THE PC POTENTIAL IN PRACTICE

Chris N French[1]

Talk of an exciting future for computers which would play games, teach, train, test eyes and keep optometric records was met at best by glazed, unbelieving looks from optometry students 22 years ago äs they looked at their decks of cards with their little rectangular punched holes!

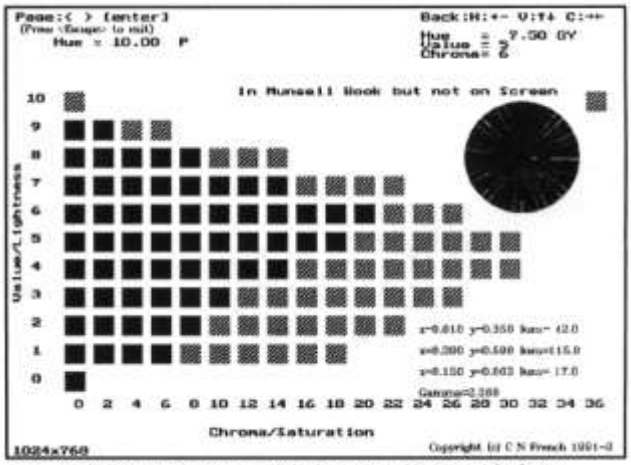
Today, in education, at long last Student attitudes are very different. Up to three-quarters of students now see the relevance of computing although the flat earth society still has its members with a small minority (5 per cent) viewing it as completely irrelevant. Of course, in reality the real educational front has moved from further and higher to secondary and thence to primary education. There were "minicomputers" in homes and primary schools over 20 years ago but it has taken a long, long time for personal computers to become commonplace and äs accepted äs they are today.

Despite this, many students still manage to come into university ill-informed about computer matters with little in the way of keyboard skills. In fact typing skills are often the biggest mental block to acquiring computer proficiency. On average, sexist education can give women a head start although the stronger motivation of men towards computers can be a compensatory factor.

Computer Devices

You can't avoid computer technology these days - whether it's your memo-watch, Nintendo games console, washing machine or video recorder. But there is a tendency, on the professional side with field screeners, keratometers, chart projectors and other Instruments, for the computer to be built-into the system with the result that it is barely identifiable.

Many of these devices are user-unfriendly. Despite the hackneyed joke that the only person who can programme the video is the family's computer-aware 5-year old, a background in computers is rarely of help. In fact some of us find computer programming easier than re-setting the alarm on our digital watches! Thus, computer training or experience may be of little benefit to professionals with this type of technology.



SuperVGA version of Munsell Page 10.0 P

PCs at Home and Work

But we have reached a stage in the evolution of computer power and pricing where a little bit of computer education, training and skills can be a very useful thing indeed.

The ubiquitous 'game machine' has not vanquished the 'home computer'. The Amigas and Ataris are still there with the capability to do all that the dedicated machine can do and far more. They have been joined by the industry-standard 'PC' (short for IBM Personal Computer Compatible). With its competitive price (£300 plus), it is making inroads on the home and school fronts äs well expanding its grip on business. In this area the move is away from the old, dedicated approach with word-processing only systems to multi-purpose PCs.

To use a PC effectively a little knowledge and training can be a very valuable thing - witness the huge expansion in computer magazines to which many people have become addicted.

PCs in Practice

Old computers were difficult to programme, but not today's. The tremendous growth in power of the hardware and the vigorous evolution of the Software means that today's professional is spoilt for choice.

Many will still feel unprepared for this 'complicated' world and

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prefer to buy a professional 'system' tailored for optometric practice. Certainly, if you want the proverbial all-singing, all-dancing system then that is probably what you should do with your PC. But others may not be yet prepared to go the füll bog. For example, they may still prefer paper clinical records and wish to test the computer water first. They might reminder s, letter-writing, leaflets, business plans and accounts. These are all functions which can be tackled by the keen amateur. The optometrist will find themselves spoilt for choice when it comes to word-processing, desk-top-publishing, spreadsheet and database software. They can mix and match software from various sources or go for an integrated package claiming all three functions.

PC in Practice

Whether or not you purchase a complete professional system or buy the components separately there is still a great deal more that you can do. Nineteen ninety-one was the year of the 386SX 'PC' or, for those doing it on the cheap, a 286 (£300 plus). At the time of writing people are buying 486 machines. For most intents and purposes the machines function in much the 'same' way äs the original '86', the Intel 8086 from the early 1970s. Each year these machines get cheaper (£600-£1,000 for middle-range machines in November 1992 according to Computer Shopper) and faster and more powerful.

But this overlooks another important, creeping improvement - the revolution in their graphics performance which is opening up a whole new window for optometrists and those with a need for visual displays.

The Graphics Revolution

Old computers gave you just 16 rather arbitrary colours and very poor resolution - typically a measly 320 by 200 pixels. There were machines that offered much more but these were expensive. Because of this many people opted for monochrome monitors with much sterile debate about what was 'best' - should your monitor be green or amber, or was 'paper white' the bee's knees?

Today's PC routinely gives you a screen resolution of 640x480 and a choice of a quarter of a million colours with the 'VGA' graphics standard. (16 million colour ranges and Super-VGA resolutions of 1024x768 are becoming more commonplace too.) Colour is no longer seen äs a luxury and most software uses it to make for a more user-friendly, graphical interface. The result is cheap, mass-produced colour machines.

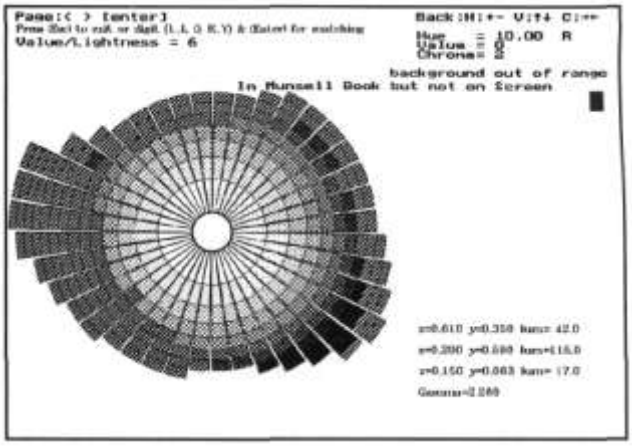
The higher resolutions, the presence of colour and the speed of these machines means that computers can now tak on a whole new ränge of activities. VGA resolutions give the optometrist the acuity potential of '6/5' tests while Super VGA enables '6/4' and probably '6/3'. But a note of caution is probably necessary. To use colour accurately on a monitor, it first needs to be very carefully calibrated and this is an area where you get what you pay for. Visit a friend's home and you will inevitably find their tv shows different colours to yours because neither of you will have followed any standard procedure to set it up.

Probably, the best way of illustrating the colour potential of VGA is by comparison with the Munsell Book of Colour. The Munsell system divides up colour space psychologically using three dimensions and the colour "solid" can be visualised äs an orange.

Each segment of the orange represents a different **Hue** or 'colour'. The Munsell Book of Colour has 40 pages (segments) covering a circular scale of 100 units over the 360° colour circle.

Value is the term used to describe the 'lightness' dimension. This is represented by the vertical axis with the top of the orange being white and the bottom black. Horizontal slices will have equal values ranging from zero (black) to 10 (intense white).

Finally, **Chroma** represents 'saturation'. The central vertical pith in an orange represents a chroma value of zero (a simple grey scale), while successive cylinders represent equal chroma values extending to 38 chroma units from the centre with colours becoming increasingly saturated.



SuperVGA Value 6 slice of colour solid

The typical Munsell Book of Colour has around 1500 colours to represent colour space. It is made up of painted chips and its ränge is limited by the need to use stable paints which will not change over time. A selection of such chips are used by colour vision tests (eg the Farsworth-Munsell 100 Hue test and the City test).

If we attempt to simulate these surface colours illuminated by Standard illuminant C with video colour we find that just under half of these colours cannot be reached. The Munsell colour solid is in fact a very odd-shaped fruit. The 'electronic' colour solid is smaller than this and also rather misshapen. This is illustrated by

the three accompanying figures which give examples of the Hue, Value and Chroma potential of a computer colour monitor and show the 'missing' colours with stripes.

It is interesting that entertainment-wise the lack of high Saturation colours has never really bothered tv-viewers.. perhaps because colours in the real world tend not to be very saturated. With four phosphors a much better ränge of colours could be achieved but tv's would be more expensive. Considerable efforts have been made by manufacturers to produce brighter screens. Unfortunately, colour monitors remain dimmer than monochrome because the CRT shadow mask reduces their intensity and in certain circumstances this can be a limiting factor. (In passing it is worth noting that, despite the tremendous improvements in flat-screen technology, modern expensive, flat screen PCs still tend to disappoint when it comes to colour and brightness.)

Computerised Optometry

For some years now you have been able to purchase special devices devoted to field screening and refraction... much like the old, rather limited word-processors were dedicated to just this process. These ophthalmic devices have been expensive, varying in price from several to tens of thousands of pounds.

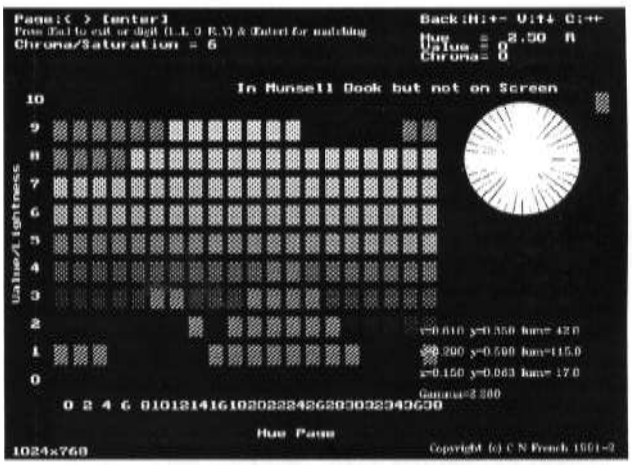
The new generation of cheap computers has the potential to be programmed to emulate these and many other optometric activities needed in practice. In theory there is little to stop a modern PC taking over *all* modern practice activities.

There is no need to buy a new computer. That same machine that writes the letters, advises on dispensing, devises the advertising copy, does the accounts and keeps the patient records can be testing acuity, assessing fields and screening for colour defects. In the same way that you buy word-processor software like WordPerfect, Works or Word to put on your PC so that you can write letters. All you now need to do to 'test eyes' *ought* to be to purchase a suitable programme.

In the future people will shop around for the optometric software they want - much äs they do these days when they make the choice between the Lotus 1-2-3 and Quattro Pro 4 spreadsheets or between Paradox 4 and Foxbase databases or Word and WordPerfect 5. l word-processors.

Occasionally one finds that one's software doesn't do everything one wants. Your word-processing might be a bit lacking in the grammar-checking department. You might want a routine to count the number of words in a document or you might need a foreign language spelling checker. You don't junk the word-processor. Instead you look for some add-ons. You might buy a grammar checker like Grammatik IV to interface with your WordPerfect. Maybe you want to give your PC some 'eyes' and get it to read text? You pop out and buy a Scanner and a suitable programme.

In the same way, in optometry you will probably end up buying little add-ons.. perhaps for distance binocular vision or perhaps a new-fangled colour vision or fields programme. There are numerous possibilities. With a little bit of enterprise you could also write your own little programme to do that something extra that none of your colleagues appear to think is important but *you* do! More and more of such programmes are already becoming available.



Chroma 6 'cylinder' against black ground in 8514/A mode.

UMIST Eye System

Like other universities, we at UMIST for many years have experimented using computers in optometric practical work. The experience gained here has prompted the development in the last few years of the **UMIST Eye System,** a software package designed to work on the modern PC computer - requiring just a Standard keyboard and a standard VGA monitor.

No extras are needed for its basic operations but if you want to make *the fallest* use of the software then there are a few things that need to be added - a chin rest to take advantage of the field screening facility, a light meter for accurate calibration and perhaps an additional monitor for convenience.

Too much can perhaps be made of the shortcomings of video displays and calibration problems. Close examination of conventional optometric equipment will often reveal very poorly printed charts. And how often do optometrists when screening for colour defects fail to use proper illumination? In contrast a properly calibrated computer monitor carries its "own illumination" with it and has the potential to show colours not available in Munsell chips.

You don't need to buy an extra computer. The present one will do if it is a modern VGA PC, but in

the same way that most families these days have more than one television in the home the pressures are there to buy additional computers. Some computers never seem to wear out but their 'front-line' life these days is only two or three years. Even in conservative areas like universities, computers are being replaced and moved to secondary roles after five years instead of the traditional seven. Of course for some years something similar has happened to the domestic tv that refuses to wear out. It gets consigned to the spare room or given to the children.

In the future too, computers are likelier to become easier and cheaper to link in small 'networks' although the presence of two computers does not represent a compulsive need to join them up!

While it has been undergoing development, the UMIST Eye System has been used routinely in two practices in England and is now commercially available from UMIST. What it does and what PCs might be expected to do in the future will be described in the next article.

As far äs optometrists are concerned, the PC computer's time has come.

Additional Reading

Chamberlin GJ and Chamberlin DG (1980); Colour, Its Measurement, Computation and Application; London: Hyden.
Travis D (1991); Effective Color Displays, Theory and Practice; London: Academic Press

Footnote

Illustrations are from Chris French's "Computer Book of Colour" programme which provides a pictorial test of the colour potential of most VGA, Super VGA and 8514/A PC AT computers by emulating the 40 pages of the Munsell Book of Colour; displaying additional constant chroma and constant value charts; and providing ISCC-NBS colour names and a colour matching system. Available from Optometry & Vision Sciences, UMIST, POBox 88, Manchester, M60 1QD.