18 blank characters to pad out the field for an individual with the name 'Li'. Alternatively, a variable length record requires a special character (one that cannot be confused with data) to separate each field and record, also taking a certain amount of space.

Random Access versus Sequential Access: A random access database utilises an index to allow the user to move immediately to any record in the file. This is particularly useful for 'real time' applications, such as in a public information system.

A payroll system, on the other hand, will almost always be accessed in 'batch' mode and can process the records in their stored order (rather than alphabetic or some other imposed order).

Flat File: A flat file system has all of its information contained in a single file, with a single record for every case or individual, much as a simple card index system has a single card for each case or individual. A simple mailing list has a flat file structure.

Relational: We can think of a 'relational' database as consisting of two (or more) flat files which are related by a field containing data that is unique to each individual and is common to both files. Motor vehicle records and criminal records might be related, for example, through a common field containing an individual's tax numbers.

Tree Structure: Another way of storing information uses an inverted tree structure, typically accessed by asking branching questions.

Tips for Using Databases

A database involves a compromise between the limitations of the computer and the need to allow for any eventuality. Most Australian surnames, for example, are no more than 15 characters long. It might seem reasonable to assume therefore that a surname field should be 15 characters wide, especially since allowing extra characters in a large database quickly consumes disk space and slows access to the information. On the other hand, imagine the problems that would result if your database was used in an area with a lot of individuals whose who had hyphenated (Featherstone-Smith) or long names.

You must also decide how to represent different types of information. A shoe size, for example, could logically be formatted as a one or two digit numeric value if we didn't know about half sizes and shoe widths. Similarly, we often code information for convenience and economy of storage; male and female might be represented by a number or single letter code, and yes/no answers might be entered as a single digit in a logical field.

- Plan what information will be in your database and how you will use it before you start working on the computer.

- Choose field names that will be short, easily typed, and descriptive enough to be easily recognised. BDATE, MDATE and DDATE would be quite reasonable for a genealogical database, but BIRTH_DATE, MARRIAGE_DATE and DEATH_DATE might be better for a general use. BD, MD, and DD would be satisfactory only for a single user system.
- Choose field lengths and types carefully. Fields that are excessively large waste too much disk space. Fields that are too short require too much use of abbreviations or codes. As for field types, things are not always what they seem. Numbers in particular are often better stored as text unless they will need numeric manipulation. A numeric field for shoe size, for example, cannot accommodate a shoe size of 7B.
- Define small fields where the data will require manipulation. It is much easier to combine the three individual fields containing title, first name and surname when printing out mailing labels than it is to try and alphabetise names in a single field containing entries like "Mr. John Doe".
- Design the database and data entry forms for convenience. An on-screen database entry form that matches the data collection form will be much easier to use and result in fewer transcription errors.
- Use common abbreviations and maintain a code book or log which lists the abbreviations and codes used. It is very embarrassing to forget what the codes in a database mean.
- Build a small database, test your data and prepare the most important reports before starting the major task. It is easier to make changes to a small database than it is to restructure a large database.
- Consider a 'last updated' field and a 'notes' field.
- You can almost always change the database design, even after you have entered the data, but working with the database will be easier, and save you significant time, if you design the database on paper before you start structuring it on the computer.

Finally, consider these suggestions from Jim Seymour of PC Magazine; they are as valid today as when he wrote them several years ago.

This is the most important piece of advice I can give. It's heartbreaking to design a database, enter a few hundred or a few thousand records, sit down with a satisfied smile and design that first report format—only to discover that you should have broken out one of the fields into two or more fields to get the report you need.

Design your input screens, enter some records to build a tiny test database, then write and actually run your most important reports before you start data entry on a large scale. I can almost guarantee the process will identify structural changes you'll want to make in the database before filling it up.

Finally, remember that the information in your database is valuable to you and your organisation. Designing the database so that it is easy to maintain will improve the accuracy of the data. Making frequent back-up copies of the database will protect you from the difficulties of lost information.

Number Processing with a Spreadsheet

Each type of application has unique advantages. A spreadsheet is a computerised financial worksheet. It could also be used for preparing text or for organising lists, however, it works best for tasks involving calculating.

Spreadsheets have a number of advantages over the traditional accountant's paper and pencil 'spreadsheet':

- the spreadsheet can be as large as the computer's memory will allow, usually several times larger than a sheet of paper;
- the spreadsheet automatically calculates the sums and other mathematical functions required, freeing the user from being a human adding machine;
- the spreadsheet can be easily changed, allowing the user to investigate a variety of 'what if' situations; and
- information from a spreadsheet can easily be reused for other purposes (reports, charts, graphs, etc.).

The spreadsheet is arranged as a large sheet with numbered rows and columns identified by the letters of the alphabet. Each location, or cell, in the worksheet can contain text, numbers or formulas. Thus the spreadsheet has two views: the numbers and text as displayed, and the text, numbers or formulas that the cell actually contains.

The way in which the information is displayed can be changed without changing the actual information in the cell. Thus the number .05 might be displayed as 5E-2, .05, \$0.05 or 5%. A quick look in the cell itself, however, would reveal that the actual value in the cell is still .05.

Data can be entered into the spreadsheet through the keyboard, however secondary data can also be generated through the use of formulas. Good spreadsheets make maximum usage of such generated data and never bury primary data in a hidden formula.

Spreadsheet Tips

- Use labels to document entries in the spreadsheet (every entry should be visibly identified).
- Organise your spreadsheet so that it is neat, logical and coherent.
- Check all formulas with dummy data to ensure that they work properly.
- Use the simplest versions of formulas. In particular, use ranges (eg: B1..B5 or B1:B5 depending upon your spreadsheet) instead of individual cell designations. Use range names where possible.
- Put all constants in labelled cells and use the cell reference in formulas rather than the constant itself.
- Check that all figures (numbers) are entered as numbers and not as labels. Labels cannot be used in calculations, even if they look like numbers.
- Use the cell protection feature to keep the user from making changes to critical formulas and data.
- Place instructions and identifying notes in the spreadsheet. This should include some general identifiers to indicate who built the sheet, and for what purpose, as well as remarks for every formula, constant and macro.
- Save your work frequently. Get into the habit of using different names for different versions of your spreadsheet to provide additional backup. Always save your previous work before adding new functions so that you can recover easily when the new function fails to work.

When working with a budget or other cyclical data save your sheet in an archive file at the end of every cycle (month, week, etc.). The archive file should be stored in a safe location, allowing you to recover from a major data loss.

E-Mail

There are notes on electronic mail use in the Network Tools Primer.

Presentation Software

Using presentation software such as Microsoft's Powerpoint (available as part of the Office suite as well as stand-alone) is very straight-forward. Preparing *effective* presentations is another matter.

- Remember the needs of your audience. What do they really need to know? What ideas will you present, and what needs to be on screen as a reminder or to lend emphasis to your words?
- Use the presentation software to display an outline of your talk or to present quotations from other people, do not use it as a script—your audience can read the slides faster than you can talk and will be bored/insulted by your reading the material off the screen.
- Keep your type sizes large, use readable fonts, and avoid jargon.
- Ensure that you have an adequate projector and all the proper connectors, etc., for your presentation before the presentation starts.

Finally, computer-based presentations often fail because it becomes impossible to change the order of material or to skip material. Consider printing the screen images onto transparency film and project them with a standard overhead projector if your presentation software is inflexible.

Minimum Presentation Standards

It doesn't matter how you prepared your presentation if the audience cannot read your materials. All too often a presenter spoils an otherwise good idea with overhead transparencies prepared in a semi-legible hand, photocopied from a standard typewriter or printer page, or in unreadable colours.

- The maximum safe area for many OHP projectors is 150 x 150 mm. Computer-based presentations have similar limitations when used with LCD projection panels.
- The minimum safe text size for a medium-sized audience (30-50 people) is 18 point Times.
- Choose plain type fonts—san-serif fonts such as Helvetica are probably best, cursive or decorative fonts like Old English are impossible to read when projected.
- Select bright colours with maximum contrast for projection with a weak projector.
- Keep the slide simple—one idea, few words. Five lines of five words each is probably maximum.
- Credit your audience with some ability to read. Use the slide as a reinforcement and reminder, not the script for your presentation. Outline points, references, and highlights from quotations are probably best.
- Keep the visuals simple and appropriate—'cute' rapidly becomes distracting to an otherwise attentive audience.

Finally, make sure that you are using the best projection facilities available and that you use them effectively.

- Video projectors are very good value, lightweight enough to easily carry, even by air, and provide a brighter image than a LCD projection panel. Wireless microphones amplify without restricting movement.
- Stand to one side so that you don't block the screen; talk to your audience (not the screen), using the microphone so that your voice can be heard (and/or be recorded) without you having to shout.
- The screen needs to be located above head level and the audio system adjusted so that your voice doesn't pop or squeal.

Groupware

Dr Geraldine Fitzpatrick

Imagine being able to consult with any clinician anywhere in the world, seeing them face-to-face, looking at the same radiographic film, being able to point to various spots and have the other person see it, being able to annotate the image with text or voice notes, being able to co-write the final report as if you were sitting side-by-side at the word processor. Imagine having computerised support for critical care paths so that when the physiotherapist has finished with the patient, radiology are automatically notified that the patient is now available for X-ray.

A lot of the technologies that we are talking about here are available now and fall under the broad category of groupware.

‘Groupware’ encompasses those technologies that enable people to work together regardless of place and time, in short, any cooperative activity.

Groupware can be considered as part of a wider area of interest, called Computer Supported Cooperative Work (CSCW). CSCW is concerned with both the technologies to support group work and with understanding the nature and requirements of cooperative work itself and how it may be supported by groupware. Neither endeavour is complete without the other.

The provision of health care, both within and across care episodes, is a prime example of a cooperative work activity. The many participants involved in the care process for an individual client are mutually dependent, even though they may be physically distributed across space and time.

For example, the cooperative nature of work in a hospital setting can be illustrated by the following activities:

- the interaction between the community services and the hospital both in the initial referral of the patient and in the post-discharge continuation of care;
- the communication and coordination among the various medical, nursing, allied health, and service people to deliver effective and timely care on an hour-by-hour basis;
- the negotiations and communications involved in preparing an operating theatre schedule;
- the information exchange at shift changeover; and
- the discussions and consultations that happen during bedside ward rounds, etc.

Artefacts that currently support this work—the patient's clinical notes; the chart at the end of each bed; the bed allocation/patient status boards at the ward station; standardised forms; and so on—are not just information repositories, but tools that play important roles in communication and coordination among the various care providers. Many of these group activities and many of these tools may be supported by computer-based technologies that fall under the umbrella of groupware.

Aspects of Groupware

Groupware can be characterised along a number of dimensions, the same dimensions that can also be used to characterise work. For example, we can talk of place and time, where place is either co-located (same place) or distributed (different place), and time is either synchronous (same time) or asynchronous (different time).

A teleconference would be distributed and synchronous, whereas the shift-based nursing care of a patient in a hospital ward is co-located but asynchronous.

Alternatively, groupware can be characterised by the main functional aspects of cooperative work: communication, collaboration, and coordination.

Communication: These systems extend and enhance traditional communication methods in a group context.

Electronic mail (e-mail) or messaging systems are among the most advanced of the groupware systems. They can be used to send a message directly to another person or to broadcast a message to a large group of people virtually simultaneously. Hence e-mail supports distributed asynchronous interactions. While the style of communication is closer to written communication, the tone and content of much e-mail makes it closer to informal verbal communication.

Studies of e-mail use repeatedly show that e-mail increases lateral communication, often bypassing organisational hierarchies, and diminishes the impact of status cues such as power, role, gender, etc., in interactions.

E-mail often facilitates a significant flow of information that would not, or could not, have taken place otherwise.

Conferencing systems are another type of communication groupware, supporting real-time synchronous interactions. They may require either designated meeting rooms (co-located) or separate desktop systems (distributed). They may be simply text-based or may make use of multi-media capabilities to also offer audio and possibly video links.

Desktop video-conferencing is the basic technology used for many telemedicine applications. A current example in the Queensland Health context is TARDIS, an intensive care telemedicine project between Royal Brisbane Hospital, and Nambour and Maryborough hospitals.

For those with Internet access, text-based facilities, such as IRC (Internet Relay Chat), chat rooms, and MUDS (multi-user dungeons)/MOOS (Object oriented MUDS), can provide more accessible and affordable real-time conferencing and communication support. [Asynchronous discussion lists are described in the Network Tools Primer.]

Many on-line support groups have sprung up where people from all around the world who want to talk about a particular issue, such as their experience with cancer treatments, will log on to a specific Internet address at a particular time and date. In this example, the meeting place might be called a 'cancer support chat room'. Often the participants will also be regular contributors to a relevant support mailing list as well.

Collaboration: Collaboration involves individuals working together to achieve a common goal. Collaboration groupware provides the shared information spaces and working contexts needed for this type of cooperation. The spectrum of such systems can include:

- message databases to support group discussions;
- document databases as shared information repositories;
- meeting facilitation tools for scheduling, brainstorming, argumentation support, distributed decision making, etc.;
- shared document editing systems; co-drawing tools; and many more.

Examples of collaborative systems already exist in healthcare. Group scheduling systems have been implemented in operating theatres to schedule people, rooms and resources. Each of the people involved maintain their own on-line calendar which is accessed by the group coordinator to derive

an optimal schedule for the group. The remote viewing, gesturing and annotating of digitised radiographic films, as presented at the beginning of this article, are supported by collaborative software, as is the shared report writing.

Coordination: Coordination groupware supports the synchronisation of people, activities and related objects/tools/information, etc., to achieve an outcome via some pre-defined process or workflow. Workflow systems or process support systems are typical of coordination groupware.

Some types of work are more amenable to automated workflow support than others. This work is normally fairly well understood, proceeds in a fairly predictable and routine manner, is often document-based, and has roles and associated actions that can be easily identified and hence allocated. Some high-level aspects of critical care paths could be captured in a workflow. Other subprocesses, such as the routine for ordering and collecting pathology tests, or for admitting a new patient, could also be fairly well defined and supported in a workflow form.

Integrated: Work rarely fits neatly into one category or another and so the ability to switch between various forms of communication or between various types of applications is particularly useful. For this reason, there are now many systems that attempt to integrate support for one or more of the above features within the same environment.

Implementation Issues

Many of these technologies have been around for years in various forms; video conferencing, for example, has been available since the 1970s. Why then have we not seen them become a normal part of the working day? There are two main reasons, one technical the other social/organisational.

Technical: Technologies such as video conferencing require expensive equipment, significant bandwidth, powerful workstations and large memory stores. Accessibility in terms of resources alone was a problem. Quality of output and slow response times were other problems.

While many of the underlying technology issues are far from being solved, current trends suggest that they are becoming less of an issue. Workstations and personal computers on the desktop are becoming more powerful and have larger memory stores. Equipment costs are generally decreasing. Bandwidth is improving with the increasing availability of high speed networks such as ISDN and EBN.

Since the quality of output and speed of applications are both improving; more and more people are becoming connected to the Internet, and by extension, connected to each other, there is a larger consumer base to make more use of such tools. The tools and applications themselves are also improving as many of the hard technical problems are being solved.

Social/organisational: Solving technical problems and building 'cute' technologies is the easy part. The hard part is trying to match and deploy the technology into the everyday social and organisational contexts in which work gets done.

The reason this is hard is because, firstly, we have a poor understanding of how work is actually carried out on the ward floor. Procedure manuals, job descriptions, and task allocations only tell part of the story. We often have a poor understanding of the subtle but often critical roles played by the existing manual system or procedure in facilitating group interaction. Think of all the ad hoc pieces of paper attached to a patient's file, and even the importance at times of the physical location of that file for communicating critical information between team members for the coordination of work.

Secondly, it is hard because systems created to be used in a group context will change the work, impacting upon it in unanticipated ways not previously experienced with single user mainframe or even PC-based technologies.

For this reason, qualitative workplace studies, often using observational techniques, are becoming more widely used both for requirements definition and implementation. In requirements definition, the aim of the study is to better understand how work gets done on the ward; not how the procedure manuals say it should happen, but how it really happens—who talks to whom, how information is shared, and how all the various health care professionals coordinate their care for a particular client when that care is distributed across space and time. Understanding these issues is the key to understanding if and how groupware technologies might be used to support work.

In the implementation phase, such a study can help identify and facilitate the subtle social and organisational changes that will need to happen for the groupware technology to become embedded into the normal working practices of the group. This begins an ongoing cycle of mutual change as both work practices and technology evolve together.

Conclusion

Groupware and its related area of CSCW have the potential to radically change the way work in general, and the work of healthcare in particular, is carried out. The challenges to make this happen are both technical and organisational but if they can be met, it is the patient who will ultimately benefit by clinicians being able to take advantage of better access to both people and information resources regardless of location or time.

References

This listing provides some useful papers, books, web-based (current at July 1996), and other references to follow up if you want to know more about groupware and CSCW-related issues.

Papers

Ellis CA, Gibbs SJ & Rein GL (1991) Groupware: some issues and experiences. *Communications of the ACM*, 34(1), 38-58.

Grudin J (1994) Groupware and Social Dynamics: Eight Challenges for Developers. *Communications of the ACM*, 37(1), 93-105.

Book

Baecker RM (1993) *Readings in Groupware and Computer-Supported Cooperative Work*, Morgan Kaufmann, San Mateo, CA.

Web URLs—Groupware in general

Tom Brinck's CSCW & Groupware Index: <http://www.crew.umich.edu/~brinck/cscw.html>

University of Georgia's web-groupware tool: <http://ginger.mgmt.uga.edu:8001> and Groupware Central: <http://www.cba.uga.edu/groupware/groupware.html>

The Groupware Yellow Pages:

<http://www.consensus.com/groupware/JRA>
A Consulting's CSCW Directory (UK): <http://www.demon.co.uk/jrac/cscwdir.html>

Web URLs—Health-related projects

TARDIS—QLD based ICU telemedicine: <http://www.dstc.edu.au/BDU/projects/telem.ed/>

CERC's Collaboration Technology for Real-Time Treatment of Patients: <http://www.cerc.wvu.edu/nlm/nlm.html>

Web URLs—Community projects

Blacksburg Electronic Village: <http://crusher.bev.net/>

Conferences/Journals

Most CHI (Computer-Human Interaction) Conferences, such as APCHI and OZCHI, have sections on CSCW. The ACM (Association for Computing Machinery) publications also regularly deal with related issues.

Acknowledgments

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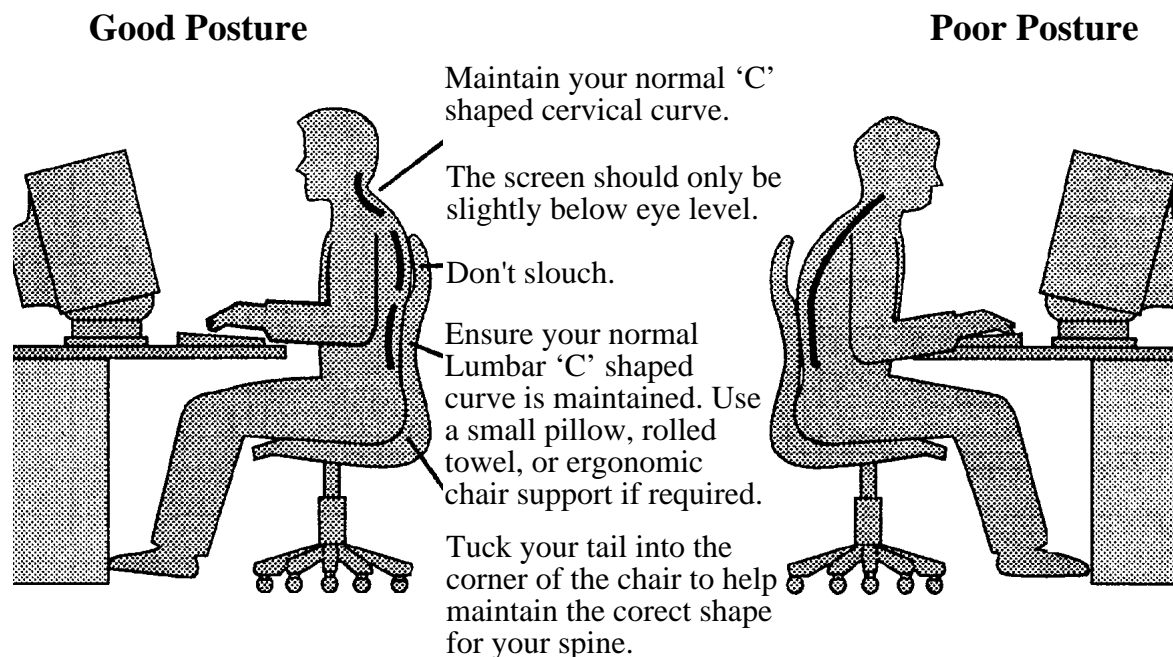
Ergonomics

Ergonomics involves engineering the workplace to make it both safe and pleasant for human workers. This Primer contains a number of hints to achieve a more ergonomically sound workplace and avoid RSI (Repetitive Strain Injury), back and eye strain, etc.

Posture

Good posture is essential for avoiding back strain and similar injuries when seated for long periods of time. The diagram below shows how to avoid back and shoulder strain while sitting. In addition, you should:

- Stand up and move around every 30-50 minutes—stretch your muscles and rest your eyes—while taking a 5-10 minute break
- Ensure that the top of the screen is as close to eye level as possible.



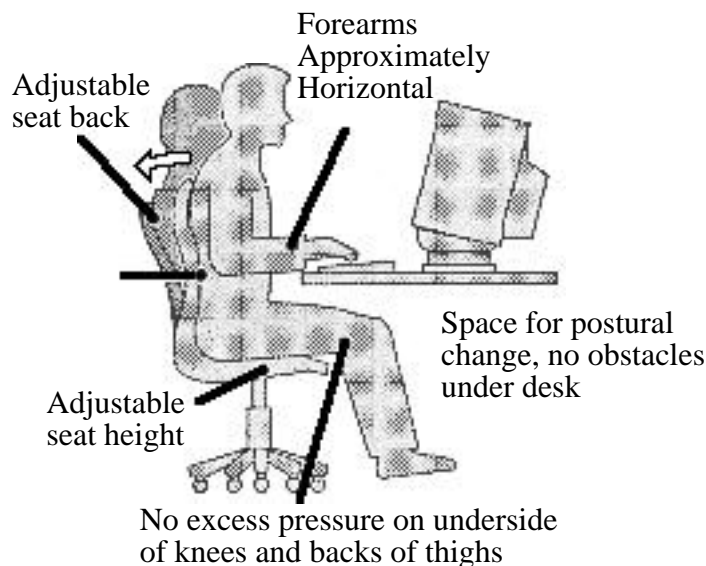
Adapted from an illustration with an article by Richard Jinman, in *The Australian*, 5 January, 1993.

Environment

The general lighting, noise levels, and placement of equipment/facilities within your environment are also important.

- Site the computer and screen so that there is adequate, non-glare, lighting (windows usually need a blind or other adjustable covering). You should not have to strain to read the screen.
- Site the computer, computer work space, keyboard, and mouse so that you are comfortable and have easy movement.
- Ensure that the work surface is glare free and spacious enough for supporting both the computer and any required materials (telephone, holders for copy typing, dictionary and other reference materials, space for spreading out work-in-progress, etc.).
- Move the screen until there are no reflections (lights, fluoros, sunlight) on the screen. Alternatively, install an anti-glare shield for your screen.
- Ensure that distractions such as noisy printers or photocopiers are removed from the working environment.

- A wedge shaped foot support may be of use when the user's legs do not reach the floor with a properly adjusted chair.



Adapted from an article from *The Times*, as reproduced in *The Australian*, Tuesday, December 1, 1992, p. 20.

- An adjustable kneeling stool may be an acceptable substitute for a chair for some users. The kneeling stool is often recommended because it forces the user to sit upright.

Tools

The software and other tools being used must also be adapted to the task. Even a good typist, for example, will occasionally find a spelling checker useful; most users, however, would be annoyed by a spelling checker which checked each word as you typed it in, beeping on errors.

Similarly, while a small digitising tablet may be useful for occasional graphic work, a large input pad would be required for efficient data entry for an architect, engineer, or full time artist.

Be Aware of Your Own Health

Checking your own health regularly is as important as checking your workplace for hazards. All too often, we 'forget' to get a regular eye check or to ask our health practitioner about unusual aches, pains, or stresses.

- Take regular work breaks—get up from the computer and move around as well as relaxing your eyes by looking out the window.
- Exercise, both before and after working on the computer.

Current workplace health and safety regulations place a 'duty of care' upon every worker, not just the employer, to correct unsafe or hazardous conditions.



The NET

Electronic mail, the Net, the Internet, the World Wide Web—how many times have you heard that if you don't have net access then you aren't up-to-date and are wasting the potential of your computer?

The spreadsheet was the first 'killer' application other than computer games, creating the desktop or personal computer market as spreadsheets made their way into corporate offices and then into the small business and home. Multimedia and desktop publishing are also killer applications, creating a market for sound cards, higher resolution video, fast processors, large disk drives and quality printing.

In all cases, the applications met a need; a need which may not have been expressed, but nevertheless one which caught on very quickly with the potential user market. In the case of desktop publishing, the market was a small niche in the overall computer market until one vendor undertook to supply desktop publishing professionals with tools which met their specific needs. The general market then saw the potential and converted the niche into a mass market.

Data communications has always been the domain of the specialist and for the average user was the one application which was most likely to cause problems in use. Much of the general use was over the public telephone networks and thus at the mercy of the technical limitations of telephony. Computer hobbyists worked within these limitations and established both general and specialist 'bulletin board systems' (BBS) to cater for the needs of fellow hobbyists and ultimately the wider public.

The BBS typically focussed on three main areas: the provision of 'public domain' or other software for 'downloading' and use on a remote computer, displaying general information on particular topics (with a greater or lesser degree of quality/accuracy depending upon the sponsor), and the 'posting' of electronic mail, both locally and to other similar systems provided you knew the electronic address of the destination system. Thus it was not uncommon to find groups such as Brisbane's *Brisbug* operating a dial-up BBS with several incoming lines, an extensive collection of software and information files of varying quality, and a mail system through which you could, with patience and a bit of luck, exchange messages with almost any other BBS in the world.

However, academics and researchers often had access to a faster and more reliable communications system, albeit one which required even more technical expertise to sustain. This electronic network, initiated by the US Department of Defence and designed to survive nuclear attack, eventually evolved into the *Internet*, an all-encompassing term for the non-commercial data networks interconnected worldwide. The services provided included text and program file exchange plus electronic mail, but the network quickly expanded into a searchable storage and transfer medium for data of all kinds (text, program, graphics, audio, video, etc.). Commercial networks established to provide similar services to business, industry, and private individuals have since interconnected with the non-commercial systems.

The Internet's latest application, the World Wide Web (WWW), is both a virtual network linking tens of thousands of computer systems worldwide and a searchable hypermedia-linked library. The Primers which follow describe the Net and its use.

Finding Resources Through the Net

Prof Amy Zelmer

In the past few years there has been an explosion of information and informal resources 'on the net'. One of the frustrations for most new users is the amount of time it takes to find the most useful resources and to search them efficiently.

The resource list which follows was prepared in May 1996. Most addresses were able to be verified at that time; others were believed to be active, but were not able to be contacted at that time, possibly due to line congestion, temporarily inactive status, or... The Primer which follows provide additional details of Internet tools.

Given the wide range of interests of health science practitioners and the continuing rapid change of materials, the following list should be taken as only indicative of what may be available to you. As you find resources which are particularly useful, please take the time to tell the author [e-mail: a.zelmer@cqu.edu.au] so that the information can be passed on to others through the HISA magazine, *Informatics in Healthcare Australia*.

URLs

URL (Universal Resource Locator). This is a system of addresses which enables the web browser to locate the resource page. Most software which lets you contact these addresses (browsers like Netscape and Mosaic) also provide systems for saving addresses which you want to contact again (bookmarks)—important as the addresses *must* be entered absolutely correctly if you are to reach the resource.

Australian Electronic Journal of Nursing Education (scholarly journal from Charles Sturt University, articles are refereed): <http://www.csu.edu.au/faculty/health/nurshealth/aejne/aejnehp.htm>

Australian Public Health Association: <http://www.hcn.net.au/pha/intro.html>

Australian Rural Health Research Institute: <http://www.menzies.su.edu.au/homepage.html>

The Canadian Bioethics Report : <http://hpbl.hwc.ca:8400/infobase/cbr/>

Canadian Society for International Health: <http://hpbl.hwc.ca:8500/default.html>

Central Queensland University—Faculty of Health Science: <http://www.cqu.edu.au>

CyberHospital (Singapore) (see Case Study next page): <http://www.ch.nus.sg>

Global Health Network Home Page: <http://www.pitt.edu/HOME/GHNet/GHNet.html>

HealthWeb (Big Ten universities and the University of Chicago, a collaborative collection of selected and evaluated resources rather than an exhaustive index): <http://www.ghsl.nwu.edu/healthweb/>

The International Committee of the Red Cross (conflict-related issues such as victims, international humanitarian law,

etc.): <http://www.icrc.ch>

Medical Journal of Australia (test and extend its peer review processes, while speeding up the publication. E-mail: mja@magna.com.au): URL: <http://www.library.usyd.edu.au/MJA/>

Medico-legal information: <http://www.opennet.com/medstuff>

Nurses' Call (professional nurses internationally, and a public broadcasting system focused on professional nursing; hopes to have Nurses' Call Webchat up and running soon to allow live conversations with nurses internationally (corporate and private sponsors)): http://www.npl.com/~nrs_call/

The Virtual Hospital (Univ of Iowa's continuously updated medical multimedia database—MMTBs, diagnostic algorithms, patient simulations, teaching files, historical information, and patient instructional and CME materials): <http://vh.radiology.uiowa.edu/>

World Bank, Human Development Department (HDD): <http://www.worldbank.org/html/hcovp/hdd/contents.html>

Social Indicators for Development 1994: <http://www.ciesin.org/IC/wbank/sid-home.html>

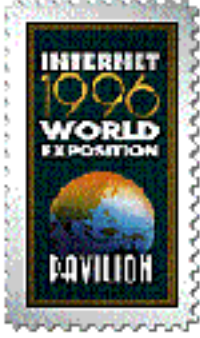
CyberHospital—A Case Study

The CyberHospital WWW site was established by Dr K C Lun of the National University Hospital in Singapore to help organise information from the mushrooming number of medical sites. Based on his own net 'surfing', this initial service organised links to sites worldwide using the metaphor of a modern hospital with specialities.


Links, however, were not adequate for two reasons: medical information is not confined to WWW sites and once a user linked to the specialised site there was no longer any reason to return to CyberHospital. Dr Lun's response was to add links to other information sources—UseNet newsgroups, electronic journals, etc., plus net 'frames' for visitor orientation and an easy return to CyberHospital.


Following a student criticism that the site catered to medical staff but not to students, Dr Lun encouraged a final year medical student to establish a student corner with lecture notes, etc. This has since become the semi-independent CyberMed[ical School]. More recently, a first year medical student helped establish the Centre for Medical Images using local materials and links worldwide. Dr Lun's latest coup is for this centre to become the Singapore mirror site for the full set of images from the Visible Human Project.

The CyberHospital can be found at <http://ch.nus.sg> and can be accessed using conventional text and image browsers as well as VRML for a demonstration of 3D virtual reality across the net.



Singapore Time at Access






Cyberspace Hospital was launched on 1 May 1995.

Since then, 33223 individuals from 77 countries have visited us.


Visit the new Haematology Dept on Level 4

You can choose to visit Cyberspace Hospital via its graphics-based interface (recommended) or its text-based interface.

Please select by clicking on your choice:



Graphics-based Interface



Text-based Interface

Electronic Lists

Electronic lists may take several forms:

- open (to which anyone may subscribe) or closed (available only to members of particular organisations or those who meet certain criteria),
- moderated (where each posting is vetted by a list moderator before being released to the list) or unmoderated (where anything submitted is automatically resent to all those 'on the list').

Subscribers may often vary the amount of mail they receive from a list by sending instructions which will cause postings to be sent in 'digest' form or suspend postings for a period of time. In contrast to WWW pages where you must search for information, subscription to a list will automatically bring the information to your electronic mailbox.

Caution: some lists are very active and the amount of mail can become a distraction or overload your electronic mailbox!

There are two addresses for any list—the manager software for the list, and the list itself. Ensure that you know which is which as list users do not appreciate receiving copies of your incorrectly addressed messages to the list manager software. Subscribing to any list requires a process similar to that in the box below:

Science, Technology and Medicine Archives (Australian):
stama@asap.unimelb.edu.au

For the discussion, publication and promotion of issues relating to science, technology and medicine archives. The list has been established by the Australian Science Archives Project to serve the members of Museums Australia-Health and Medicine Museums Special Interest Group (among others).

To subscribe: send an e-mail message to: **majordomo@asap.unimelb.edu.au** and in the body of the text say: **subscribe stama**

International Development Research Council (Canada) (replaces previous paper publication of 'Reports'): REPORTS-DL@internet.idrc.ca

For subscriptions contact:
ListProc@internet.idrc.ca

SJU Polio and Post Polio Syndrome List
(unmoderated for those interested in the late

effects of polio):
POLIO@SJUMV.STJOHNS.EDU

World Bank, Human Development Department (HDD) (moderated newsletter and archiving service on human development issues, content supplied by the World Bank): hddflash@worldbank.org

Finding Your Own Information

FAQ (Frequently Asked Questions) sheets are available on many topics and should be read before asking questions on a discussion group. There aren't any central sources for FAQs, but including the term FAQ in a search request (see search engines below and in the Internet Tools Primer) will usually find you a FAQ sheet if one is available. Some discussion lists also maintain archives of the items submitted. Information on the archives for the list will usually be provided when you subscribe to the list.

Every Internet browser (Netscape, Mosaic, Lynx, etc.) has a search facility to enable you to 'surf the net', to use the jargon. Netscape, for example, provides access to at least one search engine among its menu options. Other search engines can be added to your list of bookmarks as you become familiar with the use of different tools.

The boxed note on the next page comes from one discussion group administrator and gives the addresses for several search engines. It originates with the WWW Courseware Development discussion list.

```
Mime-Version: 1.0
Priority: normal
Date: Tue, 23 Jan 1996 09:58:36 CST
Reply-To: WWW Courseware Development <WWWDEV@hermes.csd.unb.ca>
Sender: WWW Courseware Development <WWWDEV@hermes.csd.unb.ca>
From: Stephen Downes <downes@ADMINNET.ASSINIBOINEC.MB.CA>
Organization: Assiniboine Community College
Subject: Where Can I Find...
To: Multiple recipients of list WWWDEV <WWWDEV@hermes.csd.unb.ca>
```

Hi Folks,

People ask on a regular basis where to find things on the web. Often, what they are looking for could be easily found with a quick search. Here's what you should do before sending out a request on the list server.

Point your browser to a search engine. Some of the better ones are located at:

<http://www.altavista.digital.com/>

<http://www.webcrawler.com/>

<http://www.yahoo.com/>

I especially like Altavista. It's new, it's fast, and it has a MASSIVE database of web pages.

Once you reach any of these locations you are invited to enter your search term. Type the name or description of what you are looking for in the box and press enter (or click on the 'submit' button).

Try to be precise. Eg. don't type 'HTML' - you'll get thousands of (mostly useless) results. Instead type something like 'HTML 3.0 tutorial in Postscript version'. This will return you a small number of results, most of which will be useful.

The search engines will generate a list of web sites. Altavista and Webcrawlers sort the list so the listings at the top are the most likely to be useful. You now need to explore this list. Click on items in the list which appear to be what you're looking for. If the item is not what you're looking for, use the 'back' button to return to the list of web sites.

A search like this typically takes me about two minutes (though I have spent several hours looking for some truly obscure information). This is a much faster and more efficient way of obtaining needed data than asking on the list server. Asking on the list server should be seen as a last resort, not the first option.

—

Stephen Downes * Distance Education Instructional Design Specialist *
Assiniboine Community College * Brandon * Manitoba * Canada *
downes@adminnet.assiniboinec.mb.ca * <http://www.assiniboinec.mb.ca/> *

Because some search results can yield thousands of 'hits' it is necessary to refine your search skills.

- **Think laterally:** the information you want may be more accessible under a different topic—'grammar', for example, rather than 'style guide'.
- **Think source:** It is sometimes easier to find the agency originating the data than the data itself—'UNICEF' instead of 'children'.
- **Ask for help:** professional librarians will often be much more efficient at conducting searches than the novice.

Internet Tools

The Internet provides access to a wide variety of information resources with an even wide variation in the quality of those resources. While electronic mail and other technologies have democratised information, making it much more accessible to under-privileged individuals and groups by removing some of the status barriers, there is a cost—the ease with which information can be created, duplicated, and changed, as well as electronic anonymity, makes it hard to verify the authenticity of information sources and content.

The World Wide Web (WWW or simply the Web) is the most recent and fastest growing information technology ever. It was effectively unknown when the 1993 version of this publication was being written, yet it has become the number one information source worldwide and is rapidly becoming a commercial marketplace as well. The following examples illustrate the range of Web services, commercial and individual:

- specialised information services such as CyberHospital (Singapore) (<http://www.ch.nus.sg>) which links medical-related sites worldwide and is a repository for the complete collection of Visible Human images (see the case study in an earlier Primer);
- administrative policies and related documents such as those provided by the Central Queensland University's Computer Security Committee (<http://www.cqu.edu.au/documents/compsec/home.html>);
- academic materials and information such as the course information, assignments, learning resources, and [soon] research information provided by the author (<http://mc.cqu.edu.au/staff/lynn-zelmer/lz-home.htm>) so that distance students and colleagues are not so dependent upon paper materials sent via the regular mails;
- daily news provided by conventional media such as *The Australian* newspaper (<http://www.australian.aust.com>) with text and images, *CNN International* (<http://www.cnn.com>) with text, graphics and video clips, and ABC Radio (US) *Hourly News Update* (<http://www.RealAudio.com/contentp/abc24/ihn.cgi>) with highly compressed audio files; and

Location:

[What's New?](#) [What's Cool?](#) [Handbook](#) [Net Search](#) [Net Directory](#) [Newsgroups](#)



Parliament of the Commonwealth of Australia

Welcome to the Parliament of Australia WWW Home Page.

This service is an initiative of the Parliamentary Library to provide Internet access to Australian Parliamentary Information.

This page provides access to resources which are available from the Parliament of the Commonwealth of Australia.

- [Department of the Senate](#)
- [Department of the House of Representatives](#)
- [Department of the Parliamentary Library](#)
- [Parliamentary Education Office](#)
- [Internet Trial](#) - access to Hansard and other parliamentary publications
- [Hansard 1996 \(PDF\)](#) - Senate, House of Representatives and some Senate Committee transcripts in Portable Document Format
- [Opposition Executive](#)

- government (<http://www.aph.gov.au/>) and public (<http://www.dpi.qld.gov.au/longpdk/>) [Climate (El Niño) Information for Australian Agriculture] information and data, as well as commercial and promotional materials (<http://www.bushnet.qld.edu.au/>).

The Web may be the latest information technology, but the Internet itself has been around for many years and there are a variety of tools for using the Internet for electronic mail (e-mail), transferring files from one system to another (ftp), remote access to other computer systems and databases (telnet and WWW), and searching for the information on those other systems/databases.

Electronic Mail

While longer documents (including formatted word processor files) can be attached to an electronic mail (e-mail) message, an e-mail message is essentially the equivalent of the plain (no photograph) postcard or telegram of earlier times.

E-mail is available through a number of private, commercial, educational, and public suppliers, including local hobbyist bulletin boards, most of whom are part of the interconnected networks that comprise the Internet.

E-mail can be fast—I have sometimes sent requests for information, even overseas, and had a response back within minutes—but one of its main advantages is that messages are stored in the system until the addressee is ready to access them. They may then be read on a host computer (server) or ‘downloaded’ for leisurely reading on your personal computer.

Just as with conventional paper mail or the telephone system, every e-mail user needs a unique identifier so that the system can route the message to the right recipient. E-mail addresses are of the form *username@hostname* where the username is likely an abbreviated form of your name and the hostname is the name of the computer which acts as the mail server and where you have an ‘account’. Note how my e-mail address conforms to this convention: L.Zelmer@CQU.EDU.AU (CQU is the code for my employer's computer network, EDU denotes an educational network, AU indicates that it is in Australia).

E-mail Tools

There are tools for composing, reading, sending, and managing e-mail for every computer platform. Pine and Unix Mail are commonly used by computer professionals; Eudora, one of the most popular programs, is available on both the Macintosh and Windows platforms; and Microsoft provides a proprietary program for Windows users.

Composing a mail message is easy, particularly since most mail programs allow you to copy and paste text from other sources, typically your word processor. For many poor spellers this is essential as mail programs seldom come with a spell checker.

Sending the message may be as easy as clicking on the send button or, for users connected to the Internet through a modem connection, may require running a communications program and waiting for the modem connection via the telephone. Such users usually connect to ‘download’ their waiting messages, disconnect to read and answer them, then reconnect and ‘upload’ the responses and new messages. This saves connect time, and thus is less costly.

E-mail Etiquette

As the notes in the computer security Primer indicates, e-mail is essentially the modern version of a postcard, with all that implies in terms of being able to be read by anyone. Unfortunately, an e-mail message is even easier to compose and send than a postcard, leading many users to be careless. Used

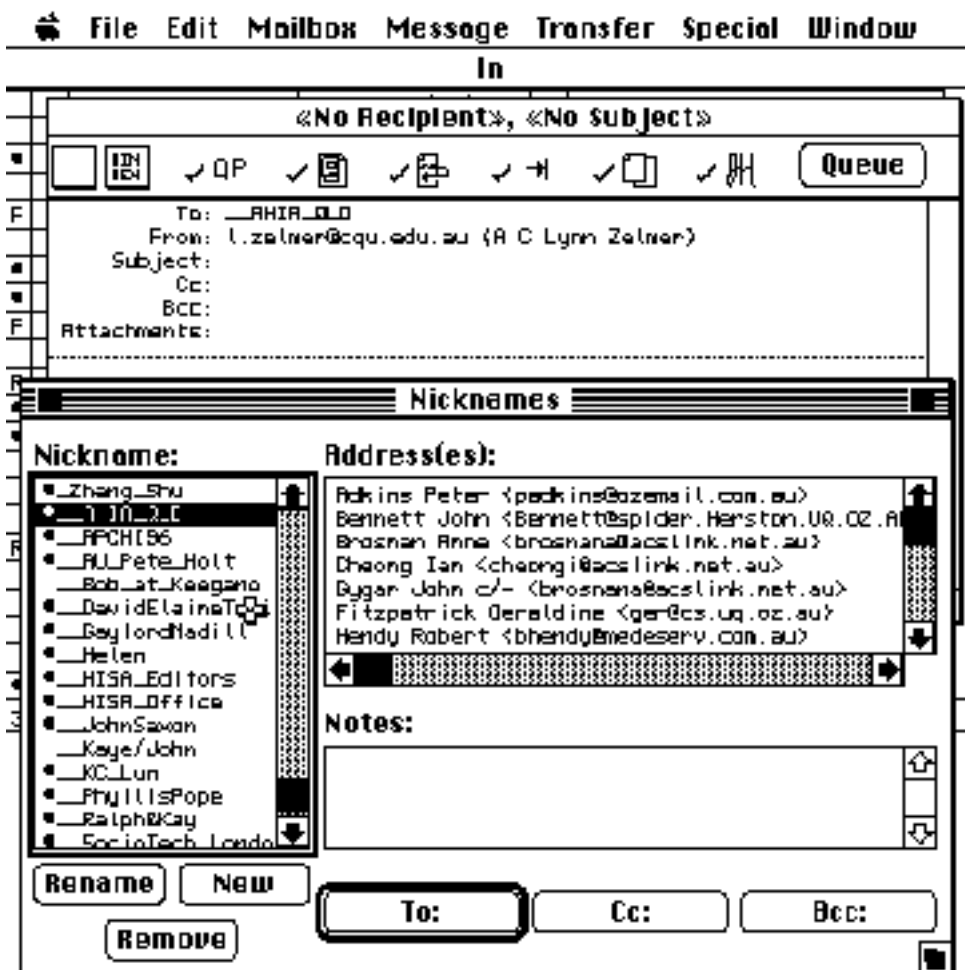
properly, however, e-mail can be your most important information and communication tool.

- E-mail messages have the potential to last forever and to be re-posted far beyond your original audience.
- Messages written in haste are often misleading and confusing;
- Since sarcasm and humour depend heavily upon tone of voice and facial expression, they are almost impossible to convey in a short written message and lead to misunderstandings, thus should be avoided.
- ‘Flaming’ is the term for what happens when you react sarcastically and/or too negatively to someone else, particularly when you copy the ‘flame’ to every member of the mailing list or work group.

Messages Written in Anger Usually Produce ANGER in Return.

- Reread your message for errors and tone before sending.
- Be selective in your audience.
- Capital letters indicate SHOUTING; use your shift key selectively.
- Hold any messages composed in anger for 24 hours and reread them before sending; delete or rewrite the message as required.

Smileys are text symbols to indicate humour in e-mail—read them sideways, and use both them and abbreviations sparingly. :-) IMHO

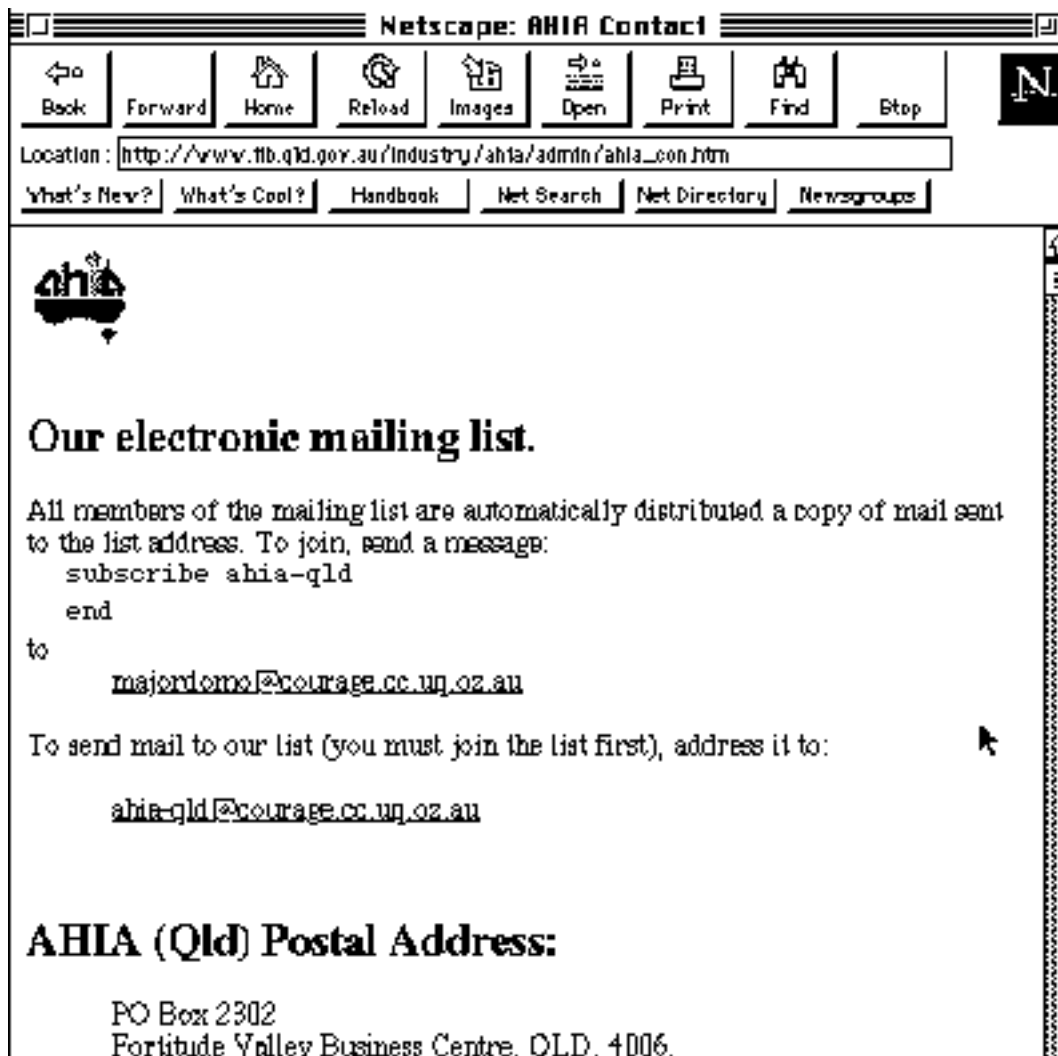


A sample screen from the popular Eudora e-mail client. Most such tools have functions like ‘Nicknames’ which facilitate sending the same message to several people at once. Eudora is available for most common desktop computer platforms.

Text-based Internet Tools

The Internet started as a text-based network and only recently began to support such graphically-oriented communications tools as the Web.

E-mail (see above) and other tools continue as text-based services because there would be little value in becoming graphical (graphics and formatted files can be sent as attached files); other text-based tools support users with slow modems or non-graphical computer systems.



WWW page which assists users to subscribe to the AHIA(QLD) Discussion Group. While this WWW page is graphical, most discussion groups are text-based.

Check with your computer centre or service provider for details of where to obtain the following programs/services and their operation.

Archie: from the comic strip, an early FTP search engine; still useful when you know that the information you require (such as a software update) is available from an Australian site which copies ('mirrors') an overseas site.

FAQs: answers to Frequently Asked Questions, available on many topics but, unfortunately, there aren't any listings of available FAQs. A FAQ on the WWW is at <ftp://rtfm.mit.edu/pub/usenet/news.answers/gopher-faq>

Include FAQ as a term in your search query to find the available FAQs for your inquiry topic.

FTP: program(s) which allow you to transfer files to and from specified computers connected to the Internet. Gopher and WWW have generally replaced FTP.

Gopher: Internet retrieval engine which allows the user to pick items from a menu rather than having to explicitly run FTP or telnet utilities.

Listserv (abbreviation for 'list server') and **Majordomo:** two software packages to manage e-mail discussion groups. The software manages one or more discussion groups, subscribing and unsubscribing members' e-mail addresses, and forwarding mail addressed to the list to all members.

There are two parts to any discussion group—the software (Listserv or Majordomo) and the discussion group itself. Think of the software as being the equivalent to a magazine or newspaper circulation department, with the list itself as the articles, columns, and letters to the editor. See the Primer, *Finding Resources Through the Net*, for examples of discussion groups and the subscription process.

News: News groups were the predecessors of e-mail discussion groups. Like discussion groups, they contain electronic mailings related to a specified topic. Unlike discussion groups, where items are forwarded to all subscribers by e-mail within a few minutes of being posted, however, the newsgroup reader must explicitly access the newsgroup and read items posted since the last time the newsgroup was accessed. News normally maintains a record of use to avoid having to reread items previously read.

Telnet: program(s) which provide access to computers connected to the Internet by simulating a computer 'terminal'. Users access the specified computer exactly as if they were connected locally, thus need an account and user ID on the remote computer. Library catalogues and the like are exceptions; typically they allow users to login as 'guest' without requiring a password. Services available to guest users are obviously limited.

Veronica: gopher search engine.

World Wide Web (WWW or Web)

The Web is a rapidly expanding collection of 'home pages', databases, information services, discussion groups, and media resources. Many web sites are freely accessible while others are restricted (usually by password) to designated users. The Web is accessed through a browser, a client application such as Netscape or Mosaic which handles the interactions with the server (remote computer) where the required information is stored. Since information on the Web is stored using HTML, a text markup language, the information is displayed similarly on any platform and users can print or save to disk the information retrieved as well as setting a *bookmark* to easily return to the site at a later time.

Unlike the text-based Internet services described above, Web surfers are able to access audio and video segments and animations as well as executing programs (applets—mini programs which have been designed to operate on any computer platform supported by the browser).

The Web also supports links to other pages—hypermedia links—allowing the reader to easily access other information services worldwide from the initial access page. There are also a number of tools—search engines, see the previous Primer and below—which allow users to search the network worldwide for information on a specific topic. There are some problems with a Web search, it may be particularly difficult to separate myth and opinion from fact, for example, but the Web provides an unparalleled access to information resources for individuals with computer/Internet access.

Increasingly the web is becoming commercialised, both through the provision of commercial services (banking, shopping, brokerage services, etc.) and through the advertising that some sites include in order to pay for the costs of providing services.

One of the attractions of the Web is that anyone with access to an appropriate server connected to the Web can be an author—have a home page—at

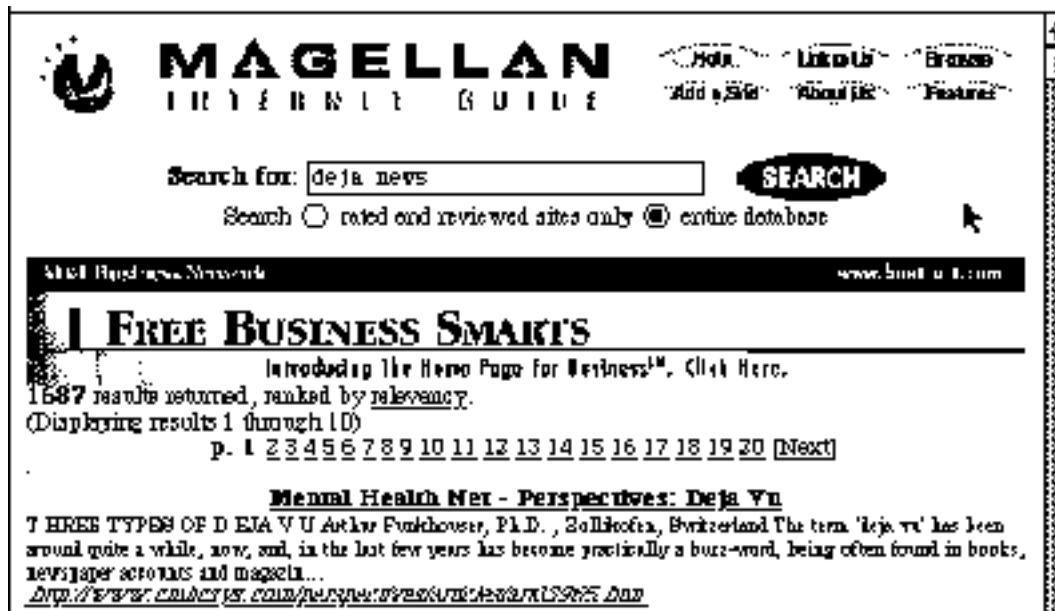
minimal cost. The best Web sites are usually professionally designed and produced, but hundreds of thousands of individuals worldwide have created their own pages, in effect becoming their own publishers. The Using HTML Primer explains how you can easily create your own pages.

Directories/Search Engines for the Web

It used to be that if you wanted to scan the 'Net for documents of interest, you'd launch your local Gopher, find the item for WAIS searches, spend a little time trying to see if there were some search syntax that would help you avoid turning up too many useless titles, run the search, and be disappointed. Doing such a search was as hard and potentially unrewarding as trying to use DIALOG to search ERIC without a librarian...

With the explosion of the Worldwide Web and the development of both social and technological innovations, those days are over. I knew that a new day had dawned when the chancellor of a prestigious medical school sent a printout of a Yahoo search to a client of mine and a memo that said "I found home pages for 15 cancer centers on the Web last night. Why don't we have a page?" (Glassman, Bernard (1995), of Blackmountain Computing, quoted by Morrison, James L (1995), <morrison@gibbs.oit.unc.edu> via the horizonlist <horizon@gibbs.oit.unc.edu> in a discussion on 'Internet Search Engines', Mon, 27 Nov)

Magellan (<http://www.mckinley.com>), shown below, provides a rating of many of the sites included in their directory. Yahoo, now a commercial service (<http://www.yahoo.com>), is one of the more popular search engines on the Web and includes both browse and search functions. WebCrawler is another (<http://www.webcrawler.com>). The WWW Virtual Library (<http://www.w3.org/hypertext/DataSources/bySubject>) is an academically oriented library directory while DejaNews (<http://www.dejanews.com/>) indexes newsgroups.



A poorly chosen search term results in thousands of unwanted retrievals; in this case the search is distracted by looking for any occurrence of the word deja, found as part of the phrase 'deja vu' but unwanted in this search.

Search for: **SEARCH**
 Search rated and reviewed sites only entire database

BUY COMMUNICATIONS SERVER -- GET FASTTRACK UPGRADES
CLICK NOW -- OUR FREE SERVER UPGRADES
DISAPPEAR

Related Topics
Internet / Surfing Tools & Resources

2 results returned, ranked by relevancy.
 (Displaying results 1 through 2)

p. 1

+++ **DejaNews**

Review: Usenet newsgroups make up a sizeable portion of the traffic on the Net and trying to find individual postings is next to impossible. DejaNews offers a powerful search engine that allows users to modify and control the search environment to be as successful...
<http://www.dejanet.com/>

+++ **The Internet Sleuth**

Review: The Internet Sleuth helps you search for knowledge on the Net by connecting you to over 1,500 searchable databases and indexing tools. Users can input a keyword directly, or choose a specific search engine to query. This tool, a parallel search engine, is ...
<http://www.isleuth.com/>

In this example there are only two matches with the correct search term and a restricted search.

The search engines all provide you with active links to the document locations retrieved, thus you can immediately jump to the document itself. Searches, and the documents, can be printed out or saved to disk using your Web browser.

The Primer, Finding Resources Through the Net, has tips for conducting an effective search. Unfortunately, even with the best search strategies you sometimes find that you cannot access the URL provided by your search. Try again, the Web is an evolving resource and sites disappear, require maintenance, or move to another location.

What You Need to Connect

While any computer, communications software, modem, and telephone line can be used to access the text-based portion of the Internet (ftp, telnet, e-mail, and the Web text), most of us will also want access to the graphical services, particularly the full-services of the Web.

For full graphical access to the Web you will need a powerful computer with a colour monitor and sound—this means a machine running at least Windows 3.1 or a Macintosh Performa or PowerPC model—plus a fast modem (28,800 bps V34 recommended) or direct Internet connection (such as the fibre optic or copper network connection as found in many business, university, and hospital installations).

If you don't already have an account with a network provider, generally through your employer, then you will need an account with an Internet provider (see next section) to provide you with your unique address and pay for the services you use.

To access some services, such as the ABC Radio (US) hourly updates described above, you will also need specific helper applications to listen to the sound file, view the animation/video, or read the formatted text file. These helper applications, or utilities, are often available free of charge, except for the cost of downloading them from the Internet.

Service Providers

A service provider is an organisation which provides you with a unique identifier (address) and defined access to the Internet, usually for a fee.

Individuals working within large organisations often already have access to the Internet through the network facilities of the organisation—a hospital or university network is just as much a service provider as any commercial organisation.

Commercial service providers may be geographically defined—there are, for example, local service providers in cities such as Rockhampton and Townsville which will, for a fee, provide a range of services, the most important of which may be a local telephone number to avoid STD charges. Other providers, such as Brisbane's Med-E-Serve, provide the same range of basic services but specialise in offering additional services of particular interest to their defined client base. Med-E-Serve, for example, provides easy access to a number of medically-oriented databases and hosted the first HISA virtual conference.

Other service providers specialise in one type of service. MCI and CompuServe, for example, provide e-mail access worldwide.

Telstat, which owns most of the cables over which the network services are carried, has also indicated that it intends to directly compete with service providers.

Netscape: Unit Selection

Location: <http://hydra.cqu.edu.au/infoweb/unit.html>

What's New? What's Cool? Handbook Net Search Net Directory Newsgroups

Unit Selection

Unit Code Year Semester

Student Type Study Centre

Mode

All
 Internal
 External

Withdrawn Students

Included
 Excluded

Report Options

Student Details Only
 Include Enrolment Details
 Include Contact Details

Sort Order

Student Name
 Student Number

Output

Screen
 Comma Delimited File

A Netscape-based form (client) used to initiate a search of a WWW server-based database. In this case, the database contains a read-only copy of the database which is actually maintained on another system. It provides convenient access for staff (no need to learn a database retrieval language) and is only updated weekly.

While visible on the WWW, access to the database requires a user account and password. It is likely that clients (students in this case) will eventually be able to access their own data using an account/password, perhaps based upon some combination of their individual ID number and other data.

LIBRARIES pros and cons

- They're cheap and easy to use... but underfunded and worn out.
- Libraries have atmosphere... if being told to keep quiet is your idea of ambience.
- Take the family... is that your only option on a rainy day?
- You can hire CDs and videos... and enjoy someone else's crackles and scratches.
- Books are durable and sensual... but how many times can you enjoy the same book?

INTERNET pros and cons

- Cheap and easy to use... well cheapish and time-consuming.
- Open 24 hours... but only accessible between 2am and 5am.
- Huge database... unedited ramblings clog the system.
- Electronic democracy... you're kidding—it costs around £2,000 [AUD 3,962] for all the gear.
- Exciting and fun... apart from the eye-strain, wrist-ache, frustration, loneliness.

James, Steve (1996). 'Throwing the book at the Internet', *The Guardian Weekly*, 7 July, 24.

Using HTML

HTML, the Hypertext Markup Language, is the formatting language used for documents published on the World Wide Web. HTML is, along with the Web itself, one of the fastest growing areas of technical publishing.

This note will describe the differences between formatting languages and WYSIWYG (What You See is What You Get) word processing and provide a brief introduction to HTML.

Background

Early computer systems had line editors, software tools which allowed you to enter program code and print it out on the system printer. Designed for programmers, editors often numbered each line and required errors to be corrected line by line. Remember that at this time most users had keyboards connected to the computer with either a CRT (video display) or a printer for viewing the output and used uppercase text characters exclusively.

The desire to use the computer to manipulate text led to the development of text formatting software. Formatting programs required their own unique codes to be embedded into the text. Symbols such as !PAR or <PAR> or /P designated a new paragraph and provided the formatting software with an indication of how to format the text.

Eventually, however, editors were improved and formatting functions were combined with the editors to provide a variety of WYSIWYG text displays. WordStar and Word Perfect, for example, allowed you to hide the codes but still get at them if needed. Microsoft's Word, on the other hand, hid the codes and, until recently, made it difficult to search for formatting codes.

The need for consistent style in a long document and the inclusion of graphics and mathematical symbols ensured the continued development of text formatting software (TeX, for example) but most desktop computer users now use fully graphical WYSIWYG word processors which provide very sophisticated text manipulation facilities, albeit with proprietary formatting codes, style sheets, and file structures.

While there are tools on some platforms, particularly the Macintosh, which allow easy conversions between different word processing formats, such tools are not common on others, notably the Wintel platform. The result is that style sheets, printer fonts, and illustrations do not convert perfectly between word processors or across computer platforms although some cross-product and cross-platform tools—such as RTF (rich text format), Adobe Acrobat (a proprietary display system) and SMGL (the markup language from which HTML was developed)—provide some assistance.

The Web was designed to provide services to all computer platforms, provided a 'browser' tool such as Mosaic or NetScape is available for the platform. The cross-platform service does, however, have the same potential for incompatibility as does any other cross-platform or cross-application tool. The Web's current solution is HTML.

HTML Basics

HTML is a very simplistic markup language but it allows

- the display of multimedia elements—text, audio, still images (illustrations, drawings, photographs), and moving images (animation and video);
- hypertext linking—moving from one part of the file to another, or to another file, even across systems; and

- communications—sending messages, completing forms, searching across the net, etc.

When a user connects to the Web server, the browser program downloads the text file containing the description of the first (home) page, followed by the files corresponding to any non-text elements. Since many of these non-text files are quite large, a fast modem or network connection is needed to work comfortably with the Web. Basic text-only browsers somewhat overcome this problem by downloading only the text files and displaying a simple place marker to indicate the existence of another element.

The markup tags (codes) in the example below control the way in which a browser program will display the text and other elements on the screen. Even though some browsers allow the user to set preferences for text size, etc., files will be displayed similarly regardless of the computer platform. Everything displayed between the <H1> and </H1> tags, for example, will be displayed using the user-set specifications for a Level 1 Heading and the tag designated a graphic for display.

```
<HTML>
  <HEAD>
    <TITLE>
      Lynn Zelmer's Home Page
    </TITLE>
  </HEAD>
  <BODY>
    <IMG ALIGN=bottom SRC="/pics/bann01.gif">

    <H1>CQU Academic Details</H1>
    <IMG ALIGN=bottom SRC="/pics/bann01.gif">
    <img src=/mc/pics/zelmer.gif><p>
```

Unfortunately, most Web page creators ignore users who lack multimedia systems, and/or who have slow modems or monochrome systems. Thus, even though it is possible to develop materials which are understandable without graphical elements, most Web pages depend upon such elements.

HTML Editors

There are many options available for producing HTML from using a simple text editor through to using proprietary programs such as Netscape Gold (Beta, requires Windows 95).

Web pages can be created using any computer tool which produces a pure ASCII text file. This includes simple editors as well as word processors. Alternatively, the text can be created using a Web authoring tool, such as Netscape Gold (requires Windows 95) which displays the HTML page as it will be on the system while editing the text file. Such tools are available for all of the common computer platforms from the WWW itself.

There are programs (and increasingly options within the word processors themselves) which convert existing documents to and from common word processor formats (Word, Wordperfect, Powerpoint, etc.). Otherwise, converting an existing word processed document into an HTML document is a time consuming and boring task as every paragraph change, etc., must be individually tagged. As well, common word processor functions such as indenting and tables cannot easily be replicated in an HTML document. Hopefully the next generation of word processors will all allow files to be saved as HTML text, just as good ones currently provide other cross-product and cross-platform 'save as' facilities.

Peter's Guide to 'good stuff' on writing HTML

Some URLs become stale very quickly, however, these were all active addresses at time of publication (mid-1996) and were primarily provided by Dr Peter Adkins of AHIA(QLD).

Introduction

A Beginners Guide to HTML (This is a beginners guide to producing HTML, the markup language used by the WWW):
<http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimer.html>

WWW FAQ:
<http://www.unimelb.edu.au/public/www-faq/index.htm>

WWW FAQ: Writing HTML documents yourself:
<http://www.unimelb.edu.au/public/www-faq/htwrite.htm>

Books about the WEB:
<http://www.unimelb.edu.au/public/www-faq/books.htm> (list of books on WWW publishing/HTML etc)

<<http://coombs.anu.edu.au/SpecialProj/QLTY/QtyHome.html>> is the home page for Dr T. Matthew Ciolek (Editor), *Quality, Guidelines & Standards for Internet Information Resources*, ANU, Coombs Computing Unit, Research Schools of Social Sciences & Pacific and Asian Studies, Canberra ACT 0200, Australia
 Scharf, Dean (1995). *HTML: Visual quick reference*, Que Corporation. ISBN 0 7897 0411 0

For more information continue here...

How to write HTML Files:
<http://www.ucc.ie/info/net/html.doc.html>

Help on Composing HTML Documents:
<http://www.willamette.edu:80/html-composition/> (Willamette University Guide)

Introduction to HTML:
http://melmac.corp.harris.com/about_html.html

The HTML Quick Reference Guide:
http://kuhttp.cc.ukans.edu lynx_help/html_quick.html Source = University of Kansas, Academic Computing Services

Composing Good HTML (Attempts to address stylistic points of HTML composition both at the document and web level.): <http://www.cs.cmu.edu/~tilt/cgh>

HTML Editors and Tools

WWW FAQ: HTML editors:
<http://www.unimelb.edu.au/public/www-faq/htedit.htm>

Word Processor Filters (This outlines which software packages transform from word processing formats to HTML and vice versa i.e. transfer from Powerpoint to HTML, transfer from Word 6, Wordperfect to HTML and the reverse. Provides a list of contacts.):

http://www.w3.org/hypertext/WWW/Tools/Word_proc_filters.html

Introduction to forms within HTML:
<http://kuhttp.cc.ukans.edu/info/forms>

Fill out forms (Returning information to the server):

<file:///SDG/Software/Mosaic/Docs/fil-out-forms/overview.html>

Reference material

The Official HTML Specification:
<http://www.w3.org/hypertext/www/MarkUp/MarkUp.html>

A Description of SGML:
<http://www.w3.org/hypertext/www/MarkUp/SGML.html>

An Information Providers Guide to HTML:
<http://www.vuw.ac.nz/~gnat/ideas/www-html.html>

General information about HTML:
<http://www.w3.org/hypertext/WWW/Markup/Markup.html>

Cerns Style Guide for On-line Hypertext:
<http://www.w3.org/hypertext/www/Provider/Style/Introduction.html>

HTML Reference Manual:
http://www.sandia.gov/sci_compute/html_ref.html (Comprehensive list of HTML Elements)

HTML Elements (Outlines what the various HTML commands mean and contains the full set of HTML in alphabetic order.):
http://www.sandia.gov/sci_compute/elements.html



Computer Security

The introduction of computers into the ward is relatively new, despite computers being involved in the accounting and payroll departments of hospitals for many years. The new technology brings with it a need to ensure that there is at least the same level of privacy and confidentiality as existed with the paper record systems being replaced.

The aim of the System Administrator must be to ensure that staff have easy access to required information while ensuring that unauthorised persons are unable to access that information. Unauthorised access has several implications, at least some of which are a crime in most jurisdictions— theft of data, theft of programs, damage to the computer system, and the invasion of private data records—requiring both physical and technical considerations.

This introduction to security on the ward is adapted from a paper by Lois Shambrook. The following Primers provide implementation details and tips.

Physical Security

Physical security predominantly relates to the physical location of the computer or work station. Central computer facilities are usually relatively secure, however, work stations located on the ward are often in plain view of any person walking nearby. Although this may be convenient for the health care worker, it allows easy access for unauthorised persons when the device is left unattended.

While the ideal location for the work station—based on security grounds—is away from public view in a separate locked room, this is not always practical. An alternative is to place the work station in a position that denies casual observation, perhaps behind a screen so that the system is not as obvious to outsiders.

Technical Security

The principal components of technical computer security are: access control, audit trails, change control, care and disposal of media, and transfer of data to and from the system. (DoD 1993)

Access Control

Access control is required to:

- prevent unauthorised use of a system,
- identify users so they can be accountable for their actions, and
- control the access of users to information and programs.

There are many ways in which to prevent unauthorised access to a computer system, but the most common form is the use of a password. Requiring a password when logging onto the computer or when requesting a higher level of access, ensures access to authorised staff only.

Software is available to manage the password function but staff must also be instructed on the importance of their password and the consequences of it being released. See the Primer which follows for tips on password selection and use.

There are hardware options involving a physical key (key, magnetic stripe card, or dongle) or a biometric scanner (fingerprint, palmprint, retina or ear

scan) which effectively replace the password. These are more expensive and have greater potential to annoy staff or to be lost or misplaced.

Many solutions include screen blanking—when the keyboard is locked or unattended for a specified time the screen will turn blank or be over written with a graphic. This ensures that information is not left visible when the computer is unattended provided a password or key is required to reactivate the display screen.

Provision must also be made for the secure handling of computer printouts.

Audit Trails

Audit trails provide a record of the every user's name/id, what action they performed and when they logged on and off. Audits allow the System Administrator to determine if there have been unauthorised/uncharacteristic accesses and the load upon the system. The knowledge that audits are kept reduces the tendency for staff to wander through the system.

Change Control

Users can be given read, write, and execute access. Read access allows the user to read information without making changes; write access includes both reading and changing the information, while execute access allows the user to invoke facilities such as printing.

Pay clerks, for example, do not require access to patient records, yet they need access to payroll information. Even a very informal system should require a different password for each such function. In the best systems the level of access is determined by the permissions associated with a user id and are password controlled, either when entering the system (poor but more transparent) or when entering a particular level of the database or program (best but often annoying).

Once files are placed in an archive they require read-only protection to ensure that they are unable to be changed at a later date. This ensures that the patient records remain true and accurate as legal documents and can be achieved by writing the data to CD-ROM or other write-once media.

Care and Disposal of Media

This refers primarily to the storage of magnetic media, ensuring its security, and the disposal of paper-based information. Removable media (diskettes, etc.) should not be allowed at a ward-based work station. The system administrator's control of the file saving functions should ensure secure back up and archive control.

Conclusion

The open working environment where computers are often found in hospitals and clinics makes it hard to ensure that only authorised people can access the system. Strong physical and technical methods are therefore required to ensure data integrity, security and privacy.

As most healthcare staff have little, if any, computer background, technical controls need to be as transparent (invisible and automatic) as possible to be acceptable to the user. Management also requires that systems be cost effective; a password protection system is the most popular method way to meet this requirement. The extra security of audit trails and change controls can often be achieved by the System Administrator without involving the user. Ultimately, however, security depend upon the cooperation of the user.

Notes and Acknowledgment

Department of Defence (1993). *Australian Defence Force Communications and Security Instructions*.

This introduction is adapted from a paper

prepared by Lois A. Shambrook for 85132 Information Systems II at CQU. That paper originally included a study of a hospital using nursing level computer work stations.

Security Guidelines—Small Systems

The Guidelines outlined in this section are appropriate for organisations with small PC-based and stand-alone systems (general practitioners, clinics, small hospitals, laboratories, etc.). The organisation should also ensure that these minimum guidelines are respected for any external system that may have access to the system resources of the organisation (eg. remote modem access by staff, laboratory results systems, etc.).

Administration and Organisation

The organisation operating a small system should adopt a written Security and Privacy Policy concerning the collection, processing, maintenance, retention, reproduction, destruction, storage, communication and release of data.

The organisation should designate one individual who will be responsible for ensuring that prudent security practices are maintained.

The individual responsible for security should be consulted whenever there are additions, changes or deletions to the hardware/software/communications configuration of the system and/or the network to ensure that security requirements have been addressed.

The organisation should conduct a Threat Risk Assessment on an annual basis.

Contingency plans for system failure or destruction should be established.

Procedures for dealing with security incidents should be established.

The organisation should establish conditions and procedures for the access and release of data to staff/other practitioners/clients and third parties.

Data must be accurate and current. Every reasonable step must be taken to rectify data that is inaccurate or incomplete.

Note: Corrections to computerised data should never delete or overwrite the original entry. The correction should append the revised data to the original entry, together with information identifying the individual who is making the correction, the date and time of the correction.

Personnel

Prospective employees who may collect, access or otherwise use data should be screened for appropriate knowledge of information principles and demonstration of appropriate practice relating to information issues, confidentiality and security. Reference checks and security clearances should be undertaken when appropriate.

As a condition of employment, each employee should sign a witnessed and dated 'pledge of confidentiality and privacy' indicating that they have been made aware of the small organisation's Security and Privacy Policy and the consequences of breaching the Security and Privacy Policy.

Employees should attend a small computer systems security awareness program that includes information concerning the security vulnerabilities associated with the use of small computer systems.

On termination or transfer of employment, the small organisation should:

- revoke access privileges (eg. user-IDs and passwords) to system and data resources,
- retrieve sensitive material including access control items (eg. keys and badges), and

- retrieve small systems-related hardware, software and documentation.

Physical and Environmental

The organisation should implement measures to secure the physical area containing data and computer equipment.

Examples:.

Entrances to areas containing data, hardware or software should be protected with secure doors and locking hardware.

Walls of rooms containing data, hardware or software should be constructed from the real floor to the real ceiling (eg. slab to slab).

Access to areas containing data, hardware or software should be restricted to authorised personnel.

Access to the areas containing data, hardware or software should be secured in the absence of personnel authorised for the system.

Surveillance methods, such as motion detectors and alarms, are implemented for the areas housing the equipment.

Removable media (eg. diskettes, magnetic tape) which is used to store data should be stored in a secure container when not in use (eg. fireproof safe rated for storage of computer media). Where confidentiality is a concern, the data should be encrypted.

Printer ribbons and cartridges, laser printer cartridges, and carbon paper should be:

- physically secured and controlled when the printer is left unattended;
- disposed of in an approved manner (eg. by burning or shredding); and
- suitably protected, including inventory control, while awaiting destruction.

Arrangements should be made for the disposal of hardcopy waste containing data by such means as shredding, mulching or burning.

Data contained in magnetic or optical storage media (eg. hard disk, floppy diskettes, magnetic tapes, optical disks) should be destroyed by such means as overwriting, degaussing or burning.

Hardware

An inventory of all system components should be maintained indicating model numbers, serial numbers and other unique identification numbers, the location, and the individual responsible for the equipment.

A hardware configuration chart should be developed and maintained.

Hardware maintenance personnel should be supervised by an employee of the small organisation .

Where equipment maintenance requires the exchange or release of components (tapes, disks, diskettes, memory, EPROMS) which may contain data, those components should not be released to the vendor unless the data has been erased or encrypted.

Power surge suppressors and uninterrupted power supplies (UPS) should be installed in those localities which have a history of frequent significant power fluctuations.

Where static electricity may affect the integrity and reliability of the data and programs processed and stored on the equipment, anti-static devices should be installed.

Records of all hardware modifications, configuration changes and maintenance activities should be retained for a period of one year.

To detect and prevent small systems from being infected by computer viruses, all newly acquired hardware, or hardware returned from maintenance, should be scanned for the existence of viruses.

Communications

For local area networks, a configuration chart of the current data communications should be maintained.

Where sensitive data is processed or stored on a system, or on a system which is part of a network, all communications with that system or network should be controlled. Where the local area network is connected to public networks such as the InterNet, it should be protected by means of a firewall.

Where unauthorised access is a concern, all unsuccessful system access attempts should be recorded and reviewed.

When transmitting data where data integrity is a concern, an integrity code should be included with the data to verify that the data has not been altered during transmission.

The following steps should be taken when transmitting personal (including personnel) data or sensitive university related data by facsimile:

- The receiver should be notified by telephone that the data is being transmitted.
- The receiver should stand by to receive the data.
- The sender must take the utmost care to assure the accuracy of the fax numbers dialled.
- The sender should transmit a cover sheet to accompany the personal (including personnel) data or sensitive organisation related data. The cover sheet should contain the following:
 - name, address and phone number of the sender;
 - name, address and fax number of the receiver;
 - number of pages transmitted;
 - a notice that the data is confidential and is not to be copied or released without the prior written approval of the sender;
 - the purpose for which the data is provided.
- Where there is frequent transmission between two points, or where faxes are sent to a fax mail-box, transmissions should be encrypted.

Cellular telephones and other radio frequency communications should not be used for voice, facsimile or data transmission unless the data is required urgently and no other alternative is available. Data transmitted over analogue cellular and other radio frequencies should be encrypted.

Data transmitted by electronic mail or electronic data interchange (EDI) should be encrypted.

Software

All acquired software should be examined for viruses, logic bombs or other extraneous malicious features.

The organisation should strictly enforce the conditions of software licenses, and respect software copyright requirements.

A current inventory should be maintained of all software (copyrighted/licensed/developed) and important (or shared) data.

Where the user identification is authenticated, the user authentication information (passwords, etc.) should not be displayed, and should be protected from unauthorised access.

At the time of initial system access, the user should be informed of the date and time of the last successful log-on and any subsequent failed log-on attempts. The system should display a banner indicating that the user has accessed a private and restricted system, that all usage will be monitored, that all communications such as data and e-mail are not considered private, and unauthorised activity may result in prosecution.

If a user recognises that an unauthorised access attempt has been made using their user ID or password, the user should report the incident to the individual responsible for security and privacy matters.

A system development life cycle (SDLC) methodology should be implemented where custom software or modifications to commercial software packages are developed for the small organisation. The SDLC should ensure that:

- security concerns are addressed,
- test criteria are met prior to implementation of operational software,
- change control procedures for operational software are implemented, and
- discrepancies for all data and software are reported, monitored and resolved.

Operations

A physical inventory of all storage media containing data should be carried out at least annually.

Where user identification and authentication mechanisms are used, procedures should be implemented which:

- Control the issue, change, cancellation and audit of user identifiers and authentication mechanisms; and
- ensure that authentication codes or passwords are:
 - generated, controlled and distributed so as to maintain the confidentiality and availability of the authentication code;
 - known only to the authorised user of the account;
 - pseudo-random in nature or vetted through a verification technique designed to counter triviality and repetition;
 - no less than five characters in length;
 - one-way encrypted;
 - excluded from unprotected automatic log-on processes; and
 - changed at least annually.

Backup copies of the essential information should be taken at regular intervals and stored at an offsite location.

System display units and hardcopy production units should be positioned or equipped with protective material, eg. limited vision screens or printer covers, such that the data displayed or processed cannot be readily viewed by unauthorised persons.

Users of a system or network which processes data should be uniquely identified. This identification should be authenticated prior to users being given access to the system and data resources.

Where equipment is to be removed from the premises on a temporary basis, control procedures should be implemented and include:

- the approval authority,
- the identity of the borrower,
- the equipment identification,
- a signed acknowledgment of acceptance and return of equipment, and

- a requirement to sanitise (electronically—remove all files, etc.) the equipment before and after the loan period.

The contents of erasable media should be obscured using an approved technique before the media is re-used.

Automated and/or manual controls should be implemented to prevent unauthorised copying, transmission or printing.

Where data integrity is a concern, control procedures should be implemented to:

- ensure data to be entered or processed has been duly authorised,
- verify the accuracy of the data,
- retain the identity of the individual(s) who authorised and entered the data, and
- maintain an audit trail of transactions entered on the system.

The system should maintain a log of all security-relevant activities on the system, eg. logins and file accesses.

Procedures should be implemented to ensure that critical operational material and media resources are identified on a continuing basis to enable restoration of the minimum essential level of service following the loss of equipment or service.

To detect and prevent small systems from being infected by computer viruses, the following precautions should be observed:

- all media received from external sources, including licensed or copyright software, should be scanned for the existence of viruses,
- all original master copies of software should be stored on media with the write-protect security feature activated, and
- computer systems should be scanned for the existence of viruses after software and hardware maintenance.

A contingency procedure should be developed detailing the course of action to be followed when a virus attack is suspected.

Risk Assessment

Risk assessment is the process of examining a system and both determining vulnerabilities and assigning priorities. Risk assessment includes identifying assets (preparing inventories—data, hardware, software, and people) and assessing each asset for potential risks, the likelihood of that risk event occurring, its impact, and the consequence of the event upon the organisation. High risk events require immediate attention and safeguards, medium risk events require attention and safeguards in the near future, while low risk events should receive attention as good business practice dictates.

Acknowledgments

This Primer has been adapted from *Guidelines for Computer Security at CQU* (Zelmer, 1996), which was itself adapted, with permission, from *Security and Privacy Guidelines for Health Information Systems* (COACH, 1995). Both *Guidelines* are primarily oriented towards larger systems but include additional details of threat risk assessment, etc.

The original COACH document, *Security and Privacy Guidelines for Health Information Systems*, is highly recommended for healthcare institutions, large or small (and is very reasonably priced). Contact COACH, c/- Healthcare Computing and Communications Canada, Inc., Suite 216, 10458 Mayfield Road, Edmonton, AB T5P 4P4, Canada.

Security Tips—E-mail: The electronic postcard

E-mail (electronic mail) is the modern equivalent of the postcard. Inexpensive, quick, and easy to use, e-mail provides a communications link for academics, researchers, and general public alike worldwide.

E-mail facilities are one of the basic services provided by many hospitals, universities, government agencies and business organisations. Individuals and smaller organisations obtain e-mail access through commercial 'service providers' who lease or own network facilities which connect to the Internet and other networks.

The Postcard

A postcard is a fairly public document and, unless written in a code or foreign language, can easily be read by any one who happens to see it.

E-mail is also very public. E-mail messages are normally transmitted using a computer code which corresponds to plain English text. This is the same whether the messages are transmitted over a closed network or sent via modem over the telephone lines. Anyone with the appropriate equipment can read an e-mail message.

E-mail also has a number of very convenient features which allow it to be sent to a large number of readers just as easily as to a single reader. It is all too easy to send a personal message to the whole staff or to a list-server instead of the intended recipient. It is just as easy to forward a copy of a received e-mail message on to other individuals or groups.

The Postperson

There are plenty of jokes about the postman who reads all the postcards in his mail before delivering them but the reality is that most postpeople are far too busy to read the mail which passes through their hands. As well, we ensure that confidential communications cannot be easily read or tampered with and post them in a secure mail system.

The same situation occurs with e-mail. It is possible for system operators, administrators, and others to read e-mail as it passes through the system just as is possible for them to read the data and other files on most computer systems. Fortunately, just as with postpeople, computer operators have earned our trust and are usually too busy to read our e-mail in any event.

The Risk

The user of any system is responsible for assessing the risk and reacting accordingly. To make an organisation's e-mail system secure would require an investment of many dollars in encryption facilities, would likely slow the system down to an unacceptable speed, and would require recipients of your e-mail to have appropriate software to read the encrypted messages.

Using E-mail

Responsible communicators use an appropriate service for the type of message being sent. E-mail works well for quick and informal messages. Secure postal systems and/or encryption should be used for confidential messages. Staff using and handling e-mail, just as with staff using and handling regular mail, also need to be made aware of their responsibilities as trusted carriers of personal and corporate communications.

Security Tips—Password Use and Selection

There are a variety of ways of protecting the data in any system. Controlling who has access to the data is often the first, closely followed by controlling where and how the data is stored, then by controlling when and how the data can be modified.

Computerised data systems often employ all of these controls but providing access control through the use of passwords is the most common. Passwords are a sequence of letters, numbers, and special characters which act as a key to give individual users access to computer services such as electronic mail.

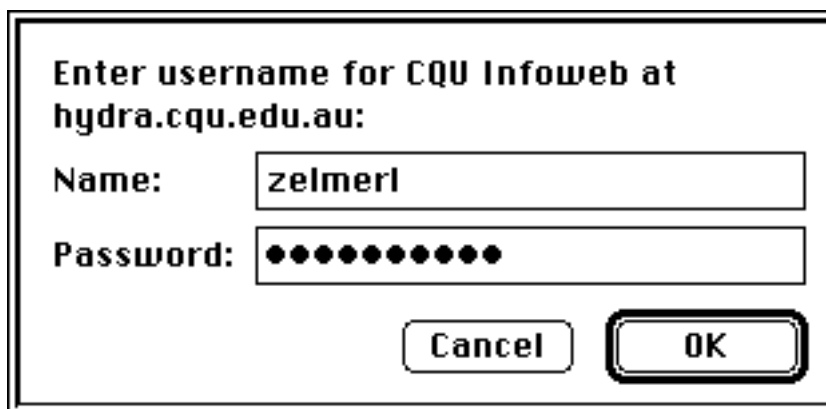
Unfortunately, passwords, like bank card PIN codes, are inherently unsafe. Even if the password has been properly selected, it still runs a risk of being stolen or otherwise lost and misused. Anyone who discovers your password has access to anything you have access to on the computer system.

It is important, therefore, to select a password properly, update it regularly, protect it as well as you can, and notify the proper authorities (usually your system manager) when you suspect that it has been compromised or lost.

Preventing loss

Preventing someone else gaining access to your accounts via your password is basically a matter of using common sense:

- Choose your password sensibly (see below) and change it regularly, preferably at least every month
- Do not write your password down in a recognisable form
- Do not let anyone see what you are typing as you enter your password
- Do not give anyone else access to your account and, if you must, change your password immediately after the abnormal access is completed
- Report any suspicious or abnormal operating circumstances to your system operator



Enter username for CQU Infoweb at
hydra.cqu.edu.au:

Name:

Password:

Selecting a Password

Use a combination of normal letters (a-z, 0-9) and special characters such as @#\$%^&*()_, etc. If alphabetic characters are case sensitive (upper and lower case letters are considered to be different) on your system you should use a combination of upper and lower case letters plus the other characters.

The password should be easy to remember--you should not have to write it down, at least six characters long (note that some systems ignore anything more than 8 characters), and quick to type so that people will find it hard to guess your password by watching you type in your password.

Use combinations of words with punctuation marks separating them, uncommon phrase acronyms or lines from a song. These should be easy to remember, but hard to guess. (ie ev_re.1, sounds like everyone,)

Avoid anything which can be easily guessed about you (names, dates, etc.)

Avoid words which can be found in a dictionary (any language)

Never use the same password twice or an easily guessed sequence such that someone would know your current password if they knew an old password

Very simple methods have been found for thinking up passwords. Numeric characters can be somewhat difficult to include, but a special number can be used to prefix or suffix a password. For example, if you are in your twenties, you could put a 2 before or after your password (unless you are trying to forget how old you are).

Some other methods include:

- A song line (Everybody knows the dice are loaded can become Ektdal2)
- A song title (Eagle Rock could become Eagl_Rok2 or Eag.Rok2)
- An album title (Hotel California could become Hot.Cal2)

The list of possibilities is endless: Book Titles, Authors, Rock Stars etc.

These methods often result in a password which is easy to remember. If you use the author of a book, all you have to do is have the book in a certain place on your shelf. You could even put a post-it note on the spine without writing on it so you know which book it is. The same method can be used with albums or even the title of a newspaper article on your wall.

Acknowledgments

Some of the specific guidelines on password selection were summarised by Brett Carter

(CQU) from Jones, David (1995) *An Introduction to Unix System Administration*.

Security Tips—Making Backups a Regular Routine

Computer systems are totally dependent upon relatively volatile media for storing data. Most of the common data storage devices (floppy diskettes, hard or fixed disk drives, and tape backup devices) rely on magnetic media and are affected by stray magnetism, heat and sunlight. Magnetic signals also deteriorate with time, even under the best storage conditions.

Most storage devices also depend upon relatively fragile mechanisms which can easily go out of alignment and regularly cease to function because of a disk "crash" (the read/write head on the device scrapes the magnetic surface, causing a scratch in the recording media) or an electronic failure. With a hard drive, for example, the question is not 'Will it fail?' but rather 'When will it fail?', and relative cost is usually a fairly good predictor of reliability. Computers, peripherals, and supplies are also prone to theft.

What Risk?

There is little risk of losing system software and application programs provided you made a backup copy of your original disks at time of purchase and have stored both originals and backup copy in separate secure locations. At the very worst, software can be replaced by purchasing new copies. Data files and system customisation files, however, are typically either expensive or impossible to replace. Imagine how much work would be required to replicate critical laboratory test results, or to replace the file containing your current patients, or to even replace your unique desktop configuration and productivity macros.

As a user you have a responsibility, therefore, to reduce the risk of data loss by regularly making backup copies of critical data and other important files.

Network Users

Most operations based on central computers—finance and administrative systems in a large hospital, for example—are backed up on a regular basis by your professional information technology staff.

Backing up your desktop computer files to a central computer may be as simple as copying critical files to your personal work space on the central computer. Alternatively, your network administrator may have a backup procedure, usually operating overnight, which uses the network connection to make a backup of specified files on your desktop computer's hard drive.

Unfortunately, central backups cannot provide you with a copy of the backup files if all files for the day are stored on one tape. Likewise, searching old backup tapes is labour intensive so it is not always easy or economical to recover lost files. Contact your network administrator for details.

Tape Drives

Some organisations use portable tape backup devices which can be temporarily attached to your computer for backing up your files. These devices typically connect through a SCSI or parallel port using a device driver (utility software) and proprietary software.

Unlike with a centralised backup system, you will normally receive (but may be required to pay for) the tapes(s) containing your files. Contact your network administrator or computer support staff for details.

Desktop PCs

Small organisations and individuals who primarily work with stand alone computers, or who do not have access to backup facilities, must backup their

files onto floppy diskettes. This is not difficult if you work in an organised manner and use backup software to automate the process. The backup software usually compresses the files and can save files across disk boundaries to minimise disk requirements.

Many computer users regularly copy their current working files to a floppy disk as a temporary backup strategy. At the very least, critical files should be copied to floppy disks for secure storage in case of loss, accident, or computer failure.

Paper Copies

It may seem silly to talk about backing up files onto paper in this age of 'paperless' offices but often paper copies made for other purposes can serve as emergency backup copies. For example, the printed copy of your annual income and expenditure statement which you prepared for the Tax Department can serve as a backup copy of your files.

Secure storage and disposal of paper copies must form part of your system.

Secure Storage

Backup copies of your critical data files are protected against loss of the original, however caused. It doesn't make sense, therefore, to store the backup files where they could be affected by the same incident (theft or disaster) that destroyed the original files.

Your central computer unit probably has a fireproof safe for backup tapes from the central system; you might consider similar facilities for securing valuables and/or storing backup tapes. Most small organisations and individuals, however, should make arrangements for their backup copies to be securely stored in a location away from their normal work place. An office of a colleague in another building might be appropriate.

Label all backup copies with a contents list and the backup date.

Remember that research and corporate data may have restrictions placed upon its use and access. Access to patient records, for example, is limited, and correspondence, research data (including transcripts of interviews), and administrative files (even drafts of reports) should be kept confidential. Backup copies of such data should be treated in exactly the same manner as the original data files.

Finally, Freedom of Information and related legislation may require you to keep proper records regarding the type and location of every copy of data files covered by the legislation.

Make it a Regular Habit

Backing up a 100Mb or larger hard drive onto diskettes can be a major chore unless you are organised. Typically, however, your hard drive will have only 10-20% devoted to data files. If you regularly make a backup copy of new or changed data files, on a daily or weekly basis, the task become quite manageable.

A good backup system will use more than one tape or set of diskettes. One set could be used for incremental changes on a daily or weekly basis, with another set used for making a regular but less frequent (weekly or monthly) duplicate backup.

The best backup system has no value if it is not reliable. Always double check your backups to ensure that files can actually be recovered.

Contact your network administrator or computer support staff for assistance.



Educational Applications

The Primers in this section emphasise the use of computers in education and training—preparing both paper- and screen-based products. The examples focus on the development of screen-based multimedia products, however, the same considerations—budgets, copyright, production technologies, etc., affect every computer-based development project.

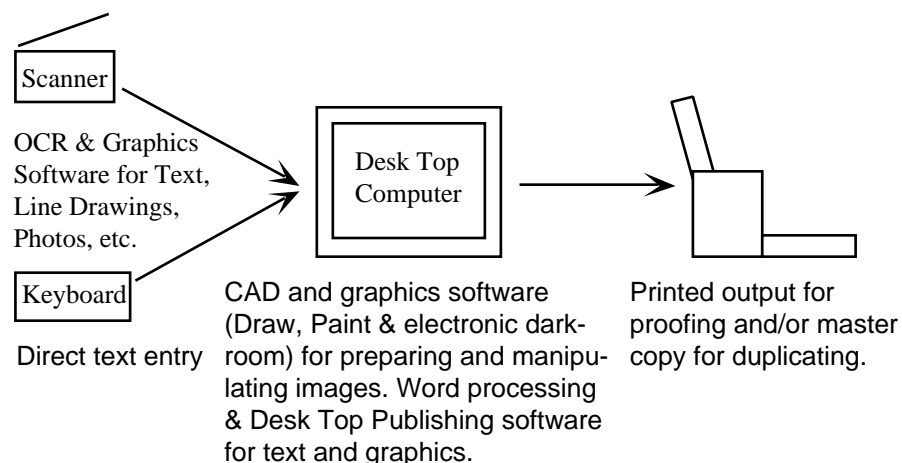
DTP—Desk Top Publishing or Desktop Editing?

Desktop publishing (DTP), the fastest growing application in the late 1980s and early 1990s, combines computer editing and printing to create print-like documents. While most word processors now incorporate DTP features, page layout programs provide support for consistent design and format for documents ranging from brochures and posters to magazines and books.

Unfortunately the software does not provide any assistance in actually designing a publication. Good design is still something that must be learned through training and experience. Thus while DTP publications may permit relatively low cost publishing, the results often look very amateurish.

Desktop publishing, is also somewhat of a misnomer—the time required for printing from the computer and the multiple copy cost on a laser or ink jet printer means that DTP is really DTE—desktop *editing*.

The computer (computer, scanner, laser printer and appropriate software) is used to prepare a master copy which is then printed and published conventionally. For many low cost publications, the photocopier is the primary printing device. High capacity photocopiers can produce several thousand copies per hour with minimal production costs and reasonably unskilled labour.



This Primer looks at basic techniques for desktop editing, particularly tips and techniques that will allow you to improve the quality of your desktop produced and edited publications.

Cost—Quantity versus Quality

A variety of copy processes have evolved for supplying inexpensive, copies for business and education. Today xerographic and similar processes are the most common, providing a good quality copy at reasonable price. The same basic process is used in both photocopiers and laser printers, however photocopiers typically produce better quality black and white copies faster and less expensively.

Some copiers (and laser printers) can produce a colour image but top quality colour images require proper printing processes and are still very expensive. ‘Spot colour’, the use of colour for emphasis, also generally requires a proper printing process (or else two passes through a copier/printer, one pass with a non-black toner cartridge).

Photographic quality images, in black and white or colour, are reasonably easy to edit on the desktop (provided you have the appropriate software and a fast computer with lots of memory). Producing an image on paper is still

difficult to accomplish at a reasonable cost with current equipment, although 600 dpi 'gray scale' laser printers are almost acceptable.

Reproduction quality is one of the major issues in low cost publishing. At the lower end of the scale we use a master copy printed on a dot matrix (ink-jet) or laser printer. This gives us acceptable quality for text and line art but is barely adequate for photographs.

We need to design our publications intelligently, using illustrations that fit the limitations of our production system. Since getting the next level of quality involves professional techniques and a major increase in expense, it is beyond the scope of this Primer.

What Do You Need?

The first task when selecting a desktop publishing system is to determine the type of publications to be produced. Complexity increases the cost!

Someone who intends to prepare training materials, local newsletters, simple sales brochures—black and white text and simple illustrations—will only need a word processing package and basic level hardware. Putting any extra time (your time to learn a new software package is valuable too) and resources into a good graphics (Draw or Paint) package will increase publication quality and productivity more than upgrading the hardware.

Materials that are primarily text-based will not even require significant hard disk or memory resources. Unfortunately, graphical software often requires extra memory and a faster processor, sometimes also a maths co-processor, just to run the program effectively. Graphic files can also require enormous amounts of hard disk space.

- If your computer will run the software, you can often make a greater speed improvement by upgrading the hard drive than by upgrading the computer's processor, unless you are working with large and complex illustrations.
- Local vendor support is often more important than price unless you live in a capital city. Your local computer dealer may not be able to repair your scanner when it breaks down, for example, but s/he likely knows where there is another machine you can use until yours is fixed.
- Adding photographs and/or colour significantly increases the complexity of the system required. Professional guidance is likely necessary to help you select an appropriate system of hardware, software, and outside services.
- Talk to one or more current users and try to get 'hands-on' use of particularly expensive pieces of hardware before you purchase. In particular, ensure that the combination of hardware and software will actually work together, particularly if you are working across platforms.

While 'needs' are very personal, and changeable, the average educator producing training materials and the occasional newsletter requires a set of tools that will easily and inexpensively produce documents with sufficient quality that the reader isn't distracted by the medium itself.

- Preparation of text and illustrations must be simple and quick.
- Hardware and software costs must be minimised and resources normally serve several purposes.
- The ability to vary fonts, and the size and style of text, is essential.
- The ability to combine text and illustrations on the same page and to make changes to the layout and design of the page is important.
- While we have learned over the last two decades to 'make do' with a black image on white or coloured paper, the ability to add spot colour would be highly desirable.

Computer based systems that include a scanner, a laser printer, a photocopier, and appropriate software will provide all of these requirements, except colour, at a cost between \$5,000 and \$10,000. As noted above, even spot colour is sometimes possible through the use of non-black toner cartridges. Unfortunately, such systems aren't cheap and can be quite wasteful (throw-away toner cartridges, etc.).

- Basic computer with normal graphic screen, adequate memory for graphical software (Corel Draw or Canvas type programs), a large capacity hard drive, backup facilities, and an optional modem or network connection to send materials to a service bureau or remote publisher.
- Word processing and desktop publishing programs; paint/draw/CAD program(s) as appropriate.



This illustration was prepared for screen use by scanning and manipulating a line drawing (see the Primer on Digitising Images), then adding colour. Unfortunately, while the illustration is still recognisable, it loses a significant amount of information when some colours, mostly brown and red in the illustration above, are converted to either black or white when preparing for monochrome reproduction on paper.

- Photocopier, preferably with the ability to incrementally resize images from approximately 50% to 200% (not at fixed stages), A3 to A3.
- Scanner with OCR and graphic scanning software, minimum 300dpi, preferably flatbed and gray scale or colour. A slide/negative scanner is also useful, but is more expensive and requires photo manipulation software (such as PhotoShop) for image capture and editing.
- Laser printer with minimum 300 dpi resolution and postscript capability.

The addition of a large display screen, colour capability throughout, and reproduction quality components (for producing glossy paper publications) will significantly increase the cost (to \$30,000++). Most serious users send their edited files to a service bureau to obtain highest quality (1200 dpi or better) output—including colour separations—when the output will be on glossy paper as reproduction quality hardware (eg: 1200 dpi printers) is too expensive for casual use.

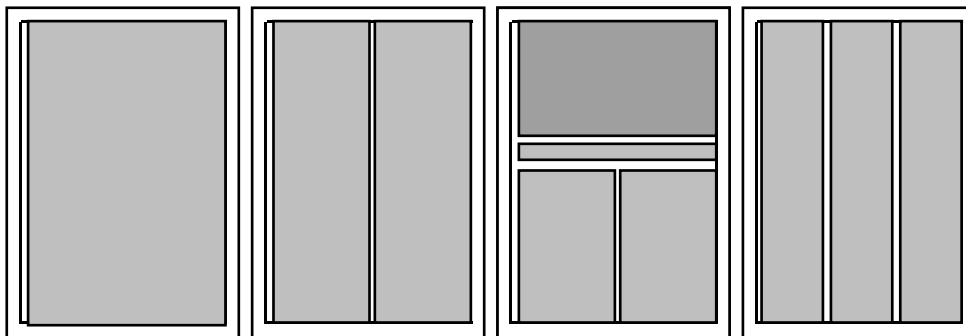
Layout and Design

The design of a publication combines the page size and layout (see typical page format illustrations), the typography (size and style of type) and illustrations, the purpose of the document, and the characteristics of the intended audience.

- A layout using two unequal columns on a three column grid with 11-12 point type such as in these Primers works well for training materials. The narrow column normally contains headings and 'teasers' for the text.
- A technical paper would also normally be printed in a single column layout, but on A4 paper with a 10 or 12 point font. The use of illustrations would be minimal and the layout would be quite formal. The small font size and the long line length results in a density of type that

makes such a document very hard to read, but a technical paper is designed for record purposes, not for casual reading.

- A reader for small children would probably be roughly A5 in size, use at least an 18 point serif font, and include many illustrations. Such a reader would probably have a single column layout fitting the large type size.



Page layout: one column, two column, one and two column mix for photograph and text, and three column grids

When computers were first used for DTP the only output devices had typewriter-style (monospaced), rather than proportional, typefaces. Today most computer systems have access to proportional fonts as well as different type sizes. Good design requires that we take this into account—as Robin Williams says in the title to her very useful style manual: ‘The PC is not a typewriter’.

Monospaced fonts should never be justified; the strange spacing of this paragraph demonstrates why. The rest of the text in this Primer is in a proportional font and could be justified if desired, although it still reads easier with a ragged right edge.

Lines, boxes, and choosing fonts are important, but leaving adequate white space—for interest and good design—is just as important when designing the page to attract, and maintain, attention.

Style Guide for Documents [Adapted from Williams, 1992.]

- Use only one space after periods and any other punctuation that separates two sentences.
- Use proper quotation marks—‘ ’ or “ ”—instead of ' ' and " ", marks which are more properly used for indicating feet and inches, etc.
- Use apostrophes (’), dashes (—), bullets (•), and other symbols, accented characters, etc. (™, ©, ®, £, ¥, ¢, °, ç, Û, Æ, etc.) rather than their typewriter substitutes.
- Start paragraphs with indents and style sheets, align text with tabs rather than the space bar, and keep indents and line spacing consistent.
- Keep the text simple. Avoid using more than two type fonts on the same page unless for a special effect, and use italics and bold text sparingly.
- Justify text only if the line lengths and type sizes allow it to work properly. In this Primer, for example, the right hand edge has been kept ragged, except within boxed text where justification normally creates a better appearance.

References

- Gosney, Michael et al (1990). *The Gray Book: Designing in Black and White on Your Computer*. Chapel Hill, NC: Ventana Press.
- Williams, Robin (1992). *The PC is not a Typewriter*. Berkeley, CA: Peachpit Press.

Computer-Based Learning Materials

Computer-Based Learning (also referred to as computer-based education, computer assisted learning—CAL, etc.), is a means of presenting educational activities using the computer. CAL materials may use any combination of teaching techniques including didactic, question and answer, simulation or problem solving. The best CAL materials use a combination of sound, text, graphics, animation, and other visual media, and provide the student with more involvement (interaction) than ‘page turning’ and multiple choice questions.

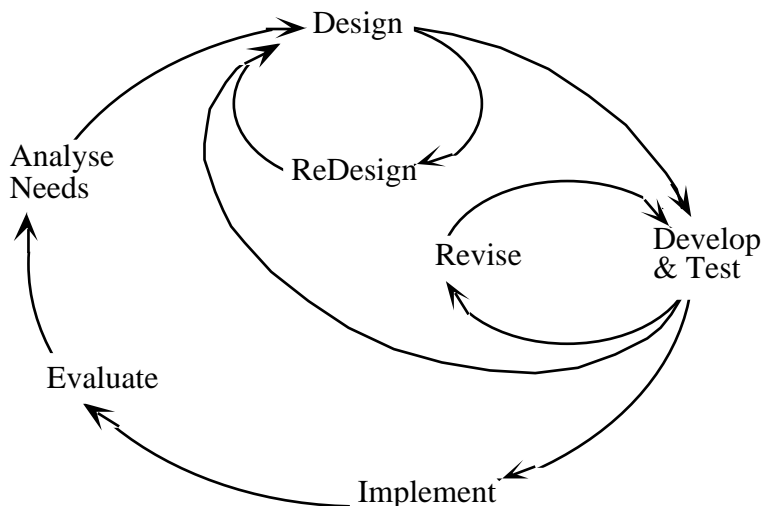
Preparing CAL Materials

Preparing CAL materials requires you to know:

- How students learn.
- What materials are to be presented using CAL techniques and where they fit in the curriculum.
- How the content should be presented for best understanding.
- How to use the development tools.

Unfortunately, many educators do not have instructional development skills, and even if they have skills related to the preparation of print or other materials, these skills may not be appropriate for computer-based training materials. The skills can, however, be learned.

The materials development process shown below is iterative: prepare some materials, test them through usage, and either revise those materials or prepare new materials with a better understanding of their use.

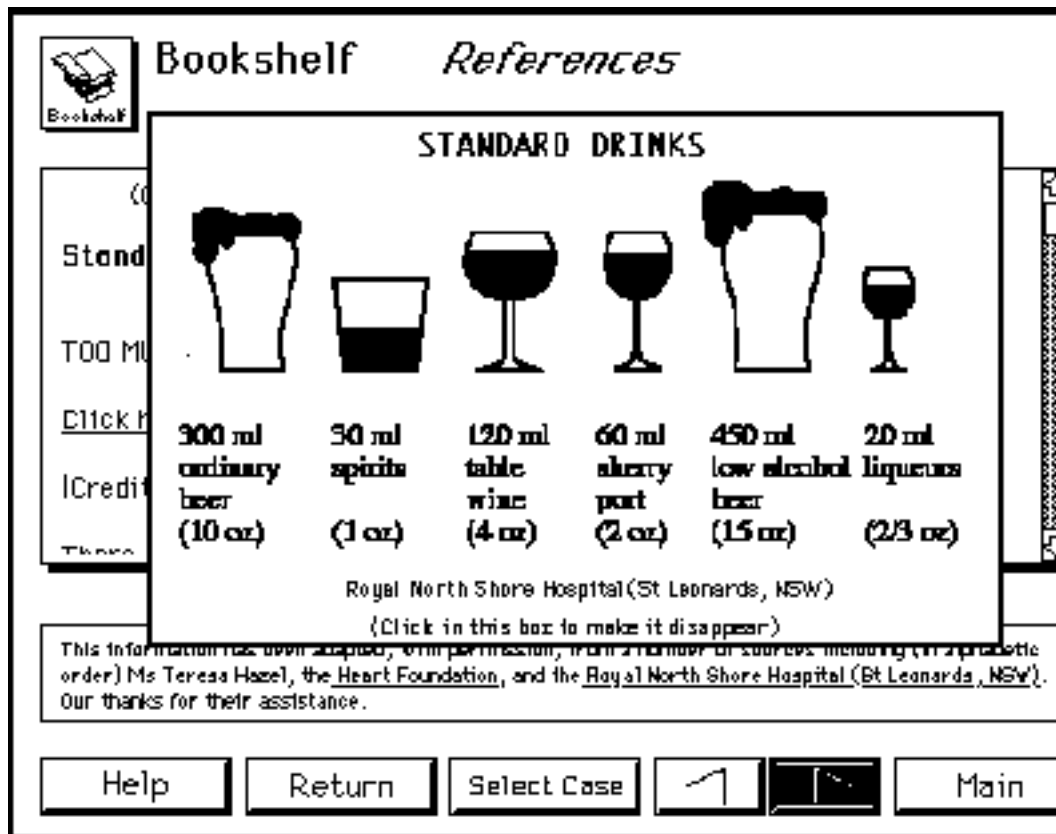


Analyse Needs: Setting the instructional objectives is the first step in designing resource materials whether for the computer or not. This involves, in part, answering questions like:

- What knowledge does the student bring to the activity?
- What is the purpose of the activity?
- What specific concept is the activity designed to reinforce?
- What level of competence is required from this activity and its prior lecture?
- How can the student demonstrate this competence?

Design: Once you know what is needed, you can brainstorm possible scenarios to achieve those ends. An effective case study, for example, requires an opening scenario or situation that ‘grabs’ the student's attention. This scenario is typically followed by knowledge or attitude testing questions; the student's responses to these questions may determine which questions, replies and other activities the student can subsequently access.

Always get several individuals, including prospective users to critique your work at every step. It is far easier to go back and redo the needs analysis or design before materials have been developed.



Screen design (above) for an interactive multimedia presentation with an information strip across the top and navigation buttons along the bottom. The inset illustration was selected through an on-screen prompt.

Develop: This stage results in a well-developed plan for progressing through the educational unit. It should include most or all of the content material, specifications for graphics and other materials, and directions for navigation through the instructional unit. At this stage, the unit could still be implemented using any one of several tools, techniques, or even media.

Implement: This stage converts the instructional materials into computer courseware, materials that can be directly used by the students themselves. Any special computer controls (sometimes using a programming language) that are required for successful implementation must be entered at this time. Graphics, animations, video components and other materials must be drawn, scanned into computer files, etc., and added at this time.

Spell checking, grammar checking, and similar quality control procedures must also be done before the materials are released to students.

The implementation stage must include extensive testing to ensure that the units function as planned, are consistent, and recover gracefully from errors. Since students are very good at finding all the problems within instructional materials as they use them, the materials should be as error free as possible before release to ensure that they assist rather than hinder learning.

Development testing can be very effective if volunteer novice users are given the materials and asked to work through them according to the prepared instructions. Observe their work and use their difficulties as a guide to immediately revising the materials.

Evaluate: Evaluation determines that the educational goals have been met in an interesting, reliable, and economical manner.

Development Team

An ideal CAL development team (or multimedia development team, for that matter) consists of content expert(s), instructional designer(s) and technical support staff (artists, programmers, typists, evaluators, etc.).

The best instructional materials result from several individuals working together to develop materials. Share your ideas with your colleagues (staff and students), assisting them in turn on their projects.

Many institutions have a technical staff employed for this purpose, perhaps in a centralised CAL unit (instructional designers, graphic artists, programmers and courseware developers). Final year 'Project' students and more limited faculty-based technical staff can also lead to successful projects.

Courseware Development Tools

There are many computer-based tools for developing courseware for both the novice and the professional. Macromedia distributes two of the most popular—and sophisticated—commercial tools: Director and Authorware. Director uses the analogy of a stage and actors to assemble the production, is very useful for presenting a melange of media types, and includes an integral programming language. Authorware is more of an instructional tool, is built around common computer-based learning activities (branching, etc.), and includes functions to keep track of student scores, etc. Both involve a significant learning curve to use effectively.

Many (including Director and Authorware) are relatively expensive; some have royalty charges based on the number of users who receive copies of the courseware generated.

Alternatively, some developers decide to develop their materials using a conventional programming language. While this is relatively easy with programming tools such as ToolBook, Hypercard, and Visual Basic, it is less easy, and often totally unproductive, using more traditional programming languages.

Selected Basic References

- This selection of articles is representative of pre-WWW resources and includes some of my favourites. More recent articles will be available in the journals indicated; a wide variety of books are also available
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Multimedia/Hypermedia

This Primer has been written to help the novice understand *computer controlled* multimedia and hypermedia applications. Some authoring and development information is provided to enable you to understand the limitations of each technology.

Multimedia commonly refers to both the presentation systems (as in a multimedia computer) and the presentation (content) of a computer controlled presentation containing a mix of text, sound, and pictures.

Hypermedia is a system of presenting information so that it can easily be accessed in a non-linear manner.

Multimedia Presentation Systems

A major limitation of current multimedia systems is the amount of equipment and cabling required. Can you imagine the difficulties facing a class of 20 students using interactive multimedia? Twenty computers, colour monitors, hard drives, keyboards, mice, CD-ROM drives, and headphones (do you want to listen to 20 different sounds being output at once?). Now add the required power points and access to a network!

To be effective, an educational multimedia system must

- be low cost,
- have good quality sound output,
- include text, pictures (video as well as still pictures and illustrations), and animation, and
- allow for interaction between user and presentation.

The ideal display system would be an inexpensive, handheld unit with a colour screen, sound (input and output if possible), a wireless interface with a 'lesson server' that holds the files required for the presentation and a network connection linking to Internet databases and other resources. As well, it needs to operate for 8-10 hours without recharging.

Current desktop systems do not come close, although Macintosh computers continues to be the best integrated.

There is no single type of multimedia presentation, even for edutainment.

- Teaching laboratories substitute interaction with a computer-based simulation, with video and sound, for previous patient examination and experimental work.
- Museums use realistic dioramas, with sound and smell, to give the viewer an impression of habitat and environment; science and technology exhibits often allow the user to manipulate the exhibits.
- Virtual reality is an attempt to create fully interactive environments, the ability to experience (and manipulate) an environment that isn't physically present (and may not exist except in a computer).
- HyperMedia techniques allow each viewer to 'navigate' a presentation on a unique path, following non-linear 'links' between concepts.

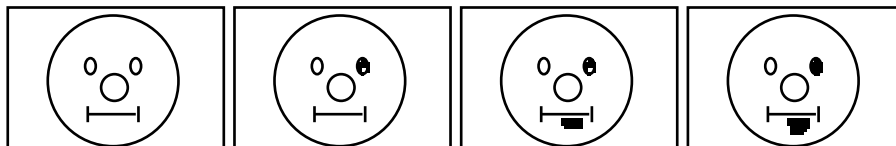
Courseware and Authoring

Courseware refers to the end product of an authoring process... the actual materials that students/patients see for their lessons. Such courseware might be organised with structured lessons, left open-ended as a resource to be explored like an encyclopedia or database, or presented as a simulation or animated sequence.

Authoring tools (specialised software) allow us to control the presentation (including testing the user at any time) and keep information on use.

A *simulation* is a tool simplifies reality. Some simulations (eg. chess) are very stylised; others, such as a computer controlled dummy for practising artificial respiration, can be quite realistic. Simulations are interactive and choices made by the user affect the outcome of the simulation.

Animation refers to a series of images (drawings usually) which change over time to show a process. For example, children's series of stick figures on the corner of successive pages of a book—flip the pages to see the figure move. Current technology, as seen in popular films, allows animation to be very complex and realistic—and even include live action.



A very simple animation sequence

Animation sequences are often used to simulate processes that would be too complex, too expensive, too dangerous, or too difficult using other means. It would be expensive, for example, to provide oscilloscopes and similar equipment to external (distance education) students for electronic experiments. Instead a computer-based lab simulation could be used, with animated sequences that simulate the test equipment, dials, etc. Social simulations are more difficult.

Creating and editing a multimedia production is very similar to the conventional process of movie editing, except that everything is stored and manipulated digitally.



A video player from a computer screen. The buttons across the bottom replicate the controls on a simple VCR.

CDs are an ideal storage medium for multimedia courseware, such as the images for student access required in an anatomy or pathology class. Compact, but with the capacity to store 120 minutes of video or thousands of individual images (text pages, graphics or scanned pictures) on a single disk, they can incorporate anything that can be put into a computer file—software to control the display as well as still images, video, and sound.

If a suitable collection of source materials exists for your needs you are indeed lucky. Purchasing a copy of the source (laser disk or CD) provides you with copyright permission for the use of the visuals on the disk—provided you don't make any additional copies. This isn't a significant restriction. Even if you are unhappy with the presentation software (system to access and manipulate the information on the disk), you will generally only want to develop a unique means of access to the disk, not copy the source information.

The real trick for the multimedia developer is to prepare materials that are useable today, but will still be useable tomorrow. This might include preparing courseware to run on a black & white screen, but using tools, and selecting options that will allow the same materials to be run on colour screens when available.

Hypermedia

The main identifier of a hypermedia document (hyperdocument) is *your* ability to browse wherever you desire within the information base(s) in an unplanned, non-sequential manner. Unlike a conventional document, the order of presentation has not been pre-determined, although the initial linkages between topics usually have been.

Some individuals have quite fixed ideas about the use of text, books and reading. For example, I recently talked with a student who couldn't do the hands-on tutorial exercise at the back of the textbook until she had read and understood the previous 15 chapters because, she said, 'A book can only be read from start to finish'.

That might be true for some books, but not all books are intended to be read from cover to cover. 'Coffee table' type picture books are intended to be browsed, collections of short stories and 'digests' are intended to be read in short spurts, and reference books (telephone directories, dictionaries, encyclopedias, catalogues, etc.) aren't meant to be 'read' at all, they are simply used to locate specific facts when required.

Hyperdocuments are designed to facilitate non-linear access to text and other materials.

Imagine 'reading' a report on a screen—as you read one sentence you realise that you don't know what a word means, so you 'click' on it and its definition appears. A few paragraphs further on, you read a statistic drawn from a recent government report—clicking on the reference brings up the page in the report containing the original table of data and a graph. Unhappy with this, you click on a portion of the table and shortly some background information appears. To get another view on the same issue, you then click on an icon that takes you to a dissenting opinion, click on another icon to see a video clip of the Premier defending the report in Parliament.

At several points in this scenario you place markers in the document(s) to allow you to easily find the information again—and you copy items into your own notebook (mark, cut and paste), complete with your own comments. At one point you also make a permanent note into the data file which, at your option can be publicly available to other users of the database(s) or private to you and/or designated users.

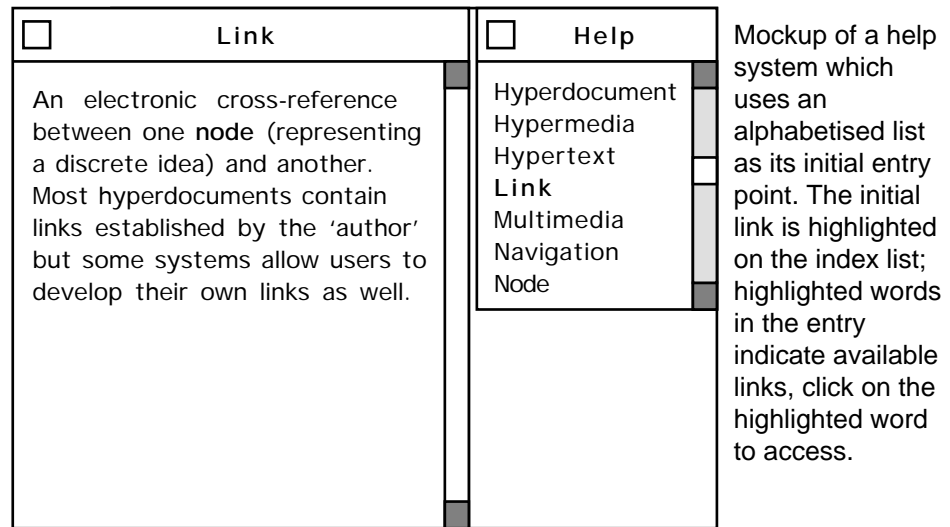
Obviously such a hyperdocument contains links to a variety of information formats—text, visuals, and sound. Equally obvious, such a document requires considerable planning and background resources. Not so obvious is the potential need for access to external databases, etc.

Navigation Problems

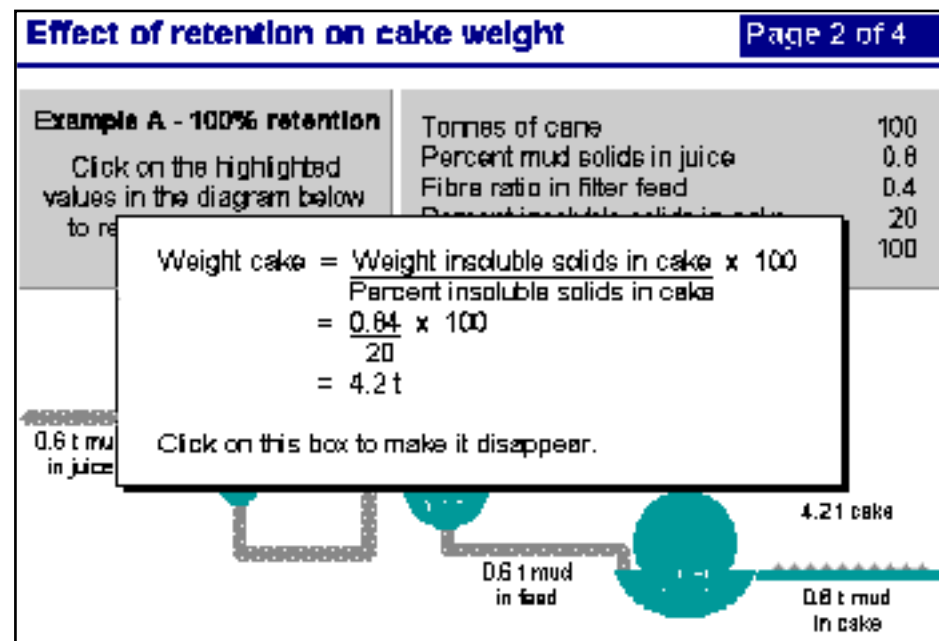
A paper-based document, while it forces us to read left to right and top to bottom, is also very flexible for the user—markers can be inserted or page corners bent over to mark location, coloured highlighters emphasise important points, and notes can be written in the margins.

Most readers are aware of how easy it is to become lost in a simple on-screen word processed document; getting lost in an electronic hyperdocument—*lost in hyperspace*, to use the jargon—is even more common. After moving through perhaps a dozen different *nodes* (pages, screens,

items, fragments) chasing an elusive thought it is often impossible to retrace your steps and/or remember why you started.



The user of an electronic hyperdocument needs built-in tools to keep track of progress and mark important materials. Many systems mark (using highlighting or possibly a check mark) index items when they have been accessed and automatically prepare a 'map' showing the nodes accessed and the linkages with other material.



Hypermedia presentation of a mathematical procedure.

'Hypertext is an attractive vision, but practical hypertext applications are hard to build. Disciplined approaches to analyzing information, identifying constraints in its structure and in the task environment, and using the appropriate implementation technology are required. Successful hypertext projects are those that take a cautious approach to problems of scale and that make the right tradeoffs along the way.' (Glushko, 230)

User Interface

All computer-based documents need to follow simple guidelines of consistency, ease of use, etc. If you are developing hyperdocuments, however, it is even more important to ensure that you have a good user interface—usually graphically oriented (highlighted text to show links,

mouse clicks to activate, etc.). The following suggestions are adapted from Hardman and Sharratt (1990).

- **Be consistent:** Structure the document so that the presentation is consistent for similar items and tasks; titles, buttons, and explanations are in the same place on every screen and are consistent in function.
- **Minimise the complexity:** Follow the KISS principle—keep the format, design, and content simple; avoid complicated actions or presentation.
- **Keep it balanced:** Hypermedia documents usually have a learning purpose; yet too many computer-based documents require more energy and time to learn how they are used than it takes to learn the content.
- **Keep it Flexible:** The document should be able to adapt to the users, not require the user to adapt to it. Flexibility includes letting the user add bookmarks, notes, etc.
- **Mirror the Task:** Present the information so that it is compatible with the user's tasks (information presented in the same order as required by the task, for example); use existing analogies from the task environment; have explanations and additional details available when the user can reasonably be expected to want/need/use them.

Presenting Text and Other Materials

The basic principles of clear writing are as important with on-screen text and illustrations as they are on paper. The following notes have been summarised from the literature and the author's experience:

- Keep text blocks brief and lines between 40 and 60 characters long.
- Use short sentences and short paragraphs.
- Avoid complex grammatical structures and jargon. Write in the active tense, use positive terms (do, not don't, etc.)
- Use spaced out lists rather than dense text.
 - Use a maximum of 6 bullet points per screen.
 - Use a maximum of two lines of text per bullet.
- Proofread and spell/punctuation check everything.
- Use appropriate illustrations, including hypermedia links and pop-up explanation panels to enhance understanding (see the math procedure screen on the previous page).
- Use san-serif fonts like Helvetica and Ariel because they are more readable on screen than serif fonts like Times.
- Use a maximum of three fonts and font sizes.
- Make your font sizes 14 points or larger. Make your illustrations large enough that they can be clearly viewed at a distance of 1 metre.
- Check your font and background colours for readability and eye comfort (blue on black, for example, is unreadable).
- Include some explanatory text (or audio track) with every illustration.

Selected References

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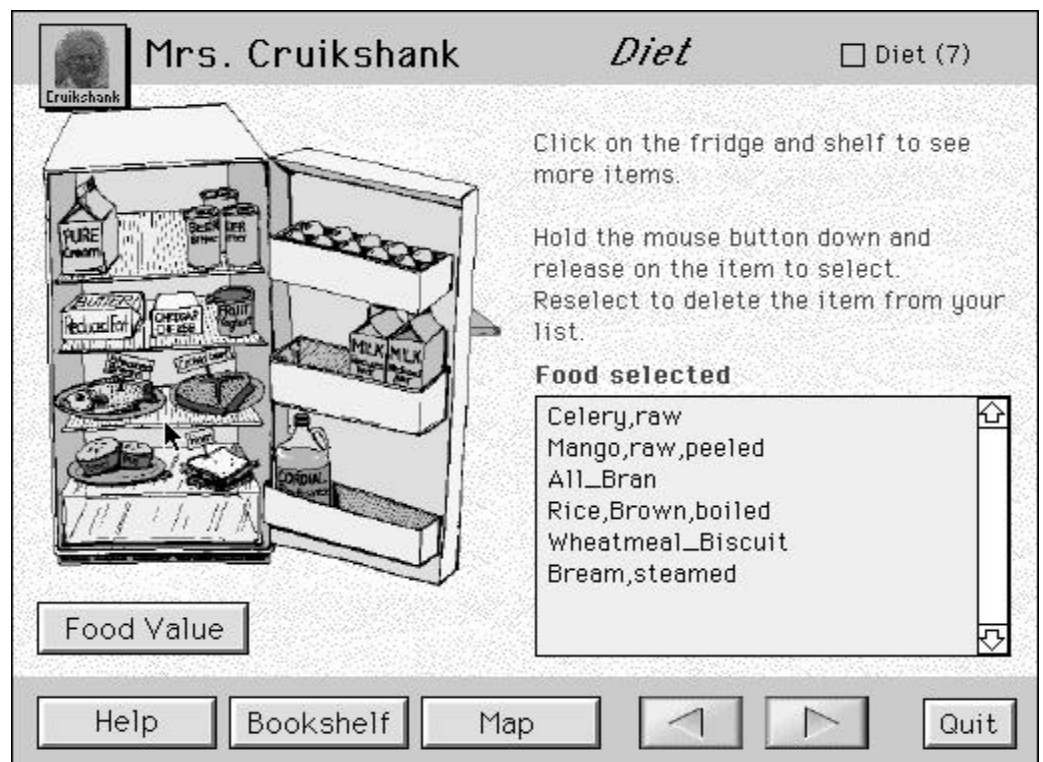
Interactive Multimedia—One Case

A C Lynn Zelmer

As multimedia products become more common, and as the line between education and entertainment blurs, it is difficult to decide whether a project is CAL or multimedia. A recently completed interactive package for diabetes education, for example, combines aspects of CAL, multimedia and hypermedia.

Each case study in the package, partially funded by CAUT (the Committee for the Advancement of University Teaching), includes a short video introduction, several problem scenarios requiring decisions and free text rationales for those decisions, and a reasonably extensive collection of resource materials which may be accessed through hypertext links or directly through an index.

The food selection in the screen below, for example, must be organised into a daily menu, then a calculation of the food values involved, and a comparison with an ideal diet. Both the Food Value and Bookshelf buttons take the user to reference materials



The project was developed using the iterative prototype process described in the Computer-Based Learning Materials Primer. It was slow developing because the project manager had failed to adequately allow for the lack of experience of the content expert and the programmer in developing non-linear interactive learning materials. As managers we often accept verbal assurances of understanding at face value; this project demonstrated the necessity to verify such assurances and to provide training programs and even trial exercises, as appropriate.

This project also demonstrated some of the difficulties which arise when technology is changing rapidly. The package was designed (and budgeted) for development using Macromedia Director and for distribution on CD-ROM. With hindsight, it might have been more appropriate to design the materials so that they could have been distributed via the World Wide Web.

Budgeting

A budget for a computer-based production follows the general rules for budgeting any media project. The budget must include both time and financial constraints, specifying all the resources necessary for the efficient completion of the project.

Most costs are fairly obvious—labour, supplies, equipment, etc. Other costs may be less obvious, the ‘on-costs’ for staff wages or the cost of replacement staff for the subject matter experts involved, for example, and others may be unanticipated—the lost time resulting from a rainstorm during a videotaping session, for example.

Some costs appear to be flexible. You can sometimes, for example, lower the apparent costs of labour by doing more of the work yourself, however, that cost will eventually be allocated somewhere, often in late deliveries and overtime to catch up on your routine work.

Within publicly-funded institutions we often ignore our own labour and other real costs of a production. The results can be catastrophic—even a well budgeted project, for example, can (and often does) end up costing several times the amount of outside funding received. The institution has to bear these costs, usually by requiring staff to undertake extra work and by diverting monies from other, more carefully planned, projects.

Estimating Costs

Experience will provide the best estimates of costs for a subsequent production. When you lack experience you must become very familiar with projects conducted by others within your organisation and other similar projects. This knowledge can usually be gained by asking for help from more knowledgeable individuals.

Familiarity with general industry pricing is also essential. Budgets often have to be prepared months and even years prior to the actual expenditure. It is critical, therefore, to know industry pricing trends. If equipment, for example, has been on a general downward price spiral it will be possible to use a current price and expect to be able to purchase the same or better equipment sometime in the future. Wages and related taxes and costs, however, usually rise over time, and it would therefore be very stupid to ignore the possibility of a wage rise in preparing a budget for several years into the future.

Wages/Staff: General wage scales are available for almost any type of work within an institution. The trick is to know how much time a particular task will take (see below), and what level of staff (either within the organisation or by outside hiring) can be expected to undertake the work.

Since flexibility is essential, I usually budget—and often pay—for a higher rate if two different categories might both be applicable. For example, I often pay a lecturing category of wage for general research duties because this rate also allows me to assign the individual general planning, support, and presentation duties.

The two most forgotten categories of labour when budgeting are replacement costs for your own time and general support for your project-related administrative duties (typing, filing, scheduling, etc.). Don't expect your colleagues to be happy working overtime because you forgot to include such costs in your budget.

Time and resources must also be allocated for recreational leave, staff development, staff meetings and other activities not directly related to

achieving the project's goals. Staff may also become a resource for other projects once they have been trained on your project, further affecting your schedule and budget.

Hardware: Budgeting for the costs of computer hardware requires determining the requirements for both production and delivery.

Your professional staff will always want the newest, fastest, and the 'best' equipment—and can argue most persuasively for it on professional and technical grounds. While their arguments may be valid, their arguments are often based on prestige and ego grounds, particularly for a highly visible technology project.

One of your tasks will therefore be to determine what level of hardware is actually required—both for efficient production of the required materials and for the delivery platform.

- What delivery platform is really required? What additional hardware will be required for user testing?
- What production equipment is really required? Which production steps can/should be contracted to specialist outside suppliers—CD-ROMs, for example. Will it be easier and more economical, for example, to develop materials on one platform (Macintosh?) and then convert it to another (DOS, Windows?) for student delivery?
- What back-up or archival facilities will be required?

Software: Software costs will be one of the most important items in any computer-based project budget. First, you must budget for software to produce the required materials; second, you must budget for royalty and other costs for using/distributing the materials.

Remember, software is seldom free. In particular, a license is normally required for each copy of a software product used on more than one computer.

Wetware: Wetware is a jargon term for people, in this case the costs related to non-staff people involved in the production—copyright clearance and similar expenses.

This category includes music royalties (sheet music fees, usage fees, performers fees, etc.), photographic use rights, video use rights, broadcast or public performance fees, etc.

Travel and other production costs: Government institutions have set allowances (per diems, meal expenses, car allowances, etc.) for staff engaged in work activities outside of their normal office. Travel agents or transportation companies can provide current costs for airline or other tickets. Always budget for normal fares but try to book with cheaper fares, this should give you enough slack in your budget to accommodate future fare increases.

Travel costs can be significant. Don't forget the extras—overweight baggage allowances, special packing for computers, parking charges, etc.

Distribution: Facilities for distribution should be separated from those for production. A basic laser printer and photocopier, for example, may be quite adequate for production purposes of most CAL/CML courseware, but may not be adequate for mass production. Similarly, diskette or CD-ROM duplication, with the related printing and packaging requirements, should probably be contracted to an outside agency.

Watch out for the small, but expensive 'got yahs'. CD-ROM price lists, for example, may not include artwork, booklets, boxes, or shipping in their basic listings.

Supplies and Services: Supplies are obvious—everything from diskettes to replacement laser printer cartridges—but you also need to remember to

include the cost of outside services—telephone and telecommunications, printing, tape duplicating, photo processing and digitising photographs, etc. The costs of promotion might be included here—refreshments for meetings with the clients or user testers, brochures and other promotional materials, contracted advertising.

Contingencies: This is a ‘catch-all’ category that makes up for the fact that you often cannot know every expenditure in advance and is often calculated as a percentage of the total cost.

Some funding agencies won't allow you to include contingency costs. As well as being short-sighted on their part, such a policy forces you to pad the other items on your budget.

Estimating Time

A good budget includes a time line (see sample budget below), complete with ‘milepost’ events and dates which can be used to judge progress and product quality. This is not a frill, without the timeline it is impossible to estimate labour and other costs.

- Construct your timeline as accurately as possible.
- Mileposts should be logical as well as practical and suited to the level of the production. For a very large project, they might be very formal with the client ‘signing off’ each step of the project as it is completed. For a smaller project the mileposts might be as simple as a report to a regular meeting of the reference or advisory group.

Budget Preparation

The budget is a document describing how you will manage the project. As such it will be used by the project staff as well as your supervisors, clients, and financiers to determine their own and others role and responsibilities within the project.

There are several schools of thought on the amount of honesty and degree of complexity required in a budget—some suggest that the budget should be wildly inflated so that it can be cut without affecting the project; some suggest that estimates should be rounded off to avoid complexity and any suggestion that the budget is more than an estimate of the foreseeable expenditures; and others suggest that a budget should be penny accurate, with exact costs listed.

Personally, I prefer to budget as close to being accurate as I can guess in advance but I round all figures off to the next higher unit—tens, hundreds, or thousands, depending upon the size of the project. In this way I know that I have set myself up for some difficulties if the project reviewer wants exact figures, however I will probably be able to rearrange items somewhat more easily than if I had a budget itemised down to the last penny.

- Budget notes, used to explain each anticipated expenditure and any possible anomalies, should always be honest and complete.
- The first page of the budget should be a summary containing a one line summation of each major budget line, a short description of the final product (client/audience, purpose, brief specifications), a brief statement of purpose, and an abbreviated production timetable.

The sample budget below has been adapted from the proposal for a recently completed project. Note that while it includes a financial summary and a time schedule, it is not include explicit project objectives, etc., thus it is not complete enough to guide the project or assist in an evaluation. It does, however, illustrate how some projects have a greater need for certain categories of expenditure and do not require others.

Sample Project Budget: Interactive Multimedia Package for Diabetes Education

This project seeks to reduce the tedium of teaching repetitive materials with a self-paced learning and evaluation tool for introductory-level university students, health workers, diabetics (there are hundreds newly diagnosed each year in Australia) and their families who require considerable information to effectively manage a diabetic condition.

A user-tested multi-media teaching program on compact disk (CD) will provide students in pre-professional health programs with a tool for their own learning and for patient education; multiple entry points enable the lecturer and student tailor the program to meet individual needs.

Budget Request

Staff

Release time from teaching for Project Manager	10,000
Release time from clinical practice for subject expert	5,000
Purchase of Services	
Graphics	2,000
Production services (coding of CAL materials) on casual basis	8,000
Printing (final print materials, concurrent evaluation, etc.)	1,000
Mastering and production of 125 x 2 CDs (Mac & DOS format)	5,000
Colour image digitising (Kodak CD-ROM)	2,500

Supplies

Film, recording tape, etc., and associated costs	1,000
Art and graphic supplies	500
Diskettes, computer paper, toner cartridges	500

Travel for Production & Testing

Within QLD, non-capital rates	3,000
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Other

STD phone, e-mail, FAX, for production and evaluation	1,000
Postage and mailers for CDs	750

Total **\$40,250**

[The project was actually funded for somewhat less than this budget estimate. Content expert changes (left for full-time employment), financial and other constraints delayed project completed until mid-1996.]

Agency Contributions (In-Kind)

Staff

Additional participation by PM	2 mo FTE
Project management and concurrent evaluation	2 mo FTE
Student participation in technical development	

Focus groups, students & staff for concurrent evaluation

Space and Services

Laboratory space for project development
Office space; normal phone; stationery
Clerical support; project accounting
Permission to use existing print and audio-visual materials within this new format will be sought from copyright holders

Equipment

Computer Hardware: 2 development computers with flat bed scanner, laser printer, video capture, VCR, etc.

Computer Software: design, production, cross-platform transfer and presentation tools (Hypercard, Canvas, Photoshop, Adobe Premier, MacroMedia Director, Word, etc.)

Timetable

Jan/95—establish focus groups and project team.

Feb-Mar/95—generate design prototype and content limitations with project team and focus groups; establish technical and presentation specifications based on available hardware and software tools .

Apr-Jun/95—develop content for units as agreed; validate content with subject-matter specialists and representative learners; refine interactive multi-media design for iterative prototype; obtain copyright clearance for incorporation of existing materials where available.

Jul-Oct/95—detailed preparation of multi-media/CD format; concurrent testing of segments with representative learners.

Nov/95—final editing and approval of content and design.

Dec/95—production and mailing of CDs; information to relevant community and professional groups re availability.

A user evaluation of the material will be conducted in 1996.

Copyright and Contracts

Copyright is the legal protection provided to artists, authors, and the like to assist them in utilising—and occasionally profiting from the use of—the results of their creative activity, their intellectual property.

Copyright protects ‘works’—the expression of an idea; it does not protect the idea itself (patents do that), facts, raw data, etc.

Copyright is not an absolute; protection varies for different types of intellectual property and in different countries. As well, it can be influenced by differences in employment contracts.

Copyright in multimedia (M/M) productions poses additional difficulties since almost any M/M work contains several underlying works, and clearance is required to include each work—script, musical score, video clip, photographs, text extract, etc.

This Primer contains some plain English guidelines to avoid copyright and other conflicts. While the tips primarily relate to developing multimedia productions, similar copyright issues arise in all computer-based work, desktop publishing, etc.

Disclaimer

Copyright is the *legal* protection provided to artists, authors, photographers, etc. Because it is a legal right, and the Australian Copyright Act is a very complicated document, it is not possible to provide a simple explanation which will always be right. Contact a copyright lawyer for specific situations and further information.

Public Domain

‘Public domain’ refers to material that, often because the copyright has expired due to the death of the creator and passing years, is effectively free of copyright restrictions.

This does not mean that anything old is in the public domain. The copyright on a particular work may have expired but republishing of the work, usually in a new or revised edition, can create a new copyright. Thus, for example, a copy of a Shakespearian play is likely covered by copyright and the illustrations, taken from a recent stage production, are definitely protected by a current copyright.

Enforcing Copyright

Copyright provides legal protection for intellectual property, with the Copyright Act providing for penalties for misuse of protected works. The copyright owner, however, is required to enforce the copyright protection. This is done through maintaining records of the development and use of any work, including permission to use underlying works, publication records, the placement of copyright notices, and litigation.

A successful copyright challenge can not only stop you using a particular work but may require the payment of damages. As well, going to court to defend your use of a work can be quite expensive.

As any user of a copyrighted work can be asked to verify permission to use such a work, the M/M producer must obtain (and retain) permission to use any item included in a M/M work.

Moral Rights

Australia does not yet have moral rights legislation similar to that in the UK and other countries, however, future changes in legislation will likely bring such protection here.

Moral rights allow the creator of a work to retain the right of publication, attribution, revision, and integrity. This may be particularly important for producers of educational M/M or CAL where materials are quickly dated or where it would be possible for an employer to revise and reissue materials as if done so by the original creator.

Fair Use Provisions and Educational Institutions

Public educational institutions have special rights under the Copyright Act which, subject to certain conditions, allows them a limited right to copy materials for student use. These 'fair use' provisions are regulated in Australia by the Copyright Agency Limited (CAL), which surveys use by educational institutions, collects fees from those institutions for that use, and distributes the fees to the appropriate publishers.

The CAL provisions are limited, both in the amount and nature of copying, and in the intended use. For example, articles, and sometimes whole chapters, may be copied for non-profit distribution *on paper* to distance education students. The materials may even be retyped with a word processor to improve the quality of reproduction—newspaper clippings, for example, generally reproduce very badly unless retyped. The same materials may not, however, be distributed electronically under the CAL license. This prohibition applies equally to distribution by diskette or CD-ROM, FTP file, e-mail or discussion group, LAN/WAN, Internet or Intranet, or WWW.

Electronic reproduction/distribution requires explicit permission from both author and publisher.

Sensible M/M Agreements

There are many sources, including specialist lawyers, for forms of agreement for copyright permission.

M/M contracts with financiers, clients, and production team alike should be in the form of time charts with mileposts or sign-off points that clearly indicate obligations and responsibilities for all applicable aspects of the production, including copyright. Depending on the complexity of the project, these might require legal assistance in drawing them up. These agreements should include:

- responsibility for underlying rights and the form of permission required
- production obligations
- warranties and indemnification
- remuneration
- ownership of results/licenses
- credits
- conflict resolution

In practical terms, much of the onus for proper procedures and copyright matters will be placed on the 'producer' (in the movie sense) rather than team members because the producer typically looks after contractual arrangements.

The producer must, therefore, ensure that all requirements have been specified in the project documentation. The benchmarks for project success, for example, should include a description of what the product will do, how it will work, the quality required, and how to assess that quality (testing and acceptance procedures).

Such agreements work both ways —producer to financier or client *and* producer to team members, and should contain sections on:

- objectives
- framework
- specifications
- testing/acceptance
- remuneration
- risk assessment
- dispute resolution procedures

Permission

The producer must obtain permission to use every component of a M/M production including, but not limited to, the intellectual property of the project team, all underlying works (video, video scripts, music, musical scores, etc.), and participating talent (actors, musicians, etc.).

While the M/M production itself may seem quite simple, the requirements and rights change as the production is displayed and used. Some music, for example, cannot be licensed for public performance, yet the use of the M/M work during a school open day might constitute a public performance. Likewise, 'TV rights' may not include converting an analogue video signal (videotape) to digital form for use in a computer-based multimedia work.

It is the responsibility of every team member, but most particularly the producer, to ensure that appropriate permissions have been obtained.

The Future

The copyright laws in every country in the world require changes to accommodate modern technologies for manipulating and displaying information. Multimedia works, because they typically combine several disparate elements are particularly vulnerable to inadequacies in the current copyright laws. M/M producers need to be aware of what the copyright law does protect, and the fact that inclusion in a multimedia work may change the copyright status of underlying works. A copy of the Act is inexpensive and is a useful resource.

Since the USA apparently feels that the current copyright conventions (Berne and Rome) have been superseded by the recent GATT agreement, it will be important to develop a GATT copyright regime.

Here in Australia, the Copyright Convergence Group examines the copyright law for required changes.

Digitising Images

The emergence of desktop publishing as an application led to the development of relatively low-cost technologies for digitising photographs and other illustrations for computer-based projects. This Primer looks at a number of these technologies.

Digitising vs halftone and other old technologies

It has always been necessary to specially process photographs and other types of illustration for use in print publications. The traditional technique involves preparing a 'halftone'—a special negative(s) (one for each colour plus black in the case of colour printing) which is composed of dots of varying sizes to approximate the continuous tone gradations of the original photograph. Look at a standard photograph and any colour newspaper photo or comic strip under a magnifying glass to see the difference.

While computer images are formed differently, they still require images to have a discretely range of values. The resolution of a scanner or other device (including the resolution of your computer monitor and printer) indicates the potential quality of the image.

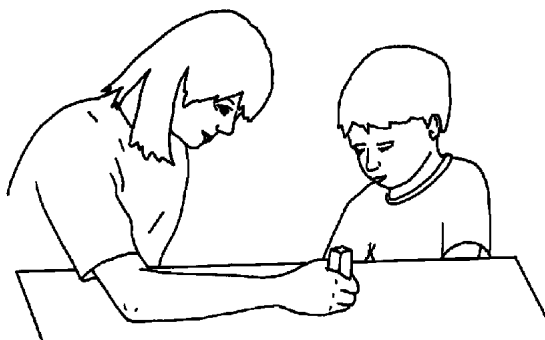
Computer printers are commonly specified using dots per inch—300 to 600 dpi being most common as this Primer is being written. Computer monitors, on the other hand, have resolutions of 72 pixels (screen dots) per inch or less and a range of colours in discrete steps of 16, 256, thousands, and millions. Multimedia developers often convert (or 'map') all their colour images to a custom palette (selection of colours) in order to conserve system resources and ensure that the images look the same on all monitors.

While scanners and other devices come with software for their use, special purpose photo or video editing software is often required for best results and some vendors supply 'plug in' modules to allow image capture from within specified editing software, notably Photoshop.

Scanning 'high contrast' black and white illustrations

Most of us don't have very much artistic talent but we can trace reasonably well. After tracing the main details on a photograph (translucent draftsman's tracing paper and pencil), I shade in some areas and detail others. I then scan the pencil sketch into the computer and 'enhance' it using a computer drawing program.

For the enhancement I generally use a drawing package such as Canvas to get rid of extraneous background marks, strengthen some of the lines, and generally improve the appearance of the image. This process involves looking at an enlarged view of the sketch (on screen) and clicking individual points (pixels) 'on' or 'off'.



Our university graphic artist used similar techniques to prepare the illustration (above) of a woman and child from an inked tracing of a collage made

from two photographs, one each of the boy and the woman. The photos were actually taken with a digital camera, manipulated electronically to get the images in the right place, printed and then traced.

Scanning continuous tone illustrations

The inexpensive way of digitising your own images is to use either a standard flatbed or handheld scanner. The quality of scanned photographs from a standard scanner is quite acceptable for screen use, however, the resolution may not be acceptable for use on a printed page. Scanners range up from \$100 for handheld models and up from roughly \$500 for flatbed models with reasonable quality colour scanners under \$2,000. [Drum scanners provide professional results but are very expensive.]

Film scanners, on the other hand provide resolutions of 2500+ dpi and promise 'high quality' and 'professional image quality' with both manual and automatic scanning of 35mm black and white and colour film (negative or positive). Prices for Nikon, Microtek, and Kodak film scanners run from ~\$3,000 to \$12,000+. Kodak also provides a digitising service (see box).



This image was 232K in a 384 x 256 colour Kodak CD file, 288K opened in Photoshop, 96K as a grayscale image, and 76K when cropped to its present size. The image occupies about 1/4 of a 14" screen as a computer image.

Video capture cards (or motherboard capture for Macintosh and other computers) and video digitisers accomplish the same purpose for still or moving video images.

Digital Cameras

If you have \$10,000 or more you can get a fill-less camera which captures a reproduction-quality image in digital form. The rest of us use one of the new point and shoot style digital cameras, such as the Apple QuickTake®, costing under \$1,000. While they do not provide an image suitable even for the family photo album, their output is quite acceptable for photocopied newsletters, computer-based multimedia, and World Wide Web use.

Screen Image Capture

Images captured from a computer screen are another source of illustrations for training materials. The illustration below is from a training manual for novice computer users, and took only a few seconds to prepare.



Kodak Photo CD

Kodak provides two services for digitising photographs. The first is their standard consumer Photo CD Master service. This provides a 'write-once' multi-session CD with up to 100 scans of 35mm slides or negatives, black and white or colour, at five different resolutions. The second service, Pro Photo CD, provides up to 40 images at a much higher resolution, and is used by professional photographers or where the photographs will be used in quality publications.

The standard service is available through any Kodak Express outlet and takes 1-2 weeks (the digitising is only done in a limited number of sites nationally). The cost averages about \$3 per image.

The CD-ROM contains both the photo image files and a small application for displaying the photos one after another, just like a slide show. The viewer software can also be used to create unique slide presentations and to change the viewing resolution of the images.

As part of the consumer focus of this product, Kodak and others supply devices to display the images on a standard TV without the need for a computer.

The photo files themselves can be accessed using software such as Adobe Photoshop, which is how I use them. I open the files in a resolution appropriate for the final use, crop the image as required, convert to grayscale in the case of colour photos, and use 'cut and paste' techniques to insert the image in my document (normally Microsoft Word).

Printing Images

While I usually use a standard Word file format, images could also be saved as Post Script or other printing formats, various graphic formats, and the proprietary formats of the applications themselves.

I have not had much success printing graphic and photographic files using a ~300 dpi ink jet-type printer because of image banding, streaking, and smearing, although the newest colour printers using specially coated paper are much better than previous models. Printing quality from a laser printer typically depends upon the amount of memory in the printer itself.

The images in this Primer have been printed using a 300 dpi laser printer. Unfortunately, the images look much better straight from the laser printer than they do in this Primer as the reproduction process is essentially photocopying with the toner level set quite dense.

CD-ROM Production

Like its music and video counterparts, CD-ROM (Computer Disk—Read Only Memory) is a technology for storing and distributing large amounts of data. With a capacity of 640 MB of computer data, CD-ROMs are now used by software and courseware distributors for distributing new and updated products. While many commercial products are sold in display boxes for product identification and to forestall theft, CDs are sturdy enough for mailing in a normal envelope or cardboard mailer.

CD-ROM Drives/Disks

CD-ROM drives are available in a variety of speeds—2X, 4X, 6X, 8X, and possibly 10X later in 1996—representing speed of access (seek-time) and performance (faster and smoother reading of data), but all read a CD-ROM with a 640 MB maximum storage space.

The next generation of CD-ROM drives/disks will be based on the Digital Videodisk (DVD) standard and should be able to store up to 4.7 GB of data. Such drives have the potential to deliver full screen 30 fps (frames per second) video as in a TV set.

The base for a normal commercial CD is a silver colour and has been pressed from a master disk in a process similar to that for phonograph records and then plated with a fine layer of reflective material. The label printing is done with a silkscreen or ink jet process on the non-data side of the CD. Once the master has been produced (at a cost of roughly \$1,000) this process enables a diskette to be mass duplicated for a few cents per CD.

Gold coloured CDs are used in CD-ROM recorders and have a dye layer which is 'burned' by a laser beam to record data. Gold CDs are produced on a single copy basis, cost roughly \$18 per CD, plus duplicating charges, and are useful for draft copies of multimedia products, backing up data, and small runs for distribution. [Fifty gold CDs from a commercial production house cost about the same as 250 mastered CDs.]

Gold CDs are also gaining acceptance as a write-once backup medium for medical and other uses where data must be retained for legal purposes. It is assumed that a signed and dated gold CD which has been stored in a secure location will be acceptable under Australia's Evidence Act.

A major use, however, is for distribution of multimedia products such as the interactive multimedia package for diabetes education which was produced at Central Queensland University under a CAUT grant in 1995-96. This package included an interactive interface to text, graphics, video, hyper-media links, and an extensive reference section and would have occupied an unreasonable number of diskettes if distributed conventionally.

Recording Tips

The CD will be identified with the same name as on the source hard drive or partition. Rename the drive/partition and change the icon as appropriate prior to recording.

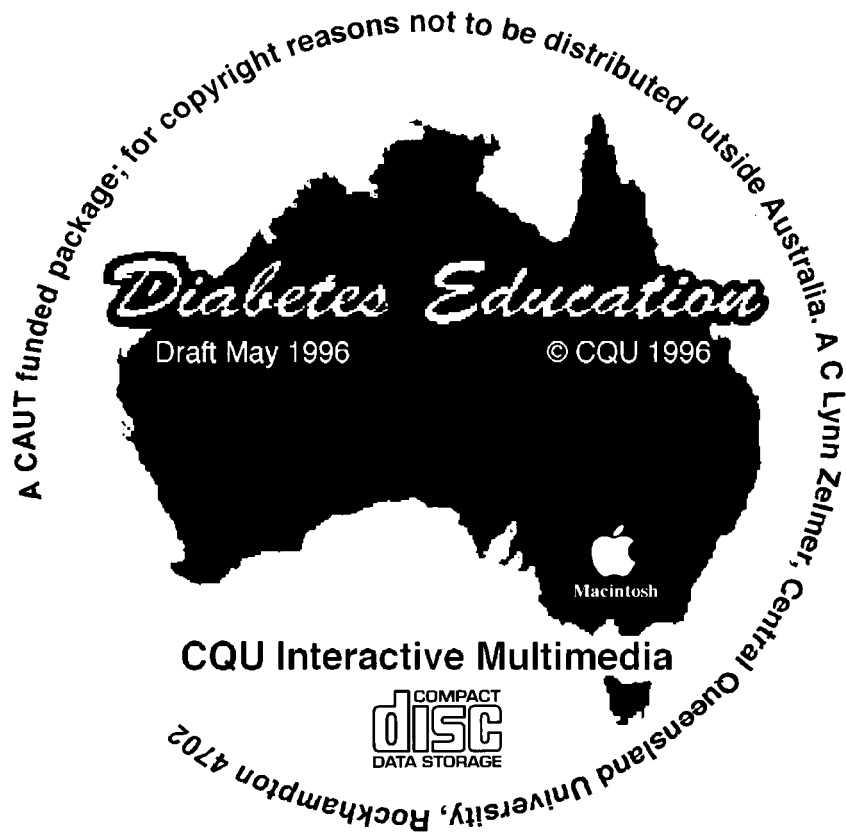
Gold CDs may be recorded as either 'session', which allows additional material to be added as another session at a later date (provided your recorder will read multisession disks), or as a 'disk'. Choose the latter for data being stored for legal purposes or for the final draft of a production to be sent to a commercial production house for mastering.

The CD recording software will copy everything in the hard disk partition specified as the recording source, including erased files, fragmented files,

etc. Repair any damaged files with a hard disk utility and defragment the disk with an appropriate utility program before recording.

Some software functions differently when it is accessed from the CD than it does from a hard drive, particularly when path names are coded into the original program. Thoroughly test your pre-mastering CDs for errors before sending for mastering—you don't need several hundred CDs with a fatal error which could have easily been corrected prior to mastering.

Test the completed CD on a second drive (not just the recorder) so that you can make a second copy if the first recording does not function properly.





Beyond the Basics

This section takes the concepts of this book at least one step beyond the competent novice. The first two Primers explain the concepts behind an information system and set out a procedure for selecting a specialised information system—a health record system.

The next three Primers provide tips for the effective maintenance of your desktop system. The last two Primers provide sources for further information.

Information Systems

The collection of data, the transformation of data into information, and the ultimate use of data for decision making, is the cornerstone of the modern information technology (IT) industry.

Data and information systems, however, are not new. Business, commerce, industry, government and education, to name just a few fields, have always depended upon information systems. Try to imagine, for example, how the Roman Emperors could have governed without an adequate system of communications (runners) to bring messages (data and information) from the far corners of the Empire.

Computerisation has brought some new challenges to the development of information systems. In the days of the Roman Empire it was probably possible for the Emperor or his advisers to read every message that came in from the far corners of the empire. With computer-based information systems, however, there is often too much data to view at one time, the data may not be in a form that is readable (encoded, encrypted, etc.), and the data may be distributed across several locations.

This Primer provides an introduction to the techniques IT professionals use to build information systems; see the Glossary for additional terminology.

Systems

Data is the term which IT professionals use for the various items which we collect to describe and record the daily activities of our lives, business, and other systems. Individual data items could include financial transactions, vital statistics such as date of birth and death, or even what television program you watched last night.

Systems make order out of our lives.

The solar system, for example, has specific boundaries within which its component parts function. There is also a definition of which interrelated components make up the solar system. Various life forms on the third planet, for example, may physically inhabit the solar system, and may be able to affect the solar system in subtle or not so subtle ways, but they are not normally defined as components of the solar system.

Those life forms are, however, parts of other systems, systems which can include components of the solar system. Thus we include both the third planet and its life forms in an environmental system, which itself can be divided into other sub-systems. Almost all of the systems on that third planet involve one particular life form—homo sapiens—which has a propensity for collecting data about its own and other systems.

Similarly, the solar system is a sub-system of larger systems.

Information systems make order out of the data we collect. Just as with the solar system, an information system has defined boundaries and components. Just as with the solar system, information systems have various sub-systems with specific organisations and functions.

Computerised information systems have greatly increased the amount of data which can be stored and accessed, hopefully increasing the value of the information which we use for making decisions.

One characteristic of functional systems is that they can adapt to change. Information systems must change when characteristics of their components

change, usually because of their relationship with other systems. Information systems for booking airline seats, for example, had to change when they were first computerised and must change again whenever new aeroplanes or computer systems are purchased.

DSS (Decision Support System): An information system designed specifically to assist in making decisions. The system does not make the decision, merely provides information in a format which assists the relevant individual/group to make the decision.

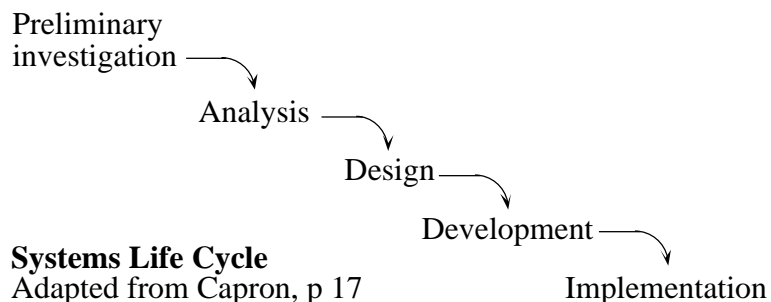
EIS (Executive Information System): A type of decision support system which provides that information required for the Chief Executive Officer and others to make critical operational decisions. The quantity and type of information provided will depend upon the critical factors required to monitor processes and make informed policy decisions, generally in pre-defined areas of interest.

MIS (Management Information System): Similar to the EIS but with more detail, used primarily by operational managers.

System Life Cycle

All systems have a beginning and an end. For many business information systems the beginning occurs as a result of a business operation opportunity. An airline, for example, would not need a booking system if there were enough seats available to fill the demand—bus transport companies need scheduling systems but they do not need booking systems.

A well designed system goes through a series of steps between need and implementation. One simple description of the systems life cycle comes from Capron (1986).



The implementation phase for most successful systems is not the end, for such systems are constantly being reviewed and revised. The systems life cycle in such cases becomes cyclical, with each review of the implementation leading to a new cycle.

- **Preliminary Investigation:** Defining the problem is one of the hardest parts of the system life cycle. The airline in the example above, for example, might identify a problem of lost bookings, and thus lost revenue, from potential passengers not getting a seat on a particular flight. But is that the real problem? Lost revenue is one part of the problem, inconsistent seat loadings might be another. The fact that planes are underutilised in other parts of the system might point to yet another part of the problem.

A systems analyst, trained to be methodical and thoughtful, is the person who is often called on to assist in identifying the problem.

- **Analysis:** The next step, analysis, requires a full understanding of the system and its users. Users in this context would include both operators of the system and their clients, however defined.

Typically the analyst will collect a wide range of data from users through interviews, questionnaires, and other data collection techniques to get the best possible picture of how the system 1) functions and 2) relates to

other systems. An understanding of the functionality of the system and its components leads to a specification for the new system.

Care must be taken, however, to ensure that the operation of the system is fully understood. This avoids developing a new system which merely replicates the existing system with all of its defects. Lateral thinking and a sound knowledge of the real needs of the users often lead to a more functional system.

- **Design:** The design step, perhaps more than any other, requires an understanding of the business process. Designing an information system involves a methodical approach to repeatedly questioning design decisions through several increasingly detailed design cycles.

There are a variety of design techniques. Some require the complete formulation of precise technical specifications before continuing, others use a prototyping approach which provides an increasingly sophisticated mockup of the final system which users can manipulate. The former approach probably results in faster development of a product, the latter often results in a more useable product because of the hands-on involvement of users.

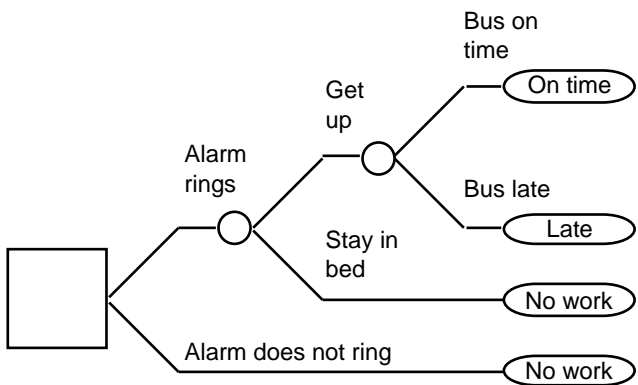
- **Development:** The development stage requires the matching of a product to the design specifications and involves both product acquisition (either through purchase/lease or program development) and testing.
- **Implementation:** Data acquisition or conversion, user training, and system modification are hallmarks of system implementation. A good implementation involves sound planning as far back as the preliminary investigation stage, continual involvement of the system users, good observation skills to identify problems as they occur, and the ability to make required changes when required.

Unfortunately, many technically brilliant systems are not used to their potential because faults were not identified early enough in the design cycle.

As was noted above, most well implemented systems do not stop at the implementation stage. All systems require ongoing maintenance as well as the training of new users. As problems arise in well managed systems the system life cycle repeats, producing a new design and implementation with the eventual retraining of users.

Documentation

A well designed system includes good documentation. This documentation extends back to the first investigation of the problem and goes on to include training materials for various types of user.

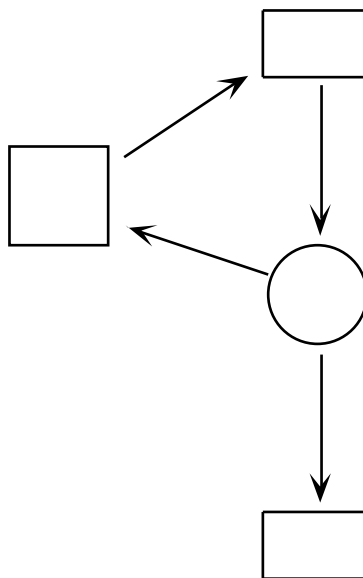


Decision tree for morning wake up

Good documentation results from a combination of communication skills, some of them computer-based, not just writing skills. The various analysis and design documents, for example, require charts and diagrams to display

the system visually, and all parts of the system are improved as a result of listening to the user—both in eliciting needs and in user testing the system and its documentation.

The Glossary includes definitions of several documentation tools: data flow diagrams (logical and physical), data dictionaries, flow charts, decision tables and decision trees. The diagram below illustrates a physical data flow diagram while the diagram on the previous page illustrates a decision tree.



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Grateful acknowledgment is given to Jo Luck and Shirley Gregor of the Faculty of Business, CQU, for the use of distance education learning materials which they developed.

Choosing the Solution

Liza Reinberger

One of the major issues facing many health care professionals and particularly MRAs (Medical Records Associations) is the storage, organisation and retrieval of information. As database managers of large quantities of critical information the challenge is to manage that information efficiently. Computers are powerful tools to help us get the information we asked for, and to present it in a useful way. In today's world of 'doing more with less' there are few alternatives to computer based tools. The computer industry has shown a continuing trend of providing increasingly powerful and sophisticated systems at a fraction of their former cost. This process is bringing computer solutions within the reach of many hospital departments.

This paper discusses the major issues facing you, as a health care professional, when you are responsible for evaluating and selecting computer equipment and software to help you in your job. It describes an approach you can take to manage and control the process of choosing a computer solution that meets your needs. The paper mainly addresses the processes involved in evaluating departmental applications, but much of it is directly applicable to any computer system selection.

The Selection Process

The process of choosing a software solution can be divided into five stages: planning, preparing, sourcing, evaluating, selecting.

Throughout the selection process, try to keep a number of key points in mind:

- **Keep each stage separate**

Ensure you clearly understand what you want from the system before you set your requirements. Complete your evaluations of each of the products before you begin to compare the results.

- **Keep lines of communication open**

Consult as many people as practicable at each stage, and make sure key people are informed of your progress.

- **Be professional**

Respond to all communications promptly. Prepare for each step and demonstration thoroughly. Expect the same commitment from the vendors involved. Ensure you inform vendors exactly what you expect from them when you request information; set the scope of the demonstrations when you are planning a site visit.

- **Be confident**

Software applications should be treated just as tools. You are the professional using the tool, so if you disagree with the vendor, you are probably right.

- **Organise information**

As you accumulate information, build up a file for each vendor, with key contact names and positions, addresses, phone and fax numbers, and additional comments you may have. Product literature, vendor responses and evaluation notes should also be included.

Stage 1: Planning

Computer products should only be bought to help you do your job. The first thing everyone associated with the purchase needs to be clear on is the reason for buying the product.

Try not to confuse the *solution* with the *problem*. Your starting point should be to determine what problems you wish to address and how the system is going to fit in with the longer term plan of your department.

To help you with this task, form a small selection team from relevant personnel such as colleagues, users and management. This group can provide valuable input in the planning stages and throughout all stages of the selection process.

With part or all of the selection team, evaluate and document the existing system and include information such as:

- How it currently operates;
- How well it is accepted;
- Outline of current problems;
- Areas where it is unable to meet demands;
- Areas that need improvement;
- The flow of information and how data is collected;
- Time critical operations;
- Inputs and outputs including management information requirements;
- Data volumes;
- Regulatory requirements;
- Ad hoc and standard reporting.

Additional information could be included such as:

- Your objectives and scope of the project;
- Your budget;
- What time constraints you may have;
- Anticipated improvements in departmental efficiency;
- What internal and external changes you anticipate in the short, mid and long term and what impact they will have;
- How the purchase fits in with the strategic business and/or technological plans of your department and hospital.

Within this document, you should include a schedule of tasks and target dates for each activity in the five stages.

You should try to identify the people responsible, include milestones you want to achieve and any deadlines to which you are working. Allow time for holidays, busy periods and continuation of other activities.

On completion of the first draft of this document, circulate it to your management, users and colleagues for comments and suggestions, and amend it until you have agreement.

Stage 2: Preparing

Once you have completed the planning stage, you can decide on the functional requirements of your computerised solution.

Together with some or all of the selection team, there should be a brainstorming session to identify what everyone wants the system to do and how the system should be doing it. Even though some suggestions may be impracticable, they should still be put into a 'wish list' before reviewing.

Discuss and agree how important each item is (you will probably go around this two or three times), logically group them, record them as a checklist and then assign a weight and/or a priority.

The weight is a number that reflects the relative importance of each item of functionality; for example, a checklist may comprise 50 functional items

with a maximum score of 500 points. Each item might have a weight between 1 and 20 depending on how important it is judged as being. Priorities such as 1, 2 and 3 (denoting mandatory, desirable and optional) could be used.

The checklist should try to force similar responses so in the selection process you are not left comparing apples and oranges. Remember, though, sometimes responses genuinely may not fall into the categories you have indicated for good reasons such as database design and additional functionality.

Some information may be required from vendors that is not subject to weighting, such as policies, plans and system performance. This information may be obtained via a vendor questionnaire. You will need to inform the vendor of the volume of information which the system will be required to store.

Avoid writing requirements with a particular solution in mind as it may distort your results and cause you to downgrade a good (but different) solution.

Circulate your checklist and questionnaire for comment to users, colleagues, management and any consultants you may have. If you have access to computer staff, consult with them as well.

Use your checklist as a guide throughout the selection process but consider reviewing it if you discover functionality not previously identified.

It is a good idea to use a word processor or a spreadsheet to build up your checklist and vendor questionnaire. This lets you modify them easily and expedites transfer of information to vendors and team members either by hard copy, electronic mail or diskette. Similarly you can get their responses via the same routes. There are several software packages available from US suppliers providing word processing and ad hoc reporting capabilities and a base set of requirements that can be changed to suit. You can enter scores against the requirements and, based on your evaluations, comparisons between products will automatically be calculated.

Stage 3: Sourcing

Now that you have established what you want and know how you are going to evaluate the product, you need to find out what is available on the market.

There are many ways to source software applications. Some examples are trade shows, journal advertisements or reviews, the good old grapevine, user groups, other hospitals or similar organisations, your respective health department, suppliers of other software, universities or colleges, the Yellow Pages and professional associations.

When sourcing software, be inclusive. Try not to eliminate any at this stage unless they clearly do not apply to your needs.

Eventually you should end up with a considerable list of products that are at least worth looking at.

Do not be afraid of contacting overseas suppliers. They will tell you their local distributors (if any). Generally, the best way to contact them is via fax.

Initial request for information should try to identify key employees in the company, a fax number and their direct phone number, in addition to requesting information in the form of:

- Information over the phone;
- 'Demo diskettes';
- Marketing information, brochures, etc.;
- 'Spec Sheets' for software, hardware and operating system;

- Capabilities overview;

or you can:

- Buy a manual;
- Attend a training course.

Once you have a good initial idea of suitable products you may choose to send the checklist and questionnaire to vendors. The responses you receive can be used in the next stage of the selection process. Give them reasonable time to respond and you should verify that the vendor's responses are accurate.

Stage 4: Evaluating

Now you have established the functional requirements and identified suitable vendors, the next stage is to evaluate the products against your checklist.

Avoid selecting products on the basis of marketing literature. However well written they will not give you a feel for how the system works in practice. It is often both tedious and misleading to wade through large volumes of brochures, design specifications, and so on.

For a preliminary review a 'demo diskette' is a good option; however, keep in mind that the diskette may not accurately reflect the capabilities of the product.

Reviewing a live system is usually the best approach, but is the most complex and time consuming. Try to include a period of time during the demonstration where you use the system yourself. Attempt to discover all the product has to offer, run reports and develop a script to push the system to the maximum of its functionality. Try to ascertain that it does all it is advertised to do. Response times are difficult to test in a demonstration environment and user or vendor statements may be required to validate claims.

You may wish to arrange a review of the system at a user site or establish a free trial period in your department. Try to run the demonstration on the configuration you intend to purchase under normal to extreme operating conditions.

Products may generally be evaluated under the following categories:

Hardware

You are looking for a tool to solve problems, and this will consist of software. Hardware should be selected to run the software you have selected and not vice versa.

You should try to establish whether the hardware and supplies are vendor specific, and if so what future do they have in the company's long term business plans.

Determine how readily (and at what cost) the hardware can be upgraded so that it is faster, has more disk space, more memory, and so on.

Depending on how you are going to use the application, you may need to know how easily the hardware supports multiple users and, if so, up to how many. You may also need to know if the hardware is portable.

Check the sort of failure record the hardware has as this may be good indication of how careful you may need to be with warranty and maintenance contracts.

You may need to know of any special requirements the hardware may have for installation; for example, air conditioning, controlled humidity, special power supplies, raised floor. You should check how much space the hardware needs and what environmental restrictions you may have.

Software

You should check whether the software is able to run on different hardware platforms or whether it is restricted to one vendor's hardware. Also check if the product uses special software languages or tools only known to the vendor.

An important facility may be interface capabilities; that is, two way transfer of information to mainframe, departmental, word processing or spreadsheet systems. An increasing number of vendors support interface protocols.

The main health care information exchange protocol is HL7. This provides a standard to allow health care systems to exchange information with each other. It is maintained by a voluntary user/vendor/consultant committee in the US, established in 1987. A new standard called MEDIX is currently under development by IEEE.

It is useful to find out if the product is widely used. Establish the age of the product and its development history. Visit the reference sites and meet with users, but remember user lists supplied by vendors do not normally include dissatisfied customers.

It is also valuable to establish the vendor's policies with regard to upgrades and revisions to the product. In particular, it is important to check on the pricing of upgrades.

The way in which the product was designed and developed may be an important factor. Of interest may be the specific development methodology employed, quality plans, qualification tests; for example, unit, system and performance tests. These factors should be documented and access to these documents may prove to be of interest. Proof that the documented information was adhered to may be required.

Human Interface

A well designed software application will reduce operator errors, decrease human and computer processing time. Alternatively, poor design will decrease the effectiveness of users and increase the period of time it takes for a user to become competent. To ensure good human interface the following points may be taken into consideration:

- Ease of use;
- Response times for screen transmission, report printing, filing or saving;
- Availability of online help at screen, field or key word level;
- Pop up or pull down windows for code options, help, special instructions, etc.;
- Good screen design, eg. fields appropriately located and labelled;
- Appropriate and consistent use of colour;
- Suitable navigation methods, eg. menu driven, direct screen access or both;
- Designed for minimum user keystrokes;
- Support multiple data entry mechanisms, eg. mouse, trackball, bar codes, touch screen;
- Option for expert or novice mode;
- Incorporation of meaningful icons.

Documentation

The information provided with and on a software application is extremely important as it defines the product and instructs how to use it.

Documentation includes just about anything which conveys information about the product to the user such as:

- Tutorials (preferably an integration of online and hard copy);
- Installation and administration guides;
- User guides;
- Programmer's guides;
- Quick reference cards;
- Online information databases;
- Error messages and screen prompts.

Depending on the nature of the documentation and your requirements, the material should be:

- Presented in the most appropriate medium;
- Readily available either online or hard copy;
- Formatted so it is easily readable;
- Clearly written, unambiguous and understandable;
- Logical and consistent presentation throughout;
- Included as part of software upgrades.

Flexibility

The ability of the product to cope with both internal and external demands for change is an important factor and the effort required to modify the system should be minimal. It may be useful to know how modifications are to be made and whether they can be carried out by you or the vendor. If future extensions or modifications are envisaged, you may need to ensure that the design of the system facilitates these changes.

A degree of user definition of the product should be permitted. You should be able to set it up around the way the hospital operates; for example, define own codes, editing rules, and so on. The facility to carry out minor customisation changes such as screen colours and error messages is a nice feature and may be considered important.

In addition to specific requirements drawn up during Stage 2 of the selection process, general functionality that could be judged as essential depending on your needs may include:

- Availability of a query language to support ad hoc reporting or online inquiry capabilities;
- Management information and processing statistics;
- Provision of inquiry facilities online or via reports;
- Comprehensive set of reports;
- Online or batch processing;
- Provision of date formats, units of measure, spelling, etc., appropriate for Australian use;
- Comprehensive editing capabilities, test and checks.

Security and Integrity

If security is a concern, check the security facilities offered. At a hardware level, machines can be turned off and locked to prevent theft and/or unauthorised access. Software should be able to restrict users either at a functional or information level or both for example by a hierarchical password system.

Back up and recovery facilities offered by the hardware and operating system should be clearly understood. The system should be capable of being fully recovered from most hardware failures without any loss of information. If it is not possible for the system to fully recover it should inform you of the point to which it was able to recover.

Support and Contracts

As this part of the evaluation process varies tremendously, it is probably better to consult with others on contractual issues or have financial staff in your hospital arrange it. Support may be derived from within your hospital (eg. MIS Department, the vendor or specialist firms) and may include:

- Training;
- Installation;
- Supply of magnetic tapes, printer ink, ribbons, etc.;
- Bug fixing;
- Inquiry facility, eg. hot line.

It is important to ascertain how product revisions or upgrades will fit in with the original contract.

If the system does not fully meet your needs, it is valuable to know if it is possible for you to add features without invalidating your support contract.

Costs

There are a number of possible additional costs associated with the purchase of a computer system. You should check which of them apply and try to gain a picture of the overall cost. Typical additional costs include:

- Optional features;
- Modifications;
- Installation;
- Training;
- Converting existing files;
- Loading information into the system;
- Operating costs;
- Design and printing of new forms;
- Multiple and single user charges.

Stage 5: Selecting

Once you have completed the evaluation of the proposed solutions, you are faced with the task of selecting the one that best suits your requirements.

It is generally better not to compare products until you have evaluated them separately. This allows you to evaluate each one on its own merits rather than against a particular solution.

Make sure that all checklist items and vendor questions have been answered and no information is outstanding from vendors.

It is useful to create a short-list of the most suitable products. This can be done by comparing the weighted scores from the checklist and by discussing the responses to the vendor questions. Short-listed systems should provide all mandatory items from the checklist and should exceed a predefined cut off score. A short list should consist of two to four systems; any more, and it becomes unwieldy.

If it is proving difficult to decide on a solution, the selection team may need to list the perceived shortcomings of each offering and draw up a list of questions for the vendor. You may well need further demonstrations of shortlisted systems.

Usually, after a second round of demonstrations and discussions you will arrive at a single selection. If not, however, you may find yourself in the situations where two (or more) products appear equally good or nothing is acceptable.

If two or more seem equally good, then go back over your checklist results and compare them carefully. Also compare the replies to your vendor questionnaire and your impression of the vendors. If you still cannot separate them, then probably either will be satisfactory.

You might like to consider choosing the product that:

- Is supplied by the more committed, enthusiastic, professional and/or businesslike vendor;
- Offers your key users the most functionality
- Has the best upgrade service;
- Is the most cost effective (in the long or short term);
- Offers additional functionality that can be used elsewhere in your hospital or department.

If no system seems to match your requirements, then review your checklist. It may be you are asking for something that is not available. Discuss your checklist with the short-listed vendors and allow each to tell you why they cannot meet your requirements, and when they anticipate being able to do so.

If it is not feasible to amend your requirements, choose the product where the vendor will commit in writing to an acceptable timetable for delivery of the missing functionality. Alternatively, you may need to consider developing a system from scratch specific to your needs.

However, if you genuinely feel that nothing meets your needs then defer your purchase. You will have learned and established a lot during the selection process, and next year something better may be available.

Conclusion

Computerisation is a very important part of developing the service your department offers to the rest of the hospital. It is therefore vital that you select the right computer tools for the job.

By following the stages described in this paper, you should be confident of your ability to plan and prepare for the acquisition of a computerised solution, source the products available, evaluate and select the correct one for your department's needs.

Following successful installation, do not stop there. Market yourself and the extended services your department can now provide and ensure everyone who was part of the selection process is kept informed of the success of the solution chosen.

Notes

Liza Reinberger originally presented this as a paper at the 14th Conference of the Medical Record Association held in Brisbane, 29 Oct-1 Nov, 1991; it was published in the AMR Journal, 22:1, 1992, 15-19. Reprinted with permission.

While this paper specifically refers to the acquisition of a computer records system, the process described is suitable for the acquisition of any large system—a Hospital/ Clinical Management System, a Patient Care System, GP System, etc.

Copying Files from Machine to Machine

The ability to copy files and diskettes, both on your own system, and between systems is one of the skills that computer users need to acquire early in their computing career.

Commands for copying files and diskettes are available in every operating system. See your operating system manual for details.

This Primer introduces you to several techniques for copying files and diskettes from one computer platform to another—between IBM/MS-DOS/Windows and Macintosh computers.

Diskette Sizes and Types

Although most computers now use CD-ROMs, 3.5" diskettes, or credit card type memory cards, desktop computers have used both 5.25" and 3.5" floppy diskettes. As well, the diskettes (and drives) came in several different capacities ranging from 360K to 1.44M bytes.

Take care of your data...

5.25" diskettes are truly 'floppies'—do not fold or bend them. 3.5" diskettes have a hard plastic case and can normally be carried in a pocket without damage. Both types are susceptible to damage from heat, dust, liquids and magnetism.

Normally high density drives will read lower density diskette formats of the same physical size. Low density drives will neither read nor write higher density diskette formats, and disk drives will not read or write diskettes of a different physical size.

Macintosh computers can generally read and write 3.5" DOS/Windows diskettes. Plain text files can be transferred between these formats without any special file conversion. For Macintosh users, this means that data files on diskettes or CD-ROM can easily be transferred to a Macintosh diskette.

File Formats Across Applications

The files generated by proprietary applications are often also proprietary. For example, word processor files contain special text formatting commands to indicate paragraphing, **bold** and *italic* text, etc. To transfer these files to another word processor computer platform you may require special conversion programs to ensure that the files retain their special text formatting features when transferred to the new system (different word processor or computer type).

Fortunately, some application programs (word processors, spreadsheets, database managers, etc.) are available for more than one computer platform (DOS, Windows, Macintosh, VAX, Unix, etc.). Normally these programs will read files prepared by the same program on a different platform once the file has been transferred to a compatible diskette format.

Some applications can also read and write files in a variety of formats.

Copying same format files and diskettes on the same machine

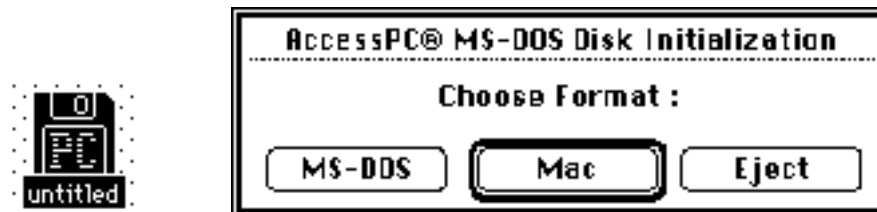
DOS-based computers have both *copy* and *diskcopy* commands; the destination disk may need to be formatted prior to starting the copy. Check your manual for details.

Copying files and diskettes on a Macintosh or Windows machine is usually as simple as selecting the icon for the file(s) to be copied and 'dragging' it to the icon representing the destination directory/folder or diskette. Menu-

based commands are also available. Again, the destination diskettes may need formatting first; check your manual for details.

Data Only Transfer on the Macintosh

Macintosh system software includes a number of tools which automatically recognise non-Macintosh diskettes and can format diskettes for DOS/Windows machines. Icons for these files will indicate their source with a PC logo.



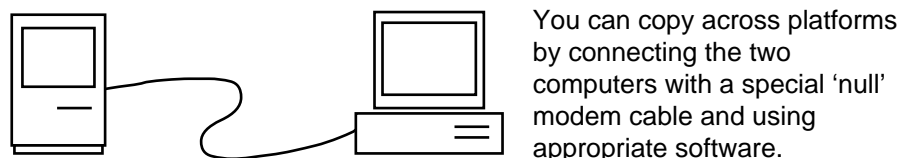
DOS/Windows diskettes can then be used as if they were native Mac diskettes. Unfortunately, these tools do not necessarily do any file translation, they often depend upon the translators available in the software packages. Microsoft Word, Canvas, and PhotoShop, for example, read and write files created by a variety of word processors and graphics packages.

It doesn't make sense to copy executable programs from one format to the other since, as the use of system resources differs from platform to platform, they can only run on the platform for which they were written

File Transfer Using 2 Machines

There are a variety of programs available for transferring files between machines, with or without a modem and telephone. *Laplink for the Mac* (approximately \$200) is one such program, and comes with the required software (a module for each machine—Mac and Windows) and a cable to connect the two machines. Read the appropriate manual for details.

Communications software can also be used to transfer files directly from one computer to another—with or without needing modems. You require an appropriate communications program, sometimes available as a function within another program as below, and a cable to connect the two computers.



Again, read the manuals supplied with the software packages for details.

File Transfer Across Networks

FTP, Eudora, and other network tools can also be used to transfer files between formats and across networks. Obviously you must be attached to the network to make the transfer but with the right software copying files around the world is as easy as copying files on your own machine, albeit slightly slower.

Your network administrator may have installed software on your network to allow you to make backups, either manually or automatically, to your work space on your local area network. This is another cross-platform file transfer since networks often use a variety of Unix for their basic functions and can normally handle files in many formats. There are some obvious potential security problems here and your administrator will normally have also installed password and other controls to limit unauthorised access.

Hard Drives, Floppy Diskettes, and their Management

This Primer provides tips for using diskettes, procedures for making backups, and some tips for managing your hard drive.

Hard drives (fixed disks) and diskettes are used to store information for the computer. This information may be in the form of computer programs or user generated data files.

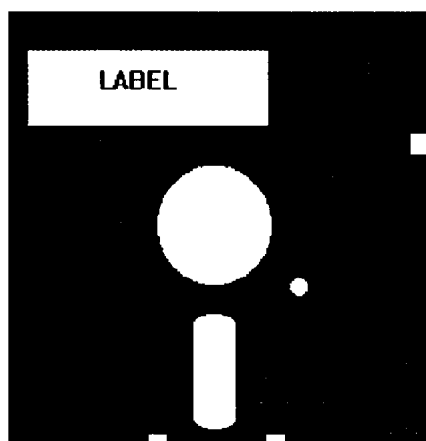
The fixed disk or hard drive has a solid platter coated with magnetic media, the same type of magnetic media that is used for audio and video tapes. The drive mechanism is sealed against dust and is controlled by special electronics within the computer. The floppy diskette is a thin circle of plastic (disk) coated with the same basic magnetic material. This flexible diskette on which the information is recorded is semi-sealed in a plastic envelope. Diskettes are susceptible to damage from heat, dust, liquids and magnetism.

Tips for Using Diskettes

Unless they were preformatted by the manufacturer, diskettes must be formatted before use. Check your computer manual for details of how to do this on your computer.

- Do NOT Remove a diskette from the computer when the computer is writing information to the diskette.
- Keep diskettes clean, dry, and away from magnets.
- Do not touch the brown plastic disk within the plastic cover.
- Never write on a diskette except with a felt tip pen; mark the labels before fixing.
- Protect diskettes against accidental erasure by using 'write protect' tabs, adhesive tabs that cover the small slot on the side of the diskette to indicate to the computer that you do not want the diskette to be erased or changed.

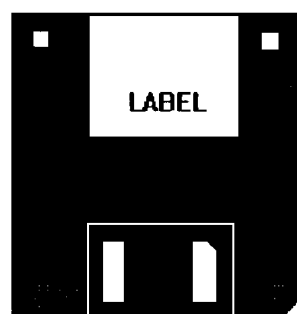
5.25" Diskette



Place a self-adhesive tag over the notch to protect the data on the diskette.

Write
Protect
Notch

3.5: Diskette



Write
Protect
Button

Sliding metal cover

Slide the button open to protect the data on the diskette. The 2nd hole on the opposite side identifies a high density diskette.

Diskette Organisation

The information that is stored on a diskette is in a coded form. Each text character or number is converted into a code that can be understood by the computer and placed on the diskette.

Think of the diskette as a file cabinet drawer with a number of random topic files stored in numeric order. Each document or program on the diskette is

identified and listed on a directory on the diskette so that the computer system can locate the information.

A single user on a floppy disk-based computer system may have more than 100 diskettes. Properly organised and stored, the diskettes provide an inexpensive insurance system against computer viruses, program damage and lost data files.

Label the diskettes with an indication of the contents of the diskette. This might include the name of the program and 'working copy' for a program diskette, or the name of a project and the date for a data diskette.

Original Program Diskettes

The software programs that allow us to use the computer for our own applications are provided on diskette or CD-ROM. The original diskettes provided by the software company should almost never be used in the computer. Use them to make a duplicate copy for normal use.

Store the original diskettes in a cool, clean, secure place away from the computer. You will only use these diskettes if your duplicate program diskettes become damaged.

Duplicate Program Diskettes

The duplicate copies of the program diskettes are used to make working copies of the program for daily use. Store the duplicate program diskettes in a cool, clean, secure place near the computer. You will use these diskettes when you change your computer system, when you buy a new printer, for example, or if your working program becomes damaged.

Working Program

The hard drive or working diskette will only contain those parts of the program that are necessary for your actual use. One popular word processor is supplied on 10 diskettes, 5 of which contain the special information for using over 100 different types of printers, others contains a dictionary for use on the hard drive and a smaller dictionary for use on a floppy drive system. You will only need the information for one or two of these printers and a single dictionary.

Copyright Restrictions

Most computer applications are supplied for use on one computer only. If they will be used on more than one computer at the same time a copy must be purchased for each machine.

Data Diskettes

Your data, the information that you type into the computer or is generated by the application program, should be stored on separate data diskettes or separate areas of the hard drive. Data may be organised by program type, user, or purpose.

For a floppy disk machine, it is preferable to use separate diskettes for each application program, and separate data diskettes for each user, purpose, or time period.

Backup Copies of Data

The wise user makes backup copies of important work on a regular basis.

The operating systems copy functions can be used to make duplicate copies of files and diskettes on a daily, weekly or other regular basis on any computer. Alternatively you may be able to copy your files to a work area on your local area network for backup by the system administrator or you may have a tape backup system available.

The frequency of backing up depends upon the importance of your data. Most business computer systems save separate backup copies daily, weekly

and monthly. The daily copies will be saved for at least two weeks, the monthly copies for at least two months, etc.

Some application programs provide their own mechanism for making backups, most notably accounting systems which may even require you to backup before you can exit the program. There are also a variety of commercial programs for making the backup process easier.

Store the duplicate copies in a cool, clean, secure place away from the computer.

For some kinds of data it is important to make a paper copy as well and store it in a secure place.

Rotating Backup Disk System

The best way of keeping back-up copies is to use several sets of diskettes or tapes in rotation. Start the first backup with one set. Use new sets for the second and third subsequent backups. The fourth backup can reuse the first set of diskettes/tapes, and so on...

You may also want to archive end-of-cycle copies. A copy of project or financial records, for example, should probably be retained at the end of each cycle—perhaps every fortnight, month, and year for financial records.

This system ensures that you will be able to recover from most data storage problems. If you only use one set of diskettes and the diskette is damaged you may lose all of your work. With the multiple diskette/tape system you should always have a useable copy of your data, even if it isn't the most recent copy.

Tips for Hard Drive Use

We have already emphasised the necessity for making backup copies of your data and other files. This cannot be emphasised too much. Although there are companies which specialise in retrieving data from damaged hard drives their services are expensive and should not be depended upon in the event of predictable failures.

We can, for example, predict that your hard drive will fail—not when, that is unknown, but the ‘if’ is guaranteed. Hard drives are one of the wonders of technology, storing a million or more pages of data in a space no larger than a paperback book, but they are mechanical and will fail sooner or later.

- Locate the drive in a cool, clean work area where it will not get wet, be moved or affected by the magnetic fields from other equipment.
- Be organised in your use of the hard drive. This includes using different directories/folders for system, program, and data files as well as regularly checking your data files so that you know where they are, delete unnecessary backup copies, etc.
- Regularly check the drive for computer viruses, lost and fragmented files, missing resource forks, etc. There are many tools available for such file maintenance. Purchase one and use it.
- Remove all of your files and reformat the drive at least annually, replacing the operating system and major applications from your program diskettes.
- Finally, if there is a problem with the drive, replace it.

Computer Maintenance

Almost any computer owner will tell you that learning how to use your computer applications (word processor, electronic mail, etc.) isn't enough—you must also learn how to perform the minimal maintenance tasks to keep your personal computer functioning.

Many users learn this lesson at an inconvenient time—the computer breaks down over a weekend or just before a holiday—and all find that good computer repair shops are few and far between, even in a capital city. Shops also charge quite justifiable, but significant, fees for work that the average user should be able to easily perform.

In my experience there are a number of practical maintenance chores that most users can, and should, know how to do. These include

- performing regular file backups,
- installing new software and hardware,
- general cleaning, and
- knowing what to do when a major problem occurs.

This Primer provides guidance in performing routine maintenance and cleaning, and some limited hints to try when the problems are major. You should also consult the manuals for your computer hardware and software, as well as any information provided by your vendor(s) relating to warranty maintenance and safety.

Warranty Service and Maintenance

Most computers and major peripherals (printers, monitors, etc.) are covered by a limited warranty for at least a few months after purchase. More reliable systems (and usually, therefore, more expensive) have longer warranties and fewer restrictions. Always have any maintenance, repairs, or other service work (boards installed, etc.) done by the designated warranty service centre during the warranty period.



Major 'brand name' manufacturers often have a network of 'authorised' dealers whose staff are factory trained in the repair and operation of their systems. Apple's educational and corporate dealers, for example, are required to have staff trained by Apple. Other major manufacturers may contract with national repair services to provide warranty and support.

It should be obvious that profit margins are too small on lower priced brands to provide the same level of support as more expensive brands. As well, some Australian distributors do not provide the same level of support as their US corporate parents.

It's *Your* Responsibility!

Ultimately *you* are the only person who can be responsible for the proper operation of *your* computer system.

Read the manual first. Often the answers to your questions/problems can be found there.

Be aware of safety requirements and follow them absolutely. This includes following safe practices for the electrical power supply and the high voltages within monitors, etc.

Always completely unplug the computer and any connected devices before opening up the computer—regardless of the reason.

Get assistance from knowledgeable friends or colleagues if you aren't sure about what you are doing, and

Call in the experts before you make the problem worse.

General Operation

Computers are sensitive electronic instruments and must be kept in a clean dry place, free from dust, bugs and interference from other electronic devices. Increasingly, computers are 'networked' to other computers through a local area network or a modem and the telephone system. Maintaining your computer may be affected by the network as well as the desk/room where it is located.

Extremes of climactic conditions are very hard on the use of a computer:

- the summer heat may cause the computer to malfunction—usually by giving erratic or erroneous results—use an air conditioner or room fan during those months;
- high humidity, smoke and sweat will cause corrosion and other damage—avoid storing or using a computer in a damp location, and never smoke near a computer;
- careless handling can damage the computer—ensure that all users know how to properly handle the computer, restrict food and drink near the computer, use clear plastic keyboard covers or enclosed systems in areas where spills may occur;
- power fluctuations will damage chips, traces and the video tube—use a proper CVT (constant voltage transformer or power stabiliser) and a spike suppressor (spikes are the short bursts of high voltage which cause a light to go bright) if your power supply is variable (rural and industrial areas particularly) and turn the computer off and unplug from the power point during a storm;
- dust and bugs will damage the moving parts of the computer and the diskettes—keep the work area very clean, cover all components of the computer system with a dust cover when not in use, clean the work area (and inside the computer, printer, etc.) regularly.

Keyboard: Your keyboard will get dirty enough to function erratically. It needs a regular cleaning, even if you haven't spilled anything on it.

Power Supply: The computer likely requires 230 volts plus or minus 10% and a frequency of 50Hz plus or minus .05Hz. Variations (surges and brown-outs) come from lightning strikes and other electrical equipment being switched on and off.

Be Safe!

Disconnect the computer from the power line, the telephone line, and all other devices during a lightning storm.

Local electricians or computer vendors can give you guidance on power requirements, grounding of equipment, power conditioning (also called power stabilisation), etc., as required. Most technicians, for example, suggest that computer power supplies are now constructed well enough that power bars with 'surge' protection are not required.

Check the power requirements for all the units to be stabilised before purchasing power conditioning equipment. A CVT (constant voltage transformer or stabiliser) of 500va, for example, will likely operate one PC and a monochrome monitor, but probably won't also operate a colour monitor or printer.

Low cost UPS (uninterruptible power supply) systems are essentially a battery and voltage converter to supply a few minutes of power after a power failure. This is intended to give you enough time to save files and properly shut down your computer. Better quality systems condition the power as well—generally they constantly charge the batteries, enabling them to supply all the power for the computer.

Portable computers often come with 'universal' power adaptors, allowing you to connect to 110-240 volt supplies at 50 or 60Hz. Check the power adaptor for compatibility before using it on a new power supply.

Check their batteries regularly, replace or recharge them as recommended by the computer manufacturer. Remove batteries before storing units for more than a few days.

Avoid extremes of heat and cold: The operating temperature of the computer is roughly 10 to 30 degrees Centigrade. While a computer may appear to function outside of this zone, errors may occur.

During the summer it may be necessary to use a room air conditioner or an extra fan while the computer is operating. This is for your computer, not you; make sure that the cool air is passing through your computer.

In general, if the room is uncomfortable for you, it will also be uncomfortable for your computer.

Avoid very high or very low humidity: Computers work best with a humidity range of 20% to 80%, non-condensing. Avoid using the computer when the humidity is low enough that there is static electricity generated OR is high enough that water condenses on the outside of a cold glass.

Hard drives: Hard drives are particularly vulnerable to damage from being jarred when moved. Operate the computer on a stable desk or table. Keep all cables neat, never allow cables to run across an aisle or other passage way.

Your hard drive, and the information that it stores, is ultimately more valuable than all the other components of your system. NEVER move a hard drive when it is on, as moving the hard drive increases the risk of a disk crash.

Be prepared, back up your files regularly.

Interference: Locate your computer components and all magnetic media well away from sources of magnetism and electronic interference. The

emissions from a colour television, for example, can affect some hard drives. The magnetic coils in a stereo system speaker can erase a diskette.

Practical Computer Maintenance

Clean the computer with a slightly damp cloth. Never let any kind of liquid run into any part of the computer. Do not spill liquids on the computer or the keyboard. In other words, keep soft drinks and other beverages away from the computer unless you are willing to accept the consequences—usually a major repair bill.

- Never spray cleaners directly onto electronic equipment—spray the cleaning cloth and use it for removing dust, finger marks, etc.

Establish a regular routine for cleaning and general maintenance of your system—computer and monitor, keyboard, printer and other peripherals, cables, etc.. Record all computer problems in a computer log book, follow-up problems, repair as necessary.

- Pay attention to unusual sounds, smells, and operating changes, recording and correcting as required.
- Use a vacuum cleaner on the outside of computer, printer, etc., but keep it out of equipment. Most vacuum cleaners can be reversed to work as a blower for getting rid of dust a accumulated bug parts inside.
- Disassemble mouse and clean as recommended by manufacturer; check keyboard and clean as required.
- Annually check insurance renewals and locate all items on the inventory (small items seem to disappear if you don't check their location), etc.

Caution: There are high voltages and other hazards inside computers and monitors.

- Leave monitor servicing to the experts.
- Always disconnect all cables before opening the computer case.
- Watch where you put your hands.
- Keep metal tools out of any place where you could accidentally cause a 'short' circuit between two electronic components. In other words, you don't want your tools to touch two components at the same time!

Trouble Shooting

If you have problems with your computer system:

- Consult your computer manual for advice on how to handle problems and error messages.
- Run the diagnostics tests on the system diskettes supplied by your computer manufacturer and follow the advice provided.
- If the problem is still not resolved, consult your computer vendor, the vendor's approved maintenance service, or a local repair service.

Be Observant

A careful computer user observes how the computer operates when it is running normally and can tell when the computer first does something unusual. It is particularly important to be observant during the startup routines. It is difficult to know what has gone wrong unless you know what should happen when the computer is working properly.

Make a record of problems, and their solutions, so that you can provide correct information about a problem to a repair service when required.

**Don't wait for a disaster to occur...
Anticipate and fix problems before they happen!**

Review—*Health Informatics: an overview*

Health informatics is the discipline which combines the study of information systems as applied to the health sector. It includes everything related to the management of the data, information, and knowledge underpinning healthcare.

Edited by Evelyn Hovenga, Michael Kidd, and Branko Cesnik, *Health Informatics: an overview* includes contributions by 36 Australian academics and practitioners with topics grouped under 5 major headings:

- Introduction
- Basic informatics concepts
- Health informatics in clinical practice
- Informatics and healthcare practice
- Health research and informatics

This survey brings together practitioners from healthcare, information technology, academia, business and vendors to bridge the gap between international and Australian practice. While every topic could spawn a book of its own (and many have in other countries), the 374 pages of this book provide a good introduction for the student and general Aussie healthcare audience.

Health Informatics: an overview

Hovenga, E, et al, Churchill Livingstone, 1996. ISBN: 0 443 05430 4

References: User Interface

Several of the Primers have references or other lists which direct the reader to further reading on the topic of the Primer. This Primer provides a list of primarily print-based references on the Computer-Human Interface, one of the most important topics for any healthcare worker doing more advanced work with computer courseware or software. Other references are available through a WWW search.

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Glossary of Basic Terminology

Animation: Concept/Software: a sequence of (generally) graphics which, when viewed in sequence, illustrates a process.

Browser software: tool such as Netscape, Mosaic, or Lynx (text only) for accessing Web resources.

Bug Software/Hardware: a bug is 'an undocumented feature' in some minds and a stupid error that should have been caught by the developer in others. Novices should understand that bugs, or errors, are inherent in almost any computer software or hardware product; it's just that some products are worse than others.

Bulletin Board (BBS) Application: a computer bulletin board is the electronic version of the display board where notices, reminders, etc., can be posted for later retrieval. Bulletin Board systems are accessed via a modem and the telephone line, and are typically operated by individuals or clubs as a community service or hobby. The best boards provide a reliable source of shareware and public domain software as well as computer advice and messaging services.

Button Concept: a screen icon which, when clicked like a physical button by the mouse pointer, etc., accesses the node indicated.

CAD/CAM Application: computer aided drafting/computer aided manufacturing. (CADD adds Design)

Camera Ready DTP: the final proof image that will be used for the preparation of the printed copy. Originally the camera ready copy was photographed by a special camera to make a negative for preparing the printing plate. In common usage today, the camera ready copy is the master copy that is used by a high speed photocopier for 'printing'.

CD-ROM Hardware: a computer data storage system using technology similar to CD music systems.

CGA/EGA/MDA/VGA/SVGA/Multisync Hardware: these are all display adaptor designations and indicate the type of text and graphics which can be displayed.

Client Hardware/Concept: in client-server terms, the desktop-based portion of a 'client-server' application which accesses databases and similar facilities based on a (normally larger) computer which maintains the database/service. In e-mail, for example, the server maintains accounts/passwords, and provides store/forward facilities for users.

Colour Separations DTP: the special negatives prepared from a colour photograph or illustration to enable the image to be printed in colour. Traditionally prepared using colour filters, separations can now be prepared using computer software. A colour image is printed by running the page through the press four times, each time with a different colour of ink (cyan, magenta, yellow, and black). The combinations of colours in any one area creates other colours. Green, for example, is produced by a combination of cyan and yellow dots. [Look at the colour comics or a newspaper photograph to see the dot structure.]

Communications Application: interchange of information using computers, see electronic mail for one type.

Continuous Tone Image DTP: a continuous tone photograph is the common black and white or colour photographic print prepared by a photo lab from a negative. In a good photo there will be a continuous range of tones from pure white to solid black, with the gray tones providing detail. Pencil sketches must also be treated as a continuous tone image to capture detail.

Copy Editing Concept: marking the draft to give the printer exact directions for setting each line. Directions will include type size, style, italics and bold fonts, column and page sizes, etc. This step, originally done manually by the copy editor as instructions for a typesetter, is fundamentally what desktop editing is all about.

Courseware Software: computer-based educational materials, a category of application software which is a cross between program and data. Courseware includes didactic teaching materials, educational games, and interactive multimedia.

CPU Hardware: the Central Processing Unit is the chip in the hardware where the computer's work is accomplished. DOS/Windows computers essentially use a CPU manufactured by Intel Corporation and referred to as a 486 (80486), Pentium, etc. The Macintosh computer uses a Motorola CPU such as the 68030 or a PowerPC.

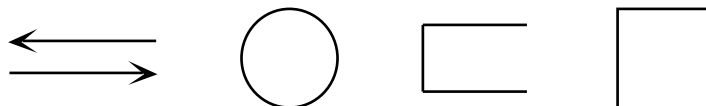
CSCW Concept: computer-supported cooperative work.

Cursor Hardware/software: the cursor is the point, usually indicated by a flashing bar or square, which indicates that the computer is ready to accept input. Normally text input will be displayed at the cursor location.

CVT Hardware: constant voltage transformer or power stabiliser.

Data dictionaries IS tool: lists every element in the complete set of data flow diagrams describing a particular system. Storing the characteristics of the data elements in the data dictionary helps keep the data flow diagram uncluttered and easy to understand. Automated data dictionary tools assist in minimising duplicate entries and help ensure completeness and consistency.

Data flow diagrams IS tool: provides a simplified visual description of the way in which data moves within an information system. A *logical* data flow diagram describes *what* is going on. If you include information about *how* the data is transformed or *who* does the transformations, then the diagram becomes a *physical* data flow diagram. Only four symbols are necessary to construct a data flow diagram:



From left to right: data flow (pipeline), process/bubble (action), data store, source or destination

Database Manager Application: a database manager allows the computer user to manipulate lists and similar data.

Decision tables and decision trees IS tool: decision tables list all of the logical decisions to be made in a given system or sub-system; decision trees provide similar information in a graphical manner.

Desk Top Publishing Application: DTP is a software and hardware combination that allows the computer user to layout and print pages of combined text and graphics.

Digital Camera Hardware: a camera which records the scene directly to a memory chip and does not use film.

Dot Matrix Printer Hardware: a low to medium quality computer printing unit that forms individual letters using a 'matrix' of small dots, often created by a tiny hammer striking the paper; 'ink jet' printers give higher quality output using a non-impact system.

dpi Measure: dots per inch, used in indicating print resolution; compare with pixels per inch, used to indicate the size of screen dots.

Draw Application: the user creates an image composed of lines rather than a bit (dot) pattern. Typically such software creates images that are defined mathematically, and can be easily manipulated for scaling, etc. A good draw package will allow an illustration to be scaled up in size while retaining the original line weight. See also *CAD* and *Paint*.

Dummy DTP: a mock-up showing the size, style, and layout of the final document.

EBN Hardware: electronic broadband (high capacity) network.

EDI Application: electronic data interchange.

Electronic Mail Application: a computer messaging system that allows messages to be stored for later retrieval. E-mail systems can communicate worldwide through telephone or dedicated network links.

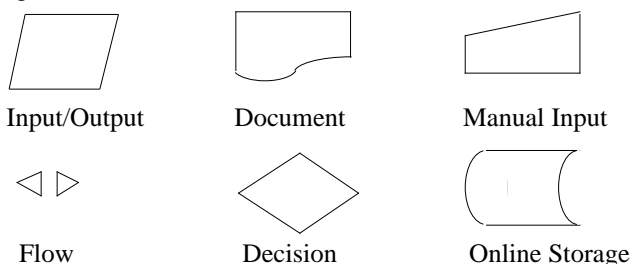
FAQ Data: answers to Frequently Asked Questions, often compiled by administrators of discussion lists and other experts; available for many topics on the Internet.

Firewall Concept: a barrier, usually maintained by a trusted network server, which ensures that unauthorised users may not access protected resources. A system might use a firewall to hide a financial database from network users, for example, while allowing access by local users.

Floppy Disk Hardware: a data storage system that uses magnetic coated flexible plastic diskettes as the storage medium. Older computers will use a 5.25 inch square diskette with

either 360K or 1.2M capacity; newer computers use 3.5 inch square hard-sided diskettes with either 720/800K or 1.4M capacity.

Flow charts IS tool: describe the overall relationship between elements in a system using standardised symbols. They can be used to summarise or simplify the understanding of a system, particularly an existing physical system. They are also used to capture procedural logic to assist programmers.



While they perform different functions, flowcharts have generally been replaced by data flow diagrams—flowcharts do not adequately represent the hierarchy of processes and tend to emphasise physical rather than logical requirements of a system.

Font Concept: the name for a particular screen or printing typeface (character set)—Times or Helvetica, for example. Most fonts are available in several different sizes (heights and widths), weights (width of line— normal or bold), and styles (normal or italic). A sans serif font lacks the small projections on the ends of horizontal and vertical lines of a character which make them more identifiable, and thus easier to read.

Games Port Hardware: a motion oriented input mechanism, usually for games use.

Graphics Application: graphics include any non-text data form (photographs, icons, drawings, animations, etc.).

Groupware Application: technologies which enable people to work together regardless of place and time, in short, any cooperative activity.

GUI Concept: Graphical User Interface or *WIMP*—as compared to a command interface which requires explicit commands to use the computer.

Halftone Photograph DTP: a photographic illustration prepared from a special 'screened' negative. The resulting photo will contain only black and white tones, with the apparent shades of gray formed by varying the size of the dots composing the photo. [Look at a newspaper photo with a magnifying glass to see the dot structure.]

Hard Disk Hardware: a hard disk uses a non-removable magnetic platter for data storage.

High Contrast Image DTP: an image composed of black and white lines only, without any grays. A pen and ink drawing or a 'line' drawing prepared using a computer drawing package is a good example.

Home Page Concept: the home, or starting point, for access to Web information resources on a particular topic or group of topics. Used generically, thus the author's home page is found under the Department's home page, which is itself under the University's home page.

Hot Spot Concept: a standardised screen convention (often highlighted text) which, when clicked (or touched) by a pointer (usually the mouse pointer) accesses the node indicated.

HTML Language: hypertext markup language, used for preparing WWW pages.

Hyperdocument Application: typically a computer-based document format which encourages readers (users) to move rapidly and conveniently, in a non-linear manner, from topic to topic as their needs dictate.

Hypermedia Application: a hyperdocument that allows users to move, in a non-linear manner, between images, sound and text.

Hypertext Application: a document format which encourages readers (users) to move rapidly and conveniently from topic to topic as their needs dictate. Since the name implies a text-based document, some writers prefer 'hyperdocument', others simply refer to 'non-sequential writing'.

IBM/MS-DOS Software (usually): commonly referred to as DOS, the microcomputer Disk Operating System jointly marketed by IBM and Microsoft Corporation.

Icon Concept: an icon is a representation of something else, usually graphical when used in computer terms, thus a graphic of a file folder is used to represent a data storage location; part of a *GUI*.

IMHO Abbreviation: for 'In my humble opinion' in e-mail and similar messages; almost always used sarcastically IMHO.

Interface Concept/Hardware/Software: the system by which the user interacts with the computer—commands, icons, buttons, etc.

IRC Application: Internet Relay Chat, a text-based synchronous Internet service.

ISDN Hardware: one of several standards for data networks, marketed by Telstra and very expensive in Australia, for dedicated and 'on-demand' electronic data and voice networks. Higher capacity and faster than using the standard telephone network.

Java Application tool and language: Java technology allows small programs (applications), called applets, to be run on a variety of platforms (Sun, Intel, other Unix, and Macintosh) from within a WWW browser. The application is downloaded from the server along with the html page description code and executed relatively transparently.

Justified Concept: the practice of inserting various sized spaces between words and individual letters so that all lines have exactly the same length. Also called, right justified. The resulting text is usually harder to read than text with a ragged right edge, and is often full of 'rivers' of white space running down the column.

Laptop Marketing: a laptop computer is small enough to be used in an airline seat and is usually battery powered.

Laser Printer Hardware: a paper printing technology that works much the same way as a photocopier except that the image is generated by a laser beam onto a sensitised drum. Medium to high quality output.

Link Concept: an electronic cross-reference between one node and another. Initially a hyperdocument contains links established by the 'author' but some systems allow users to develop their own links as well.

Link Anchor Concept: the visual indication in a hyperdocument that a link exists to another item of information. Normally the user points to the link anchor, a button or hot spot, to move to the desired node.

ListServer Application: a network mailing list; a list server is an application which maintains addresses for the members of an affinity group and remails messages addressed to the group mailing address to all members of the group.

Modem Hardware: converts digital data to sounds that can be sent over the phone lines and vice versa.

Mouse Hardware: the most common of the alternate input devices that includes trackballs, light pens, touch sensitive screens, and digitisers.

MUDS/MOOS Application: multiuser adventure games or multi-person environments based on the games environment, normally connected via the Internet.

Multimedia Application: a presentation (or document) which utilises images, sound and text.

Multimedia Computer Hardware: a computer system which, in 1996, includes a CD-ROM drive, speakers/earphones and high resolution monitor, and system resources (RAM, hard drive space, fast processor, etc.) to use with commercial multimedia and games software. The popularity of multimedia games, encyclopedias, and edutainment packages has almost made this the minimum standard for a personal desktop computer.

Navigation Concept: movement through and around a document. Navigation in a hyperdocument can be quite confusing because of the non-linear movements possible and special navigation tools are usually provided.

Network Hardware: any interconnection system to allow computers to share resources such as printers and disk storage, or to communicate using electronic mail or similar facilities.

Newsgroup: Application: the network version of a bulletin board; newsgroup software maintains messages on specified topics and makes them available to readers on request.

Node Concept: basic unit of information—ideally a single topic—in a hyperdocument. A node is often a single screen, but it can be as small as a single word or as large as a whole book, and can contain any kind of information including text, graphics, animation or video.

Paint Application: computer software that allows the user to make a bit image—an image prepared by turning ‘on’ or ‘off’ the individual dots which comprise the picture. The spray can tool within most paint packages, for example, leaves a trail of dots resembling a sprayed line. See also *CAD and Draw*.

Paper Sizes Concept: A4 is the most common size of paper used in a technical report, letter, or photocopier (210 by 297 mm). Folded in half to make a sheet with the same proportions, it results in an A5 page. A3 is twice the size of an A4 sheet (297 x 420 mm). Copying four A4 pages onto the two sides of an A3 sheet results in a 4 page document that can be folded to make a much neater package than individual sheets stapled together.

Paperless Office Myth: just as computers have been promoted as being the salvation of any business, they also supposedly cut down on the amount of paper used in any computerised activity.

Perfect Binding DTP: a relatively inexpensive process that uses hot glue or plastic to bind a stack of paper. Most magazines, paper bound books and notepads are perfect bound, which is why pages can be easily removed.

Postscript DTP: a page definition language where text and images are described in mathematical terms with combinations of lines forming objects; the objects can be empty or filled.

PPP Protocol: point-to-point protocol, one of the communications protocols used for connecting a desktop computer with a service provider to gain access to network resources.

Presentation System Application: presentation systems are common business applications for the presentation of ‘slides’ combining text and visuals on the computer.

Printer Driver Software: special files that enable your software to convert its print output into a format that is designed for the specific features of your printer.

Proportional Type Concept: text characters whose width varies with the complexity of the character; for example, a ‘w’ is much wider than an ‘i’.

Public Domain Software Software: in the early years of personal computers many developers produced useful computer products simply for the pleasure of doing so. As they didn't want to be bothered with commercial distribution they put the products into the public domain, allowing the software to be distributed without cost. Today there is almost no software distributed in this manner and computer users should be prepared to pay for the software they use.

QTVR Software: Apple's QuickTime Virtual Reality tools provide a highly compressed low-tech solution for ‘fly-throughs’ and other desktop virtual reality applications.

QuickTime Software: Apple standard for data compression to utilise video and other graphical materials on the computer; available on both Macintosh and Intel platforms.

Server Hardware/Concept: in client-server terms, a computer providing database access (eg. a data warehouse for MIS/EIS applications) for (typically) desktop-based access from distributed sites, desktop machines run the ‘client’ portion of the application; in local/wide area network terms, the server provides a central storage facility (for e-mail messages, private work spaces, common message areas, etc.), maintains passwords, e-mail alias lists, and communicates with other network servers, routers, etc.

Service Bureau Concept: a business supplying text and graphic art services for the desktop publishing industry or similar video and reproduction services (including CD-ROM production) to the multimedia industry. Materials may often be supplied to the service bureau on disk or via modem. One of the major difficulties with using a DTP service bureau is ensuring that the same fonts (brand and type) are used by both the desktop editor when designing the page and the service bureau when printing the page.

Shareware Software: a category of semi-commercial software where you can evaluate the item before purchase. Shareware is inexpensively distributed through user groups and individuals; if you use the software you are required to send a registration payment to the software developer. While some shareware packages cost as much as their more commercial counterparts, the normal registration fee of a shareware package is \$50-100.

SLIP Protocol: serial-line Internet protocol, one of the communications protocols used for connecting a desktop computer with a service provider to gain access to network resources.

Smileys Concept: text symbols to indicate humour in e-mail—read them sideways, eg.
smile :-) wink ;-)
sad :-(

SneakerNet Concept: the use of hand-delivered disks, tapes, or removable hard drives (such as the low-cost Iomega Zip drives) for transferring files from computer to computer rather than via a network facility.

Software Software: the application programs which make your computer functional.

Software License Concept: computer users typically purchase a license to use the application when purchasing the physical embodiment of the software (disks, manuals, etc.). Other rights, especially the right to distribute copies of the software, are retained by the developer. Unfortunately some users distribute bootleg copies of software, a practice which is both illegal and damages the ability of software developers to survive.

Spreadsheet Application: a spreadsheet is the electronic equivalent of an accountant's worksheet, complete with formulas and functions that permit automatic calculations, etc.

Telemedicine Applications: telecommunications-supported medicine; applications include remote imaging, treatment via videoconference, electronic information exchange.

UPS Hardware: an uninterruptible power supply keeps your computer operating at least long enough to shut down properly when the power fails.

URL Concept: Universal Resource Locator—address for a Web resource.

Utility Software: a category of software which includes all the useful programs, often small, which make your computer tasks easier. Utility programs assist in finding files, executing programs using a menu system, translating files from one format to another, etc.

VDI/VDU Hardware: the computer screen or visual display terminal/unit, provides a paperless output device for your computer work.

Virtual Memory Hardware/Software: something that is virtual doesn't really exist; a virtual memory system uses slower, but cheaper, space on the hard drive to expand the working memory available to the CPU.

Virtual Reality Application: system for presenting a simulated real-life situation via the computer. Some virtual reality systems allow the user to 'fly-through' the simulated environment, others to manipulate virtual objects.

Voice Input Hardware/Software: an input device that controls the computer through spoken commands by matching a voice pattern with a small list of commands that have been previously 'learned' by the computer. Note that some computers also have voice output, usually accomplished through a voice synthesiser reading text rather than from digitised sound.

WIMPS Concept: the attributes of a gooey (GUI or graphical user interface)—windows, icons, menus and pointers.

Windows Concept: similar to house windows, a computer software window provides different views of the same data, similar views of different data, etc.

Windows/Windows 95 Software: an enhancement to the IBM/MS-DOS operating system to effectively use mice and provide a graphical user interface.

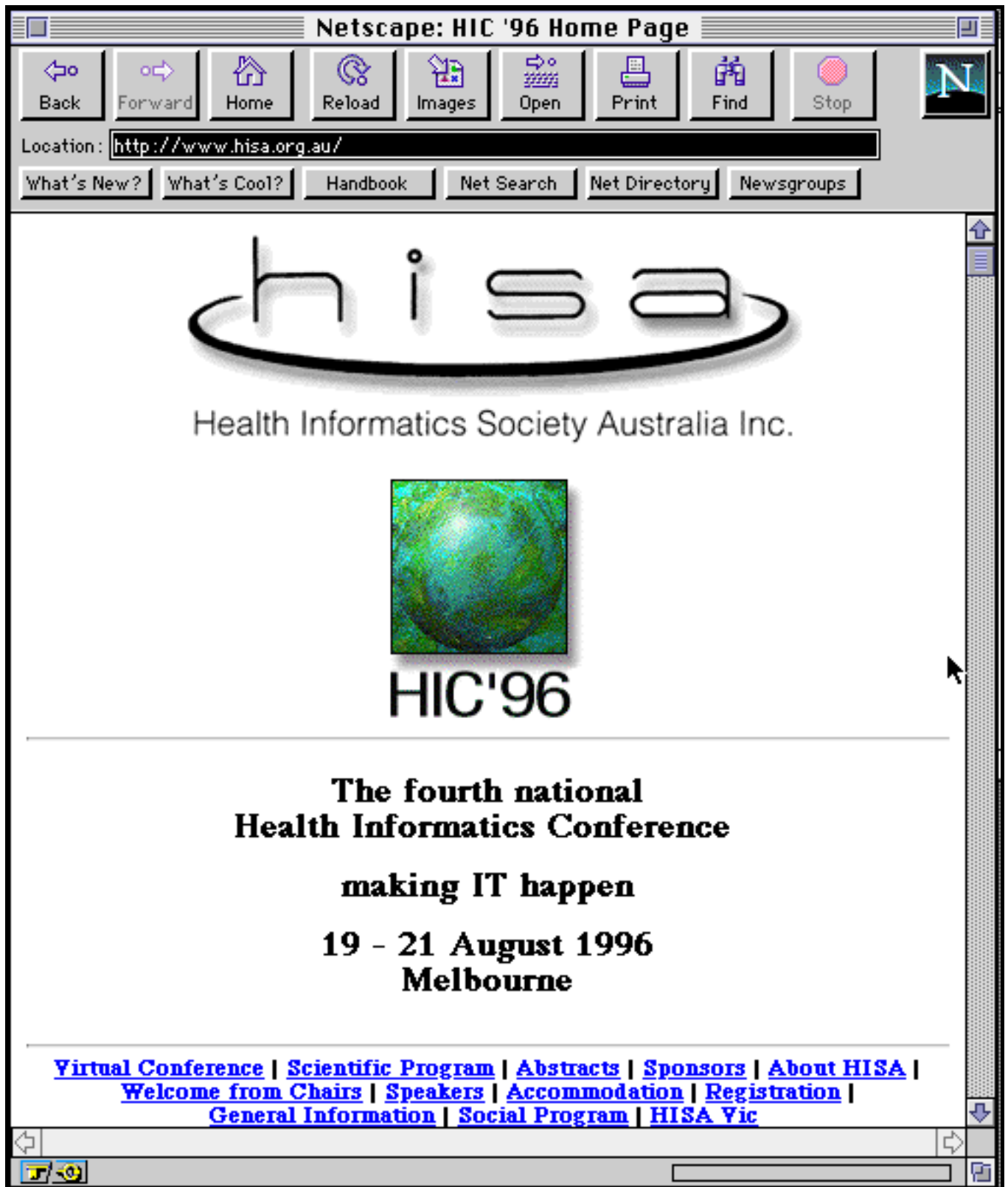
Word Processing Application: allows the computer to be used as a sophisticated typewriter; while spelling checkers and other utilities are often used, any word processor will allow text to be created, revised, stored and printed.

Work Station Hardware: a powerful computer unit for individual use, may be stand alone or part of a networked computer system. Work stations are common in CAD, mapping, graphics and engineering applications and normally provide a GUI.

VRML Language: Virtual Reality Modelling Language, the virtual reality facility similar to HTML for WWW and similar applications.

WWW/World Wide Web Application: the fastest growing communication tool on the Internet; the WWW allows text, graphics and other visual materials, as well as sound and video to be delivered consistently to different computer platforms.

WYSIWYG (pronounced 'whizzy-wig') Concept: 'what you see is what you get'. Attribute of a graphically oriented word processor or page layout program as compared to text-based editors or text formatters which used colours and other conventions to indicate text formatting. WYSIWYG tools display font changes, **bold**, *italic*, and other formatting as they will appear on the printed page.



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