



A Survey of Note-Taking Practices

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HPL-93-107
December, 1993**

**note-taking,
memory, notebook
computers, filing**

Twenty-eight people from a variety of occupations were interviewed about how they made notes in order to provide guidelines for the development of pen computers. They were questioned about various aspects of note-taking including the situations of note-taking, what is noted down, the characteristics of notes, organization and filing, referring back to notes, problems with notes and the physical aspects of note-taking. An overview of the findings is presented and the implications for the development of a system to support the taking of notes discussed.

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1. Introduction

1.1 Aims

There has been considerable recent interest in pen-based computers following a number of technical developments in hardware and software. There has been less interest however in what functions or uses pen-based computers might serve. For pen-based systems to be of optimal use they must provide at least some of the value of pen and paper, support the writing strategies employed by the user and finally, provide benefits not currently supported by pen and paper. The aim of this project was therefore to investigate the strategies people use when writing notes on paper and to study the physical aspects of note-taking in order to identify guidelines for the development of notebook computers. We also hoped to identify a number of possible new application areas by analysing the reasons why people take notes.

1.2 Key issues

Issues concerning note-taking strategies include why and how people write notes and what exactly they take note of. What type of notebook and pen people prefer to use are addressed in our analysis of the physical aspects of note-taking. There has been minimal research into these areas within the note-taking literature. As a result, this study was exploratory and therefore the methods of investigation, naturalistic observation and informal interview, were designed to maximize the information and data that could be obtained rather than to investigate specific variables in controlled experiments.

As a consequence there are some reservations to be made when drawing conclusions from this study. For instance it cannot be certain whether the sample of 28 interviewees were representative of note-taking behaviour in the general population as a whole. In addition, the interviews were analyzed by interpretive rather than statistical methods, because of the qualitative nature of the data.

Most of the past research into note-taking has concentrated on how much is learned when notes are taken and has used students as subjects. This study used people from many different occupations and was not concerned with the effect that various types of notes had on memory. Instead issues such as the organisation and filing of notes, what is noted and the physical aspects of note-taking were investigated. We were interested in note-taking accompanying face to face conversations and not note-taking from text. This contrasts much with past research. A final reason for focusing most of the study on note-taking in meetings and consultations was because there has been so little research in those note-taking situations and also because they seemed the most suitable situations to study when considering the potential market for pen-based computers, given that a large proportion of the time when people take notes is when they are in conversation with others.

1.3 Related Research Work

- ◆ *Is the taking of notes useful?*

A primary question when investigating note-taking is whether notes are any use, i.e., do they help people to recall the original conversation? There appears to be a certain amount of confusion on this issue. Fisher and Harris (1974) concluded that note-taking was *not* beneficial to students whilst others such as Aiken,

Thomas, & Shennum (1975) found that note-taking did lead to superior recall of material when compared with non- note-takers. In order to clear up this debate Hartley (1983) conducted a survey of studies relevant to the question of whether the process of note-taking aids recall. He found that of the 38 studies using audio presentation of information to subjects, 21 studies concluded that note-taking helps learning, 15 studies argued that note-taking has no effect and 2 studies concluded that taking notes actually hinders recall. Carter and Van Matre (1975) have suggested that the conflicting results can be explained by the differences in whether a review of the notes was allowed, the timing of a review and the length of the retention interval. Hartley (1983) also studied the investigations addressing whether reviewing notes aids recall, and found that with audio presentation 13 studies out of 17 concluded that reviewing notes helps learning and 4 studies considered that reviewing has no effect. Hartley also concluded that there was enough evidence to suggest that note-taking can aid the learning process in certain situations and that reviewing notes can be a useful procedure. I have only quoted the results for audio presentation of information to subjects because it was decided that this study would concentrate on note-taking in situations where "conversations" were taking place such as in meetings and consultations. However there has also been some work studying note-taking from text, from a video presentation and from a film presentation (see Hartley, 1983). Generally it seemed that note-taking from text was superior to note-taking from audio. This could be because making notes encourages deeper text-processing or because it takes longer to make notes from text and more time is available for organising notes from text as opposed to trying to write notes in a fast moving lecture or meeting where the words "disappear" as opposed to remaining permanently on a page with note-taking from text.

Aside from the academic research it is clear that noting certain types of information aids recall of material which is unlikely to be retrieved otherwise, e.g. the writing of phone numbers, dates and other information where verbatim recall is critical.

♦ *Notes as a memory aid*

When people try to remember information they may use two types of memory aid:-

1. An internal memory aid relies on memory internal to oneself and includes such strategies as mental rehearsing, mental retracing and mnemonic systems.
2. An external memory aid is a tangible physical aid external to the person such as writing on a calendar and making lists.

Notes to aid recall were labelled under the term *external* memory aids by Intons-Peterson & Fournier (1986) who suggested that these external memory aids were likely to be used in the following conditions.

- Situations in which memory must override the potentially interfering events that often separate learning & recall such as having to go shopping after work. Here, a shopping list can be very important when there is intervening activity.
- Situations where there is a long time before learning and recall such as making an appointment for three months in the future.
- Where there is a need for highly accurate or even verbatim recall of information as in the case of a journalist interviewing a person in order to write an article.
- When the to-be-remembered information is difficult to understand and notes are needed to preserve important aspects such as in presentations or seminars.
- Situations where there is limited time available for encoding, rehearsal & using mnemonic techniques, such as writing a key point of information during a telephone conversation.

- When total attention in trying to remember information is to be avoided, such as where attention has also to be given to other activities e.g. participating in a conversation.

Intons-Peterson & Fournier (1986) stated that external memory aids such as notes are likely to be used when a person knows that memory will be required and has the opportunity to prepare for recall.

◆ *The cognitive aspects of note-taking*

Past research into note-taking has centered on the cognitive processes that take place before, during and after taking notes, such as how note-taking enables information to be encoded, stored and then retrieved from memory. Note-taking as a metacognitive process (i.e. the employment of high level strategies in order to decide what lower level strategies should be used) is a relatively unexplored area (see Brown, Bransford, Ferrara & Campione, 1983). Although not investigated in this project the cognitive processes of note-taking are also of interest because a knowledge of these processes may provide indications of how computer systems could support users current methods of learning and retrieving information.

Hartley & Davies (1978) conducted a study on note-taking using students as subjects and concluded that students take notes for two reasons - one being concerned with the process of note-taking and the other with the resulting product. The results from their survey suggested that the process of note-taking aided attention, helped determine the structure of the material and assisted subsequent recall. The production of the notes themselves allowed the students to restructure the material, provided evidence of the effort invested, and acted as material for revision and reference purposes.

The process of note-taking has its effects on memory by *encoding* (e.g. DiVesta & Gray, 1972) whilst the product of the notes acts as *external storage* (e.g. Miller, Galanter & Pribram, 1960). The encoding hypothesis postulates that note-taking is facilitative through transformation of the material into a subjectively more meaningful form, but how much transformation of information actually occurs in note-taking is questionable. Alternatively the external storage hypothesis considers that the benefit of notes is not in taking them, but in having an external record - so that encoding is facilitated during later review, rather than when notes are actually recorded. Evidence has been mixed regarding these two hypotheses.

When investigating what is learned in note-taking and how notes aid recall Peper & Mayer (1978) concluded that note-taking allowed more than just new learning overall but resulted in a 'broader learning outcome'. They attributed this learning to generative activity where note-takers integrated new information within their own past experiences. Two other theories have been put forward which are quite closely related to each other and attempt to explain how note-taking effects encoding. These are the attention theory (Fraser, 1970) which states that taking notes increases a person's overall attention to new material allowing encoding to take place, and the effort theory where it is proposed that the effort required to make notes means that the material is encoded more deeply (which is similar to Craik and Lockhart's (1972) theory of 'levels of processing').

- ◆ *Note-taking styles*

Cognitive issues aside, there has been very little research concerning the various styles of note-taking. One investigation discussed three types of note-taking forms (Risch & Kiewra, 1990). These being:- *conventional* where notes are taken without any particular structure to them, *linear* where the subtopics are listed beneath each topic heading in an outline form and *matrix* where the topics are presented across the top of the page with the subtopics along the left margin. These note-taking forms were imposed on the subjects by the experimenters: for example, some subjects were required to take notes according to matrix structure of topics and subtopics during the experiments. There have been other studies which have also imposed note-taking structures on subjects, these usually being either detailed notes, main headings or no notes. As yet there seems to have been no proper classification of "real" notes taken by people in their everyday meetings and consultations, and this was one aim of the study.

1.3 Pen Computers

According to market research figures there is a potential for 4.1 million pen computers to be sold by 1995. However to fulfill this potential the pen computer must overcome some serious obstacles as appropriate applications must be discovered and usability problems overcome. The software available includes Go's PenPoint and Microsoft's Windows for Pen Computing. The issue here is whether Microsoft's system, which although has a great many users familiar with the interface, is the most suitable interface for a system to support the taking of notes which may need a special type of interface and which may attract many first time users not familiar with Microsoft Windows.

Pen-based computers record the movement of the pen in "digital ink" as real ink would record the movement of a real pen. Some pen computers also recognise certain "gestures" as commands, so that for example, writing a carat can serve to insert a letter. There is also continuous progress in the area of handwriting recognition. Handwriting recognition would be an important advantage of pen computers over pen and paper, because it would have the potential of reducing the time taken to rewrite notes. It would also make it easy for other people to read the information and would additionally aid the organisation and retrieval of notes. However handwriting recognition is at a very early stage of development at the moment and there are trade-offs, as the battery power and memory needed to be able to carry out handwriting recognition are great.

Issues such as screen display, screen writing, memory, battery life, suitability for working conditions, optimal features and peripherals, standards and cost have been discussed very comprehensively in a Technology Overview Pack by Tangent Technology Design Associates Ltd, (1992). However particular issues such as backlighting, screen size, and texture resolution and type of pen all need to be addressed and questions referring to the physical aspects of note-taking were aimed to provide some insights into these issues.

1.4 Note-taking Situations

Past research has tended to use students as subjects and therefore the context in which note-taking has primarily been studied has been that of the lecture where one person is presenting information to several people (the students). Other possible note-taking situations include:-

- (a) meetings involving several people,
- (b) two person consultations (e.g. doctor and patient, lawyer and client),
- (c) telephone conversations,
- (d) situations where a person may write down their own thoughts and ideas as notes,
- (e) situations where people may have to read instruments or take measurements about features in their environment and then note them down.

For a diagrammatic representation see Figure 1. This study concentrated mostly on note-taking in meetings and consultations and to a lesser extent on making notes during telephone conversations and notes of people's own thoughts and ideas. It was hoped to discover whether the note-taking strategies and the physical aspects of note-taking differed depending on the context of the note-taking and the task which the note-taking was dependent on.

2. Method

2.1 Naturalistic Observation

This being an exploratory study we began by observing several meetings to study general note-taking behaviour and in particular the frequency of note-taking in the context of a meeting. Three project meetings at Hewlett-Packard Labs were observed and four people attending these meetings were informally interviewed about their note-taking strategies. This also allowed the interview questionnaire to be piloted. The results of these observations are discussed in section 3.1.

2.2 Interview Questionnaire

An interview questionnaire was designed to address as many issues relating to the strategies and physical aspects of note-taking as possible. This questionnaire is shown in the Appendix. Unfortunately it was not always possible to cover all the questions in a single interview when the interviewees were under strict time constraints. In general the interview schedule can be divided into the following seven topics:

- ◆ Situations of note-taking
- ◆ What is noted and what is not noted down
- ◆ Characteristics of notes
- ◆ Organisation, filing & storing of notes
- ◆ Referring back & searching notes
- ◆ Problems encountered with notes
- ◆ Physical aspects of note-taking

2.3 Interviewees

28 interviews were carried out, 17 of which were with volunteers from HP Labs (mostly from administration and management although eight of these people were researchers) and 11 of which were obtained through personal contacts of the author and other members of the Multi-media team. An effort was made to ensure that the sample of subjects contained people who took notes in a wide variety of contexts. Table 1 gives the initials of the subjects involved in this study and their work area.

2.4 Procedure

Arrangements to observe meetings were made by talking to project managers. For the interviews potential interviewees were contacted by e-mail and phone, and then appointments were made to visit each interviewee. The interviews took from 10 minutes to one hour, averaging out at 30 minutes. Where an interview had to be kept short only key questions were asked. Tape recordings were made and notes were taken throughout the interviews. MH requested that the interview not be recorded. An impromptu meeting with RC and a recording failure with AK meant that these interviews were not taped. Photocopies of interviewees notes were taken in 23 cases.

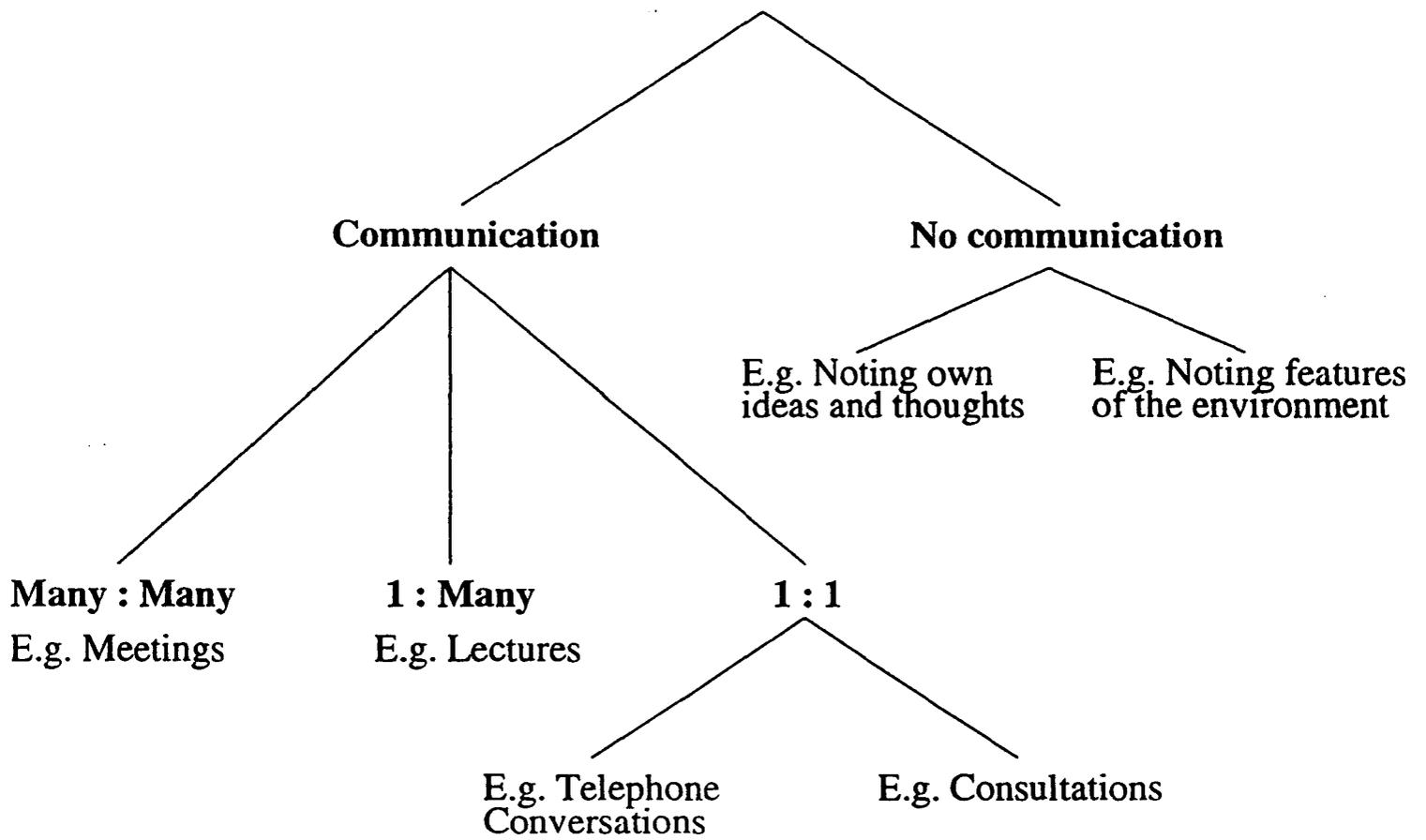
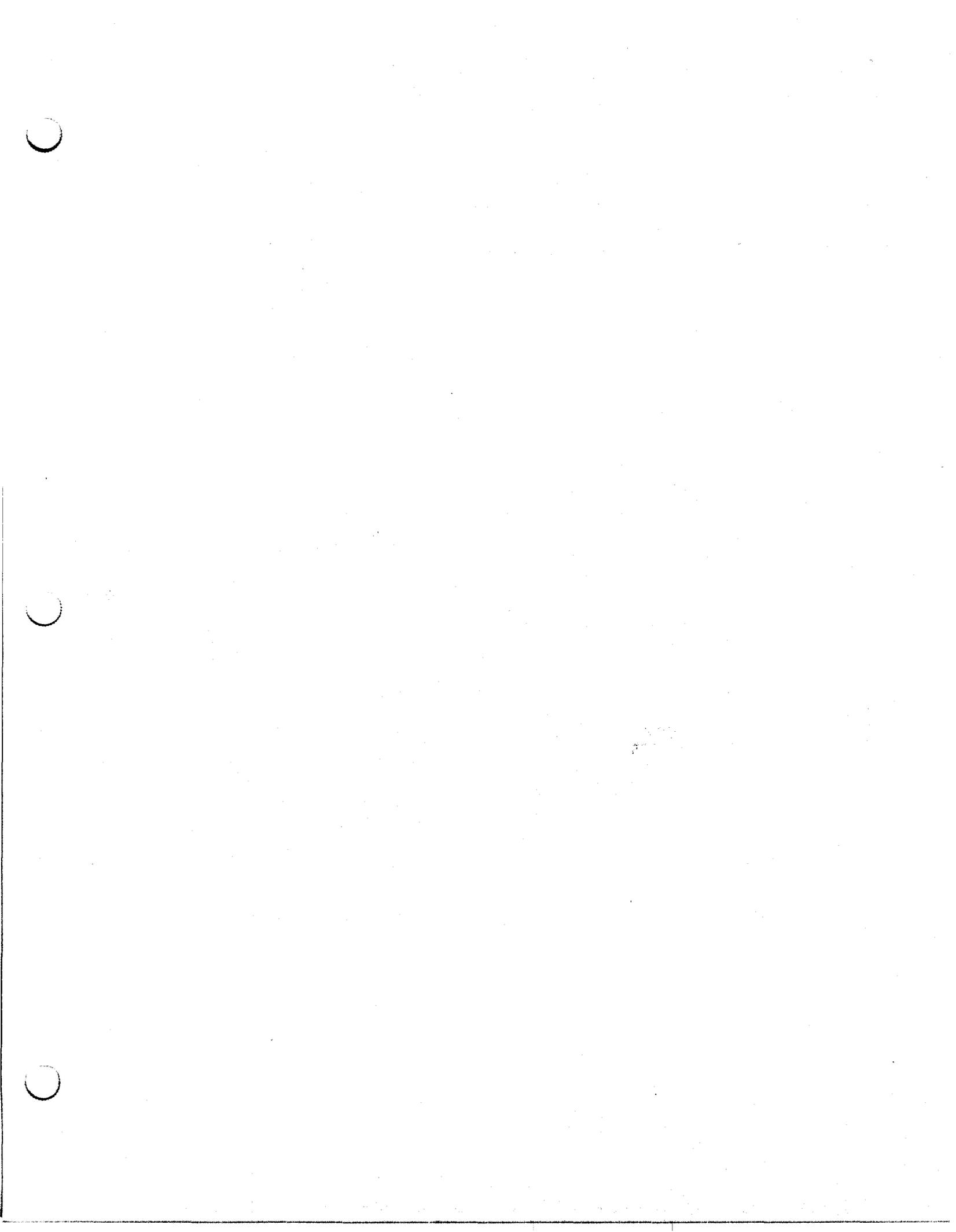


Figure 1. Note-taking Situations



2.5 Analysis

Summaries of each interview were written using the interview notes together with the interview tapes and samples of notes. The interviews with FC, JV, and SK were fully transcribed as a check for the effectiveness of the summary method. Each question was analysed and the results have been given in Section 3 of this report. The implications of these findings have been discussed in Section 4.

Initials	Occupation
RC	Head of student welfare
MW	Doctor
MH	Administrator
SK	Accounts handler and secretary
LF	Social services researcher
CF	Lecturer & researcher
JH	Student
JV	Journalist & editor
AR	Solicitor
DW	Assistant accountant
LR	Operations manager for Midland Bank
PF	Consultant for HP Labs
ST	Manager for information services
AP	Training coordinator
CMT	Personnel
MR	Personnel
BR	Knowledge engineer
TB	Technical supervisor
AZ	Secretary
ET	Business planning manager
GW	Head of personnel in Labs
FC	Departmental manager
AK	Project manager
AS	Researcher in Labs
CS	Project manager
PR	Project manager
AH	Researcher in Labs
LLH	Researcher in Labs

Table 1. Interviewees

3. Results

3.1 Observation of meetings

Three meetings at HP Labs were observed with 3, 4, & 5 people attending them. All the meetings attended were project meetings. The general points of interest are noted in the following bullet points.

- On the whole very few notes were taken, from 0.5 - 10% of the total time of the meetings.
- Each time someone made a note it would usually be for only 20-30 seconds.
- When there was a general discussion with everyone participating, people only made the odd note when the discussion was over and they were moving onto a new topic.
- Everyone dated their notes.
- Nobody used an eraser.
- All the people used their notebooks flat on the desk.
- An electronic whiteboard was used in two of the meetings and an ordinary whiteboard was also used in one of those two meetings when the people in the meeting had to change room half way through. Copies of what had been written on one of the electronic whiteboards were made and each person received one.
- One person made a twenty minute presentation and used an overhead projector to show some diagrams. People only made the occasional note throughout his presentation.
- Lab notebooks were used in most cases except for one person who used a smaller notebook.
- Nine people used bios to write their notes. The other three people used ink-like pens.
- Nobody doodled in the meetings.

The frequency of note-taking in these meetings was very low and so to check whether these findings were typical of meetings in general, interviews were carried out with people from a variety of different occupations. The results of these informal interviews are presented in the following sections. Section 3.2 presents a summary of each question with many of the responses shown in terms of percentages. Section 3.3 gives some miscellaneous results and section 3.4 tries to break down interviewee responses into different categories depending on the note-taking situation and the task for which the notes are being made.

3.2 Summary Of Each Question:

♦ Question 1: What do you take note of?

Most interviewees each gave several responses to this question. The responses have been divided into six categories.

1. **Facts** - 17 people included facts in their list of information that they noted down. Facts being names, addresses, telephone numbers, technical details, procedures, dates and other such information.
2. **Actions** - 12 interviewees replied that they noted items which they had to do something about, and they often did this even if minutes were being taken of the meeting.
3. **Opinions** - 6 interviewees responded that they wrote down some of the comments other people in the meeting or consultation made.
4. **Ideas** - 5 people remarked that they would write down the best ideas mentioned in a conversation, and some people also took the time to note down their own ideas and thoughts when they were on their own.
5. **Decisions** - 2 people replied that they would note any major decisions made.
6. **Summaries** - 1 person remarked that they noted a summary during the meeting of what was being discussed.

Nine people mentioned that they took note of keywords and keypoints but it was decided that a keypoint was a term that could cover all the categories discussed above. From these responses it cannot be ascertained in what proportions the various categories are noted down. For example, an individual may have answered that they wrote down facts and opinions but they may note opinions 80% of the time and facts 20% of the time or vice versa. This could be investigated by asking people to divide up samples of their notes into the six categories which would be interesting because there is some evidence that the various categories are dealt with and organised quite differently. For instance it appears that actions are more likely to be referred back to than any other category, and to take another example, it seems that when people write down their own ideas they are more likely to use different colours, diagrams and structure their notes more.

◆ **Question 2: When would you not take notes?**

Reasons for not taking notes were numerous and are summarised as follows :-

1. When the information is not relevant - 12 people gave this as one of their reasons for not making notes.
2. On occasions where taking part in or leading a discussion is more important than taking notes. 5 interviewees said that they would not take notes in such situations which suggests that taking notes makes participation in a conversation more difficult.
3. When someone else in the meeting is taking minutes or summaries to distribute to everyone present at the meeting. Five people remarked that they would not take notes here because they knew that all the information would still be available to them.
4. Five interviewees said that they would not generally note down other people's opinions.
5. Three interviewees who attend regular consultations felt that they were often in situations where they could not take notes because of the nature of the consultation. RC (head of student welfare) said that she would not take notes if the person she was talking to was upset. DW (accountant) and GW (head of personnel in Labs) felt that the person they were speaking to would not be comfortable if they were continually looking down and writing notes whilst trying to converse at the same time.
6. One person (ET, business planning manager) said that he would not take notes if the information being discussed was very complex or technical because in such situations he had to direct all his attention to listen and understand the speaker.

7. One interviewee (AS, researcher in Labs) replied that in informal meetings he did not take any notes.
8. CF (lecturer) remarked that he would not make notes if someone was coming to him for information as on such occasions he would usually just be answering their questions.
9. AK (project manager) and PF (consultant) both replied that they did not take notes most of the time. The few notes that they did make were action items and facts.
10. MR (personnel) and JH (student) said that they rarely did not make notes, both said that they were usually writing all the time.

◆ **Question 3: For what reason do you take notes?**

The major reason given for taking notes was to aid the recall of information, that is, to jog the interviewee's memory of what had been said in the meeting or consultation. One person found that note-taking helped their understanding of the meeting. AR, the solicitor, mentioned that she also took notes in her consultations because she was legally required to.

◆ **Question 4: How do you make notes?**

This question was not answered very satisfactorily. Interviewees gave answers which were very similar to the replies that they gave for question 1, such as, "by using keywords". The question was intended to address the issue of how people decided what they should write down but perhaps there are better ways of studying this: one could ask subjects to take notes while watching a video tape and then going through each note they made to see exactly how and why they wrote it down.

◆ **Question 5: Do you use diagrams in your notes?**

50% of interviewees responded that they did use diagrams in their notes, but it seemed that people only drew diagrams in meetings when copying them from a whiteboard or flip chart. 17% of interviewees replied that they only used diagrams very occasionally and 33% did not draw diagrams. The term 'diagram' is being used here to include graphs, flow charts and tables.

◆ **Question 6: Do you date your notes?**

54% of people replied that they always dated their notes, 12% considered that they usually dated their notes, 19% replied that they did not always write the date and 15% thought that it would depend on the situation such whether it was a formal or informal meeting. However the dating of notes may depend on whether a notebook is being used with notes in chronological order, in which case people may not feel they have to date their notes so regularly.

◆ **Question 7: Do you mark or highlight any of your notes?**

Generally interviewees did mark and annotate their notes with only two people responding that they never marked their notes. The range of marks and highlights were very varied. Asterisks were the most popular form of marking and were usually used to signify the importance of a point of information and the need to remember it or act on it. Other markings used to signify importance included circling points, drawing a box

around points, using arrows, dashes, brackets, exclamation marks and drawing a line down the side of the relevant points. Numbering points or using small dots or bullet points was often used as a way of structuring the notes. Most of these marks were made at the time but 28% of interviewees mentioned that they did sometimes go back and mark their notes or annotate them after they had been written. This also included two people who wrote pre-meeting documents and then just annotated these documents in the meeting. One interviewee did annotate his notes but considered this to be "cheating" because he felt that notes should not be altered once written so that they were a true representation of what was written on the date that the notes were taken.

◆ **Question 8: How do you organise your notes?**

The manner in which the interviewees organised their notes depended on whether they wrote their notes in a bound book or on loose pages. The most common method of organising notes in a bound book was in chronological order. One person mentioned that he had tried to organise his notes into different labelled sections within his notebook (i.e. a "separaters" method) and as a result was able to search for information very easily, however he did have problems in knowing in which topic heading to put information and knowing how big to make each section. Two people remarked that they wrote an index at the front of their notebooks as a way of organising their notes. If people used loose pages they tended to manage them by putting them in folders, box files or filing cabinets. One person said that they usually kept their notes in a tray. A couple of interviewees who used paper folders just kept them piled up on their desks. For details of how people organised their notes within files see question 9.

◆ **Question 9: How do you file your notes?**

70% of interviewees filed their notes by content, that is, they gave each set of notes a subject or topic heading and created folders or box files to place all the notes with the same subject heading together. People remember customer names or project names easily so it is perhaps the most obvious and easiest way to file notes by putting them under these headings. Within a file notes were usually in chronological order. Some interviewees (10%) used an indexing system of numbers to file their notes which perhaps could be most useful when several people need to use the files and a standard method of filing is necessary. 10% of people filed their notes in chronological order which could lead to organisation problems unless they had a good diary system to find the notes for particular meetings or consultations. 10% of people did not file their notes, with one person using the analogy "out of sight, out of mind" remarking that the notes were practically redundant once they had been filed away.

◆ **Question 10: How often do you refer back to your notes?**

44% of people said that they very rarely referred back to their notes. The only occasions when these interviewees said that they did look back at their notes included when they needed a particular piece of information, immediately after a meeting to check for actions they had to do, once a year when reviewing what they had accomplished during the year, and lastly in the case of the student, when revising for examinations at the end of the year. 24% of interviewees referred to their notes occasionally and 32% reviewed their notes regularly. One person remarked that he did not find it necessary to refer back to his notes because he remembered all he needed to know anyway. Another interviewee also mentioned this and

thought that it was the process of note-taking that helped his recall. The doctor (MW) referred back to the notes he made about each patient each time they came for a consultation and he also looked back at his notes when trying to identify people with a common problem or prescription to see what happened to them and to check that the appropriate decisions were made.

♦ **Question 11: Do you always understand your notes?**

None of the interviewees seemed to have great problems understanding their notes. The few occasions there were problems were because:-

- Their writing was not legible
- They had forgotten the context in which they had written something
- They could not remember what an abbreviation stood for
- They had simply not written enough notes and as a result some important points had not been written down

Generally people found it harder to understand their notes the further back in time they were written, but as people did not usually refer very far back it was not really a problem. A few interviewees commented that although they did not have a problem understanding their notes, they thought that other people would have problems if they gave them their notes. It seemed that if a person knew that they would have to give their notes to other people then they would make the effort to type their notes up so that the other people could understand them.

♦ **Question 12: Have you ever wished that you had written better notes?**

70% of interviewees replied that there had been occasions when they wished that they had written better notes and 30% said they had had no such occasions. The reasons for them having problems with their notes were as follows :-

1. Their notes were inadequate because a piece of information that they needed had not been written down because it had not seemed important at the time.
2. They could understand their notes at the time of writing them but had now forgotten what they meant because they had forgotten the context in which they were written or the abbreviations were too obscure.
3. Sometimes notes were inadequate simply because there was not enough time in the meeting or consultation to write all the points down.
4. One person remarked that she had problems when she decided not to write an item down because she thought that she would be able to remember it but ended up forgetting it anyway.
5. When they felt uncomfortable taking notes in a two person consultation because they did not want to break eye contact too much and as a result had not made enough notes.
6. On occasions where they had to concentrate on participating in the meeting and therefore did not make many notes.
7. When they could not understand their writing or had forgotten what the shorthand terms meant.
8. AR (solicitor) commented that as a lot of her consultations were carried out on the telephone she had experienced problems when a client or another solicitor claimed that she had said something on the telephone that she was sure she could not have. This type of problem arose as she usually did

not write down in her notes what she advised her client because she did not expect that to be necessary.

◆ **Question 13: How long do you store your notes for?**

The majority of interviewees (64%) kept their notes for years before throwing them away. 20% of people stored their notes for months and only 8% regularly threw away their recently made notes. It seemed that notebooks were more likely to be stored for longer periods than loose pages and 8% of interviewees said that they would keep notebooks for years but throw loose sheets of paper after a few months. The people who threw notes away soon after they made them usually only did this because they had rewritten them in the form of minutes or official documents, or had completed the actions that they had noted down. JV said that as a journalist she was legally required to keep her notes and her audio tapes for 6 months and AR, a solicitor, had to keep all her notes for 6 years because if someone wanted to bring a professional negligence claim they had to do so within 6 years. Although JV (journalist) did keep her notes for 6 months she often reused her audio tapes simply because she saved money doing this. Businesses who had client and customer files often stored those files for several years. For instance, DW (accountant) remarked that the accountancy firm he worked for kept non-current files in a store in another building for at least 3 or 4 years. LR (operations manager) who worked for a high street bank said that customer notes were kept "forever".

◆ **Question 14: Do you ever rewrite your notes?**

In answer to this question 79% of interviewees replied that they did rewrite their notes occasionally. The reasons given for doing this included when writing up minutes (7 people gave this reason), when their notes were particularly untidy and had to be passed round to other people (5 interviewees), and lastly when they had to write a report or article using their notes (5 interviewees). 21% of people said that they never rewrote their notes. Although many people remarked that they did rewrite their notes it was not ascertained exactly what percentage of their notes they rewrote. The notes which were rewritten were those which in some form or another had to be given to other people. Notes which were just for private use were not generally rewritten. JH (student) commented that he never rewrote notes because he felt that his original notes were usually the ones that best jogged his memory.

◆ **Question 15: Roughly what percentage of time do you spend writing in your meetings?**

The amount of time that people perceived themselves to be writing in meetings was highly variable. The estimated percentages of time spent writing in consultations was also very variable. For both meetings and consultations the estimated percentages ranged from 0-50%. It appears that the amount of time spent writing notes is dependent on three factors:- the task for which the notes are being written, the individual writing the notes and the situation in which the notes are being written (for a fuller discussion see section 3.4). JH (student) thought that he spent at least two thirds of the time writing in lectures and said that much of his notes were almost verbatim records of what the lecturer was saying.

◆ **Question 16: Do you use any abbreviations in your notes?**

Of the twenty-three people who were asked this question all of them used abbreviations in their notes. Standard abbreviations such as e.g. (for example), i.e. (that is), and f.a.o. (for the attention of) were the most common form of abbreviation with fourteen interviewees responding that they used standard abbreviations. Nine people also used personalised abbreviations such as shortening words that they regularly used in their notes or, as in the case of SK (accounts handler), giving projects "pet names". Three people included the use of people's initials in their notes as a form of abbreviation and four interviewees mentioned that they used several acronyms when writing notes. Four interviewees used shorthand in their notes but only one of these people AZ (secretary) used shorthand regularly.

◆ **Question 17: Do you ever doodle in meetings?**

80% of the interviewees answered that they did doodle whilst 20% did not draw any doodles. Reasons given for doodling included :-

1. MR (personnel) - when she are bored with sitting still.
2. LF (social services researcher) - when discussing something very technical
3. JH (student) - when the lecturer is talking about something which he does not need to write down.
4. CF (lecturer) - on occasions where he has got a pen in his hand yet has nothing worth noting down.
5. FC (departmental manager) - if the meeting is not directly interesting but is sending him on a train of thought then doodling can help in the thinking process.
6. GW (head of personnel in Labs) & JV (journalist) - when trying to concentrate on something as doodling aids the process of attention.
7. AR (solicitor) - if a client is giving her unnecessary information or she is waiting for someone to fetch a file for her.

◆ **Question 18: Is a whiteboard used in your meetings? Do you copy notes from it?**

56% of the interviewees replied that whiteboards were used in their meetings and consultations. Flip charts were used 25% of the time. 19% of people remarked that they did not use whiteboards or flip charts at all in their meetings, with one person remarking that the only reason a flip chart was used in their meetings was to lean things on! It was generally the case that people responded that they did copy information written on the whiteboard into their notes unless it was an electronic whiteboard in which case they could get a copy anyway.

◆ **Question 19: How would you search for a bit of information in your notes?**

Interviewees mentioned several ways of searching for information in their notes:-

1. The most common method (10 people included this in their list) was that they just flicked through the pages of their notes until they found the relevant piece of information.
2. Six people said that they used their memory of where the particular note was likely to be and then went to this place in their notes. If this failed, they would then flip the pages until they found it.

3. Six people mentioned that they used their diary occasionally to find out when the meeting or consultation in which they were interested took place.
4. Five interviewees said that they knew from the content of each meeting / consultation where to look for the information.
5. Four people said that they often had a visual image of where exactly on the page the piece of information was, and so they would just search through until they found that particular page in their notes.
6. Using an index system was another common method of finding notes (used by four interviewees).
7. One person (SK, accounts handler) mentioned that she tried to associate the time she wrote the note with a particular event that occurred just before writing the note or just after writing the note so that she could locate the bit of information more easily.

♦ **Question 20: Are you ever given handouts in your meetings? How do you use them?**

86% of interviewees replied that they did receive handouts in their meetings and consultations and 14% of people were not given handouts, however it is not known what percentage of occasions the people received handouts. The term handouts is used to cover agendas, working papers, policy documents, contracts and other general information given for discussion within the meeting. One interviewee remarked that handouts were useful if kept with the notes from the meeting to act as a trigger for what was said in the meeting. 43% of people said that they found it useful to write on the handouts themselves. One person said that being given a handout meant that he could feel that he had much of the content of the meeting already so he was able to concentrate on participating in the meeting much more.

♦ **Question 21: What size paper do you prefer using?**

It seemed clear that A4 was by far the most popular size of paper, with 61% of the subjects using A4 all the time. The space available with A4 paper seemed to be its greatest advantage which also meant that some subjects considered that A4 was too cumbersome to carry about when travelling and hence 7% used A4 most of the time except when they had to travel to meetings outside their workplace. 11% of subjects felt that A5 paper was the most convenient size with one subject, AP (training coordinator), remarking that it forced her to be concise. The journalist-type spiral bound notepad (12.5*20cm) was preferred in 7% of cases - i.e. by SK (the accounts handler) and perhaps not surprisingly by JV (journalist). Some subjects (11%) used non-standard sized note paper and one subject (3%) had no preference. It should be noted that several subjects thought that they had been conditioned to like A4 paper because that was usually all that was available for them to use.

♦ **Question 22: Do you like using a bound notebook or loose pages?**

It appeared that most subjects preferred using a bound notebook (43%) mainly because the notes then required very little organization and the pages could not be lost. Some people preferred the spiral-bound notebook (11%) because the pages could be removed easily. Loose pages were used by 39% of subjects

primarily so that the pages could be filed away and also because the pages could easily be given to other people or thrown away. Some subjects (7%) chose to use a combination of loose pages and a bound book.

◆ **Question 23: Do you use your notebook flat on the desk or tilted towards you?**

For this question 50% of subjects responded that they wrote with their paper flat on the desk while 27% preferred to lean their notebook against the edge of the table so that it was tilted towards them. 9% of people said that they used both of these methods for writing. Some subjects (14%) replied that there were occasions where they did neither of these because there was no writing area available as for example in the case of the journalist (JV, journalist) at a press conference.

◆ **Question 24: Do you prefer lined or plain paper?**

For a number of reasons 76.9% of the subjects preferred lined paper. Some subjects remarked that the lines helped control their writing thus making it more legible. The secretary (AZ) remarked that the lines were essential for her shorthand because there are three different positions for the writing depending on the vowel sounds and the lines are needed to guide the position of the words. 7.7% of interviewees stated a preference for plain paper, the reasons given being that lines were too constraining and that it was easier to draw diagrams on plain paper. Two interviewees (7.7%) who made regular graphs, tables and line drawings expressed a preference for graph paper. A couple of interviewees had no preference of paper-type.

◆ **Question 25: Do you use different colours when writing notes?**

The majority of interviewees (59%) responded that they very rarely used different colours if at all. This was usually because they had no time to do this when they were taking notes or they were not organized enough to carry around different colours. 23% of interviewees did use colour in their note-taking and stated that this helped them to structure their notes and to direct attention to particularly important points within the notes. DW (accountant) was required to use a set colour coding scheme when writing up audit papers which included using a green colour for audit ticks and having references to work papers in red. Some interviewees (18%) said that they would not use different colours ordinarily but they might if they were writing up their own thoughts and ideas or copying down a diagram which had various colours in it.

◆ **Question 26: What sort of pen do you prefer writing with?**

There was no clear preference for one particular type of pen. 22% of the interviewees preferred to use pencil, 22% chose the biro as their most preferred writing instrument, whilst 15% liked using an ink pen. Some interviewees (22%) preferred using a combination of pencil and biro in their notes whilst 19% used a combination of biro and ink pen. Pencil was often favoured because notes could then be amended easily. One interviewee (JH, student) remarked that he often used pencil when making annotations in the margins, another person (MR, personnel) commented that she felt more in control of a pencil than she did a pen and MH (administrator) felt that a pencil provided that right amount of friction between the pencil and paper.

Reasons given for disliking a pencil were that notes written in pencil were hard to read, that using a pencil was too slow, that pencils became blunt too quickly and that pencil could be amended without a trace. The interviewees who expressed a preference for biro often stated that this was because it was the quickest pen to write with, it did not smudge, the writing was easy to see and it was fairly permanent. One interviewee (FC, departmental manager) explained that he did not like using most bios because the writing was not very smooth as bios tend to "skip too much". For those interviewees who preferred to use ink pen it seemed that this was because their writing was better and more legible in ink, but a couple of people remarked that they thought that ink pens were too slow to write with. Some interviewees expressed that perhaps their preferences only related to whatever writing instrument they were used to making notes, in other words perhaps they had always used a biro through habit and so just assumed that they preferred the biro above all other pens. Several interviewees remarked that preferences aside, they usually used whatever pen was handy at the time.

◆ **Question 27: Do you use an eraser when writing notes?**

Overwhelmingly the response to this question seemed to be "no" - with 72% of interviewees replying that they didn't use an eraser and 20% answering that they used an eraser only occasionally. The reasons given for this was the lack of time to use an eraser in note-taking situations and the ease of being able to cross words out. One interviewee, MH (administrator), remarked that he didn't need an eraser because he seldom made mistakes. Most of the people who remarked that they used an eraser only occasionally did not use an eraser in meetings only in situations where they were writing down their own ideas and thoughts. Only 8% of interviewees replied that they did use an eraser regularly. The concept of the permanence of notes is important here. For some interviewees it seemed important that the notes should not be altered once written as in the case of MW (doctor), and whilst AP (training coordinator) did use an eraser she always put brackets around the space where she had erased words to mark that something had been there.

◆ **Question 28: Do like to have a margin on your paper?**

50% of interviewees replied that they preferred to have a margin with some interviewees even drawing a margin themselves if there wasn't one already. Interviewees frequently remarked that margins were useful to number points and asterisk them. A few people (30%) expressed no particular like or dislike for margins, whilst 20% preferred to use paper without margins. One person (LLH, researcher in Labs) remarked that margins were pointless unless someone else was going to write on the paper too, and another (AR, solicitor) stated that she could leave space herself and didn't need a line to do that for her!

◆ **Question 29: Do you ever need to or want to lock your notes away?**

The majority of interviewees (64%) did choose to lock at least some of their notes away, usually those concerned with information about people (such as performance evaluations) or financial matters. 36% of interviewees did not need or want to lock their notes away.

◆ **Question 30: Do you ever think about the level of lighting when writing notes?**

Some interviewees (44%) did worry about the amount of light in the environment whilst writing their notes and some made a point of switching on a desk lamp or turning on a room light when the lighting was poor. One person (JH, student) said that he was very conscious of the amount of light in a room because he was now suffering from bad eyesight due to having worked for long periods in badly lit environments. 56% of interviewees were not concerned with lighting probably because they worked in well lit environments anyway.

3.3 Miscellaneous Results

This section discusses some interesting extra points mentioned by the interviewees.

1. Post-it Notes.

Six of the interviewees remarked how useful post-it notes were. Their uses included:- to act as bookmarks, to stick onto pages of notes which are particularly important, to pass messages onto other people, and to use when bored of using larger pieces of paper! Only three of these six people used post-its in the "conventional" sense, that is, to write telephone messages and other small pieces of information such as names and addresses. One interviewee stated that she was beginning to dislike post-its because she now had so many of them each containing such important information that they were getting difficult to manage.

2. Note-taking on Computers

One person (AK, project manager) used her PC as a note-taker by typing in her ideas in a raw form without editing them. For her the issue of a large screen size was very important. As suggested in the summary for question 21 an A4 size writing area was the most popular size and apart from AK, some other interviewees (PR, project manager & JV, journalist) also felt that any screen size smaller than A4 was too small to write notes on easily.

Whilst carrying out his consultations with patients MW (doctor) wrote half his notes straight onto computer and made the rest on paper records. He found that searching for information on computer was easier than on paper and he was satisfied with reading information off a screen. He stated that he would be perfectly happy to write all his notes on computer if only he could be certain that the records could not be altered by anybody else or be altered without a time-stamp automatically being attached.

3. Summary boxes

MW (doctor) pointed out that the important issues in his consultations were put into summary boxes which he found very useful when referring back to his notes. CS (project manager) remarked that he thought it would be helpful if there was a separate place for actions within the notes so it would be easy to access that important information quickly. It may be that having separate areas for important points may be worth building into a note-taking system especially if the system could automatically construct the summaries by using the points which people naturally mark (e.g. by using asterisks) while writing their notes.

4. *Restrictions on note-taking strategies*

Some of the interviewees' note-taking was dependent on the materials and guidelines that were supplied by their employees. For instance DW (accountant) was required to write notes on specialist accounting paper supplied by the firm he worked for and had to write notes according to a set methodology for which he received training when joining the firm. MW (doctor) had certain legal requirements to take notes and had to take them both on computer and on specific paper (called Lloyd George paper) that again was supplied for him. This study asked people how they preferred to take notes and what materials they liked to use but it should be noted that there may be many people who do not have the option of taking notes the way they would like to.

3.4 Note-Taking Situations & Their Effects on Note-Taking Strategies

As discussed in section 1.4 there are several possible note-taking situations (see Figure 1) and this study focussed mainly on note-taking in meetings and consultations. A meeting being defined here as a face to face gathering of *more* than two people and a consultation as a face to face conference of two people. Notes are taken to be able to carry out a variety of tasks:-

1. To increase a person's knowledge (e.g. a student using notes to revise).
2. To prepare an article or formal document.
3. To write up the minutes of a meeting to give to others.
4. To gather information to be able to make a balanced decision on an issue.
5. To have a general record of what was discussed (perhaps for legal reasons) but with no specific purpose for the notes.
6. To keep as private notes with items noted that the particular person requires (actions, general information).
7. To be able to communicate or advise other people verbally using the notes as a basis.

This section discusses whether people's note-taking varies according to the situation and the task dependent on the notes. To do this a few questions have been picked out and examined more closely.

♦ *Question 1 - What do you take note of?*

The answers to question 1 were divided into six categories. By analysing these categories the evidence suggests that the items that are noted down are dependent on the situation in which the notes are written. When considering those people who wrote down the opinions of other people in the meeting [JV (journalist), MW (doctor), SK (accounts handler), GW (head of personnel in Labs), ET (business planning manager), JH (student)], it seemed that with the exception of JH (student) that these were the people most likely to attend two-person consultations where the noting down of the other person's opinion would be very important when trying to make decisions and judgements on these comments (especially in the case of the doctor, MW, & the head of personnel in Labs, GW), or to write a report or an article as the journalist, JV (journalist), would have to do. It is also useful for JH (student) to note the opinions of the lecturer in order to decide what stand to make about a certain theory when writing essays or answering examination questions.

The interviewees who noted down good ideas were all people from HP Labs [PR (project manager), BR (knowledge engineer), ST (manager for information services), AH (researcher in Labs), AS (researcher in Labs)] where new ideas are an essential part of their work and are likely to be discussed during meetings.

Of the 12 people who included actions in their list of items they wrote down [AH (researcher in Labs), TB (technical supervisor), BR (knowledge engineer), ET (business planning manager), PF (consultant), MR (personnel), MH (administrator), LF (social services researcher), MW (doctor), FC (departmental manager), JV (journalist), & GW (head of personnel in Labs)] all of them attended meetings and MW and JV who usually had only two-person consultations in their work said that they only noted down actions in the meetings they did attend (e.g. departmental meetings and editorial meetings respectively). An action is usually something that the person is responsible for going away and doing and one would expect the assignment of such duties to occur in meetings.

Facts seemed to be written down across all occupations and note-taking situations which one would expect as facts are likely to be the most essential type of information.

Therefore on breaking down the responses to question 1 it seemed that the items which people noted down were not task dependent but situation dependent. Generally there was evidence to indicate that in meetings facts, actions and ideas are noted whilst in consultations facts and opinions are more likely to be noted.

◆ *Question 2 - When would you not take notes?*

As interviewees gave a variety of reasons for not taking notes, some seemed to be task dependent and some situation dependent. Situations where communication is the major part of the process (meetings, consultations, telephone conversations) seems to, in part, determine when people do not take notes. For instance the act of trying to participate in a conversation means that it is more difficult to take notes at the same time. Another example is the situation of a two-person consultation where a note-taker is more likely to be uncomfortable about breaking eye contact when writing down notes. Where people do not note particular items such as opinions it is usually because they are not needed for the task that the notes are intended for, which is a good example of task dependency.

◆ *Question 10 - How often do you refer back to your notes?*

It may be the case that referring back to notes is task dependent. The student JH (student) referred back to his notes a great deal when he had to remember them for his examinations, so if notes are written to be able to revise from then it usually means that they will be referred to a lot. JV (journalist) said that she only referred her notes while writing an article but once it was written she felt that there was no need to look back at her notes because she had the article to refer to. A similar situation may arise once a person has written the minutes of a meeting, or once a decision had been made, or the general points communicated to others. Whether private notes are referred back to may be more dependent on the individual.

◆ *Question 14 - Do you ever rewrite your notes?*

Whether notes are rewritten could be said to be task dependent. If notes are for private use such as to learn from or to use as a general record, then they are unlikely to be rewritten. However, the process of writing a document or minutes means that the notes have to be rewritten. Therefore the aspect of rewriting notes seems to be task dependent.

- ◆ *Question 15* - Roughly what percentage of time do you spend writing in your meetings?

It seems that the amount of time that people write in meetings and consultations does depend on the individual as well as the task for which the notes are being written and the note-taking situation. The people who wrote the most notes were those who had to write an article or document using their notes as a basis as in the case of JV (articles), DW (audit records) and AR (legal documents). These people had to write a great deal to capture all the details as well as the major points to be able to carry out their tasks. JH (student) also needed to make a lot of notes so that he had as much information as possible to be able to revise and pass his examinations. Many of the people in HP Labs spent very little time writing in their meetings because they were usually only making a general record of what was being discussed and marking the points and actions directly relevant to them so this task required less writing time.

As has already been discussed the note-taking situation can also influence how much is written down. For example RC (head of student welfare) often felt that she could not write very much because the person she was talking to was upset. A number of people commented that they were uncomfortable about burying their head down and writing when they were in a two-person consultation. The need to participate in a meeting or consultation often dictated how much time they were able to spend writing notes.

Lastly, it can be the case that people in the same meeting making notes for the same reason will spend very different amounts of time writing because, as ever, individual differences play a huge part in note-taking.

- ◆ *Question 21* - What size paper do you prefer using?

A4 paper was generally preferred even though the interviewees took notes in various situations and for very different tasks. It is likely that the size of paper is not dependent on the task or the situation. Although it could be said that some note-taking contexts meant that some sizes of pages were more preferable than others such as in the case of JV (journalist) who uses a journalist's notepad because it is easy to hold in the palm of her hand when interviewing someone while she is standing up. Some people did prefer A5 paper in the context of travelling because they considered that it was easier to carry. One person who preferred a small notepad remarked that in the context of a meeting she had to use A4 paper because it looked more professional!

- ◆ *Question 25* - Do you use different colours when writing notes?

The use of different colours in notes may to a certain extent be situation dependent or perhaps more accurately time dependent. For example, a person in the situation of writing up their own thoughts may use colours to structure their ideas better and they are able to do this because they have less time constraints on them than people in a fast moving telephone conversation or meeting. The aspect of time dependency may also influence the use of an eraser (see question 27, section 3.2).

It was not clear from the data obtained whether the other questions could also be broken down into those which are influenced by the note-taking situation and those which are dependent on the task for which the notes are being made. Many of them seemed highly dependent on the preferences and strategies of the individual.

4. Implications

4.1 Variations in note-taking strategies

Trying to make generalisations about note-taking is not possible due to the fact that note-taking seems highly dependent on the situation in which they are taken, the task for which the notes are being taken and the individual taking the notes. But taking this into consideration there are a few points that summarise what type of notes may be taken in the different situations.

- *Taking notes on the telephone* - It seems that often when talking on the telephone the type of notes written are short and often contain facts such as names and addresses. Actions are also likely to be noted. Small notepads and post-its seemed to be used regularly in these situations.
- *Making notes of one's own thoughts* - People seem to structure their notes more as they are writing them in these situations due to the fact that they are not usually under any time pressure and they do not have to participate in a conversation. Ideas, summaries, facts and actions are all likely to be noted.
- *Consultations* - Notes in consultations are very dependent on the task for which the notes will be used. For example if the notes are expected to be used to write a report or article then usually a large proportion of the consultation will be spent trying to take notes as well as participate in the discussion. Generally it seemed that the opinions of the other person may well be noted down in a consultation along with facts and decisions.
- *Meetings* - As with consultations, notes made in meetings are also task dependent. However the evidence suggests that people are more likely in meetings than in consultations to note down actions that they have to do, decisions made, and any good ideas. Facts were regularly noted in meetings.
- *Lectures* - As students often have to revise from these notes, they are usually fairly comprehensive, with almost verbatim excerpts of what the lecturer is discussing. Commonly, facts, opinions, summaries will be noted.

4.2 People's perception of the adequacy of their notes

Generally people perceived their notes to be adequate and on the whole they did not experience many problems in understanding or finding information in their notes. When there were problems it was usually because people's notes were too brief and selective. However because people were often able to refer to minutes or to ask someone else who was present at the meeting, any problems caused by the brevity of notes were easily solved and as a consequence interviewees did not feel the need to change their note-taking strategies.

When asked, people were able to list problems they encountered with their notes and early pilot data from the user testing of Filochat suggests that people quickly see how problematic their notes can be and realise the value of having audio recordings which are easily available to refer to.

4.3 The use of audio to supplement note-taking

Only one interviewee, JV (journalist), made audio recordings of her interviews to back-up her notes. However, as she wrote up her stories very soon after the actual interview she did not refer to her recordings very often. When she did refer to her tapes it was usually to check that her quotes were accurate or to clear up the odd occasion where she did not understand her notes.

The finding that most people did not experience huge problems with their notes must be part of the reason why they do not feel the need to make audio recordings of their meetings and consultations, together with other reasons such as the difficulty of browsing audio tape and the general dislike by people of having their meetings recorded. Naturally any problems of not taking enough notes or not remembering what the notes meant would be solved by having an audio recording. Work is being carried out at the moment at HP Labs (Wiley) investigating the management of audio recordings.

4.4 The life-span of notes

It appeared that generally the usefulness of notes was fairly short-term. In the case of meetings the notes were not often referred back to and those that were, were usually the action items and basic facts. FC (departmental manager) commented that often he only referred back to the last 50 pages of his notebook and the rest of his notes were virtually redundant. Although in most cases people did not make full use of their notes in terms of referring back to them they did not throw them away either. They seemed to be loath to do this just in case the notes would be useful one day. As a result, a useful note-taking system would support the retrieval of notes written fairly recently and would enable easy storage of notes in the long-term.

4.5 Finding notes

When searching for a piece of information, the most common retrieval system that people employed was to use their memory of roughly whereabouts in their notes the information would most likely be and then to flick through their notes until they found it. Using a diary to locate the exact date of the meeting or consultation was also quite a common method of retrieving notes. On occasions where people had diaries but chose not to use them it was usually because they thought they had a pretty good idea of where the information would be. They therefore decided that they would save time by just visually searching through the pages. Obviously the diary system is a much more accurate method of finding information, so when considering how a system could support the retrieval of notes, a built-in diary which required the minimum of work to manage, access and browse would perhaps overcome the natural tendency to search for notes by the imprecise method of flicking through them.

4.6 Technological Implications

This section draws attention to the problems people encountered with their notes and suggests how technology might be able to solve them.

1. *Problems with efficient retrieval and storage* - A possible solution for the user would be to have a counter to check how many times each document was accessed so the user would be able to access documents using information gathered on the frequency of retrieval. This could also be of use to indicate which documents are never referred to, so that deletion of them could be suggested to the user to aid the system. For certain professions where they are legally required to keep their notes for a certain length of time (e.g. lawyers - 6 years, journalists - 6 months) in case someone wants to bring a professional negligence claim or some sort of law suit, then when documents had been kept for as long as is required the user could be alerted to this and asked whether they wanted to continue storing them.
2. *Organisation problems with post-its* - With the increasing use of post-its the management of the important information they contain, is becoming more difficult. An electronic post-it which had some editing functions, and handwriting recognition would allow for easier access and search. It would perhaps be useful to be able to file post-its with names, addresses and telephone numbers away in an in-built address book and diary.
3. *No dates, times or indices in notes* - For people who forget to date their notes, automatic time stamping would solve this problem. In addition a link between people's notes and an in-built diary using the time stamps would help in the retrieval of notes. Finally, instead of people manually creating indices if they were to add titles to their notes then indices could be automatically created.
4. *Poorly organised notes* - In many note-taking situations there is little time to structure notes as they are written, therefore a system which allowed for the manipulation and editing of notes once they were written would cut down on the work of rewriting, aid the preparation of documents and make the notes more understandable.
5. *Difficulties in reviewing the keypoints* - It seems that when people review their notes they quite often just want to see the most important points or actions. As people usually mark these keypoints (e.g. using asterisks) whilst making their notes it would be useful if they could be written automatically into summary / action boxes for easy review. It would also be useful if the notes could be accessed via the points in the summary boxes, via handwriting recognition. One example would be where the user wants to see the sentence before the marked sentence.
6. *Forgetting what abbreviations mean* - The occasions where people forget what they meant by an abbreviation would be helped if a key of abbreviations was automatically built up when writing notes. If a key was written then when a user wrote an abbreviation the system could automatically substitute it with the long form. Having an audio recording of the note-taking situations would also aid the user as it would be possible to replay the relevant sentences to understand what the abbreviations stood for.
7. *Poor notes because of having to participate in the discussion* - There are some occasions where (a) minutes are not being taken in a meeting or consultation and (b) there is a need to participate in

the discussion. This means that adequate notes cannot be taken. Here an audio recording of the note-taking situation would be a useful addition.

8. *Inadequate notes when it is not socially acceptable to take notes* - There are occasions when a person may feel awkward taking notes as in the case of RC (head of student welfare) when she was talking to a person who was upset. In these situations having an audio recording might make up for the lack of notes, but there are clearly social and personal issues associated with this type of solution.
9. *Poor notes because meeting moving too fast* - Sometimes points are missed because the meeting or consultation is moving too rapidly to be able to write down all that is necessary. Again the use of audio recordings would be the best solution.
10. *Writing not legible* - Having an audio recording would also help those situations where people cannot understand their own writing.
11. *Lack of verbatim record* - In some situations a verbatim record is necessary such as in consultations to keep an exact record of what each person said so that no one can argue that they or the other person said something that they did not. Making an audio recording is the best way of having an exact record of what was discussed and this could be useful in some doctor - patient, lawyer - client, journalist - interviewee consultations, where there are no "social problems".
12. *Notes are lost or altered* - As a backup in situations where notes are misplaced or there is uncertainty over whether the notes may have been altered by someone else, then an audio recording could be used to replace the notes and check their validity.

4.7 Areas for future research

As this study was exploratory the interviews would benefit from being carried out on greater numbers of people to increase the validity and reliability of the results. But besides pure replication, the next step would be to carry out tests to see whether users are satisfied with writing notes using the screens and pens available at the moment, to check whether the software available matches user needs and to study what improvements should be made. If writing systems for niche markets (such as journalists and lawyers) then user studies must be carried out using people from these professions. Finally it seems that the use of audio recordings in meetings and consultations would solve many of the problems encountered with notes so a profitable area of research would be how to improve matters such as browsing and access of audio to encourage more people to use audio recordings.

4.8 Conclusions

In general people do not seem to have any problems with their note-taking which they cannot cope with by changing their note-taking strategies. Therefore technology designed to support note-taking would have to have extra features that are not available when note-taking on paper. Handwriting recognition may be very important as a major advantage when trying to organise and rewrite notes. Note-taking systems which are tailored to the needs of specific professions such as journalism (where audio recordings are already used) would probably be the most marketable systems.

Acknowledgements

Thanks to Steve Whittaker and Erik Geelhoed for their guidance and encouragement which was much appreciated.

Thanks also to Cliff Kerr for transcription of the interviews and to all the interviewees who gave up their time to talk about the wonders of note-taking.

References

- Aiken, E.G., Thomas, G.S., & Shennum, W.A. (1975). Memory for a lecture: Effects of notes, lecture rate and informational density. *Journal of Educational Psychology*, 67, 439-444.
- Brown, A.L., Bransford, F., Ferrara, A.H., & Campione, J.C. (1983). Learning, remembering & understanding. In Mussen, P.H. (ed), *Handbook of Child Psychology*. Vol.3. Wiley.
- Carter, J.F. & Van Matre, N.H. (1975). Note taking versus note having. *Journal of Educational Psychology*, 67, 900-904.
- Craik, F.I.M. & Lockhart, R.S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 11, 671-684.
- DiVesta, F.J., & Gray, G.S. (1972). Listening and note taking. *Journal of Educational Psychology*, 63, 8-14.
- Fisher, J.L., & Harris, M.B. (1974). Note taking and recall. *Journal of Educational Psychology*, 67, 291-292
- Frase, L.T. (1970). Boundary conditions for mathemagenic behaviors. *Review of Educational Research*, 40, 337-347.
- Hartley, J. & Davies, I.K. (1978). Note-taking: A critical review. *Programmed Learning and Educational Technology*, 15 (3), 207-224.
- Hartley, J. (1983). Note-taking research: Resetting the scoreboard. *Bulletin of The British Psychological Society*, 36, 13-14.
- Intons-Peterson, M.J. & Fournier, J. (1986). External and internal memory aids: When and how often do we use them? *Journal of Experimental Psychology: General*, 115, No.3, 267-280.
- Miller, G.A., Galanter, E., & Pribram, J.B. (1960). *Plans and the structure of behavior*. New York: Holt.
- Peper, R.J., & Mayer, R.E. (1978). Note taking as a generative activity. *Journal of Educational Psychology*, 70, (4), 514-522.
- Risch, N.L., & Kiewra K.A. (1990). Content and form variations in note taking: Effects among junior high students. *Journal of Educational Research*, 83, 355-357.
- Wiley, M. (1992). *The use of audio recordings in the office*. Hewlett-Packard Laboratories Technical Memo.

APPENDIX

Questionnaire for Interviews on Note-taking

1. What do you take note of?
2. When would you not take notes?
3. For what reason do you take notes?
4. How do you make notes?
5. Do you draw diagrams in your notes?
6. Do you date your notes?
7. Do you mark or highlight any of your notes?
8. How do you organise your notes?
9. How do you file your notes?
10. How often do you refer back to your notes?
11. Do you always understand your notes?
12. Have you ever wished that you had written better notes?
13. How long do you store your notes for?
14. Do you ever rewrite of your notes?
15. Roughly what percentage of time do you spend writing in your meetings?
16. Do you use any abbreviations in your notes?
19. Do you ever doodle in meetings?
20. Are you ever given handouts in your meetings? How do you use them?

Physical aspects of note-taking

21. What size paper do you prefer using?
22. Do you like using a bound notebook or loose pages?
23. Do you use your notebook flat on the desk or tilted towards you?
24. Do you prefer lined or plain paper?
25. Do you use different colours when writing notes?
26. What sort of pen do you prefer writing with?
27. Do you use an eraser when writing notes?
28. Do you like to have a margin on your paper?
29. Do you ever need to or want to lock your notes away?
30. Do you ever think about the level of lighting when writing notes?
31. Is there anything else we haven't covered?

