Refereed papers

A visual study of computers on doctors' desks

Christopher Pearce PhD MFM MBBS FRACGP FACRRM FAICD FACHI
Honorary Senior Lecturer, University of Melbourne and Deputy Chair, Melbourne East General Practice Network, Australia

Hannah Walker BA (Hons)
Research Officer, Centre for Ethics in Medicine and Society, Monash Medical School, Melbourne, Australia

Carolyn O'Shea MMed MBBS FRACGP
Senior Lecturer, University of Melbourne Department of General Practice, Australia

ABSTRACT

Background General practice has rapidly computerised over the past ten years, thereby changing the nature of general practice rooms. Most general practice consulting rooms were designed and created in an era without computer hardware, establishing a pattern of work around maximising the doctor–patient relationship. General practitioners (GPs) and patients have had to integrate the computer into this environment.

Methods Twenty GPs allowed access to their rooms and consultations as part of a larger study. The results are based on an analysis of still shots of the consulting rooms. Analysis used dramaturgical methodology; thus the room is described as though it is the setting for a play.

Results First, several desk areas were identified: a shared or patient area, a working area, a clinical area and an administrative area. Then, within that framework, we were able to identify two broad categories of setting, one inclusive of the patient and one exclusive.

Conclusion With the increasing significance of the computer in the three-way doctor–patient–computer relationship, an understanding of the social milieu in which the three players in the consultation interact (the staging) will inform further analysis of the interaction, and allow a framework for assessing the effects of different computer placements.

Keywords: doctor–patient–computer interaction, computer placement, general practice

Background

This paper is designed to examine how Australian GPs have integrated computers into an environment that was not designed around them, and thus how the doctor, patient and computer interact in this workspace. Most of the research on consultations focuses on the content and not the environment. Consulting rooms have many constant elements to facilitate the interaction, such as desks, chairs, examination couches and bookshelves. This study focuses on the area where most of the interaction occurs, the desk and surrounding chairs.

Australian general practice has computerised rapidly over the past decade, with over 90% of GPs working with a computer and associated paraphernalia on and around their desks including central processing units (CPUs), keyboards, monitors and mice.[1] Each consulting room is unique in its setting, and in most cases the specific arrangement of the various items has been purposely moulded by the doctor in a way that suits his or her working style within the constraints of available materials.[2] How much influence the doctor has will be dependent on whether they share the room, or how

much say they have in practice management. Most GP consulting rooms, and all those in this study, were created in an environment where paper was dominant; the computer can be seen as an interloper in this environment.

There are, of course, constants within the contents of the room. Fixed elements include desks, examination couches and computer equipment. However, within those constraints, doctors are able to make individual decisions about the layout of items such as chairs, the specific placing of the desk and placement of screen/keyboard etc. The physical setting is generally understood to have an impact on the consultation. Current teaching of Australian trainee GPs, based on the precepts of the Patient Centred Clinical Method (PCCM)[3] and the importance of making the patient feel more equal in the interaction, teaches doctors that the optimal arrangement for a seated consultation is with the patient seated beside the desk and minimal obstruction between them and the doctor,[4] which differs from the preceding model, which had the patient seated opposite the doctor with the desk in between.

In this context, others are starting to consider what role the computer has in the doctor–patient relationship,[5,6] the influence of the physical presence of the computer,[7,8] and even make recommendations.[9,10]

Booth[7] identifies three positions of the computer screen, roughly corresponding to the set-ups encountered in Figures 1, 3 and 5, but fails to take into account the positioning of other items on the desk (or room set-ups such as the traditional configuration), whilst Frankel[8] merely observes that the set up has an impact, without describing how or why. With Purves[11] and our own earlier work[12] recognising the increasing significance of the computer in the triadic doctor–patient–computer relationship, an understanding of the social milieu in which the three players in the consultation interact (the staging) will inform further analysis of the interaction and allow a framework for assessing the effects of different computer placements.

as though it were a play, the consulting room as a stage and objects as props used in the play. Despite much descriptive work there is little formal theorisation of the medical consultation,[15] and Goffman's methodology is ideally suited to formalised, structured interactions such as those in medicine,[16] although it has much wider applications. Goffman held that the entire structure of society is made of rituals and thus the 'self' is in fact a socially enacted ritual, that it is how we appear to others that is important in constructing social relationships. The setting (the 'stage') thus has relevance to the interaction.

Fixed images of the 20 rooms taken either by digital camera or from video stills at the time of recording constituted the sample. We examined the still shots as though they were referents,[17] by which we mean that the images carry with them their social context and can be interpreted. In this analytical frame the images are interpreted as 'lived visual data', the examination of images as representations of three dimensional spaces that humans inhabit[18] and not as flat, abstract items. The presence of objects(or artefacts) in the room can have meaning beyond the seeming practical application.[19] Items such as the paper record and document storage trays, can have an influence beyond their practical application in a medical setting,[20] being used as stage props by the actors. Riggins[21] describes a set of contextual tools to describe the objects that we see in photos. *Intrinsically active* objects are those designed to be used or handled – such as the stethoscope or computer mouse. *Intrinsically passive* objects are those intended for contemplation or decoration, such as posters on the wall.

All photos were examined by two researchers in the context of the larger study (described in detail elsewhere[13]). The framework was developed and applied by one researcher (CP), and then independently applied by a second (HW). The framework and insights then developed were applied to the videos of consultations.

Method

For this descriptive study, 20 GPs who used computers significantly in their daily work were recruited (as part of a larger study[13]) to have a consultation session videotaped. Seven female and 13 male GPs were recruited, with ten from rural and ten from urban areas. We recruited GPs who made high use of medical records, which we defined as using progress notes, pathology ordering and many other functions. Approximately 50% of Australian GPs fall into this category.[1]

The larger study used the dramaturgical methodology of Erving Goffman,[14] treating the consultation

Results

In all the photos we were able to identify common areas that served as basic elements of the staging and then were able to describe two types of computer layout, in the context of the relationship between the three 'actors'. In general, the working areas were identified to have constant spaces of administrative, working and clinical areas. There were also parts of the desk that were shared between patients and doctors (often marked by the tissue box). Placing of the computer components in that environment created settings that were inclusive or exclusive of the patients.

Basic elements

Seventeen (out of 20) of the doctors in this study had desk settings where patients were adjacent to the desk (along the PCCM line mentioned earlier), the remaining three opting for the traditional model. In each room, there was a common set of identifiable areas:

- *administrative* – common place on the desk that is occupied by forms, request slips and other administrative paraphernalia, often including the phone
- *working* – often in front of the doctor, this area is usually strewn with papers. The papers there are awaiting processing, and are not necessarily related to this patient, but represent works-in-progress for several clinical and administrative tasks
- *clinical* – where various tools of the trade (such as thermometers and BP cuffs) are kept
- *shared* – there is a piece of patient-owned desk real estate, where patients place keys and other personal belongings. This piece of shared real estate is often marked by the presence of the tissue box. In effect this part of the desk becomes part of the patient's personal space (personal space being the concept that humans in different situations have a varying physical distance over which they perceive ownership).[22]

The computer elements are placed in variable positions within the staging of the consultation. CPUs are usually placed out of direct sight, on the floor or in a desk space, and will feature little in this discussion. Monitors, by contrast, figure prominently in all settings in a way that they can exhibit agency in the consultation. It is the screen that becomes the 'face'[23] of the computer and is the object of the human attention. Two types of monitors are available to GPs – the more usual cathode ray tube (CRT) and the liquid crystal display (LCD). CRTs are bulky, heavy and take up considerably more desk space than equivalent LCDs, which can be moved easily and occasionally are found mounted on a flexible arm, allowing the GP to move the screen to involve the patient. LCDs have become more affordable and appear in many of the doctors' surgeries observed. The physical orientation of the screen is significant and at times it was positioned in such a way that it was impossible for the patient to see the content. More commonly, although the screen was facing the doctor, it could be partially viewed by the patient. Within the patient-centred setting, the most common arrangement finds the keyboard and monitor sitting squarely on the desk in front of the GP, requiring him or her to make at least a quarter turn away from the screen to face the patient. Consequently, patients seated at the end of the desk do not usually have a direct view of the screen. Those doctors with traditional settings had the computer off to the side, again a quarter turn away.

Printers were prominent pieces of computer equipment. There were two predominant types – inkjet printers and laser printers. Inkjet printers are generally slower, single sheet feeders. Laser printers respond more quickly to the print command, are much quieter in operation and have the facility to run multiple paper types. Multiple trays means that the doctor is not required to insert paper or change paper type between printing a prescription and a letter. Many doctors choose to have the printer between them and the patient, whilst others position themselves between the patient and the printer. Often the printer is on a different desk or on a shelf, physically separate from the main area of the interaction.

Display syntax

It is not just what is in the room, but the *display syntax*[21] (the arrangement of objects in relation to each other) that is now examined. We see in Figure 1 the first of the examples. The entry door is between the two green chairs. Patients usually sit in the chair adjacent to the desk. This seating arrangement conforms to the patient-centred principles outlined earlier. An administrative area is seen in the corner, a stack of forms, with intrinsically passive, decorative objects sitting on top. The clinical area is between the administrative area and the monitor (marked by a spirometer), and there is a working area just in front of the clinical area.
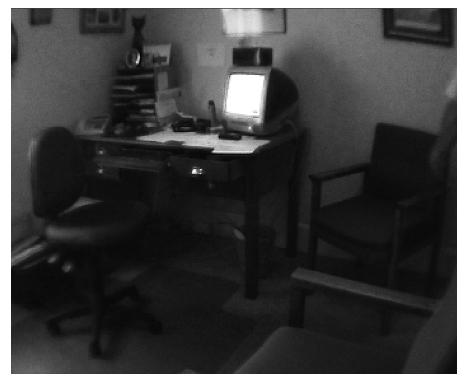

Figure 1 Room setup

Central to this space we find the computer; its component elements distributed around the room. The printer is on the floor, in a position where the left hand can grasp forms from the administrative area to be placed in the printer, and then easily retrieve the printed forms. The keyboard is placed on a sliding shelf, so as not to disturb the working area. The mouse is placed in the administrative area, and is used by the non-dominant hand, so that the doctor's stance is open and oriented to the patient. Finally the screen

(which contains the CPU for this type of computer) is placed in the shared area of the desk and directly oriented towards the doctor. Note the placement of the tissue box on top of the monitor screen, squarely in the patient personal space, now occupied by the monitor. As he sits, the doctor is faced by two 'faces', the patient's and the screen, and can take them both in easily. However, the patients do not easily see the computer. The clinical area is concealed from the patient by the screen, as is the administrative area. This setting serves to exclude the patient from the computer.

By contrast, Figure 2 shows a room set up by a doctor who uses the more traditional arrangement, with the patient across the desk. As the patient enters the room he or she sees the imposing wall unit along the entire wall on the left. The administrative area is again off to the left, away from the main doctor–patient axis. The screen is similarly placed to the one in Figure 1 so that the doctor can see two faces of patient and computer. The tissue box sits behind the computer, accessible to the patient. Screen watching by the patient is impossible. The keyboard is interposed between the doctor and the patient. The overall syntax of this arrangement is to deny the patient access to the computer. It is an *excluding* arrangement, the patient is not involved with the computer screen.

Figure 2 Traditional room

Figure 3 shows us another room with the patient-centred configuration. We see a flat screen, placed on a movable arm. For patients in the chair next to the desk, the screen is not visible unless they move to different positions, but the doctor can move the screen to display relevant information. Patients are also more likely to sit in the chair with easier access to the screen. The keyboard is placed directly before the screen, in 'typewriter' configuration. The placement of the printer (a large laser printer) has significant effects on the rest of the spatial arrangement. It is set away from the patient, thus the doctor is not affected by the printing process. The main administrative area is now placed in the patient area, on one side of the screen, and is much smaller. The clinical area is quite small, and dominated by a sharps container. This syntax is much more patient inclusive, particularly as the mouse is (again)

used by the non-dominant hand. Note, though, the tissue box is well away from the patient.

Figure 3 Inclusive room

Figure 4 is another room with the patient-centred configuration. The door is off to the right, and the chair placement is such that the preferred patient chairs are those creating a direct, uninterrupted line between the doctor and the patient. With no intrusion of the desk between them, there is little or no shared area. The clinical area (see the blood pressure cuff) occupies that space. The monitor and screen are in typewriter configuration, and the administrative area is away to the left of the desk. While this arrangement includes the patient, it is less inclusive of the computer.
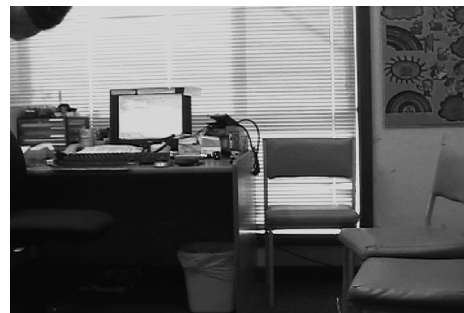

Figure 4 Inclusive room II

The final example presented here is the setting of a larger, L-shaped desk. Five doctors in the sample had this style of desk, two in the traditional configuration and the others in a patient-centred one. The extra desk space changes the syntax of the elements involved. The administrative area includes the printer, in this case adjacent to the screen, with forms and papers extending on the arm behind the doctor. The workspace is sited there as well. The screen and keyboard are in typewriter configuration, and placed behind the doctor's right shoulder. The face of the screen is towards the patient, but too far away for them to be able to read what is on the screen. The patient area is well marked by clear space and between the doctor and the patient is a mixed clinical and administrative area, with thermometers and pens and paper clips. There is significant

decoration with intrinsically passive props, some visible to the doctor (on the shelf just above the desk) and some only visible to the patient (the cricket poster above the cupboards). In this image we can clearly see the CPU, tucked away under the desk, inanimate as far as the consultation is concerned. The overall effect is of an open, flexible, inclusive environment, although one clearly stamped as being dominated by the doctor.

When viewing the videos the effects of the staging could be seen. Exclusive and inclusive settings produced different behaviours in both doctors and patients. For patients who desired to see the screen, exclusive settings produced some challenges and patients would adjust their position in the chair, or even move the chair, to enable them to see the screen. Inclusive settings were much more likely to develop a triangle of doctor and patient sharing screen time.

All doctors made extensive use of the keyboard and mouse. In contrast to the monitor, keyboards and mice were never shared with the patient, and were always placed either in front of the monitor or in front of the doctor as they faced the desk. When in front of the monitor this is termed the 'typewriter' configuration, as it mimics the typewriter of old. These items (keyboard and mouse) were for the exclusive use of the doctor when they were interacting with the computer. Four doctors in the sample used the mouse with their non-dominant hand, freeing the desk space on their dominant side and at least one doctor told the researcher he did this to minimise the disengaging body language from having an arm across the patient's vision when turning to use the mouse. Further details of these analyses will be published in further work.[24]

Discussion

The computer needs to physically exist within a space previously reserved for humans and their furniture;

Figure 5 L-shaped desk

but the computer, its input devices, monitor and printer are more than just pieces of furniture. Their requirements shape the physical layout of the interaction. The limitations of participants' ability to influence their environment are central to this article. The doctor largely determines the physical set-up. The computer is quite passive in this process, although its physical size and its connection needs shapes the decision-making process. So too do the needs of the patient, in that chairs are required, as are various tools of the trade (blood pressure cuffs, etc). Nevertheless, it is the doctor that actively creates the workspace.

The inclusive and exclusive categories are not pejorative, more a manifestation of how the doctors create the three-way relationship. The titles *inclusive* and *exclusive* are thus seen to be ways in which the doctor designs the physical environment to meet his or her expectation of the interaction and enactment of the consultation. Rather than simply describing a layout, the terms emphasise the relationship that exists. This staging is fixed and familiar for the doctor, but for the patient becomes a setting within which they have to improvise their performance. We can see very early if patients are accepting of the computer in the consultation, simply by the way they interact with the environment. We see this variation in the fixed ways that doctors treat the beginning of the consultation as compared to the variety of ways that patients interact. The categories *inclusive* and *exclusive* are not the only feature to influence the consultation, but can be seen to be a significant one

The introduction of new technology always changes the way we work, often in a piecemeal and unsystematic way.[25] The consulting room fits the model for a computer supported co-operative work (CSCW) environment,[26] where the actions of the computer unfold due to many factors, including practical and social. Not only are those actions important in this process, so too are the impacts of the physical environment created by the computer.[27] Dividing the space into clinical, administrative, patient and working areas allows us to look at the various placements of computer hardware and their effects on the display syntax as experienced by the 'actants'. How the subsequent interactions will be played out relates to the placement of these props. This sample is too small to indicate the relative proportional effect of different settings, but does give a framework for further work. It allows for the various elements to be discussed, analysed and tested in a formalised fashion.

The computer screen now represents a third 'face' in the consultation, one that is the object of regard of both doctor and patient. The keyboard and mouse are symbols of control over the computer, in much the same way that ownership of the stethoscope indicates status in the relationship.

Table 1 Setup effects

Setup	Effect
Patient inclusive	Doctor chooses to share the computer screen with the patient, allowing the computer's face to have greater effect within the consultation. The patient has a choice of faces to view, and greater variety of potential interactions
Patient exclusive	Doctor limits patient exposure to screen, and thus only the most active patients, particularly triadic patients, can share the screen. The patient is required to focus more on the doctor, who controls their access to the computer's face

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CONFLICTS OF INTEREST

None.

ADDRESS FOR CORRESPONDENCE

Dr Christopher Pearce
Melbourne East General Practice Network
PO Box 127
Blackburn 3130
Victoria
Australia
Tel: +613 8878 3755
Fax: +613 9894 3119
Email: drchrispearce@mac.com