# Requirements for interpersonal information management*

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**Abstract**

Current personal systems aim to support personal information mangement (PIM) on the move. In this paper I argue that future personal systems should support interpersonal information management (IPIM) involving verbal and written messaging, interactive document use and work-related conversation. Requirements for such support are identified from a video based study of mobile professional work.

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# 1 INTRODUCTION

Office technology is finally catching up with office work. While traditional office systems have tended to support solitary work within a fixed office base, a new generation of office appliances are beginning to support interactive and mobile work. Much of this is being made possible by the miniaturisation of computers in portable laptop and palmtop formats; by improved and increasingly wireless connectivity between appliances; and by the convergence of communications with computing facilities in voicemail servers, pagers and the like. Although this new office technology is being aimed at mobile professionals who travel and communicate extensively, it is also of potential benefit to ordinary office-based workers who have always worked in a variety of locations around the office site, in conversation with others (c.f. Wynn 1979).

Personal information management technology is at the centre of these developments because as appliances become portable so they become more personal to their owners. Whereas before, fixed computing and communication facilities were a resource for office information management and 'automation', mobile facilities have become resources for personal information management and 'empowerment'. Such **personal systems** are attractive to users as a way of enhancing personal work practice independently of methods prescribed by management for the office. They are also attractive to technology providers since personal systems can be sold direct to end users without group or management permissions and policies.

In this paper I describe some findings from a new requirements study for personal systems based on the shadowing of two mobile professionals. It's aim and scope are similar to the 'office' studies of the early '80s which set out to identify requirements for traditional office systems (e.g. Suchman 1983, Malone 1983). However, its focus on the mobile and interactive aspects of individual office workers lives sets it apart from these studies and orients it towards the '90s technology. A central finding of the study is that much of what we now think of as personal information management (PIM) is intimately tied up with communication and interaction with others, and that the real opportunity for personal systems is to support what might be called interpersonal information management (IPIM).

In the next section I compare and contrast PIM and IPIM activities and show that early personal systems are predominantly focussed on supporting mobile PIM. I then describe the scale and character of naturalistic IPIM tasks as observed in the shadowing study before going on to identify some requirements for their support.

# 2 PERSONAL AND INTERPERSONAL INFORMATION MANAGEMENT

Figure 1a shows a spectrum of PIM activities organised along two dimensions. Visible information management activities predominate over verbal ones and tend to involve either real-time use of documents or a kind of self-correspondence in which notes are written to be read by oneself later. Rather more obscure verbal information management activities such as talking to oneself or dictating notes to oneself also fall into this set. Note that all the activities in this diagram are performed alone

Figure 1a. A space of Personal Information Management activities

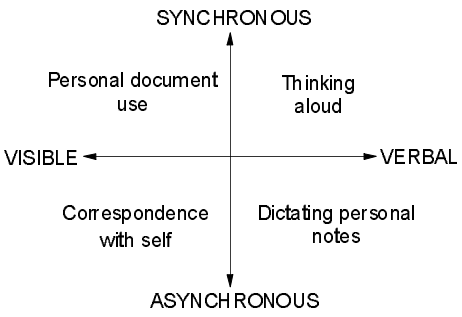



Figure 1b. A space of InterPersonal Information Management activities

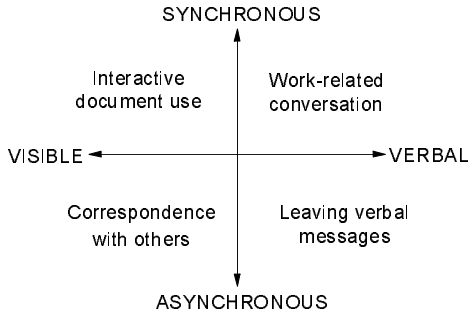



Figure 1b shows a spectrum of IPIM activities organised along the same dimensions. Here verbal information management activities predominate over visible ones in the form of work-related conversation and voice messages left either with machines or other people. Visible information management involves both real-time interactive document use and written correspondence with others. Most of the asynchronous activities of handling written or spoken messages also take place alone, whereas the synchronous ones take place in interaction with others.

Most current personal systems are either portable computers or palmtop organizers. Organizer packages can be bought to run on conventional desktop PC's and might also be referred to as personal systems of a sort, since their aim is to help people manage their personal time and information.

As portable computers, personal systems are really supporting the traditional set of solitary and visible information management activities at a wider range of locations. These include personal information management tasks like document creation, editing, storage and retrieval, together with numerical calculations. Since many of the documents created may be letters, portable PCs can also be said to support interpersonal information management in the form of correspondence activity; a feature that is further extended with email or fax connection to computer or telephone networks.

As organisers, personal systems are supporting a restricted set of solitary visible information activities, this time with specialised support for notetaking. For example in a recent review of computer-based 'PIM' products, Bradbury (1992) shows that the usual facilities include a diary, text editor, to-do list, address book, and spreadsheet. An interpersonal dimension is added with connectivity to other appliances or networks, but this usually takes the form of a simple message exchange. Automatic diary reconciliation appears to be the only IPIM facility which supports a (previously) synchronous activity involving interactive use of documents.

The development of personal pagers and voicemail facilities is further extending IPIM support of an asynchronous kind. However, as I will show in the rest of the paper, these facilities are still only scratching the surface of what could be done to support the range and variety of IPIM currently carried out through both synchronous and asynchronous talk and document use at work.

In short, the coverage of both PIM and IPIM activities by present day personal systems is patchy, and generally better developed in the PIM than the IPIM area. This seems to be the

result of focussing on the mobile rather than the interactive benefits of the new technology, where the major trend has been simply to miniaturise personal computers for use away from the office. In the next few sections I want to re-focus attention on the interactive aspects of present day office work, and begin to indicate the scale and character of each form of IPIM shown in Figure 1b. Only when we understand the details and difficulties of current practices in interactive office work will be in a position to support and extend them through new kinds of (inter-)personal systems.

## 3 NATURALISTIC INTERPERSONAL INFORMATION MANAGEMENT

### 3.1 Methods of study

In order to understand present day practices and problems in IPIM I videotaped and analysed a week in the life of just two mobile professionals. A mobile professional is defined as someone who reports working away from their desk at least 20% of the time (Ablondi & Elliott 1992).

The first subject, B, is Communications Manager for an industrial research laboratory. She manages public relations and marketing communication, and facilitates collaborations between research and manufacturing. She is often away from her desk interacting with others mainly on-site. During the target week she was engaged in four main activities: organising a customer visit involving about 10 internal and 10 external people, identifying the marketing and communication requirements for a research project, organising Lab participation in a press conference, and planning a communications strategy presentation.

The second subject, R, is a surveyor for a medium sized consultancy dealing with commercial property letting and valuation. He works as a professional negotiator for landlord or tenant clients facing rent reviews or lease renewals. He is often absent from his desk both within the company site and on frequent trips to client premises around the city. He interacts extensively with others, mainly using his phone for business negotiation with clients. During the target week he was engaged in about 30 ongoing cases. Three demanded particular attention: a written response to an opposition report about a rent review undergoing arbitration, arranging to act for a new tenant in a rent review case, and completing three related lease renewals.

Video-based observation was used, in conjunction with ad hoc interviews and document samples, to obtain a rich, detailed and accurate picture of communication over time and avoid known inaccuracies in the reporting of communication behaviours (Panko 1992). Individuals rather than work settings were recorded in order to examine longer term patterns of communication across media and locations which are usually hidden from observational 'workplace' studies (e.g. Suchman 1992).

A new technique called remote shadowing was developed for the study in which the activity of a moving subject is recorded without an observer being present. This was achieved through the use of a portable camcorder fitted with a wide angle lens and a radio microphone receiver. The camcorder was fixed in the corner of each subject's office base and subjects wore a radio microphone transmitter which relayed all their conversations around the office site back to the office camcorder. An observer was absent but on hand to change batteries and tapes, obtain document samples, and make arrangements whenever necessary to move the camcorder to special meeting rooms or to off-site locations.

Applying this technique to two subjects for a week each resulted in the collection of 55 hours of videotape containing alternating periods of naturalistic and 'interview' data. Removing the interview data, confidential conversations and poor quality material resulted in a corpus of 29 hours of high quality naturalistic data. This contained a total of 152 face-to-face 'own office' interactions, 108 'phone' interactions and 142 face-to-face 'roaming' or out of office interactions with 97 different people. Another 116 interactions with 81 additional people are represented in the document collections for each subject through letter, email and fax messages. Thus, although only two target subjects were shadowed, many more are represented in the data. This allows at least an exploration of communication patterns which might be validated with larger numbers of subjects at a later date.

## 3.2 Work-related conversation

B and R spent a large proportion of their working week simply talking to other people. For B this figure was 37% and for R it was 70%. A more detailed breakdown of their workplace activity is given in Figure 2. The proportions for each subject were calculated from the absolute amounts of time spent in each activity in the corpus, defined as follows:

Phone - time spent on the telephone, from pick-up to replacement of the handset
Walking - time spent walking around the office unaccompanied
Offsite - time spent in face-to-face contact with others outside one's own office complex
Solitary - time spent alone in one's own office
Own office - time spent in face-to-face contact with others in one's own office
Formal - time spent with others in special meeting rooms on-site
Roaming - time spent in face-to-face contact with others around one's own office complex

Given that at least half of B and R's solitary time was spent reading and writing messages, the total proportion of their time spent in interpersonal information management was in the order of 63-88%. These figures are comparable to the estimates of between 60-85% of time spent in 'interpersonal communication' made by managers and professionals in a variety of different

Figure 2a Proportion of B's actual time spent in different work activities: B corpus (16:06:00 hours)

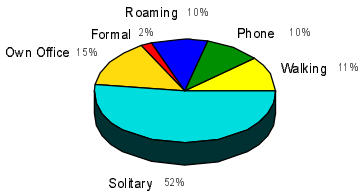
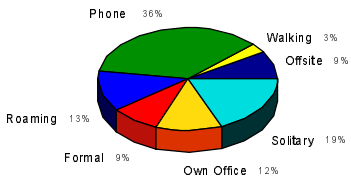



Figure 2b Proportion of R's actual time spent in different work activities: R corpus (13:13:00 hours)




studies (Panko 1992), and serve to indicate both the actual and perceived importance of interactive work in office life.

The general character of synchronous interactions in the corpus is summarised in Table 1. They tended to be brief, two party, unscheduled interactions. Although they took place is a variety of locations inside and outside the office site, the majority of interactions took place in individual offices.

Table 1. Some properties of workplace interactions by setting

| | Phone N=108 | Roaming N=142 | Own office N=152 |
|---|---|---|---|
| % Unscheduled interactions | 95 | 97 | 90 |
| % Two party interactions | 100 | 85 | 82 |
| Average duration (mins:secs) | 2:03 | 1:23 | 2:22 |

One of the shorter interactions is shown in Extract 1 below. It lasts 12 seconds, comprises just 5 turns and has no formal opening or closing. At the beginning of the episode R's secretary S is looking through a filing cabinet next to R's desk. She turns round to ask him a question. Transcription conventions are shown in the Appendix.

Extract 1. A brief workplace interaction (R/FTF/90, 12 secs)

1 S Can you remember the |name of the |road of one nine three? ( )
2 R ((Coughs)) I honestly don't know actually (.) its just the-its just the Asda
3 superstore
4 S Does ( ) know?
5 R I was wondering (.) oh perhaps it might be-
6 (0.3)
[7 R Double check with Arthur (.) see what it's listed in
[8 S ((Nods)) |Yeah

The most striking feature of these kinds of interactions is their open-endedness. For example, a detailed analysis of own office face-to-face interactions revealed that only 11% contained any form of greeting by participants and only 3% contained a farewell phrase. In 68% of cases the caller simply began speaking and tended to raise the reason for calling in the first turn (see again Extract 1). In 75% of cases this reason related to an issue already discussed in a previous interaction. Either party is equally likely to terminate the interaction once it has begun, though sometimes it is brought to a premature close through interruption by a third party (in 12% of cases). This kind of open-endedness and connection with previous interactions makes individual work-related conversations look like parts of a more extended conversation with the same person conducted on different occasions during the day or week. In this sense, the talk functions to achieve certain immediate work-related purposes with a minimum of ceremony and fuss, while at the same time sustaining longer term relationships with a mixture of team and non-team colleagues, clients and others.

In the light of this longer term function of talk, it is not surprising to find stretches of interaction devoted to apparently non-work related topics. An example of this is shown in Extract 2. This episode occurs at the end of a handover of work from B to a secretary J.

Extract 2. Work and non-work related talk (B/FTF/15, 23 secs)

[1 B: And I'm sorry but (.) by lunch time ple:ase
[2 J: I'll I'll go an' see him today
3 J: Ye:ah don't worry I'll go an see- (.) 'cos I'm out from about (.) half past
4 ten ish 'cos >I've got to go to the doctors with my daughter< so- .hhhhhh

[5 I'll er::hm
[6 B: She alright?
7 J: Ye::ah she's >got a throat infection< so
8 B: A|o:h
9 J: I've got to get it (.) (done now) 'cos it's really ba:d
10 B: °Mmm:h°
11 J: So
12 B: °Right°
13 J: So what I'll do is I'll erhm (.) speak to Colin
14 (0.4)
15 J: ((Rests head on hands))
16 But he's not here
17 B: ((Leaning forward))
18 Well-(.) Then David can do it

Although the talk is ostensibly about J's daughter, it has relevance for B and J's working relationship since the severity of the daughter's illness will affect the likelihood of J being available to do the work just delegated to her. This is presumably why J raises the issue at this point. The delicacy of the matter for J is reflected in her somewhat ambiguous response to B's enquiry 'She alright?'. Though she begins with 'Yeah' she goes on to describe a throat infection that must be attended to because 'its really bad'. B's sympathetic intonation in lines 8, 10 and 12, and her co-operative suggestion in line 18 all contribute to the impression that she understands the problem and is prepared to get involved in its solution for the immediate work at hand. On a more emotional level B indicates her concern for J by actively discussing the health of her daughter, thus cementing their personal relationship for this and future occasions of work.

Another aspect of work-related conversation highlighted in Extract 2 is its informality. It is no accident that tangential issues such as J's availability are raised at the end of the more formal part of a meeting. This appears to be a common environment for them, together with chance encounters by the coffee machine, business lunches and so on. Subjects spoke at length in interviews of the usefulness of such contexts for doing certain kinds of business which cannot be done within the constraints of a phone call or arranged meeting with an explicit 'agenda'.

A great many purposes are reflected in the interactions in the corpus, often with the same interaction seeming to fulfil several purposes. While it is not possible to present a comprehensive classification of interaction function in this paper, a few functions stand out as worthy of special mention.

A considerable number of interactions related to the whereabouts, plans and actions of oneself or other people. Subjects often 'announced' their intentions to leave the office or see certain people in the future, and gave or requested verbal accounts of recent interactions and agreements with others. Such accounts and reports amount to a kind of gossip which serves to inform colleagues not only of one's own movements and progress, but also of those relating to other people not directly accessible or available to them. The very same 'gossip' is also a vehicle for the monitoring, reporting and supervision of work. A very clear example of this was given in an episode where R hears a colleague F put the phone down and immediately asks 'Is he alright?'. In the ensuing account by F, R discovers that F is proposing to act for the

tenant of a property on which R has previously acted for the landlord. As this is an untenable position for the company, action is agreed to avoid it.

Finally, in a large number of interactions, 'information exchange' turns out to be an excuse to engage in discussion with someone about some problem which is troubling the informant. For example, on one occasion R rehearsed an argument with a colleague by telling him about the content of an opposition agent's valuation report he was reading. He began by shouting 'Fundamental error!' before describing what he believed to be a flaw in the other agent's case. This prompted the colleague to asks for clarification and expansion before volunteering a personal opinion on the matter. Sometimes this kind of feedback appears to be solicited as much for its emotional as its intellectual value; as when R related the story of a lost contract to four separate colleagues within the space of a few minutes.

### 3.3 Interactive document use

Many work-related conversations around the office simply involve two or three people talking together. In the above section I have concentrated on the general properties of these conversations and especially on what is happening in the talk itself. However, a substantial proportion of conversations involve some reference to a written document by at least one party. This occurred in 53% of the own office face-to-face interactions where it was possible to monitor visual as well as verbal activity from the videotape record. In this section I want to describe some important features of this interactive use of documents as revealed in this part of the corpus.

Of the 53% of own office conversations involving documents only about half again (46%) involved co-ordinated joint visual reference to the document. In many cases personal documents were used in support of the conversation but by only one owner at a time. Some straightforward examples of this were **document delivery**, in which one person would hand over a document for information or signing, referring verbally to its content while the other person looked over it. While there is a sense in which the delivering party can see the document under discussion from a distance, they may never have recourse to co-ordinate their looking at a particular part of the document with the receiving party. Indeed it was common for the document to be turned round as it was handed over in a literal 'face-to-face' situation so that it became upside down and sometimes backwards facing (if lifted up) from the delivering party's point of view.

Another example of the private use of documents in interactions was when a document was used as **a cue for a question** about its content or as **a resource for answering a question**. Extract 3 shows this happening between B and her secretary K. K is concerned about the value of an invoice she must pay and asks B for the original quotes obtained for the service involved. Notice how reference to the invoice held by K is used right at the beginning of the interaction to set the context for the questions which follow. Use of documents in this way appears to be an effective method of quickly identifying which of many open topics of conversation is now relevant to the talk at hand. As it happens, K's concern is answered not by the original quote which she is handed by B in line 8, but by joint reference to the invoice in lines 20-24. B is able to indicate by pointing and speaking at the same time that it is the figure *before* VAT (Value Added Tax) is applied on the invoice which should be compared to the quotes. Quick movement between semi-private and joint use of a document in this way is typical of the interactions in the corpus.

Extract 3. Private and joint use of documents in conversation (B/FTF/6, 28 secs)

[1 K ((Enters holding A4 sheet))(Pointing))
[2 This erhm (.) this
[3 B ((Looks at document))
4 K This est- er invoice that's come in
5 B Mmmh
6 K Have you got the original quote
7 (0.3)
8 B ((Reaches over to coloured file and hands it to K))
9 K And have you got also the quote from:: Triangle
10 B ((Looking around))
[11 K 'Cos it look-
[12 B ((Pointing))
[13 B That pile the:re
14 K It seems like an awful lot |to me?
15 B Ye::ah
16 (0.7)
17 B THEIR'S was about two hundred pounds more
18 (1.4)
19 K Are you |sure |it was |eight thousand pou|nds
20 B ((Stands and moves alongside K))
21 No (.) What's the one before V A T
22 K ((Looking at document with B))
23 six nine four one
24 B That's the one you've got to look at

**Note taking** in conversation with others was relatively common, although as with other forms of private document use there was a joint aspect to the activity which appeared to influence the talk. This became particularly clear in an information gathering meeting between B and a colleague L (B/FTF/28). Sitting opposite each other across a table, B led the conversation with simple questions about L's project and took notes on the answers. L appeared to pace her talk to the note-taking activity of B, carefully looking between B's pen and eyes to determine when to stop. Although L almost certainly could not read B's notes upside down and at a distance, it became obvious that she was monitoring the shape and phrasing of the writing when she made statements like 'this point I made earlier' while pointing to the corresponding block of scribble. In short, the apparently private note taking activity of B here served as a backchannel cue giving feedback to L about the adequacy and uptake of her talk. In this sense, note taking is equivalent to facial expressions, verbal acknowledgements and intonation.

There are two consequences of this phenomenon that may be exploited in meetings. First, because of the lag between one person speaking and another writing down what was said, note taking may be used to introduce a systematic pause into the conversation and thus provide a speaker with additional opportunity to elaborate their talk. Second, because of the selective nature of noting down only the significant parts of a speaker's talk, note taking, or the lack of it, may be used to indicate interest or disinterest, agreement or disagreement. A striking example of indicating disagreement by *not* taking notes took place in a face-to-face negotiation between R and a visiting opposition agent C (R/FTF/107). R indicated his reaction to one demand from C by dropping his pen on the table and folding his arms in silence. Only later did

he follow this up verbally with "Interesting concept but I'm not sure whether it's persuasive to me'.

A final form of interactive document use was systematic reference to a document **to structure a discussion**. A brief example of this is shown in Extract 4 in which B is talking through the draft agenda for a meeting she is arranging with J. This is the earlier and more formal part of the meeting represented in Extract 2 (B/FTF/15). B makes verbal comments on what work she would like J to do, and annotates the agenda with marks and notes summarising her instructions. This is probably the clearest example of full joint use of a document in the corpus, yet it still involves a rather unequal access to the document with J having little opportunity to add any of her own marks or notes to it.

Extract 4. Talking through a document (B/FTF/15, 38 secs)

| | | |
|---|---|---|
| 1 | B | ((Lifting papers))((Places paper on desk) |
| 2 | | What I ne:ed is (.) I need to:: |
| 3 | B | ((Draws box around paragraph)) |
| 4 | | ha::ve a couple of sentence:s to replace the:::se (.) of what we are going 5 |
| 5 | | to talk about |
| 6 | J | At the meeting |
| 7 | B | ((Moves top sheet over)) |
| 8 | | Yes (.) because this guy needs to give something to:: |
| 9 | B | ((Draws box around paragraph on bottom sheet)) |
| 10 | B | And the people you can ask about that i::s |
| [11 | B | ((Draws box around name)) |
| [12 | J | °I'll ask Colin° |
| 13 | B | Ma:rk |
| 14 | B | ((Draws boxes around more names)) |
| 15 | | Steve Wright (.) and Colin \|the:re >great< |
| 16 | B | ((Moves back to previous sheet)) |
| 17 | | Now the things that they should al\|so answer that (he) is specifically |
| 18 | | interested in is |
| 19 | B | ((Writes '1' and circles it)) |
| 20 | | O:ne |
| 21 | B | ((Writes 'Project funded -')) |
| 22 | | P r o j e c t f u n d e::d |
| 23 | B | ((Writes 'What state -')) |
| 24 | | Wha:t s t a t e it's i:::n |

At the end of the meeting J leaves with a copy of the annotated agenda as a physical reminder of the work she must do. In this sense, the document has now come to represent both the work-so-far and the work-to-be-done. As parts of the work are completed J marks them off on the agenda and writes further notes in the margins; eventually returning to B for a 'handback' meeting in which she then talks through the document (B/FTF/40). This is typical of the oscillation between interpersonal and personal activity at work, and of the way in which visible information can sometimes tie the two together over time.

### 3.4 Leaving verbal messages

Verbal messages for others are extremely common at work. An indication of this is given in Figure 3 which shows the proportion of unsuccessful to successful telephone calls in the corpus, and the resulting proportions of messages left with other people or machines.

Figure 3a Proportion of successful and unsuccessful phone calls made by B and R (79)

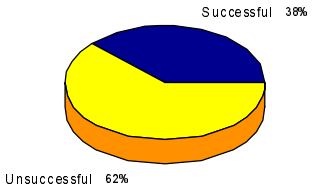
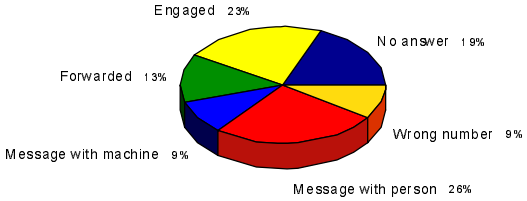



Figure 3b Types of unsuccessful phone calls out (51)




An equivalent problem of connection was also experienced by subjects trying to find others around the office site. This is more difficult to quantify because there may only be a pause in the footsteps audible on the videotape as B or R stop at the empty office of a target colleague. However, on numerous occasions, they can be heard to leave a verbal message with a nearby colleague. This is often more than a request to call them back as shown in Extract 5. Here B instructs S what to say to C when she returns.

Extract 5. Leaving a verbal message face-to-face (B/R /12, 17 secs)

| | | |
|---|---|---|
| 1 | B | Sue: would you do me a \|fa\|vou:r |
| 2 | (0.4) | |
| 3 | B | When Catherine's free could you ask he:r (.) about the Pisa Science |
| 4 | | Centre: and (.) say that they are updating this new booklet? |
| 6 | S | Mmhm hmm |
| 7 | B | Of (ninety three) and do we really want (.) thi:s under there or no:t |

The ramifications of such verbal messaging are considerable. On the positive side, office workers get to know what is going on at a rather detailed level in the work lives of others through the messages they take on their behalf. On the negative side, their own lives become filled with delays and interruptions as leavers, takers and target recipients of messages.

From the message leaver's point of view, finding people out is annoying because their purpose for calling cannot be satisfied immediately and may have to be held over for an unpredictable period. It also involves them in rather unsatisfactory conversational work to leave the message and lays them open to a future interruption by the target recipient. From the message taker's point of view, receiving a message for someone else is doubly disruptive. Not only must they suffer the interruption involved in taking the message, they must also find an early opportunity to pass on the message to it's intended recipient. The same difficulties are inherited by the target recipient in receiving the message from the mediating party before getting back to the message originator who may him/herself be out, and so on.

Although mobile phone and answerphone technology appears to offer a solution to this cycle of delay and interruption, their success is likely to be limited by two aspects of verbal messaging behaviour. The first is that subjects in the study usually chose not to phone target recipient's first before going over to see them in person. So for some business the phone is too

formal and will not be used. This is likely to be even more true for answerphones or voicemail which tends to be seen as a medium of last resort today. The second aspect of verbal messaging is that it is delicate and difficult to do. Most verbal messages left with other people tended to involve some degree of negotiation and clarification with the message taker, while most messages left with a machine involved self-corrections, restarts and elaborations. So recording detailed verbal messages in real-time appears to be too demanding for most people and will probably be avoided unless absolutely necessary.

## 3.5 Correspondence

Written messages in the form of letters, faxes and emails were used extensively by both B and R during the selected weeks. Figure 4 shows the distribution of each type of correspondence for both subjects, together with the proportions of verbal messages on videotape. A major difference revealed in the figure is that B made considerable use of company email facilities whereas R relied on letters as his primary medium for written communication.

B received much more impersonal and junk mail than R in both email and letter media. This accounted for her greater proportion of messages in than out. For example, by letter she received a number of trade magazines, credit card bills and adverts which tended to be from organisations rather than individuals. By email she received a large number of newsletters and messages copied to her for information but not reply. In contrast, most of R's letters in and out

Figure 4a Proportion of messages to and from B during the selected week (74)

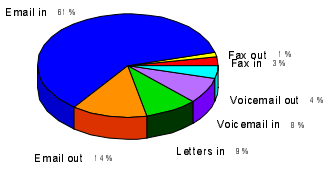
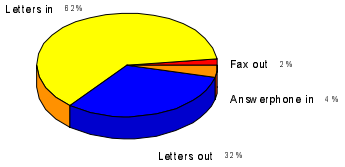



Figure 4b Proportion of messages to and from R during the selected week (53)




were documentations of various stages of negotiation relating to individual property cases. Although he also sent out a smaller number of messages than he received, this seemed to be more related to the fact that he was constantly behind with his replies, rather than to the fact that his incoming letters did not need replies.

These patterns of correspondence reveal a number of important aspects of interpersonal information management in this medium. First, correspondence such as adverts can be used at the beginning of a relationship to invite further interaction. Second, correspondence which is copied or forwarded to individuals constitutes a written form of 'gossip' in which people are kept informed of the conversations and activities of others they would otherwise not have access to. Third, handling and keeping up with correspondence may be a problem for some people at work, especially when they receive a large volume of messages requiring replies. Forth, the function of personalised correspondence in an ongoing relationship appears to be to

set out complex positions on technical matters clearly, for later discussion, or to clarify and commit to prior verbal agreements.

Regarding this last point, visible information in the form of writing or text appears to carry special weight at work. There is a sense in which it can always be used 'in evidence' against the originator to remind him or her of responsibilities and obligations freely entered into at previous stages of work. For this reason written messages are used carefully at certain points in a working relationship, not simply to sustain the relationship during periods of absence, but also to move the relationship in stages onto a firmer footing. This could be seen most clearly in R's strategic use of letters during the course of a business negotiation. For example, in Extract 6, R is reporting back to a landlord client on a recent discussion with an opposition agent in a rent review case.

Extract 6. Letter of clarification for later discussion (R/C/9)

1 Dear Mr O,
2 I write to advise that I have now met with the Tenant's agent and the following
3 proposals have been discussed.
4 Unit 2
5 Revised Rent £13,500 per annum
6 Unit 6
7 Revised Rent £9,500 per annum
8 The above figures show a marginal increase on the passing rent, although it will
9 provide an income of £3,200 over the next four years.
10 This is the highest the Tenant's agent will offer and is largely given due to the
11 costs that would ensue if the matter goes to third party.
12 Should you wish to discuss the figures in greater detail then, of course, please
13 do not hesitate to telephone me.
14 Yours sincerely,
15 R

The letter from R sets out two key figures from his discussion, together with statements on their implications for the clients income and on the unlikelihood of agreeing higher figures outside arbitration. Notice that the letter is sent out ahead of telephone discussion which is specifically invited in lines 12-13. This has the effect of consolidating progress already made and giving the client time to reflect on the level of rent increase he can reasonably expect, before responding.

## 4. REQUIREMENTS FOR PERSONAL SYSTEMS

### 4.1 Supporting the interpersonal

The findings of the above study imply that interpersonal information management occupies more than half the working life of office-based professionals and yet remains largely unsupported by computer-based technology. If this finding is generalisable to the broader population of office workers then the opportunities for personal systems appear to be greater than those for office systems in the 1970s. This is in itself a major challenge to the area.

To meet this challenge, future personal systems will have to take on more of an interpersonal flavour. This in turn, leads to a number of technical and marketing requirements.

### 4.2 Technical requirements

The more technological requirements have to do with expanding the forms of information management that future personal systems can support. The following forms were commonly exploited by subjects in the study but could not be easily handled by current systems:

**Verbal information management** - Office conversation is really the primary medium for information exchange in office work. Not only does this involve direct synchronous conversation with target recipients, it also involves indirect verbal messaging through mediating people and technology. Supporting such behaviour may require the integration of speech material with text and image data, and much greater attention to methods of recording, storing and retrieving verbal messages than currently exist.

**Transitory information management** - An examination of interactive document use has revealed that documents may be quickly and temporarily 'recruited' into conversations as aids to the talk at hand. After the talk, they may become irrelevant to participants as pieces of information per se. This is quite a different *function* for documents than that usually ascribed to them as information holders in their own right. To support this interactive and transitory use of documents requires something more like temporary projection and reference facilities rather than the more obvious kinds of document exchange or transfer.

**Spatial information management** - Another important feature of interactive document use appears to be the orientation and layout of visible materials with respect to the participants involved. These variables are manipulated strategically by participants to control the access and reference to documents as aids to talk. Supporting this kind of behaviour electronically requires more sophisticated control over information display than simply presenting a single document full-on to a single participant. Furthermore, it seems to require *much* larger screen sizes than are currently available on portable appliances.

**Informal information management -** The way in which two or more colleagues located in the same workplace drifted in and out of conversation with each other was impressive for its brevity, ease and effectiveness in the study. This contrasts with more formal mediated interactions involving communication technology, in which (usually two) parties are brought together through a connection process and stay fully engaged with each other until the connection is broken. Much faster connection or more open multiparty channels of

communication are required to support the informality of co-present information management between people.

**Controllable information management** - Ownership of information at work appears to be controlled by sophisticated practices of documentation, borrowing, lending and transfer. Thus we saw in Extract 4 how a draft agenda for a meeting got annotated and handed over in a face-to-face meeting, as a token of work-so-far by B and work-to-be-done by J. In this case B, as originator of the document, retained overall ownership, although J gained temporary ownership and limited rights of amendment after the meeting. This kind of subtlety in information access and transfer is beyond the scope of standard 'security' and communication features on current personal systems and remains a significant challenge for future systems (see also Thimbleby, this volume).

### 4.3 Product marketing requirements

The marketing requirements for the field have to do with making personal systems out of interpersonal applications, and with finding applications of real value to customers.

On the first point, it is a mistake to believe that personal benefits and purchases can only be achieved by supporting the more personal aspects of information management. As we have seen, a large proportion of work time is taken up with interpersonal information management which, if enhanced, would significantly improve personal productivity and performance. The trick is to provide an interpersonal benefit in a form which is modular and lightweight enough to be valuable, either in its own right or in combination with just a few other units or devices. The personal pager or answerphone are examples of such systems, since they have immediate benefit for interpersonal work, even if no-one else buys them.

Some of the lessons learned in the area of groupware are relevant here, since we find that the more successful groupware systems are those which deliver a personal as well as a group benefit to users. A good example of this is given in a comparative evaluation of two community care systems designed to collect healthcare statistics from community care workers such as Health Visitors, Social Workers and District Nurses (Savill & James 1993). The first system introduced, called COMCARE, ran on handheld computers and required workers to input patient and visit statistics primarily for management audit. The second system, called COSS, ran on laptop PCs and incorporated an additional knowledge-based patient care planning system to assist workers themselves. Not surprisingly, the second system was much more successful for workers and management alike because it provided a benefit to workers which made it worthwhile maintaining accurate and up to date records despite the considerable costs of doing so. In this respect, designing personal systems with interpersonal benefits may be a better approach to groupware than designing a group system with personal benefits.

On the search for applications, it must be said that there is a need for better understanding of what is difficult or problematic about IPIM today, given the current set of tools and media available. Too many groupware systems have set out to improve 'meetings', or 'design practice' or 'communication' without any real idea of *why* they need improving in the first place. The current study has identified the following activities as potentially problematic and worthy of further study: locating others, initiating interactions, controlling interruptions, sharing materials and tracking relationships.

Curiously however, the default position of *simulating* current IPIM behaviours electronically may be a good starting point for personal systems, in the absence of a clearer understanding of IPIM problems. This is because there does appear to be a growing need to sustain the quality of face-to-face interaction at a distance. Increases in international trade and travel, and in freelance and teleworking are all contributing to the need for better distributed workgroup interaction and collaboration. At the moment the primary tools for this are telephones and written messages, but these fall far short of supporting the kinds of information management I have observed in co-present settings.

### 4.4 Deskslate: An example IPIM appliance

A good example of a personal system which begins to satisfy some of these requirements is the *Deskslate* prototype developed in our laboratory[1]. Deskslate is a pen-based appliance which allows two people to view and annotate a shared document over the 'phone (O'Conaill, Geelhoed & Toft 1994).

It tackles the problem of preserving the quality of face-to-face interactions at a distance by enhancing the use of the telephone. In fact, provision of a shared working area to telephone partners actually improves on the kind of unequal access people usually have to shared materials when face-to-face, because now both parties can write on the same document at the same time. In field trials of Deskslate we found that this led to the composition of joint meeting notes on the same piece of (electronic) paper which were later felt to be a valuable resource in their own right.

Technically, the device incorporates many of the new forms of interpersonal information management identified above. It really supports remote interactive document use by adding facilities for spatial and transitory information management to those for verbal information management. To the extent that it has special features for the joint annotation of documents it might also be said to support controllable information management.

Although the full value of Deskslate is experienced through interaction with other Deskslate users, it can provide some immediate personal benefit by working asynchronously as a pen-based fax machine. Furthermore, the interpersonal benefits begin to acrue from the very first partner and scale up continuously as others buy the device. This is in stark contrast with some groupware products that have to be bought for an entire workforce and implemented in distinct phases as a management policy.

In short, Deskslate is an IPIM alternative to current PIM appliances such as portable PCs and personal organisers. As such it reinforces the main message of this paper which is that the future of personal systems and personal information management tools may lie in their ability to better support the interactive dimensions of office work, perhaps sometimes at the expense of mobile and personal work.

[1] Deskslate is now an HP product called Omnishare.

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## APPENDIX. TRANSCRIPTION CONVENTIONS

Conventions are based on the transcription system developed by Gail Jefferson for conversation analysis and are described in further detail in Atkinson & Heritage (1984). A brief key to the symbols used in this paper is shown below. One addition to the Jefferson system is the use of *pairs* of lines for each 'speaker' where necessary, to represent concurrent visual and verbal activity. Here visual activity is shown as aligned 'stage instructions' in double brackets above the talk.

| | |
|---|---|
| [ | Concurrent activity by both parties |
| (1.3) | Pause duration in seconds |
| (.) | Micropause of about 0.1 second |
| ( ) | Untranscribed activity |
| ((Coughs)) | Transcribers description of activity |
| ten ish | Emphasis or stress (underlined) |
| ple:ase | Stretch of immediately prior sound (to colon) |
| ⎢ | Shift into higher pitch |
| ⎢ | Shift into lower pitch |
| three? | Rising intonation (prior to ?) |
| THEIR'S was | Relatively loud sound (capitalised) |
| °Right° | Relatively softened sound |
| >I've got to go< | Quickened sound |
| .hhhh | Inbreath |
| it's just the- | Cut off utterance (before -) |