

INFORMATION  
HANDLING :  
  
CONCEPTS WHICH  
EMERGED  
  
IN PRACTICAL  
SITUATIONS  
  
AND ARE  
  
ANALYSED  
CYBERNETICALLY .

Doctor of Philosophy

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INFORMATION HANDLING: CONCEPTS WHICH EMERGED IN PRACTICAL SITUATIONS AND ARE EXAMINED BY CYBERNETICS ANALYSIS. ABSTRACT. 1990 Genevieve M Hibbs A thesis submitted for the degree Doctor of Philosophy. Department of Electrical Engineering, Division of Cybernetics, Brunel University UXBRIDGE UB8 3PH

The thesis provides a cybernetics examination of information handling, and concepts which emerged during attempts to fulfil large information handling requirements.

Case studies, descriptions of commonplace realities, are seen to have common themes which if fully appreciated would help information handling:

information recovery: a distinct concept demanding consideration in the design of information systems;

batching and classification;

paying detailed attention to 'insignificant' processes resulting in unexpected effectiveness and efficiency;

unaccounted, unobserved losses;

Theoretic themes developed include:

success of batching / classifying information for each need, a critical factor for success of organisations and organisms;

dynamic, interactive information pathways and classification systems as algorithms, flow charts or heuristic methods to enable efficient batching;

'leakage' of information, attrition on a grand scale, proves to be the converse of successful batching / classification;

a notion of robustness of information is explored. Logical networks of concepts act similarly to neural networks in providing stability for increased retrieval;

'asnegsist' as good as if it didn't exist', and the 'way in' to information systems are explored;

information recovery assisted by findings on perception and interpretation from readability research;

'way in': a subset of 'design' dealing with access to systems.

Further research and developments are proposed.

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Without a universe which is held together consistently and that is open to information in a way that accords with the notion of an omnipresent, omniscient, omnipotent God, the exercise of preparing this thesis would have been impossible. Without people this thesis would have no meaning.

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## P r e f a c e

Case studies are used to develop this thesis because within their context the reader can relate the concepts to his own experience in a positive or negative way. The main concepts of the thesis and their cybernetic underpinning are presented in the main body of the work. The case studies are introduced before the theoretic themes arising from them and following the theoretic setting to enable the reader to relate historical events to their own experience. They would be assisted in linking that newly related information with the new theoretic material. One further case study, developed by utilising theory from within the thesis, on the theme of 'way in' is given as a post script, and working example.

This preface is provided to form a 'way in' a 'user friendly front end' to ideas which might otherwise be somewhat inaccessible. To enable this to happen I related a selection of my career experiences to provide the reader with specific background material from which an appreciation may be gained of the aims, content and style of this thesis.

At school one of the few ideas I remember consciously having generated myself was that if I could work out the answer to a problem I didn't need to waste energy on memorising the answer, and if I could work out one answer there were probably a variety of other answers that could be worked out using the same method. I valued that conservation of effort!

For several months, as kitchen junior, I spent the mornings preparing vegetables and the afternoons washing up cooking pots. Then the chief cook left and no one else knew how to decorate cakes. So I carried on with the 'spuds' in the morning and cake decoration in the afternoon. Until fairly late on in the preparation of this thesis I perceived the latter experience as the more important, due mainly to its position in the kitchen social structure. Now, it appears the relatively simple routine of the 'spud bashing', enabled practical learning relating to batching, critical path and efficient working which was complemented by a series of possible batching operations relating to decorating the variety of small cakes. The experience has underpinned my learning and work ever since.

After first ward allocation as a junior nurse, matron told me that I was getting on satisfactorily. However, she said I was slow. My confidence and mental response that slowness was all right because what I was doing was working out the complex routines which was bound to be slow. Once those were mastered I would be quicker than the rest. This confidence seems to have been based on the 'spud bashing' experience.

There were repetitive tasks in and out of work where I was sometimes able to assess my own performance against that of others. Conservation of resources, including information and mental activity, had a relatively high priority.

Between 1959 and 1962, as student at the Moody Bible Institute, Chicago I was introduced to:

a superbly working administrative structure;

computer graded testing;

using a customisable alpha numeric thesaurus for filing pamphlets to create a 'Christian education file';

the techniques for the creation and cataloguing of a pastors' library.

I catalogued my few books, with author, title and subject cards, and filled a drawer and a half with my pamphlet file. Efficient and effective information handling, along with the conservation theme developed further.

Before and after going to Japan, I was employed in the general office of the Overseas Missionary Fellowship with a variety of routine clerical duties. Some time after leaving it was commented that only during my time in the general office had the records been kept up to date over the busy Christmas / end of year period. My understanding of the main reason for that state of affairs was due to application of ideas of physical efficiency and in particular the batched filing method used for letters, where the current month's letters were kept separate from the rest of those in the six month period until the end of each month.

In 1969 I became Senior Occupational Health Nursing Officer at Cadbury Ltd. There were 9,000 employees on site, 60,000 in the UK and 120,000 world wide. I was overwhelmed with staff coming saying "Mr. X's child has chickenpox. Is he all right to come to work?" and similar questions. One had books to look up the answers, but staff needed the information directly accessible to them in suitable form for making their own decisions. I located a chart for infectious diseases, produced by the school health service, which was fairly easy to modify to the Bournville site requirements and agreed it with staff and the company medical officer. Lay clerks then used the chart, relieving the professional staff. Staff output was enhanced and service improved.

There were many similar information needs and I sought to make the precise information available where and when it was needed. I built my own customisable alpha numeric thesaurus for filing pamphlets to create an 'Occupational Health Department file', and made alphabetic card

files of useful addresses as well as equipment and services. I also developed or redesigned a wide variety of working forms and algorithms to enable complex procedures to be carried out accurately and efficiently even by temporary staff, leaving adequate record for management and administrative procedures. I carried out a series of small research projects to provide precise data for decision making.

Information was needed relating to situations which would only arise occasionally, but which might be anticipated, and situations which existed, but no one had imagined that there might be information that could result in useful transformation. The situations concerned would have in common that in some way they would affect the organisation's operation and had some relation to the health of employees, the hygiene of the products, or indirectly affect either.

As I collected and collated I began to realise more of the potential. Then it became obvious that although I had much information on my desk it was too expensive to reproduce the files and make them available on the desks of other staff. People, including staff, too often didn't come and for a variety of reasons, including their failure to anticipate a helpful answer. That there were inherently powerful forces antagonistic to effective and efficient use of information began to impress itself on my mind.

These phenomena brought to my attention the more general, and already partially recognised, problems named and developed in this thesis as the 'way in' to material and the problem of something being 'as good as if it didn't exist.' asnegsist\*.

\*Asnegsist: pronounced: 'as' 'neg'ative 'exist'ence with the 'eg' of negative and the 'ex' of existence overlapping.

During this period I explored the potential for occupational health service of 'Management Services', 'Organisation and Methods', 'Operational Research' and 'Industrial Engineers' and some of their work studies, as well as other services within the company. I recruited the services of all of these specialist departments for projects relating to the occupational health work. I attended components of the industrial engineers training course. National and local research services and organisations were also consulted. The 'Heart Disease Prevention Project' team worked with us in the occupational health department over several years. (cf Rose; Heller; Tunstall-Pedoe; Christie 1980)

Over time I realised that the work of the occupational health nurse could usefully be viewed as being primarily concerned with matching people and jobs.

Why has this person come to my attention?



What are the factors in this person or job which are incompatible on health and / or safety grounds?

What intervention is required to make the two compatible or should another solution be sought?

As I developed this 'people and job compatibility model' I identified need for extensive knowledge of significant people factors, job factors and interventions. Although I had not clearly seen the main implications of the model when at Cadbury's I had sensed the information need. The importance of creating sophisticated tools to enable application of that information by staff or client at the most appropriate grade seemed to be imperative. My research into the rationalisation of the pre-employment health assessment (for Master of Public Health, Dundee University) showed me that nearly all the proper functions of the occupational health nurse could be seen in the pre-employment health assessment procedure, and that people and job matching could be seen as the major theme in both.

Another important finding which came from that research project was that all job applicants under-reported their health history, even though many, especially in the management grades had appeared to be cooperating fully in the procedure. What was happening to the information? The loss could not be accounted for by applicant perversity. Early exploration of that phenomenon is included in appendix B 'Reporting and under-reporting in health history taking' and the implications of that contribute to ideas developed further in this thesis.

In 1979 on starting to run Occupational Health Nursing Certificate courses, students came to me for information. I might have had it written in longhand at home, or known how to find it myself, but to enable students to find it themselves was incredibly difficult. The most economic solution appeared to be to publish my information sources, using word processing to keep human time costs to a minimum. RESOURCES resulted, an accumulative, updating, sources-of-information journal published from 1981-1985. The final group of students to use that tool were given exercises to increase their ability to demonstrate variety within topics, and to sort that variety into functional groupings.

For example:

The students were asked to construct logical spiders (demonstrate variety and sort it into functional groupings) and create outlines (formalise the organisation of the functional groupings) from the spiders in each of a series of short papers they were required to produce.

The students were given questions like: "If you had access to all possible types of hand cleansers in the world what would be the criteria you would use to decide which one to use in a given workplace? (NOTE This is a question about criteria of choice.)"

With these cybernetic exercises they leap-frogged over previous students' work, using the examples in RESOURCES as models and springboards to their own improved models. They produced publishable work within their first term at college (day release).

Much of the potential benefit was dissipated. The college gave no encouragement to the development of RESOURCES and tutors on courses run by the validating body actively discouraged students from using it. The final group of students' cohesion and unity of purpose was later destroyed by malicious interventions exploited for political reasons at the time of higher education cut-backs. There had been interventions from the former tutor to the course who was then tutoring courses run by the validating body. She (possibly among others), approached the authors' students, over a period of years, in their work places inciting them to complain about their course and the competence of their tutor as a nurse. This bore devastating fruit in that final group of students which the college was glad to exploit in its efforts to find people to make redundant. Here was an example of massive destruction of potent information which is part of what I came to call 'information leakage' (see below).

Throughout this period I both directly and indirectly scanned literature covering a wide range of disciplines for teaching and publication. One gem I came across, which has been largely overlooked when talking of the Hawthorn experiments on improving work output and the development of organisation and methods (O&M) by Taylor (Taylor 1911) and others concerned primarily with the office environment, is 'Psychology and the day's work: a study in the application of psychology to everyday life.' by Edgar James Swift (Swift 1918).

"Scientific management is an attempt to introduce an intelligent plan into industry ... 'Efficiency experts' require a wide knowledge not only of the business in which they are engaged but in related subjects. Psychology is needed for any occupation dealing with humans. (Swift 1918 p19)

"Education, in its broadest meaning, consists in coming into such rapport with the environment as to meet successfully the exigencies which arise." (Swift 1918 p24)

and, to paraphrase Swift: The manufacturers did not think that uncommercial scientists could give them good advice, until the first world war forced them to try to overcome shortages. They found scientists sources to often be better, or cheaper than existing ones. They had been acting without the facts. (Swift 1918 p62, 63)

Having been made redundant in the higher education cut-backs, and not being able to take up further planned research in the short term I accepted temporary employment in 'Your Computer

Megastore'. My first role was as 'administrative consultant' (from recruiting the company accountant to cutting back the brambles), and my next role as 'sales coordinator', an equally broad role. I noticed the central place of information in such an enterprise. It was noticeable that information was being dissipated with great abandon, (I labelled it 'information leakage' and later discovered that Beer talks of differentiation leaking through the system. (Beer 1959 p48)). I also noted the role of batching in enabling success in this small company, as in other organisations. 'Information leakage' and 'batching' seemed to be complementary aspects of the information recovery theme. Later I was accepted on my own terms as employee at a young roofing company, comparison and contrast with the situation at the megastore was potentially very fruitful. The complex of ideas I was labelling 'information recovery' was becoming more evident.

Then, involved as a member of the National Information Forum, a voluntary organisation concerned with meeting the information needs of disabled people, I volunteered to do a limited literature review of readability, which relates closely to perception, decoding and processing of information. The analogies of reading and readability to retrieval of information from non-printed sources gradually emerged and are related to 'information recovery' in this thesis.

At first the concept of 'way in' appeared pretty dull, being not much more than book cover design, for example, which though of intrinsic interest and challenge has already been exploited. I felt there must be more to 'way in', even in the total design of a book, that was not adequately covered by the concept 'design' which, in any case, for so many lay people still primarily means attractive appearance.

According to BBC Radio 4 and aiming to correct some misunderstandings (Steve 1989):  
Designers are not artists. They do not please themselves. They are not "only pleased when they give the customer what he doesn't want". They sense the market and respond to it. They cannot work without clients. (This representative designer claimed to have worked for Woolworths, Wimpey and Top Shop)

My understanding of 'way in' felt to be very incomplete, even though the 'way in' was part of the design consideration in well planned libraries and hospitals. In 1988 I applied unsuccessfully for employment as administrator, then became a major participant in the organisations' multi part survey, along with professional market researchers, and myself became a 'grass roots' member of a complex voluntary organisation. I found myself observing my experiences and observations with the question 'how does this relate to 'way in'?' nothing much seemed to result until the early summer 1989 when analysing results of the survey, suddenly the major components of the 'way in' came together and flowed out into a transitional report of approximately 10,000 words. Relevant selections from this report, demonstrating what now appear

to me to be the key components of 'way in' form the basis of the post script case study. One which could not have existed had the thesis not been well advanced at the time.

The more I am involved in cybernetics the more I see inter-relationships. I have chosen the case studies to provide examples of information handling concepts where the relationships seem to emerge forcefully once the information handling and information recovery theses are explained.

To summarise the issues:

study of the 'information recovery' complex and its components, provides a 'way in' to understanding major information handling problems;

the potential for making powerful, transforming information available to the end user or at the location that is most accessible to them is restricted by dissipatory mechanisms which are often not perceived;

precise data in designing the decision making tool is often unnecessarily unavailable;

information needs for significant occasional situations which might be anticipated can fruitfully be fulfilled, but 'asnegist' needs to be actively prevented;

there is need to project into situations which exist but where the utility of information for those situations is unimagined;

the cost of making high quality information available along with widespread failure to recognise its value with resultant loss;

the dramatic improvements possible by preventing degradation of information;

the role of batching in the success of organisations and organisms and the prevalence of 'information leakage' frustrating this success;

the role of perception, decoding and processing of information, in 'information recovery'.

NOW as a result of seeing these issues:

I see the need for 'information pathways' to be mapped and accessible where predictable information needs exist and solutions are available in 'economic' chunks;

I recognise the importance of encouraging exploration of unmapped routes to extend the variety available for research and development;

I see that algorithms, flow charts and heuristics are particular types of interactive information pathways which may be intermixed with more durable pathways, and that algorithms correspond to dynamic classification schemes which are adaptable to particular cases;

I observe that where information pathways require the incorporation of critical decisions which the user is invited to make, to be successful the nature of the critical decisions involved must be clearly understood both by the path designer and by the user (Hibbs 1988 2/1);

I seek to make available potentially transforming information which is easily accessible and in some ways known about but totally ignored 'asnegsist';

I consider how to, and how to enable others to, tap information which is accessible but is not sort because its transformation potential is unimagined;

I have had my eyes opened to the 'way in' to one organisation which I have attempted to generalise for wide and fruitful use.

## Some conventions used in this thesis

Conventions used in this thesis follow normal custom and practice in the main. Where they differ the aim is: on the one hand to improve electronic handling of the text, especially in searching and reducing need for text with special markers where those markers appear to be redundant; on the other hand to improve, or at least not degrade, the visual cues which assist the reader in navigating the material. Description of specific conventions follows.

### 1. Re: lettering and numbering of sections:

For the structure of this thesis (but not the heading formatting) the Chicago style is used. For non-structural divisions round brackets are used around the chosen alpha-numeric. This differentiates them from the structural divisions both visually, for the reader, and electronically for automatic layout and search / replace functions in the computer. The thesis hierarchical structural divisions are as follows:

Roman Capital numerals I, II, III, IV etc. for main divisions;

Roman Capital letters A, B, C etc. for major subdivisions severally: case studies, chapters and appendices;

Arabic numerals 1, 2, 3 etc. for sections within major subdivisions;

Roman lower case letters a, b, c etc. for minor subdivisions;

Roman lower case numerals i, ii, iii, iv etc. for further sub-divisions required.

The above was adopted in preference to the use of:

the 'scientific' decimal divisions (1., 1.1, 1.1.1; 2., 2.2.1 etc.);

Roman numerals (I, II, III etc.) for chapters and main divisions;

Arabic numerals (1., 2., 3. etc.) for paragraphs;

((1), (2), (3)) clauses within paragraphs

as suggested within Hart's rules (Hart 1986 p19) which offers only three levels of hierarchy, a relatively flat hierarchical structure.

Also, the word processing system to be used finally for the thesis was still undecided by December 1988. Microsoft Word was a probable choice and could be set up to support an outline layout based on the Chicago style, among others, automatically.

The Chicago style by delineating five clear levels using a mixture of alpha, numeric, Roman and Arabic characters signals hierarchical structure more clearly and strongly

than alternatives. The author assisting occupational health nursing students, often with little previous experience of structuring written work, found this system the most helpful during their early struggle to organise their work.

## 2. Re: quotations:

Direct quotations are put within double quotation marks: " ...".

Quotations quoted directly from a third source are put within repeated double quotation marks: "" ... "".

Indirect quotations are used fairly widely in the thesis. They are signalled by the reference being attached to them, and where necessary introduced with acknowledgment of the author or, where they are extended, the section is indented. No quotation marks are used for indirect quotations.

Single quotation marks in pairs: ' ... ', are used for items which are not direct or indirect quotations per se, but could be, or where it is desired to emphasise the contents themselves, or to alert the reader that normal words are being given special treatment. Truly foreign words are also treated in this way.

## 3. Re: indentations and single spaced material:

Normally, single spaced material is indented, and this indicates that the material is direct or indirect quotation from elsewhere (see above). This format is also chosen for the rarely used footnote or parenthesis.

## 4. Re: abbreviations:

Where possible, without undue risk of confusion for the reader, full stops are not used for: abbreviations like 'ie' or 'eg', nor for persons initials within the bibliography. (Part of 'open' punctuation (Drummond; Coles-Magford 1982) This convention assists electronic searching and reduces confusion arising from what the computer has been instructed forms a sentence. (ie any alpha characters followed by a full stop, or, in some cases, any full stop.)

## 5. Re: foreign words:

Where foreign words are used that are well used in English they are treated as English. They are not underlined. For example: per se, etcetera. Others are put between single quotation marks. '...'.

## 6. Re: entries in the bibliography:

Entries in the bibliography are prefixed with '+'. This convention arises from the facility such a marker gives in locating records in a sequential file on computer. This marker has been retained in the printed copy as it provides a 'way in' in the form of a route sign facilitating visual location of entries.

## 7. Re: index entries:

Guidance has been taken from the following references (Hart 1967 p20-23; BSI 1988 \*\*\* Winsler). Perceived purpose, and constraints of implementation has determined the final outcome. The process of production of the index has also been used to identify:

1. where significant concepts occur;
2. alphabetic listing of contents pages content and concepts (capitalised entries);
3. location of 'markers' of missing material;

## 8. Re: names in lists:

In lists of names, like those in a bibliography, it is inconvenient to write them in natural order eg 'Joe Bloggs' where they are needed in alphabetic order by surname. The following convention has been applied eg 'Bloggs:Joe ' the surname is immediately followed by a colon and the first name or names followed by two spaces before any other characters. This protocol is one which the computer could be instructed to unscramble if later required to do so.

## 9. Re: use of colons in 'See', 'See also', 'Now' etcetera in similar cross reference contexts:

Where 'See', 'See also' and similar cross reference contexts are used the colon is placed with a space before and after it. This convention arises from the development of the RESOURCES data base where the space before colon differentiated this class from all other uses of the colon allowing for efficient searching.

## 10. Re: use of spaces within paragraphs:

In the normal way a single space is used after words and words with their punctuation within a paragraph. This applies equally to the full stop at the end of a sentence, where much modern practice calls for two spaces in that location. This also means that both right and left justification, which would involve padding text with extra spaces is not used.

1. Justification causes the text lines to line up with the margin of the text space, right and / or left as specified. Where both right and left justification are used together (often referred to as right justification), extra spaces are inserted to space words out across the text block.

When using a mono-space font, a font in which each space inserted takes a single character width, a word processor like Micropro WordStar v3.0 will normally select full stops as location for its 'soft' spaces (automatically machine inserted characters which are coded differently from their equivalent inserted through the keyboard), justification spaces. Where two 'hard' (normally coded characters normally inserted through the keyboard) spaces had already been allocated following the full stop there is high probability of justification space also being added at that point.



2. Where text is designed for use in a variety of formats for different purposes, and may be handled in a variety of processors (word processors; text processors; page formatters; print definition processors) a single, normally coded space offers least probability of complications.

3. Search and replace facilities within machine handled texts can act in an unpredicted way where 'soft' spaces (and / or even 'soft' carriage returns\* in some programs) split the search string.

\*A soft carriage return is one which entered automatically by the machine when the line of characters reaches a predetermined length. It contrasts with a 'hard carriage return' which is differently coded and is normally entered by the user. The process of entering soft carriage returns is called wrapping, as after the soft carriage returns in this paragraph the next words are 'wrapped round' to start all the lines apart from the first. 'Soft carriage returns' have the added advantage that if the standard line length is reformatted or if the text before it is reduced or increased they may be placed in a different position automatically.

A double space is being used in this thesis in the bibliography to locate the end of the first part of a name which has been used out of natural order as in 'Brown:John'.

#### 11. Re: capitalisation:

Capitalisation is used, in general according to Hart's rules (Hart 1986 p10-13) but without use of small capitals.

Capitalisation is not used for principal names in the titles of articles, books and journals except where these are proper nouns or adjectives in their own right. In this it departs from the Hart model (Hart 1986 p139) but is consistent with IFSEA, CIBA, ELSE guidelines for preparation of camera ready copy. (O'Connor 1980 p22, 23)

Capitalisation is used for the principal names in the titles of the names of electronic databases.

#### 12. Re: hyphenation:

For similar text-searching reasons to those limiting use of spaces and full stops, hyphenation is kept to a minimum. Hyphenation is nearly always significant in string searching.

Now that all major commercial word processors and, many electronic typewriters have 'wordwrap' facilities, as described above, the problem of unanticipated long words protruding too far into the right hand margin, or having to be split, is largely overcome. However, automated hyphenation routines are available in many word processors, 'soft hyphenation marks\*' are entered automatically or at user approval. This facility has not been used in this thesis for reasons of searching mentioned above.

Hyphenation 'rules' have changed within typing courses recently. Quite a big thing is still made of where hyphens should appear in words in 1977 but

not in 1982 (Drummond; Scattergood 1977 cf p42; 51; 67...; Drummond; Coles-Magford 1982)

\*soft hyphenation mark is a hyphen added by an automated process and coded differently from a user entered 'hard hyphenation mark'. Such 'soft' marks can also be removed automatically when the string in which they are entered is relocated by a reformatting process.

13. Re: use of full stops:

Full stops are not used in many places where they have traditionally been used. This is mainly because most word processing systems recognise an alpha character followed by a full stop as being a word, however once this value has been taken on board other advantages of minimal use of full stops occur, and are alluded to below. The style without full stops for abbreviations is referred to as 'open punctuation' (Drummond; Coles-Mogford; Goulroger 1985 p1)

Typing instruction manuals (cs Drummond; Scattergood 1977; Drummond; Coles Magford 1982) have gone futher than the author had done by removing the full stop from Mr. and Mrs., but they were only retained in effort not to unnecessarily upset more conservative people. Also, because in typing full stops in those two locations tended to be learned as part of the words they were attached to they were less extra effort to type than full stops mixed up with random capitals and spaces and so on.

14. Re: markers:

Markers (marker) have been places throughout the thesis where an idea (or the kernal of an idea) is noted but not developed.

## INTRODUCTION

The thesis being presented here is that during a cybernetics examination of information handling in representative practical situations a series of concepts emerge. It is proposed that these concepts, as a group, and some individually are of sufficient practical significance to be worthy of wide-scale consideration.

### 1. Recommendation to read preface and apologia first.

The reader may find it helpful at this point to read the preface, provided as a user-friendly 'way in' to this thesis, and then have a quick look at Section III Apologia before reading the case studies.

### 2. 'Information retrieval' an inadequate concept.

In the author's examination of information handling it emerged that the relatively common term 'information retrieval' embodies an inadequate concept. It is argued, that to cope with the realities of research requirements, the notion of 'information recovery' as developed in the thesis, can be seen to offer greater potential for meeting the actual requirements of enquirers' whether business people, the serendipitous, students or 'the general public' than 'information retrieval'.

### 3. Requirements of specifying, identifying and locating information.

The requirements of library enquiry desk users are examples of the general and complex problem of specifying, identifying and locating information components from multiple, varied sources (paper, electronic, human sources and real world etc.). Continuation of the task involves constructing and reconstructing those information components, without incalculable losses, into a form required for utilisation.

### 4. Information systems, organised activities which work or don't.

Information handling as developed here is primarily concerned with information systems, organised activities in which information is the main or a key component, and what makes them work well or what hinders them or stops them from working well.

## 5. Cybernetics analysis: what to expect.

Cybernetic analysis (ie aligning cybernetic concepts alongside those of the topic under analysis and examining what information results from making the two to inter-react), is used to display the thesis topic of information handling. Cybernetics analysis leads to the poverty of lack of choice or the poverty of desire, in at least some cases, being replaced by an explosion of ideas and concepts from which to choose or desire, which is itself in some circumstances problematic and perhaps to be avoided. At least, the insignificant can then be removed from a widely representative set.

## 6. Sussing out governors or controllers.

The thesis explores a wide variety of factors and other concepts which govern or control information handling in organised activities (systems). A short cybernetics analysis, which gives an introductory example of the type of method, also occurs within the thesis in the case study on 'Information for the occupational health nurse' in the section: 'introduction of cybernetics concepts changes the development of the database' and the appendix 'A cybernetics example'. A major analysis also occurs within the post script case study on information recovery from a complex system, or the 'way in' to an organisation or organism.

## 7. Major divisions in the thesis.

The presentation of the thesis is divided into five main sections: (1) the key theoretic aspects; (2) case study context; (3) an apology (in the Greek sense, an explanation) which makes connections between the practical and theoretic; (4) the theoretic themes arising from the case studies; and (5) an emergent example. Enrichment material is provided in the appendices. This approach has been chosen so that the reader has a 'way in' to appreciate the significance of the theoretic themes. Real life examples are offered to the reader who can relate them to his own experience and is enabled to discard any theory being offered that is redundant for his purposes.

## 8. Rationale for case study method

The case study method has been used, initially, because the author became aware of important connections between a variety of her experiences and their increasing relevance to information handling demand upon her. Once the concepts that linked the experiences together began to emerge, description of the key experiences offered opportunity for scientific report, and a 'way in' for the uninitiated to identify with the concepts.

The later case studies benefited from a form of 'action research' where the researcher intervenes and monitors the results. The final case study 'an emergent example' arose from considering implications of the concept of the 'way in' which itself emerged from the thesis research.

As indicated, the case studies have been chosen for their contribution to the development of the 'information handling' theme and the concepts, identified in the thesis, which govern or control the process of information recovery in systems which are like organised activities. However, many of the inherent psychological and political factors will not be developed. Markers are placed at many points in the thesis where fuller development is clearly possible but impractical if the thesis is to provide sharp focus.

## 9. Case study topics.

The topics of these case studies cover systems, in the form of organised activities, which may or may not work well. The organised activities are mainly in the work place and represent mixed systems with humans, machines and information interacting. In some cases information handling and control is the central feature. How can such organised activities work well? What happens if the systems don't work well enough? What are the reasons for the failure or success of such systems?

The topics of the studies range from learning about batching, critical path and efficient working by repetitive potato peeling, to applying those lessons to batching and interfiling in a general office. They include experiences relating to meeting information needs of occupational health nurses, to seeing how the authors' introductory exploration of cybernetics suggested a way forward.

Two young business organisations provide an observation post of significant information controls and a test bed in which to examine the effects of manipulation. The case studies

continue with examination of a complex information recovery problem where large numbers of variables and values are involved in the input and output of a computer, a situation analogous to the communication complexities in many examples of information recovery.

## 10. Concept of 'information recovery' to be introduced.

The first major section of the thesis introduces the concept of 'information recovery'. In this section 'recovery' is differentiated from the ideas of retrieval, restitution and salvage. 'Recovery' is shown to be appropriately linked with 'information' as a dynamic concept where quality "is the central problem of" this information age (Brown; Weiner 1984 quoted in Out of context. 1984) and where new information poses particular problems of acceptance. This point is clarified in the following paragraphs:

Fulton presented his plan for a submarine, but the five man team appointed to examine it were so sure the plan was worthless they reported adversely without asking explanation of the plans, tests and experiments. Langley suffered similarly for his 'flying machine' though he had "discovered the essential principle of aeroplanes, and with a little more money would have made the United States Government ... the ruler of the air." He was another of those "who gave their lives to science ... unappreciated." (Swift 1918 p56, 57)

Lord Kelvin in 1896 claimed not to have "the smallest molecule of faith in aerial navigation other than ballooning." The British Secretary of State for War in 1910 that aeroplanes would "be of any possible use for war purposes" and the British Secretary of State for Air in 1935 that "scientific investigation into the possibilities (of jet propulsion) has given no indication that this method can be a serious competitor to the airscrew engine combination." (Page 1979)

"The habit of suspending judgment ... is not easily acquired ... there is always a strong tendency to interpret facts so as to make them fit and justify, our beliefs." (Swift 1918 p55) "We all believe many things which we have no good grounds for believing," Bertrand Russell has said, "because, subconsciously, our nature craves certain types of action which these beliefs would render reasonable if they were true." (Swift 1918 p55 quoting 'Why men fight.' p5ff)

## 11. Breadth of 'information handling' as a topic, appropriate for a cybernetics thesis.

'Information handling' is a broad topic which may be considered too general to be tackled in a PhD thesis. However, cybernetics has traditionally been concerned primarily with the comprehensive and general. For this reason cybernetics may be seen as an appropriate discipline within which to pursue such a broad topic. This point is argued further later.

## 12. Cybernetic content dimension of the thesis.

The thesis topic also has a cybernetic content dimension which is explored through cybernetic concepts like 'governing', 'controlling', 'purpose', 'logical nets', 'negative feedback' and 'systems that are open to energy but closed to information and control' with all the components of information and control to be examined' (Ashby 1956 p4) That general theoretic discussion is linked with the case study information and the theoretic themes arising from the case studies, in a transitional section.

## 13. Theoretic themes from the case studies.

The theoretic themes arising from the case studies are then picked up and developed. Examining these examples of handling of information cybernetically and beyond the restraints of mere 'information retrieval', newly identified concepts, or newly applied concepts emerge.

A notion of robustness of information arises from the linkages of information of assessed validity to other relevant information structures. The author shows how this leads to the formation of batches. The author also suggests that ability to form information batches successfully is a major criterion for assessing the potential for growth and stability of an organisation or organism. These ideas are also related to a practical application in the development of a database, and briefly to the major area of learning theory. The phenomenon of information being 'as good as if it didn't exist' (asnegsist\*) and the 'way in' to material, the access to material in any kind of storage system are other important concepts which are addressed in this thesis and exemplified in the case studies. Neither of these latter ideas are new. The names given them here are new. The 'way in' has been considered as part of the design process with reference to books, reading materials and the broadcast media over the years, but it had not been named, and its generalisable features had not been highlighted. Later these concepts are applied to a further case study, that of a complex institution which exists for those outside itself. Some key points are made, about specific features which are displayed.

\*Asnegsist: pronounced 'as' 'neg'ative 'exist'ance with the 'eg' of negative and 'ex' of exist overlapping.

The 'leakage' problem, is described and examined in relation to a variety of examples. Happily, because they intrigued me and my students developed remarkably by using them, algorithms fit into the theory, and may usefully be thought of as dynamic classification systems which, along

with flow charts and heuristics, form information pathways creating vital structures for information handling, and within which, information recovery may take place. Finally, practical ideas on preparation and presentation of (primarily written) communications so that the recovered material will be used as intended are presented.

#### **14. A post script case study.**

As a post script, following the theory from the case studies as already mentioned there is examination of a complex organisation, organism, which exists for people outside itself. It highlights the general difficulty of finding a 'way in'. It demonstrates some of the potential of the analytical methods proposed.

#### **15. Appendices for support.**

Appendices, including background papers support this thesis. One paper shows how, by working out a cybernetic example of 'all possible uses', one may identify important information gaps. Another, on how examination of pre-employment health assessment results lead to increased understanding of health history reporting and its implications, contributes an example of information recovery with some of the human causes of its difficulty.

In further appendices theoretic components of 'information science' and 'information technology' are proposed and some observations on online information. A functional 'low tech' pamphlet filing system is also described, and some examples given from the RESOURCES data base.

#### **16. Conclusions and further potential.**

Finally to fulfil expectations, conclusions are presented and suggestions made for further research. However, these and supplementary to ones throughout the thesis which are indexed for reference purposes.



## I . KEY THEORETIC ASPECTS

This section sets the stage of 'information handling' and major concepts of the thesis associated with and arising from that notion. The 'Information recovery' concept is introduced, justified and distinguished from 'information retrieval', then 'retrieval', 'recovery' 'restitution' and 'salvage' are examined. A chapter on information reception addresses the issues of information overload as well as ambivalent responses to new ideas which reduce the potential for information handling. The issue of the size of the topic 'information handling' and its suitability for PhD thesis is then argued. The section concludes with a multi-topic chapter relating cybernetics to handling of information and the related concepts of this thesis.

## Chapter A. The rationale for examining 'information handling'.

In a generalised and rather vague way we humans recognise that the information we need to use is not as 'ready to hand' as might be expected in the age of information technology. Some information is easy to locate and use, but we know from experience that other types are not worth trying to search out. We rationalise and cover up so that we experience minimal discomfort from the difficulty, and others cannot see our impotence. Our poverty, our lack of choice, when we know a rich variety of solutions are 'out there' if we only knew how to tap them, is bewildering.

One major area of information handling comes when a potential user of information has a question and is prepared to search for an answer. Recognition of this situation is formalised in the provision of library and information services, where 'information retrieval' is offered as being a, possibly, the major solution. The bewilderment is still here. A new way of thinking about the problem is required. A new concept, new concepts which enable clear thinking about the components of the problem, and hopefully, some solutions.

In this thesis the distinction is not made between information and data(marker) where the only items which become information are those which are actually utilised. (cf Lancaster University) That distinction while useful for some purposes would make the understanding of asnegsist more difficult, for example.

In this thesis data is seen as information which has been identified in at least some minimal way as having value and/or potential further value if manipulated.

## Chapter B. Where does 'information recovery' come into it?

If 'information retrieval' has proved inadequate one may ask whether 'information recovery' might better meet the bill? Or, why not even 'information salvage' or 'information restitution'?

Many expert man years have been spent in the research on information retrieval and in the development of retrieval systems. A quick survey of current literature on library and information yielded the following which shows the prominence of the 'information retrieval' theme.

There were 18 OSTI (Office of Scientific & Technical Information) or British Library Research and Development reports with 'retrieval' and 'information' implied or actually in the title 1965-1982 and many more without. (British Library Undated) There were also some 150 titles in the section 'Information storage and retrieval, cataloguing, classification, indexing' of 539 items in the October 1987 edition of 'Library and information science abstracts.' These supplement research reports on library classification systems which date back into history, and where classification of non-book materials (eg Abell-Seddon 1987 in L A Publishing 1987) and automated computerised systems (Ashford; Matkin 1982; Bagley; Oyston 1982; Gratton 1983; Hawes; Botten 1983; Lovecy 1984 MacKenzie 1986; Plaister 1982; Reeve 1984 in LA Publishing 1987) are current issues of retrieval.

There is also a major move in the United Kingdom, on government initiative, for local authorities responsible for library services to draw up five year library and information plans (LIPs) plans empowered by the Public Libraries and Museums Act 1964 (LISC 1986 Executive summary; Editorial 1988), to enable optimal retrieval from national and local, public and private library and information resources (cf Brown 1988 (LISC); Plaister 1988 (LASER); and others LIPs 1988)

The concept of information recovery, as opposed to information retrieval becomes a focal concept in this thesis. It is this distinction which is examined in more detail in the following chapter.

## Chapter C. Retrieval, recovery, restitution, salvage.

In this chapter the words 'retrieval', 'recovery', 'restitution', 'salvage' and the prefix 're' are brought into focus to highlight the characteristics of 'recovery' as a code for a mental model which has attributes worthy of its key position in this thesis.

### 1. Retrieval presented.

Here retrieval is presented in the normal way that it is used in everyday English relating to information handling. (see also : in glossary)

In simple terms, a record (eg a book) is filed (eg put in its correct place on a library shelf). For it to be used someone has to take it (retrieve) it from the shelf so that it can be read. Similarly, data (eg a bibliographic record) may need retrieval from an information system (eg data base held on magnetic medium). 'Retrieve' might be thought to be an appropriate description of what is happening since the data would have been put into a data base (a structured format for the containment of data), or the book (itself a coherent data source), onto its place on the shelf. It is now needed for its anticipated use, and all that is required is for the user to find out its address (location from the index or catalogue), and then to extract the needed information (along with whatever is required in the way of handling the medium on or in which it is stored.)

Another use of 'retrieval' implies repair, recovery, restitution from disaster, loss and error (Sykes 1976), but is not normally used with that connotation in information science.

### 2. Recover has the connotation of something disordered, damaged, broken up, that needs restitution.

Recover is used in defining the 'retrieval' of information, and has the connotation of something being out of order, broken, damaged that needs restitution (Sykes 1976). Recover would not normally be used to describe something being generated entirely new from '100% pure virgin wool' or any other completely previously unused materials. However, there are limited information components which could be combined and yet be completely 'virgin' in that sense. Even the words used in the thinking about the information are codes in cultural context, a concept which is developed later in this chapter.

### 3. Concepts within the prefix 're'.

Where a prefix, suffix or infix appears incorporated as part of an integrated and familiar word its derivation and the impact of meanings associated with it may get overlooked. The meaning of the prefix 're' in recovery can be undervalued in that way.

The meanings of the prefix 're' include: "once more, again, afresh especially in order to alter or improve or renew (and) ... Back, with return to previous state after lapse or cessation or occurrence of opposite state ..." The 'Concise Oxford dictionary' says that these uses are not always distinguishable. (Sykes 1976) Retrieval, restitution and recovery are not listed under either, perhaps because they exemplify those not easily distinguished.

In using 'recovery' there is desire to emphasise that 're' has the component "in order to alter, improve or renew". So that 'recover' is understood to mean the information is out of order, broken up or damaged needing retrieval and restitution to alter it, improve it or renew it. This points straight away to a key aspect of the notion of 'information recovery' that is developed in this thesis. This aspect of the imperfect state of the information to be recovered and its fragility, in spite of a commonly more robust appearance, is the precise point where there is most potential for productive change.

### 4. A word in the brain, a model, our representation of things as 'given' to us, not conforming to things as they are, leads to imperfect retrieval.

As information (eg a new word) is first 'given' to us we receive a context to which we add our preconceptions. Later, by trying the information (the word) out to find the boundaries of its message, with experience of the information (the word) in other contexts as we relay it to other people and use of validation sources (eg dictionary) and questioning, we refine our understanding. This section highlights the disparity which exists between words, concepts and the realities to which they relate, this very disparity leading to many of the problems of information recovery.

Information in peoples' minds, as a model, also, is normally substantially different from the reality of the original as Kant expressed. He said "our representation of things as these are given to us, does not conform to these things as they are in themselves, but these objects, as appearances conform to our mode of representation." (quoted in Papert 1965 pxiv) What do we

hold in our mind, visualise, when we think 'tree'? How do we represent the reality of the tree in our mind? Whatever it (the model) is certainly far removed from the reality of any given tree. We forget that we had to learn to use words, that "with no picture or concept to put to a word the child (or adult) cannot begin to comprehend." (Russell 1988 p17)

Our failure to adequately allow for the discrepancy between model and reality results in imperfect information recovery to a degree which is not normally appreciated.

## 5. "in our minds, as information tied to word, ... a code in context."

What is in our minds as information, tied to words, is a code in a context. The particular version of code which is in that mind and the context used by the individual whose mind it is in, at that specific time and at that particular stage of experience is unique. The code for a word which is in an ordinary word processor code in a digital computer, is divorced from its meaning context, without interpretation, even by its relation to its surrounding words, or even of the word itself. By contrast, by the time a word is in the 'hear and speak - read - write (correctly or even incorrectly)' vocabulary of an individual, that individual will have experience linked with it, experience perhaps of movement, hearing, seeing, smell or emotions as well as information about its relationship to other words and the way it may be used (cf Elstob et al 1988 19/5) as Russell also said "a pre-reading vocabulary is closely interwoven with self, movement and cultural background." (Russell 1988 p17)

When expressing and specifying an information need, as to a librarian (but it could be any human who we feel at ease communicating with), we naturally use words as part of our communication, being careful to specify the context to the extent it occurs to us, or the librarian elicits from us. In any such conversation the communication is likely to be very distorted due to the unique codes-in-context in the two brains involved.

'Organisational myths', a graphic, entertaining and valuable book deals with some of these concepts from a different perspective (his line drawn characters have their perspective spectacles on too). The book is highly recommended for further material on this subject. (Westerlund; Sjöstrand 1979)

## 6. A word and its context encoded as a unit in memory...

The idea of a word as a code-in-context in the brain was presented in the previous section, here the author proposes that in some way the context of the word is attached to it as it is processed as a unit of memory in the brain.

This context for the word is in some way attached to the word, or the word as part of some bigger code-in-context unit, as it is encoded by the brain into memory. The phenomenon has value in the 'recovery' of the word (information) in part, where components are already present in the brain, to be attached to it, that in some way enhance, or add value to it. However, some of the components of the context may further assist in the breaking up, or disordering of the information because they are inappropriate to the particular use, or redundant and just assist in the dilution of its meaning. These inappropriate or redundant components contribute to rejection of new material as is discussed later.

## 7. Selective rejection of word context in creative thinking.

Having worked through the idea of a word in the brain being a code in context, and any particular use of that word being enhanced by the brain by the attachment of context from previous experience this section looks at the unpredictable, and usually unsystematic, selective stripping of that context in the creative thinking process and its potential effects.

When the information within our minds which is tied to words is required for creative thinking or some carefully premeditated communication much of its context may be, as it were, stripped off. The selection of what is to be stripped off and what retained, and how the resultant remainder is ordered determines how effective the communication will be. This selection and ordering is required to alter, improve and renew the information. Whether within the brain, or at some other stage of processing there is plenty of scope, indeed need, for such alteration, improvement and renewal of information if it is to fulfil its full potential.

In normal thinking and communication little thought is given to the acquired context of words, leading to problems like asnegist and the total rejection of new information.

## 8. 'Information salvage' rejected as an alternative to 'information recovery' as a descriptor.

In seeking appropriate vocabulary for a concept one needs to examine words which are reasonable contenders for the purpose. Apart from choice widening effects of such an exercise, excluding a related word, for identified reasons, helps to define the limits of the concept (such exercises of exclusion and negation are encouraged by general cybernetic theory). 'Information salvage' is a suitable contender to consider in lieu of 'information recovery' but is rejected on account of its emphasis on the state of being lost or waste, and its lack of being just raw or having potential of already being good for some other purpose.

The meanings of salvage:

"1. 'noun' (Payment made or due for) saving of a ship or its cargo from loss by wreck or capture, rescue of property from fire, wreckage, etc; property salvaged. 2. Saving and utilization of waste paper, scrap: metal etc.; materials salvaged. 3. 'verb transitive'. Make salvage; save from wreck ..." (Sykes 1976) seem to emphasise the state of being lost, or wasteness of whatever is to be salvaged, and exclude the connotations of the material being already good for some other purpose or perhaps just in raw, unprocessed, state.

This exclusion of 'salvage' as a suitable alternative to 'recovery' emphasises that what is to be recovered is not just lost, waste, badly damaged information that is only usable by basic reprocessing or major repair / reconstitution, though there may be components of this type.



## Chapter D. Limits of information reception..

During information recovery information flows in many directions into, out of and through a variety of animate and inanimate media, at different times and sometimes simultaneously or in parallel. There are limitations on the reception of information, whatever the medium, based on physical characteristics of the media, and information. Where animate media are involved the physical limits of reception are modified by psychological, sociological and spiritual controllers, in very complex ways. This chapter scratches the surface of these phenomena, sufficiently to pick up two syndromes\* especially relevant to information recovery.

\*Syndrome: a cluster of expressions of a systems' behaviour (symptoms and/or signs in medicine) which may be given a descriptive name. (cf Collocot 1971)

The first syndrome, information overload, may be seen as a simple extension of a physical information overloading, and has some similar features and characteristics, however, it is obviously more complex once psychology and the ability to plan are taken into account. The second, the acceptance of new information, while it is analogous in some respects to the merely physical, appears to be a much more complex phenomenon where psychology and sociology play significant roles.

### 1. Information overload.

Whether in natural, living or man made systems which are capable of handling information the potential for overload can be expected to be present. The signs, symptoms and results of that overload will depend on the nature and state of the system being overloaded, characteristics of the information concerned and its relationship to other information in that system. In systems capable of anticipation, planning and self-organisation, ability to respond to information loading levels will not be limited by merely mechanical factors.

This short section is concerned with information overload in humans where psychological response to information levels is more the limiting factor than the anatomical and physiological.

Mooney is said to have seen humanity afflicted by "'information sickness' a response of epidemic proportions to information overload that was characterised by: disconnected speech, apparent disorientation, and a desire to touch everything." Brown and Weiner (Brown; Weiner 1984 quoted in Out of context. 1984) go on to state "the concept of information overload, is a wrong one. The human brain can take in more information than even the biggest computers." It is

the quality of information, rather than the quantity which 'is the central problem of the information age.'

Beer talks of there being an excess of data but a shortage of analysis. (Beer 1975) Data collection is much easier these days, especially with computerised systems, but knowing the questions to ask of it, and presenting it in shapes and forms that cause it to yield its nuggets of information needed for change is still a great challenge to ingenuity and careful processing (cf Elstob 1988), such as by cybernetics analysis.

The author remembers times while working in the occupational health department when she was being required to handle an average of three live decisions simultaneously and felt reasonably stretched. Then for a period of months the load doubled, leading to considerable stress and some missed responses. Such overloads are too common at management levels where individuals find themselves 'back to the wall' fighting the latest 'fire'. 'Time management' and related techniques that became popular in the early 1980's help in managing heavy information handling demands to prevent overload. On reflection, components of the information recovery complex formed the major part of the authors' overload in the occupational health department. In particular, asnegist and information leakage contributed substantially.

## 2. New information accepted, rejected or . . .

In all types of systems capable of receiving or transmitting information there may be problems arising when the characteristics of the information change. Modification of the receiving system, perhaps in the nature of recalibration, may be necessary, and the then modified system may go on to have problems with the type of information received satisfactorily before, or there may be storage or transmission capacity allocation conflicts.

The author recalls a series of floppy disk drives (on Intertek 'Superbrain' computers) with different (and altering) calibrations where untold hours of data collection were lost. Many users never did achieve compatibility of data on floppy disks with these particular drives. (cf Stewart et al 1983)

Processing problems of the different types of information are also likely to occur.

In humans new information, ie information presented to the mind with content which conflicts with that already in there poses particular problems of acceptance which might have, on further research, proved to be mainly only subjectively of a different order than that in inanimate systems.

What follows concentrates on the human problems of acceptance of new information.

### **a. At the individual level.**

(cf Gabor 1983 p70-71)

#### **i. Habit.**

Reflex responses in the newborn occur to a small range of stimuli (like the hands of a newborn baby gripping when a finger, or similar object is placed in the palm). When other stimuli, which are new experiences, impinge on the relatively virgin brain of an infant some kind of impression is made (also depending on the physical and mental maturity of the particular infant in relation to the particular experience). Learning gradually proceeds, sometimes with extended repetition and practice being necessary for habits (simple or complex largely subconscious behaviour patterns) to form. Such habits relate to physiological and psychological functions often in complexes with physical movements, and emotions linking with mental information handling. The individual can be expected to have chosen, even if reluctantly, which habits to form, so would have some commitment to them.

Once habits are formed the person can normally carry out the habitual function with minimum of conscious effort and awareness of time passing. The conscious mind is freed for other activities.

Partly because habits are largely subconscious, and the person has some commitment to them, there is a sense of security and comfort associated with them. The individual also builds up experience of how others respond to his habits in social situations.

#### **ii. A vested interest in the already established.**

Habit formation has involved investment. There is substantial vested interest in the already established. The author is reminded of her own investment in learning a writing style and more recently, in prepared lecture material, including audio and visual aids and handouts.

When the author moved to a new school at age 10 she was arbitrarily required to change her 'copper plate' style cursive handwriting to a script without loops. Such a change of a major highly complex habit adversely affected her ability to succeed in any written work for a

prolonged period of time. The opportunity for the author to enjoy the experience of success at that school was markedly reduced.

Recently, while a senior lecturer, new ideas were coming in thick and fast from all the new research. On the one hand, there was the problem of evaluating which were important enough to pass on, and on the other what was the implication of those which were sufficiently important for existing teaching material. The individual who is presenting information to others, and claiming some authority for doing so, needs a consistent message. Where the material is changing rapidly, it is difficult to remain consistent since the implications of the new ideas affects existing ideas, and the energy required to work the implications of a major concept through a syllabus is immense. (See below). In any case, has the 'teacher' the authority to do that? The 'teacher' is subject to course committees and academic boards, departmental leadership and validating bodies, to say nothing of students and their peers and sponsors. Many of these interests have their own investment in preventing such change, arising from their own complex context, its relative stability and the resources available at any given time. Saving face may be what appears superficially as the cause.

### **iii. Preoccupation, listening and attention span.**

The attention and listening spans of individuals are generally related to age, experience and self discipline. However, poor mental health and stress levels can reduce them in general, and particular preoccupations as and when they occur.

If the individual has other concerns competing for their attention or for other reasons has a low listening or attention span the opportunity for the new ideas to be coherently absorbed and understood is reduced or obliterated.

### **iv. Seeking predetermined goals.**

The individual may have a fixed agenda of goals. When he receives a communication he may immediately relate it to the goal it seems to fit most closely. Parts of the communication which don't fit are overlooked, and the individual's own ideas which do fit are substituted. This is described as 'wishful hearing' 'wishful thinking' and 'jumping to conclusions' (cf Gabor 1983 p71)

### **v. Unwarranted assumptions.**

The listener and communicator, make assumptions about the knowledge base, understanding and motivation(s) of the other parties. No two individuals have the same view of the world (or its components), nor does any individual retain the same view of the world over time. Any individuals' world view is very dynamic. As a result if assumptions are not tested, unintended and corrupted communications will be received, prejudicing the likelihood of acceptance. An especially important cluster of assumptions relate to justification spaces described briefly below.

We interpret the information after we have decided the reason for its being given, or we answer the question put to us, after we have first decided the reason for its being posed. Frequently our interpretation for its reason is a false assumption.

For example: The author developed a painful neck with pain in one arm late on Friday. She bought a cervical collar and some 'B' vitamins, the latter as general conditioner for the nerve that appeared to be damaged. On Monday she made appointment with the doctor. The doctor asked was she taking any tablets. She answered 'no'. The doctor asked if she needed any. Again 'no'. On coming out from the surgery 'eurika'. The author had assumed the doctor was asking about pain killers, his question was about tablets.

#### **vi. Use of differing justification spaces (Stewart 1983 4).**

The individual approached with a new idea will evaluate it, and so justify his response, in some way to some degree. He may choose to value it (and so justify his position) economically, aesthetically or by a variety of other value systems (leading to justification systems). If the new idea has little economic value but can lead to great aesthetic satisfaction and the individual applies only economic evaluation it will appear to be not worth considering, and he will be baffled as to why it is being presented as worthwhile. For successful communication both communicator and recipient need to be evaluating (and justifying), at least partially by the same evaluation ((and so) justification) system. ie their justification spaces need to overlap.

#### **vii. Stylised memes resisting replacement.**

Our discussion (Elstob et al 1989 18/5) focussed on meme's (discrete, 'selfish' ideas, which 'grab' the minds of many people in a society and may or may not have a basis in reality).

Examples of memes:

(a) eating carrots makes you able to see in the dark (marginally true, but introduced to the public during World War II when the Britain had developed radar, and wanted to keep it secret from the Germans. They put it about that the airmen were eating lots of carrots);

(b) the prime agency to help people suffering from alcoholism is Alcoholics Anonymous. Most occupational health nurse students from 1979 to 1984 tended only to name that agency for the purpose, few could not name that one. It was very difficult to improve the situation during the eighteen month day release, Occupational Health Nursing Certificate course;

(c) doctors and nurses tend to think that the treatment for tenosynovitis (a painful condition arising when the synovial membrane covering a tendon becomes inflamed and exudes fluid; usually arising from unaccustomed, repetitive exercise) is to put the affected limb in plaster for three weeks, as repeated medical text books have recommended. The authors' research while at Cadbury's showed that application of some form of heat (microwave, wax or infra red) accompanied by some support for the limb (such as an elasticated splint fastened with Velcro) and continuation of work had produced far better results. (Hibbs 1983 p1-10)

How can such ideas be generated? The carrot and night vision gives some idea. Or how can they be displaced or replaced? Whatever the answer they certainly act as controllers in relation to reception of other information.

#### **viii. Learning and recall.**

The authors' research on pre-employment health assessment (Hibbs 1979) lead to the section in the appendix 'Reporting and under-reporting in health history taking'. Self reporting of health history compared with verbally reported health history and physical examination showed that under-reporting of morbidity (illness) was far more extensive than expected. As a result a literature search was carried out to find explanation.

The way an individual's health history (or any other experience) is learned is complex. Even a major illness will not be 'learned' if the individual has no vocabulary for it, and especially if it merges with other unwellness which is accepted as a norm in that society. Even major trauma like a broken leg will tend to be forgotten after forty years or so, unless recall is assisted.

The ability to 'learn' new information in a 'robust' way, and to be able to recall it when required requires specific effort, as well as an appropriate learning context.

#### **ix. Maintaining a sense of control and security by limiting the reference frame.**

Lennon talks of people who 'felt safe in their unbelief because they limited the questions. They kept control of the subject by opening their mental door to admit only the bits of reality to which they had already issued entry tickets.' They explained phenomena outside their accepted limits 'as tricks, imagination, or even something to do with a vague spirit-world which posed no threat to their life in this one.' (Lennon 1989 p77)

It must be the unusual individual who does not have some area of reality where they limit the questions. To permanently maintain a clear dividing line between a healthy scepticism and prejudice must be impossible. In any case such decisions must usually be made at the fringes of our knowledge we are least able to make that judgement.

The outcome of such prejudice is limitation of our reference frame. That is to say we will not mentally consider matters about which we have prejudice as legitimate for consideration. We will try to ignore them and live as if they do not exist. We will only acknowledge what we have accepted as legitimate.

#### **b. At the social level.**

Landauer, in 1984 spoke strongly about this difficulty in a social group (Landauer 1987 p8-9). He claims that 'a critical nucleus of interest must be achieved before a proposal can get serious public attention ...'. To get that 'critical nucleus of interest' often requires that the matter be aired in 'international conference' or in academic journal, but Landauer then points out, as have others (cf Stewart et al 1984-1987), that the way our conferences are organised tends to promote the views of a limited club or repeat widely heard earlier talks. Also, Landauer says, that the excessive number of publications forces repetition if ones voice is to be heard, and the referee and review system favours the publication of 'safe' and uncontentious material. This system, says Landauer, requires some negative feedback to overcome 'the low signal / noise ratio' which is now characteristic of our scientific literature. (Landauer 1987 p8-9)

#### **c. At the organisational and governmental level.**

Organisation, whether of higher education, into traditional disciplines, of government into departments (see below), or of research councils to cover major discipline areas, militates against the development and acceptance of new ideas. People with their careers, money and power

are associated with the existing structures, and they are not encouraged to, and may be actively discouraged from, promoting ideas on the periphery of their organisations' interest.

**d. The authors' experience personally, socially and at the governmental level.**

The author's experience with running the occupational health nursing course provided example of these problems of change. The understanding of physiology, for example, had changed (and was continuing to change) out of all recognition during the working life of the students who were over about forty years old (and the teacher's bosses). Physiology was an important underpinning of many of the other topics. For example, the new knowledge of the specific vulnerability of the conceptus at various phases of its early development (pre-conceptual care (an entirely new topic in late 1970's)):

pre-existing dietary deficiencies suspected of leading to mongolism (one student asked 'experts' who assured her it wasn't the case.), and other abnormalities in some cases (diet; abnormalities with implications for employment and health);

effects of drugs, like thalidomide (pharmacology) which resulted in thousands of children born with missing or deformed limbs in the late 1960's;

the 'oxygen cascade' and the low pressure of oxygen available to the conceptus at best jeopardised by the presence of carbon monoxide from smoking or car exhaust (physiology toxicology; smoking);

Occupational health nursing, as practiced in the United Kingdom suffered substantially from not coming wholly within the interests of any one government department. The Department of Health and Social Security is responsible for the National Health Service (NHS), and for the training and employment of the majority of the nations' nurses.

Traditionally most occupational health nurses were employed outside the NHS. The Department of Employment has interest in the health of people but has delegated that functional area to the Health & Safety Commission, and the Health & Safety Executive with its major emphasis on the Employment Medical Advisory Service (EMAS), rather than health workers employed by particular organisations. For educational purposes the Department of Education and Science (DES) is involved, but here again occupational health nurses are few in number and well out of the main stream of their interests. Much of the effect of falling between the interest of different government departments was worked out in a response to 'Professional training and qualification in occupational health and safety. A discussion paper.' (Hibbs 1983). It is precisely this type of 'falling between departments' interests' which can make acceptance of new initiatives impossible.



## **e. Application of existing theory to the phenomenon.**

### **i. psychologically**

Even before rejection of new information at the fully conscious level Swift says new ideas are often only accepted if they don't disturb existing ones (Swift 1918 p63). But that cannot be the whole story. Stewart says the new ideas are actually censored out and replaced with existing knowledge. The censoring which results, in part from the coding and classification of information in the brain to reduce memory load, enhancing memorisation and problem solving. However, it also tends to 'label' new information or insert it into existing categories, the person perceiving it as familiar rather than new. (Stewart 1984 13/2; 19/3 cf also Westerlund; Sjostrand 1979 also Hibbs 1986a) This whole mechanism is analogous to the 'falling between departments' interests' described above.

### **ii sociologically;**

Naturally we shrink from the responsibility of standing and acting "alone" and there are intellectual difficulties associated with "these moral flaws (which) are shown by the rareness of force and originality of thought". The opinions of those in authority are readily accepted as binding. (Swift 1918 p65 quoting Galton)

### **iii. the sociological interacting with the psychological, a moral and emotional soup.**

In one sense "...the more unanswerable the arguments the more prone the vanquished is to deny them." Galt is said to have claimed that having been shown our error when we are conscious of its hopeless character is the greatest incentive to unreasonable anger (Swift 1918 p66 quoting Galt in Strong 1906). Emotional prejudice makes following an antagonistic line of reasoning impossible according to Swift. (Swift 1918 p66) That overstates the power of emotions, potent as they are.

## **3. Information degraded by default.**

The limits of information reception result in considerable 'leakage' and degradation arising from rejection of new information. This chapter has shown that forces antagonistic to

information recovery are inherent in information systems and institutionalised in human systems. Awareness of the mechanisms and powerful remedial strategies are needed to overcome such forces.

## Chapter E. Is 'information handling' too wide a topic?

This brief chapter addresses the suitability of such a wide topic as 'information handling' for a PhD thesis. In it the author argues that as the main values of cybernetics relate to its working primarily with the comprehensive and general it is appropriate to take such a topic. Particular examples are reported and worked out in depth, and the topic is displayed within its broad intellectual framework.

Might 'information handling' be too wide a topic for a PhD? The topic is wide without question, and the general principles identified have wide application. To focus on a small, discrete area of application, would be to deny expression of the nature, and main values of cybernetics which works primarily with the comprehensive and general. It is a discipline which is not concerned with "what will this machine" (information) "produce here and now" but "what are all possible things it will produce" (Ashby 1965 p3)

Although the thesis has the main aim of developing important general notions set in the context of general theories, it does refer in detail to particular examples relating specifically to the development of its own themes.

## Chapter F. Cybernetics and how it relates to the thesis topic.

In this chapter the author looks at cybernetics as a discipline, and a selection of its key concepts and shows how they are relevant to this thesis. The concepts examined in this thesis are ones of information and its control, or gubernation, which are central concepts for cybernetics. However, the thesis is not concerned with a mathematical treatment of these ideas.

### 1. Cybernetics is . . .

In this section a brief introduction is given to cybernetics as a discipline. Derivation of the name, the origins and formal nature of the discipline are simply described. The following sections describe major concepts of the discipline distinguishing it from other disciplines fitting it for analysis of this thesis topic.

Cybernetics has many definitions but derives from the Greek word 'kubervnètn' government, from 'kubervaw' to steer, to direct.

The 'New testament' of the first Century AD uses 'kubervaw' in two forms, (See also in glossary.) one as a gift to the churches of 'administrators' (British & Foreign Bible Society 1954; cf Bible 1973 I Corinthians 12:28), and secondly as 'manager' and 'steersman' of a ship (British & Foreign Bible Society 1954; cf Bible 1973 Acts 27:11). Administrators, managers and steersmen have in common that they constrain the activities and actions of other people and / or forces in order to achieve their own purposes.

'Governing', and 'controlling' in relation to information, are used in the same sense as factors which constrain. For example, any give item of information might be available to be freely exchanged among humans. It would not be available, however, because of the governing factors, such as individuals out of touch with other humans due to unconsciousness, or babies being too immature to comprehend, for example. The unconsciousness or the inability to comprehend would be the governing, or controlling factors in this case.

The cybernetician is concerned with 'the extent to which the system is subject to determining and controlling factors', 'the governing factors, the government ... of any system whatsoever.' (Ashby 1956 p3 and Clark 1969 p109) Conversely, the cybernetician is not concerned with 'including in cybernetics everything which concerns control ... or attempting to reduce cybernetics to a comparative study of the relation between control systems in engineering and those in living beings.' (Glushkov 1969 p47)

## 2. Purpose as a cybernetic concept.

In this section 'purpose' as a theoretic concept in cybernetics is briefly delineated. As a concept 'purpose' is relatively prominent in the behavioural sciences. Cybernetics embraces biological and non-biological systems, information and values, so including material normally covered by the philosophic and other non-material disciplines.

Purpose is an important cybernetic concept in addition to the relation between control systems in engineering and those in living beings. General principles of mechanisms embodying the concept of purpose were presented in a paper of Bigelow, Rosenbleuth and Wiener and description of a logical calculus and principles of a class of computing machines permitting "the embodiment of any theory of mind or behaviour" providing it satisfied some "general principles of finitude and causality" by McCulloch and Pitts introduced a "new frame of thought" which Papert identified as cybernetic. (Papert 1965 pxv) The teleological (doctrine of final causes), causality and purpose themes are largely absent in sciences other than physics (teleological and causality) and the biological ones (all three).

Papert claims that the common feature of the proposals was McCulloch and Pitts' "recognition that the laws governing the embodiment of mind should be sought among the laws governing information rather than energy or matter." Further, he claims that "the principal conceptual step" was that the basic phenomenon of regulation by laws of final cause of behaviour in systems is the return of information in a closed loop. (Papert 1965 pxvi) As Floyd says "... negative, or error controlled feedback was seen as being a crucial topic of cybernetics, 'the science of control and communication in man and machine' (Floyd 1984 p11 referring to foundations of cybernetic discipline in Rosenbleuth, Wiener, Bigelow 1943), and a special case of government. So we see that within causality and purpose, feedback, especially negative feedback, and information systems with closed loops is an essential component of cybernetics.

## 3. Networks, omniscience and massive redundancy.

This section reviews the start of interest in networks at the beginnings of cybernetics and the exploding current interest in them in 1988/89. Extract from McCulloch's writings in 1943 on cybernetic theories of nervous activity and their inherent deficiencies for omniscience in the human are followed by one from Fredkin who sees omniscience possible from outside the universe, because, according to his theory no information is ever destroyed. Neural nets and their

characteristic massive redundancy, and tendency to stability and robustness are of major interest in cybernetic theory, as also in this thesis. The section closes by relating omniscience to batching as a possible partial explanation.

### **a. Networks at the birth of the cybernetics discipline, and now.**

From the earliest practitioners of cybernetics as a discipline, networks were of interest, not surprising since a telecommunications engineer and a neurophysiologist were together with a mathematician trying to converse with the then, incommunicable concepts, which led them to see the need for the discipline. In 1988 a major section of one of the largest UK information technology shows the 'Which Computer show' was, for the first time, devoted to networks, and as the author writes the BBC programme 'Science now' in its New Year broadcast (Science now 1989 3rd January) speaks of hugely increased interest and attendance at meetings on neurophysiology and man made network. (But no mention of them at all in the equivalent broadcast in 1990 (Science now 1990 3rd January)).

### **b. Inherent indetermination due to disjunctive\* relations in humans.**

\*disjunctive Disjoining, involving separation. (cf Sykes 1976)

'Cybernetic theories of nervous activity' was first published in 1943 by McCulloch and demonstrates that in the specification of nervous nets incomplete knowledge of space and indefinite knowledge of time past is inherent in the human because it is not possible to "compute from the description of any state ... the complete determination of the one before" due to the inclusion of disjunctive relations. (McCulloch 1965 p35) This takes theory close to the considerations of Fredkin (Durham 1985 p24-25) who conceiving the universe as a cellular automaton concludes "no information is ever destroyed. From the point of view of an observer outside the universe the entire past and the entire future could be deduced from the world's present state." Which is not claiming the same omniscience for anyone inside the universe. One notes that such claims are consistent with a Christian Theistic perspective. Durham, and others, do also claim that computer science (and presumably he would include the cybernetics that gave rise to the computer science), can illuminate questions of physics like randomness and irreversibility.

### **c. Characteristics of neural nets, massive redundancy, tendency to stability and robustness..**

The characteristics of neural nets, their massive redundancy and their tendency to stability and robustness in processing information, are a major topic of cybernetics, and are obviously relevant to the topic of information recovery.

### **d. Omniscience based on batching?**

To be omniscient it is conceivable that the omniscient one, by being able to work out the effects of any change, only needs access to one piece of information to be able to compute all the implications (cf Dewhurst 1988 and chaos theory). This is not quite so daunting a concept if one considers the batching theory developed further into this thesis where components within the batch may retain their unique identity. Batches of batches might be nested in such a way that one piece of information is a key to all.

## **4. Information tight systems, but not mathematical (in this thesis).**

Cybernetics is not mathematics, since that is too restrictive. Neither is it computers, "Computers aren't relevant". Neither is it brains and computers. However, "if relationships are seen between brains and computers then some of the right concepts are included." The ability to talk intelligibly about the brain or the computer without the audience knowing which they were talking about would be evidence of a fair understanding" of cybernetics. (Stewart 1984 1/9 verbal)

As Ashby says cybernetics is "the study of systems that are open to energy but closed to information and control - systems that are information tight." (Ashby 1956 p4) Open to energy, in that the amount of energy available is irrelevant, but closed to information and control in that all the components of information and control are to be examined. (Ashby 1956 p4) The thesis topic is 'information handling' which is clearly concerned with concepts central to cybernetics, in this respect.

## **5. Regular, determinate, reproducible behaviour.**

Cybernetics "... deals with all forms of behaviour in so far as they are regular, or determinate, or reproducible." It is not dependent on the laws of physics or other properties of matter." (Ashby 1965 p1) This thesis presupposes that the behaviour involved in 'information recovery' is in important respects regular, determinate and / or reproducible.

## 6. "flow of information within . . . systems."

According to Floyd, the general systems theory of Bertalanffy is a second strand of cybernetics which concentrates on understanding the flow of information within biological systems, needing an extensive generalisation of the principles of physics and physical chemistry, complementing the usual theory of equilibria in closed systems, and dealing with open systems, their steady state and the principles governing them." (Bertalanffy 1950 quoted in Floyd 1984 p13) It would seem that not many cyberneticians would be happy to be restricted within biological systems as seems implicit in the statement above. From this description of Bertalanffy the other concepts seem to parallel some of those of Ashby mentioned earlier.

This thesis focuses on information flow within and external to biological systems, though the organised activities described have significant biological components.

## 7. Functional goals are characteristic.

In contrast with traditional sciences, it is characteristic of cybernetics to state functional goals. (Walter 1969 p97). This research clearly has the functional goal of improving the usage and utility of information in organised activities like work in employment.

## 8. Economy within concepts.

In common with other scientists (Andrews 1985), cyberneticians aim to explain what they observe in the smallest number of concepts. Taking the point further, Glushkov says that one of the fundamental principles of cybernetics is the use of the universal alphabet, the two character one, which allows one to reduce an arbitrary transformation of data enabling simulation of any one data transformer by others. (Glushkov 1969 p51) Admittedly this data transformer is more to do with formal symbols than with meaning (Elstob 1988) though meaning can be transmitted in this way in some circumstances (See re Universal Decimal Classification below).



## 9. Universal alphabet.

The use of the 'universal alphabet', binary code, in itself epitomises a major tool for those who first applied 'cybernetics' to their science in the 1930's, who realised that different disciplines were using different labels for concepts that barred the information exchange urgently needed for scientific progress. They "shared the conviction that the most fruitful areas for the growth of the sciences were those which had been neglected as a no man's land between the various established fields." (Wiener 1948 p8). This has led to some commentators seeing cybernetics "as a philosophical approach aimed at synthesising an enormous variety of sciences both pure and applied" asserting "the essential unity of the animals and the inanimate" (Rose 1969 p10)

At 'Medical Informatics Europe 82' (cf Lindberg; Reichertz 1982) the author noticed that one could converse with delegates at length, not knowing what their discipline was, and then discover that their background was perhaps, computing, medicine, nursing or one of the social sciences. Binary code had, in a real sense, assisted information exchange, in a way that has yet to be fully appreciated.

## 10. Translation systems.

The author claims that concepts proposed in this thesis have been reduced to binary code in as much, only, as the thesis code has been processed in that form. However, by use of 'look up' tables, in limited circumstances, concept names can certainly be translated via binary code into a range of natural languages. This would be the case with the wide range of concepts within the Universal Decimal Classification where there are different language versions. (cf BSI 1961) However concepts translated in this way (syntactically) would still require some explanatory material (for full semantic transformation), since it is unusual for words to be precisely equivalent in different natural languages.

An example of one machine translation system is given (Schneider 1988 p14):

METAL (machine evaluation and translation) of natural language "is a language-independent system of open design. ... it translates on the basis of sentences ... METAL comprises various grammar and lexicon modules for the source and target languages ... (which) cover ... meanings of individual words (in relation to objects or ideas they represent) and their functions within a sentence. METAL's core software features analysis procedures applicable to all languages translated." A special transfer lexicon links the source and target languages for each language pair and

direction of translation. Entire sentences are read and interpreted on the basis of grammar rules and "hierarchically organised monolingual dictionary modules." These dictionary modules list all the meanings and morphological behaviour of the words. They also identify the parts of speech. "... function words, such as prepositions, conjunctions and articles" are dealt with by the highest level in the hierarchy. The general lexicon comes next with some 5,000 words of the common core of the language containing about 90% of all texts in the European languages. General technical vocabulary comes next, and company or product specific vocabulary comes in lower modules. Regional and subject variations can be recognised.

Linguistically, METAL analyses lexical and grammatical information simultaneously to distinguish between subject and predicate. The various constructions possible are analysed by using 550 parsing rules recursively. The output from this stage is in the form of a tree which maps out the syntactic relations. "At each node in the tree, outputs from the lexicons and the applied rules converge. ... The analysis tree is then transferred to an analog structure in the target language ... Its raw output is post-edited by professional linguists."

## 11. Seeking cues from existent and non-existent machines that learn.

Boulanger sees the building of machines with conditioned reflexes, that can learn or that can imitate life, the science of robots, as "perhaps the most striking and concise definition of cybernetics" (1969 p4) which is "the science of control and communication processes in both animals and machines" (Boulanger 1969 p4, and p6 referring to Wiener 1948) Boulanger's statement on cybernetics as definitive is, however, one example of defining an example of the application of the science of cybernetics as the science itself, a common problem with this misunderstood discipline.

Indeed, the precise machines (or information) of cyberneticians may never exist, since cybernetics offers a model "on which all individual machines may be ordered, related and understood." It deals with theory first and the applications later. (Ashby 1965 p1, 2) This thesis might appear to deal with theory after application, but in reality it is on the one hand seeking clues to underlying theory from animate and inanimate systems and on the other illustration of theory working out in practice. It points to applications but is not importantly concerned with applications.

## 12. Significance of negative concepts.

Another important theme of cybernetics which has not yet been mentioned, but which is also relevant to this thesis, but is not developed, relates to the significance of negative concepts, including negative feedback. (cf Ashby 1956 p80).

A cybernetics definition of an entity, for example, may characteristically be given in the form of a statement as to the state of affairs which would exist if the entity were not present. As Stewart puts it more technically "The freefall of a system in the absence of that thing is a definition of that thing." (Stewart 1983 4) The main application of this principle in the thesis is in the use of negative information in the 'RESOURCES: an attempt to improve on the sources of information guide'. Here information was retained, as a marker, about situations that had ceased to exist, or were not known to exist because there are situations when the known non-existence of something can be more useful than no information about it.

## 13. Systems and environment.

To complete this section: Floyd claims that cybernetics "is based on the proposition that some of the most important and interesting questions concern the relationship of systems to their environments." and is especially interested in the way systems respond to their environments. (Floyd 1984 p15).

Information is essentially concerned with relationship of systems to their environment, and the way they respond to that environment. It is only concerned where there is relationship, or the potential for it. Information recovery is only relevant where there is indeed such relationship of system to environment or potential for it.

## II. THE CASE STUDY CONTEXT.

These case studies are provided to enable the reader to identify with real life experiences which demonstrate aspects of information handling, especially the information recovery complex, and show up controllers of information handling. These information handling controllers are syndromes which have been identified as affecting the successful utilisation of information. Several of these controllers have more importance than has been recognised up to now. With that in mind, each case study is introduced and concluded with information about concept(s) (in this context, controllers of information handling) being demonstrated.

The studies have been chosen from the authors' experience to exemplify concepts relevant to the thesis. They are displayed in a wide range of circumstances to show that the problems are general. The author does not claim that all the interventions used were especially original or notable. The author does claim that where a destructive or value inhibiting controller is clearly identified (or to use a medical analogy, where the morbidity is properly diagnosed) there is greater opportunity for a even a modest intervention to have remarkable results. In too many cases the controllers are never identified. These case studies aim to help the reader clearly identify the controllers.

## Case study A. "A mucky wet job spud bashing."

### 1. This case study shows . . .

This case study shows how the author learned practical lessons about efficiency, working out the critical path of a repetitive job, and ordering the sub-tasks of the job to keep to that critical path whenever that best suited the current situation. The author also learned some components of batching, at least that there was a variable size of load which could be processed through the potato peeler for most effective results, and that if the size of load were outside those limits there was considerable extra work or time wastage. At the time the author did not have the specialist vocabulary to describe these concepts. It is possible that some of the concepts had been understood in a rudimentary way from earlier experience of handling garden produce (topping and tailing gooseberries; picking fruit; peeling apples ...) from the quarter acre garden, of my home at the vicarage, during the food rationing of war time and afterwards, and also while assisting on local farms.

Controllers of processes which are highlighted by default are listed at the end of the study.

### 2. An earthy, repetitive job.

'A mucky wet job spud bashing', the earthy Anglo Saxon vocabulary of my rural Yorkshire youth 'muck.' (dirt), 'spud' (potato), 'bashing' (in this context the whole process of preparing potatoes ready for cooking), describes the job succinctly. Over a six month period it was the authors job to prepare vegetables each morning for up to 230 people. Potatoes were the most consistent vegetable to be prepared. There was a potato peeling machine consisting of a barrel with a rough lining into which some eight pounds of potatoes could be put at a time. Water was piped into the barrel and the barrel rotated by electric engine to abrade the potatoes and remove their surface. If the rotation were too long or the water supply excessive for the time, the weight reduction would be dramatic. That meant little further preparation by cutting out eyes and blemishes but further potatoes to process, and an aggrieved management. Conversely eyeing time could be greatly protracted if the rotation time or water supply were not enough, and system blockage and a general mess result if inadequate water supply had been used. The age of the potatos, their maturity, state of their eyes, water content and amount of damage they had received also interacted with the other factors in determining optimum quantity and timing for each batch.

The art of getting away from the damp, wet, mucky, relatively isolated conditions of the vegetable preparation room, with the approval of management, consisted in working out the ideal timings for keeping the machine working and completing the manual parts of the process while causing minimal waste and mess and avoiding blockages of the system. There might also be situations where one might prefer to stay in the vegetable preparation room for longer. A mastery of the process gave considerable flexibility for the occasional skive with little fear of awkward questions, and plenty of ammunition should any such questions arise.

### 3. Concepts involved.

As mentioned, the concepts involved included those of batching, finding the size of batch and the characteristics that enable it to be processed most efficiently. The recognition of the concept of the critical path (which is not one of the particular thesis themes so is dealt with only in this study) was recognised by the author in an analogue mental image. That the entity that had been recognised was the critical path, came only on reflection many years after the event. In the intervening time, early 1970's, the author explored the critical path concept using text and magazine articles. In the early 1980's a broadcaster pointed out that married women returning to work intuitively know how to do critical path analysis from their family responsibilities. This proved to be an integrating insight for the author.

The author is also aware that a variety of psychological and social concepts were involved in the experience of spud bashing. The personal long and short term goals of the operator, from the crudely physical (avoidance of cold damp conditions) to the pleasure of beating ones own record (aesthetic enjoyment) and the social interactions with other staff (seeking approval, desire for companionship) played a significant role and the author also continued to learn (academic) various aspects of manual dexterity and coordination (kinaesthetic appreciation). These factors are not dealt with elsewhere in this thesis outside this study.

### 4. The critical path.

To clarify: the critical path is a feature of a job which involves a sequence of interdependent processes where part or all of those processes may be carried out by more than one 'machine' (animate or inanimate in this case the potato peeling machine and the human operator), or by a self actuating system (such as yeast leavening bread), simultaneously (ie the alternative pathways including the critical one). The utilisation of the 'machine(s)' or self actuating system(s) is essential to the completion of the task (the task cannot be completed without at least one of them - hence essential to its completion). The critical path is then the shortest

route from the start to the completion of the process, and would normally involve the 'machine' on the critical path, in this case the potato peeler, being kept going as near continuously as possible during the stage of the operation it is required for. Other tasks would be fitted in while the peeler was not needing attention. Tasks involved in getting potatoes ready to be fed into the machine would have priority (because they are on the critical path, ie the rest of the task cannot be completed without them.) if otherwise machine processing would be delayed.

## 5. Principles of scientific management revisited.

On reading 'Shop management.' (Taylor 1911) and 'Principles of scientific management.' (Taylor 1911a) the author mentally assented to the need for detailed study of manual tasks of a complex nature. Taylor claims to have worked primarily

"with people who ... either through lack of education, or insufficient mental capacity" could not be expected to understand the science underlying "each workmen's act" but he says that with "men" capable of generalisation who might be expected voluntarily "to choose the more scientific and better methods ... scientific law which are developed are so intricate that the high priced mechanic needs (even more than the cheap labourer) the cooperation of men better educated than himself in finding the laws, and then in selecting, developing, and training him to work in accordance with these laws." (Taylor 1911 p97)

Working out the critical path by trial and error on the job when one does not have the concept in mind must inevitably imply sub-optimal efficiency. Taylor listed 12 independent variables to be considered in examining machine work, but about five of those are specific to working with metal. Of the rest: thickness of shaving; supply of coolant to tool; depth of cut; duration of cut; elasticity of work; ... pressure of chip or shaving on cutting tool surface (Taylor 1911a p108-109); are closely related to the potato peeling task. The changing 'elasticity' of the potatoes through the season (and depending on their water content) could only have been learned over time. Given that most workers doing the potato peeling job are likely to work at most, for one season, the worker is not going to be in a good position to work out the best way to take account of this factor during their working period, unless they bring this knowledge with them perhaps from doing domestic chores at home.

## 6. Controllers highlighted by this study.

Controllers of processes highlighted by default in this case study include:

- a. time (cf duration of cut): the duration of rotation of potatoes in the barrel; the eyeing time;
- b. lubrication (cf supply of) coolant to the tool and waste removal: amount of water used during the rotation of potatoes in the barrel;
- c. quantity: the number and size of the potatoes: input and output;
- d. state (cf elasticity of work surface): water content; damage or disease of the potatoes skins including dirt on it and eyes;
- e. capacity: of barrel; of drainage system;
- f. characteristics of tool and setting (cf thickness of; shaving; depth of cut): depth of abrasive surface and abrading characteristics of the barrel lining;
- g. etc. anatomical, physiological, psychological and sociological ... (markers)



## **Case study B. The author learns values of batching and interfiling..**

### **1. This case study shows ...**

This case study shows how in the context of a general office, knowledge of methods from the authors' earlier experience, was put to good use in working out sorting (order into sorts according to some classification), batching and merging (blending of two or more sorted batches) routines. This experience strongly influenced later work and lead indirectly to some of the theories further developed in this thesis.

Because the subject of this case study is concerned with handling paper with variable information on it, it is perhaps easier to see, than with the potato peeling operation, that it might relate to information recovery. In a sense it acts as a bridge showing that concepts relating to batching from the use of the potato peeling machine being appropriate to office records are also relevant to information handling.

### **2. Records of donations and journal subscriptions in a mission office.**

For a few months after returning from Japan in the middle 1960's the author was employed in the general office of the Overseas Missionary Fellowship. Her particular responsibility was to maintain the records of donations and journal subscriptions. Daily, after the secretary had removed any money and checked that the amount received tallied with any covering note or form (letter), the latter were passed for processing. The journal subscription records\* were kept in geographical order ((classified) by county when the author started, and (classified) by Post Code\*\* (first set of characters) on the authors initiative when she left). The letters were put into geographic order (classified) using a home made alphabetic sorter (highly recommended! (see Appendix E)), then the journal subscription records were updated (as a batch), then the letters were resorted (reclassified) into the filing order (by surname or organisation) and then filed. At the beginning of a six month period the day's letters would be filed in a new file, on subsequent days the presorted letters would be interfiled, ie merged in batches, with the existing ones for the current six month period.

\* The subscription records were in size and shape like a 3 1/2" floppy disk but made of heavy card board with a 'window' of a translucent fabric which was typed on to produce a stencil which could be inked to put an address or whatever onto envelopes or paper.

\*\* The post code order system must have been changed again in the interim because twenty years later "Already we have achieved a substantial cut in the cost of sending out (the magazine) last November because we could sort labels into Post Code order." (Circular letter. January 1988)

The author contributed to the: sort; record; re-sort; file; or interfile batching routines, and this produced considerable time savings. The greatest time savings occurred in the second to sixth months of the period when instead of merging the days letters into the whole of the period's letters a 'current month' batch file was set up and the contents of that only merged with the rest of the period at the end of the month. This procedure resulted in the records being kept up to date over the busy winter period for the first time in many years. However, because it was less convenient for the secretary on the few occasions in a week when he had to look up correspondence, and the permanent office staff member objected to changes the author made and that part of the system was stopped as soon as the author left.

Keeping the records and filing up to date on a daily basis considerably reduced time spent searching for letters, or indeed having to search both card and letter sometimes, since apart from the current day's mail the two could be expected to map to (correlate) each other.

### 3. Coping with the complexity of the work.

The classification and sorting component of the work was: (a.) the days batch of letters into geographic order by post code (first two alphabetic characters) and town; (b.) the same letters into filing order, by surname or organisation name, which was written up on the top right hand corner to correlate with that on the subscription record.

These tasks appear superficially to be fairly straightforward but: (a.) in the 1960's a large proportion of letters had no post codes on them; surnames are not necessarily easy to decipher; (b.) organisation names can often appear in several different forms including abbreviations and initials. As a result it was easy to accidentally generate duplicate subscription records, and to file letters under different headings.

### 4. Concepts and controllers in this study.

Batching and classification form the major concepts of this case study. Each activity has a variety of controllers.

### **a. Batching in sorting and filing.**

Batching came into its own, both in the sorts, where it was noted that sorting speed slowed down substantially after a certain volume was in the sorter. In this case the sorted letters would be put on one side and the next batch prepared. (The question arises as to how one knows when it is best to start a new batch.) The two or more batches would then either be merged into a single days set or each batch would be recorded in turn on the subscription records.

Batching was also involved in the development of the 'current month' file. The batches involved were the days letters each day which were put into a 'current month' file rather than straight into the second to sixth month's files. As with the potatoes in the potato peeler, there was an optimal size of batch.

An important factor to consider in batch size, as David Dewhurst suggested, is that a batch ought to be "ergonomically user friendly" (Dewhurst 1988 16/6) with the size constrained by the processing capability of the processor providing upper limits. The lower limits would be identified by use of the processor either slowing the process, causing processing errors, or negative human responses in combination or singly to a greater extent than if the processor were not being used. (cf also Elstob et al 1988 16/6)

In the filing job, the size of the sorter determined the upper limit, since beyond a certain number of records physical handling of the records in the sorter became difficult. Below a certain minimum number the time involved in getting the sorter out would not be justified by the time and effort saved. As with the potato peeling the author spent considerable time sussing out the dimensions of the task. At least several months of the six month cycle would be needed to assess the main alternatives available, though more than one full year might be needed to appreciate all the variables. Taylors' variables for assessing machine work are not applicable to this task. (cf Taylor 1911a p108-109)

### **b. Classifying without unique identifiers and other confusions.**

Lack of unique identifiers for classification added considerably to the complexity of filing and retrieval. This is well recognised as a problem in the case of organisation and personal names. 'Name / authority' lists are used to control the variety in some large information systems.

Library of Congress 'NAME-AUTHORITY FILE' database contains over a million records of personal and corporate names, conference and geographic names and uniform titles. The 'NAF (NAME AUTHORITY FILE)' database contains authority records for all corporate, conference and series names, as well as personal names catalogued by the National Library of Medicine. (Publicity literature)

This factor of lack of unique identifiers for classification is further complicated by illegible handwriting when handwriting is illegible and components of the identifier are missing.

## **5. Controllers by default.**

Controllers of processes highlighted by default in this case study include:

### **a. time:**

value of completing the main part of the cycle on a daily basis; value of reducing interfiling from daily to monthly; temporal rhythms, from seconds to hours, days, weeks, the six monthly filing cycle, and annually;

### **b. quantity:**

size of batch

### **c. state:**

presence or absence of unique, and suitable, identifier; legibility of handwriting;

### **d. capacity:**

volume in the sorter

### **e. characteristics of tools and equipment (tool and setting):**

file and folder sizes and arrangements letter sizes and paper; subscription records; sorting area and facilities;

**f. etc. anatomical, physiological,  
psychological and sociological ... (markers)**

## **Case study C. Information for the occupational health nurse.**

Occupational health nurses are those nurses, usually registered, though sometimes only enrolled, who specialise, after their training in the health care of people at work. In the United Kingdom a post basic qualification, the Occupational Health Nursing Certificate has been available to nurses on the register of General Nursing Council for England and Wales, or now registered as nurses on the general part of the register of the United Kingdom Central Council. However, due to the requirement for an understanding of chemistry and physics concepts for toxicology, nutrition, environmental control and so on, entrance to the specialist course has been quite selective.

Nurses specialising in the health care of people at work may be presented with health enquiries relating to any age. Grannies' health or the new baby can be the cause of ill health at work. Nurses specialising in health care at work are in 'the front line'. They see the 'patient' first and are responsible for deciding initially how, where, and by whom he will be treated. The information requirement of that nurse so that on the one hand she can make good decisions, and on the other she can successfully intervene within her competence in as many cases as possible, is immense.

### **1. This case study shows . . .**

This case study looks at a specific examples of:controllers relating to information handling in general, but with emphasis on those of 'information recovery'. It shows controllers which lead to the difficulty of finding certain types of information even if diligently searching for it and, perhaps, knowing it to be within the search area. It also shows how fragmentation of information arising from its classification for other purposes than the readers' act as controllers and may lead to unreasonable demands on the.

### **2. The difficulty of locating a standard;**

Supposing an occupational health nurse wanted to set up a clinical testing programme involving taking blood pressure measurements. She might realise that it would be helpful to take and record the measurements in a way which would assure the clinical team and patient, as far as possible of the validity of the tests and enable her to compare results from other sources, some 'standard' method but where should she look? There are many routes she could take. Unless

she has specific expertise herself or direct access to such expertise in the early 1980's there was small chance of her finding the answer even where such a one, or one with acceptance in some part of the profession exists.

She might expect that a national or international standard might exist, but 'British books in print' is not likely to be of direct help in this search, even if she happened on the British Standards Institute (BSI) catalogue, or looked for one or looked for one of the few standards which have become British standards having had published earlier editions with book numbers.

(Ironically, the majority of British Standards do not have International Standard Book Numbers (ISBN's), a characteristic of small unprofessional publishers, some voluntary groups, and of some government and quasi governmental organisations.)

Most other general book directories are unlikely to be much help since without ISBN, and not being available through normal retail trade there is little incentive for directory producers to include such book information.

One place where standards information might exist is the British Standards Institute library at Milton Keynes where international standards and some foreign standards as well as a complete set of all British Standards, with a few early exceptions, are kept, and from where photocopies may be obtained if they are out of print. In the UK there are several public libraries which are said to have full sets of British Standards Institute publications which available for reference or perhaps loan, there might be one near her workplace, Feltham Public Library in West London is such a one, but she is unlikely to have access to it in normal work time even if she knew it was there.

(Only a few British Standards Society publications, although in the BSI catalogue are likely to be found at these centres. The four publications relating to company standards (British Standards Society 1979; 1980; 1983; 1986) were neither at Feltham or Ealing libraries or in the British Library Science Reference Library and were thought not to be available in the London area on public access in April 1988. Companies House was unable to help and the Department of Trade and Industry said they only have library facilities for internal department use. Having explained the difficulty BSI did volunteer the author perusal access at their sales counter at 195 Pentonville Road London.)

Having found a BSI catalogue our nurse would find using it a daunting task as it is even to the experienced user. Should she decide to buy, the price structure, demanding a hefty annual payment, but for which one gets a catalogue and subsequent copies at members prices, is prohibitive. It is very unlikely she would know whether her employer, National Health Service or private, was already in membership and is likely to view requesting the expenditure by her employer as an insuperable barrier.

(It is my observation that nurses do not generally perceive themselves as people who can ask for investment in literature to assist their work. The subscription patterns in RESOURCES seemed to confirm that observation. Nurses would subscribe personally for what clearly should have been a work expense in organisations that were well able to provide.)

Even the general information package from British Standards Institute and the British Standardline (BSI Line) information (BSI Line database came on line for remote computer users via the telephone in November 1985) provided did not offer 'per copy' catalogue price information. The BSI ROOT thesaurus (#50 each) is available to help you search BSI Line. It was 'too heavy' we were told, to be brought to a BSI Line instruction day although "ROOT is indispensable for the online user of STANDARDLINE." (BSI 1986). If it is that heavy it is not likely to find room/space on overcrowded shelves either. Also, how frequently will purchase a new 'current' version be required?

There are a great variety of standards which are not documented at all by the national or international standards institutions. BSI Line had nothing that the demonstrator (1987 27/1) could find about bar code in any form, even code(s) were barely mentioned, though certainly work has begun on standardising a variety of codes. Codes are used in standard book numbers (ISBN's), for example. It is fair to say that currently (1988) BSI Line is only bibliographic and has not full text records, though title, abstract and descriptor are used, as well as 'control' terms from the ROOT thesaurus, but the thesaurus ought to have something to provide a 'way in' to such a 'standard' concept, even if it were the negative statement that there were no British standards relating to codes.

BSI Line does not cover international standards but does cross reference to them where they are directly related to the British standards.

If our nurse did try to search online she would find that INFOLINE, the online 'host' to BSI Line helps the searcher by enabling 9 to be interchangeable with IX during a search, and for BSI numbers to be found by using either the old or the new numbers. However, to reach that stage she would have had to overcome a variety of other hurdles and the #1 a minute 'search time' might well be the last straw.

The search would have been more productive had she approached an expert who really did know, and there are stepping stones to that which she might happen upon, or did a literature search for research on surveys involving blood pressure recordings, like the massive Heart Disease Prevention Project (involving Cadburys' men over age 40 as one of many participating groups) of



the late 1970's, which would lead her directly or indirectly to methods and such standards as have been written up. RESOURCES had a bibliography of such standards in its first edition and again in its final year, the only section apart from 'organisations' to be repeated.

### 3. Using a sources of information guide.

Some of the problems of non-standard publishing arrangements alluded to above, affected the author in her use of Gauvain's undated 'Occupational health: a guide to sources of information' in the early 1980's (Gauvain 1978). The relevant section titles are listed below with 'B' to indicate that book titles are included in the specific sections whatever other materials might be present. (cf Gauvain 1978 p3, 4):

- (1.) 'B' TEXTBOOKS;
  - (A) Occupational Health classified under General Aspects and 16 special headings ...
  - (B) Occupational Hygiene and Toxicology;
  - (C) Environmental Control and Health;
  - (D) Management and Administration in Industry;
  - (E) Human Factors in Industry;
- (2.) Special Journals;
- (3.) 'B' her Majesty's Stationery Office;
  - Ministry of Agriculture, Fisheries and Food;
  - Ministry of Health;
  - Department of Employment and Productivity ...;
  - Ministry of Power;
  - Ministry of Social Security;
  - Ministry of Technology;
  - Medical Research Council;
  - Industrial Fatigue Research Board ...;
  - Home Office;
  - General Register Office;
  - Office of Health Economics;
  - Central and Scottish Health Services Councils;
  - Organisation for Economic Co-operation and Development (OECD);
  - Central Office of Information (COI);
- (4.) Government Departments;
- (5.) 'B' Libraries;
- (6.) Universities;
- (7.) Research Units and Services;
- (8.) Organisations;
- (9.) 'B' Miscellaneous Sources;
- (10.) World Occupational Health;
  - Industrial Organisations with World Interests ...;
  - 'B' International Labour Office;
  - 'B' World Health Organisation;
  - Commission of the European Economic Community;
  - International Atomic Energy Agency (IAEA);
  - International Commission on Radiological Protection (ICRP);
  - International Radiological Protection Association (IRPA);

International Social Security Association (ISSA);  
 Permanent Commission and International Association on Occupational Health;  
 Africa ... West Indies;  
 Journals and other Publications;  
 United States of America;  
 'B' United States Government Publications.

For the user of that guide trying to find out which might be the most appropriate books to obtain on a particular topic a mini research project is involved, requiring imagination and endurance. One can understand how the guide came to be presented in that way. The sources used had grouped the material that way and it was easier to keep the existing organisation than try to 'interfile' the references. Word processors and other electronic aids were not so readily available in the early 1970's as they are now and the process of typing, integrating and retyping in different orders is laborious, expensive, and likely to introduce a high error rate, even using skilled typists. As a result, for the user, the 'way in' was awkward and off putting.

#### 4. The way material is generated may affect its classification and therefore its utilisation.

This case study has concentrated on showing controllers relating to the way certain information is generated and distributed, and arising from that, is classified. As a result it is especially difficult for the user to locate and use. In the case of the British Standards Institute material, many directories and voluntary organisation magazines, the restrictions, or lack of interest, in normal commercial sale lead to limited listing in commercially oriented bibliographies and directories. The principle applies widely in publishing, as shown in Gauvain's guide (Gauvain 1978), and the term 'grey literature' is used to describe a mass of similar literature which is often 'difficult to trace' and ephemeral.

More generally than in written communication only, any type of information may often be inaccessible because the way it is classified 'hides' it from the potential user. The potential users' own expectations and assumptions act against him in his search, blinding him to the possible applicability of material which is proximal to him.

#### 5. Powerful controllers prevent access to information.

The controllers, highlighted in this case study, inhibit access to information which may be being actively sought.

On the one hand there may be a series of factors relating to the publisher, the methods of publishing and publicity. The title, and other aspects of the context of the material, may emphasise, or suggest content which is misleading.

On the other hand, fragmentation arises from the classification of the information for purposes other than that required by the reader. The publication may be listed under topic(s) the researcher would not anticipate. Unable to ask the appropriate 'open sesame' question, the user is completely denied access.

## Case study D. RESOURCES: an attempt to improve on the sources of information guide.

### 1. This case study shows . . .

This case study exemplifies a practical attempt to overcome some of the deficiencies in what information was currently available. The main difficulty arose from the dynamic nature of the information and the limited choice of format available to a high cost production on inadequate budget. Although the production overcame some of the problems of non-standard book publication by presenting material in topic groups, it developed as many problems by its page numbering arrangement and absence of traditional printing cues. Major book publishers evaluated it (including John Wiley & Sons in 1984) with a view to online and hard copy development but the British Medical Association offered a database at the same time and that was accepted instead.

### 2. Opportunity to publish.

When Guavain produced a text book as the second edition to replace her sources of information guide the way was open to attempt a better and more comprehensive directory. There was great requirement for information at Cadbury Ltd. where the author was working, and although a substantial collection had been amassed, other staff were reluctant to use it in the bosses office even if they could have retrieved it. It was not economic to supply it on other desks since much of it was hand written on hundreds of file cards and about twelve shelf-feet of lateral filing. The only economic solution seemed to be publication of what was on the card files and selected information about the rest.

After the material had been reordered and expanded to take in more general aspects of public health arising from the authors' research for the degree Master in Public Health, the authors' occupational health nursing students at West London Institute of Higher Education could have no greater access to it than the staff at Cadburys.

Publication was started using word processing (in batches called files) as the only perceived way that the material could be handled economically.

The dynamically changing nature of the information led to decision to publish as the accumulative and updating journal RESOURCES. The material was in two sections, sources and articles. The articles were designed to promote high standards in occupational health nursing care. Updates (batches of updated material) were issued quarterly as a booklet with standard

two ring punch holes to allow division and interfiling. The adhesive, acting as reducer of unwanted variety, along the spine of the booklet made it easy to separate the different sections without having loose sheets to get lost. It appears that few users did the interfiling so many could not use the logical ordering of sources topics. It is not clear why the interfiling was not done in so many cases. (There is some discussion of this phenomena later in this case study.)

The volume of information on the various topics expanded so rapidly that only a sample was able to be published. In addition, the full range of topics was only just being covered when publication ceased five years later for economic reasons.

Cross referencing was an important and increasing feature, and material was provided that could not be obtained elsewhere, such as a list of algorithms and flow charts relating to occupational health and safety . The authors' occupational health nurse students developed some algorithms and flow charts of their own and some of these were also published (see below).

One of these groups of occupational health nursing students who used RESOURCES and were exposed to some cybernetics ideas were able to produce publishable materials within their first term, but in general the RESOURCES materials seem to have been wasted. The 'way in' was not easy, and persistence was required.

The tutor group at the Royal College of Nursing is reported as having actively discouraged their students from using such radical materials.

### 3. Introduction to cybernetics concepts changes the direction of the development of the database.

The direction of development of the database changed after the following experience:

On starting to study cybernetics the author was recommended to read Ashby's 'Introduction to cybernetics.' (Ashby 1956) (See appendix for contemporary report of this experience.) Having read and made notes on the first three pages of Ashby's 'Introduction to cybernetics.' and slept on it. The author constructed the following chart:

Table II. D. 3. 1 A cybernetics analysis format.

<u>Subjects</u>		<u>Concepts</u>	<u>Acted on by</u>			<u>Leading to</u>	
		Represented	C	R	C	W	
		by	O	E	O	H	
I		transformation	O	G	N	A	
N		---	R	U	T	T	
F		Stability	D	L	R		
O		---	I	A	O	A	
R		Ultrastability	N	T	L	R	
M		---	A	I		E	P
A		Feedback	T	O			R
T		---	I	N		A	O
I		Independence	O			L	D
O		within	N			L	U
N		mechanism					C
		---				P	E
T		Coupling				O	
I		potential				S	
G		of				S	
H		mechanisms				I	
T		---				B	
		Statistical				L	
S		modelling				E	
Y		(of large					
S		complex				B	
T		systems)				E	
E		---				H	
M		Black box				A	
		---				V	
M	I	Coding				I	
A	N	---				O	
C	F	Noise				U	
H	O	---				R	
I	R					S	
N	M						
E	A					I	
	T					T	
	I						
	O					C	
	N					A	
						N	

(Hibbs 1983b)

It seemed a good plan to choose a simple machine and to process it through the chart. Initially, a ball point pen was chosen as the 'machine', but that seemed too complex and a 'lead' pencil was picked and soon redefined as "lead pencil, plain wood with paint." Each of the concepts in the list were applied in turn to the pencil producing batches of concepts, then going back through the original findings the question was asked "What are all possible behaviours that the pencil can produce?".

The results of such processing were so fruitful that during the initial stages of developing the idea of 'all possible uses for a pencil' the author did not follow up the: lettering; paint; glue; chemical specifications and the implications of the chemical structure of the wood. Even the graphite was left with open ends for possible uses because of the size of the potential. The author started to draw some of the relationships as logical spiders after the style of Tony Buzan (Buzan 1982) but the physical drawings were rudimentary compared with the mental drawings which rapidly filled the area of a small sized room.

Progress was reported at the next seminar (Stewart 1983 28/4) and Dr. Stewart suggested stopping the activity at that point and learning cybernetics before taking it further, but posed the question as to whether the author would consider it possible to programme a computer that someone could interrogate and come to the same logical destinations as the author had. ie was the process a logical one or was it a 'creative' one that others could not necessarily follow. The immediate response was that ultimately it was a logical process.

The knowledge base used in the initial processing had been very wide, and to identify 'all possible uses' would have to be massive. One could travel a long way on 'all possible applications' of specific chemicals, for example, using such sources as the online databases CHEMLINE, TOXLINE and MEDLINE and others as programmed steps in compiling the specifications, then use product information databases over the whole range of disciplines to match the specifications. (The shortcomings of even the best of those databases, for this type of purpose, were not known by the author at that time. The Appendix 'About online information' addresses some of those issues.) Examination of logically related words in a good thesaurus would help. (Now (1987) the author would say 'using a wide range of thesauri'. In 1990 the author would say the thesauri have their part to play but ultimately the content of the database itself maps most accurately to itself and for many purposes, with modern search tools, is best searched directly. (cf Stewart 1985; Wilk 1990 23/2)

One of the end results of this exercise was the identification of new databases that were needed to fill the logical gaps.

The RESOURCES database was developed along the theme: 'Pathways to Solutions' in 1987. The principles developed included those from the themes of this thesis, in particular: the addition of components to fill the logical gaps:

Where it was expected that organisations existed but had not been included up to that time a concept reference would be inserted and cross referenced to related concepts and possibly other relevant organisations. The presence of the concept reference

would act as a 'marker' to alert the observer to look for other organisations relevant to it.

information pathways ( : see also : theoretic themes):

An information pathway would be some kind of logical information trail taking the user to some destination within or external to the sources of information guide. Within the guide a simple pathway might take an enquirer from a concept to an organisation name and to its phone number. A complex pathway might go via several stages in various directories, including perhaps an online database, where the user is offered options along the pathway, and electronic technology might automatically carry out such functions as dialling the host and responding to user identification prompts.

For example: the reader might want to find some material about communication and decide to see if there is a book listed on the subject. He could look first in the contents section and find communications as a main section under environment. He may want to browse in the book list and decide to try and get hold of that book. The book would have ISBN and publisher details which might be used directly. If he decided he wanted the book by mail order he might look under 'mail order' and find booksellers who do that or come via 'book' where 'mail order' is an option. From there he might look up the booksellers details and get the phone number.

Other options available in this pathway would include: a listing of databases relating to communications at the top of the section on communications; a listing of relevant directories at the top of the 'book seller' listing; a listing of journals cross referenced to publisher and where relevant database.

interactive information pathways ( : see also : theoretic themes)

The complex pathway described above would be an interactive information pathway if the system and human were in some way responding to the actions of each other in travelling the pathway. It would also be interactive if the system the human is interfacing with and another system were in some way responding to each other in travelling the pathway as a result of the human information requests.

For example: in the example above the electronic version would enable some of the likely options to be offered, as the enquirer progresses in his search. As suggested above, the phone number might be automatically dialled if required.

algorithms and flow charts ( : see also : theoretic themes):

A section in RESOURCES, sources, was devoted to bibliographic references to algorithms and flow charts relating to health and / or safety. Additionally, in RESOURCES articles, several articles presented such material relating to clinical or management aspects of occupational health and safety (Carolan 1984; Gray 1981; Ruddoch 1984; Varns 1982), and one special study presented a whole series of such material relating to safety and first aid in a plating shop (Burgar 1983)

heuristic methods ( : see also : theoretic themes):



In the RESOURCES database and journal heuristic methods, in the sense of being "a set of instructions for searching out an unknown goal by exploration, which repeatedly evaluates progress according to some known criterion" (Beer 1981 p402) would not be obviously present. Heuristic methods were being used implicitly in the compilation in the sense of being expressions of belief or hunches which can be tested out and which need to be confirmed by experience (cf George 1967 p90; Andrew 1967 p108). There were entries, especially in the form of 'markers' which are of heuristic nature.

standardisation ( : see also : this case study):

Standardisation was the theme of a section in the bibliographic part of the RESOURCES database, ZSTAN, which included standards materials from the national standards institutes as well as the International Standards Organisation (ISO). It also included references to thesauri, and local efforts to standardise, including codes of practice of whatever degree of sophistication or development. Some of the entries relating to these local efforts to standardise are acting as markers and some heuristic, or both since if the boundaries of standardisation practice are to be extended efficiently what is happening on the periphery is likely to be of particular development interest. The presence of this 'fringe' material was dismissed by a representative of British Standards Institute as having "little to do with standards or standardisation." (BSI 1985 25/4)

batching ( : see also : case studies 1, 2 and theoretic themes):

Batching was used within RESOURCES in the logical grouping of the bibliographic materials. It was also used extensively in the processes of research, preparation for printing, and the maintenance of the database, but that is a material for another day!

marking ( : see below and also : theoretic themes):

'Marking' was used increasingly in the database as its heuristic value became evident.

As indicated above:

Concept cross references were also inserted as markers to alert the researcher to look for entries relating to those topics.

Marking was especially valuable in highlighting change, an emphasis which agrees with cybernetics principles.

An organisation that had become defunct would be retained as an entry of a defunct organisation. The user who found such a record would know that it had existed and now didn't and could choose to chase further about what it had done, or regret its passing and look to other sources. Either way they would know that it had discontinued and not waste time continuing a fruitless search.

Where an entry address, phone number or other information had changed the date (precise or to nearest year depending in data available) it was known to have changed was entered as a marker. This helped to reduce changing entries back to outdated information, as a result of using undated source material.

significant:

people;

places;

organisations;

concepts;

locations;

(ie The 'who does what, when, where, why and how' that crops up in epidemiology and other creative, divergent thinking activities. The 'when' ie the time dimension, was connected to each of the other dimensions by coding which indicated date of source or verification of information.)

negative information ( : see also : 'Cybernetics and how it relates to the thesis topic');

Negative information included in the RESOURCES database mainly took the form of statements to say that an organisation or service no longer exists. The retention of markers at such points, theoretically, is considerably more value than total removal of the entry but may be considered 'untidy', and in any case does not appear to be generally valued.

retrievability:

Underlying the whole philosophy of the RESOURCES data base was concern that information put into it would be readily retrievable, especially as compared with the best that was then available for the occupational health nurse, Gauvain's 'Guide to sources of information' (Gauvain 1978).

logical grouping and cross referencing:

In effort to enhance retrievability bibliographic material was logically grouped, though some books and papers were difficult to group, but organisation details were alphabetically ordered by common name of organisation, as far as possible. Initially, the organisations had been divided (classified) into 'research organisations and services' and 'self help organisations' alphabetically by the part of the name referring to the topic of its interest, where possible. So, 'Action Against Allergy' was put as 'Allergy, Action Against' and so on, but eventually a merged alphabetic listing was preferred, and names were put in their natural order, 'Action Against Allergy' with a cross reference at 'Allergy' to 'Action Against Allergy', other organisations concerned with 'Allergy' and such topics as 'Hayfever; Humidifier; Immune; Pollen and Pollen count in summer'.

The single alphabetic listing meant that if the name of the organisation was known there would be only one listing to search. The cross references that were then built in to the main listing enabled the lesser known names, abbreviations, variations and changes in name to be accommodated.

Eventually it was realised that the system of referencing helped to prevent items getting lost or forgotten 'asnegsist', and that lists were being formed incrementally, of groupings that were not generally known. On example of this was 'Hygiene Services (Occupational, Environmental)' with about 70 cross references where the 'generally known' components appearing in other listings was, at best, about a dozen. So, another benefit from the extensive cross referencing was the unexpected generation of such unusual and potentially valuable listings.

#### 4. Issues involved in an attempt to improve a sources of information service.

This case study has addressed some of the issues involved in an attempt to improve a sources of information service. A variety of cybernetics principles were applied to the database and the journal but there was no overall success. Some of the principles applied seem to have been rejected in the way new information is rejected. The author believes that some of the use of markers fell into this category, but in general, it was the overall combination of unusual content, presentation (especially the visual appeal, and difficult topology) as well as the presence of markers and heuristic features 'Why ONLY a marker?' when most directories omit such a reference entirely, but by its complete omission falsely appears to present a complete set of information, a situation which seems to be generally preferred.

After working with the cross referencing system in RESOURCES for some time, the author became aware that each organisation entry that was cross referenced to a couple of topics, tended to be lost less easily than if it were left as an isolated entry. Also, it appeared to be more likely to be updated and used. Much later, when dismantling the database was considered, or transferring part of it elsewhere, the author realised that the cross referencing had made the whole structure more robust. An analogy was drawn with the principle in engineering where a triangular structure more stable than many other physical arrangements, and on examination it appeared that a triangular information structure with a cross reference to a concept which in turn cross referenced back to the original item might indeed be substantially more robust than other arrangements.

Why might RESOURCES users have failed to interfile the updates? No direct research has been done into this specific situation. The author has used various Croners reference books which have had updates to interfile and / or replace monthly or quarterly. In this case, the pages are separate, and not usually to be replaced in groups, whereas with RESOURCES nearly all was groups of pages (batches), so there were very few units to add, and hardly ever anything to remove. The author has found herself reluctant to do the Croner changes at times, but has found

sufficient motivation to overcome reluctance from the danger of degradation of the information if the books are not up to date. Certainly there is effort involved in interfiling updating materials of this type which is vulnerable to procrastination, especially if the benefits of doing the job are not immediately obvious.

## 5. Controllers observed.

Many and complex controllers are observable in this study. Economic constraints are the main 'value' controllers which emerge, though aesthetics and group / institutional resistance to change also played some part.

Mechanical factors acting as controllers related to:

- the volume of the information;

- printed paper as a medium for handling dynamically changing information;

- the practicalities of reproducing and distributing paper based material while retaining complex indexing;

- sorting and merging large volumes of information before and after typing, before and with word processing.

The controllers of handling, availability, storage, production, redundant components are still operative as mechanical factors even if the economic is excluded. As word processing was used extensive cross referencing was built up, using traditional and unusual cross reference patterns. This was shown to lead to generation of unexpected, unusual and potentially valuable listings generated.

Controllers also relate to the imagination, 'way in' via information pathways, signposting and interaction, and the presence or absence of concept reference and omission markers. The concept reference markers might signify the state of a situation or inform about its presence or absence. Also in this human / system batch of controllers the attitude to and availability of fringe materials appeared. Insistence on a 'positive approach' might also be seen to have controlled by inhibiting the acceptance and importance of negative information.

Other controllers observed in this section included:

- cybernetics analysis to discover 'all possible uses';

- algorithms and flow charts (facilitating some operations, inhibiting others);

- heuristic forms;

batches;

preventers of creative divergent thinking;

the linking or failure to link time with other dimensions.

## Case study E. The computer megastore and the roofing company: information leakage in two young businesses.

This case study describes selected aspects of information handling in two very different young businesses in which the author was employed. Both businesses were fragile, and had poor financial control. Neither had budgets. At the beginning of the authors' time with each company neither had any clear idea of the value of time, and the importance of administrative procedures, enabling it to be used most effectively.

The authors introduction to the two companies is included as background information. The common business processes of the two companies are compared and contrasted. Data processing, invoice processing, data base functions, word processing, supplies and equipment, staff turnover and filing in the two companies were resulting in considerable waste and loss or degradation: of information. The mechanisms are discussed, and remedial actions with mixed results described. The concepts of 'asnegist' and information leakage' (ie loss of a volume of information in such a way that unless active steps are taken to salvage it, or it is not salvaged by some other system, near the point of leakage it will never be recoverable information) emerge from the material presented.

It also shows how the controllers relating to classifying and batching information related to both to that information leakage and to the achievements of the two companies.

### 1. A disclaimer, despite what this case study shows.

Notwithstanding all that follows it should be made clear that 'the owner' of the megastore is skilled in buying, selling and marketing, and has managed to achieve substantial success in circumstances which would have submerged most of us. Indeed, the company appeared to be in an unsurviveable condition on every occasion when sufficient information appeared to be available for reasonable assessment. It survived over a year after the author was made redundant.

### 2. Introduction to the two companies.

When at the 'High Tech in Education Exhibition' the author said "Here am I with all these skills and qualifications, what about a job?" 'the owner' of the megastore said "Would you like to come and learn to run my company and run it for me while I have my baby?" Little did the

writer imagine the interest and experience that would be coming her way before being made redundant when the company accountant resigned, nine months later.

The computer megastore grew from a front room to having a 3 1/2 million pound turnover in four years. It appeared to have all the problems which one might associate with too rapid growth, such as:

those arising from inadequate administrative infrastructure;

staffing difficulties (relating especially to changing job demands and frustrations relating to the other problems);

financial instability.

When the author arrived the graduate owner ran it, her husband and his brother were two directors and the brother's wife was 'customer services manager'. There were three staff in accounts, one other in sales, and a technician, as well as a part time cleaner, a part time packer and two weekend students.

The shop was very busy with mail order and retail customers. Energy seemed to be liberally available. The paper was elbow high in places.

First contact with the roofing company MD came when the author investigated solutions to the dripping warehouse roof of the megastore. The author found herself, nine months later (July), in the roofing company as a word-processing temp and recognised by the MD as 'I thought you were running it (the megastore)'. A permanent, low grade typists job was offered immediately, and refused on the grounds that neither party would be satisfied with such an arrangement. The author was then asked to suggest an acceptable package based on the same salary. The proposed package included a minimum of 12 days per annum training or attendance at exhibitions etc., paid overtime, same times and holidays as others, and a regular donation, proportion of current salary, to a charity named by the author. Within weeks the author was told by the MD to come and go as she liked and to do what she liked.

The roofing company was in shared premises with limited office space and even more limited stock yard space and access. The atmosphere was thick with smoke, rough language and effects of heavy drinking down stairs in the Slating and Tiling Department. It was there that the author started to work. High standards of spelling and presentation, and conformation to set standards were demanded by the MD's PA in the typed material and the six estimator / surveyors mostly concurred with that in requiring good spelling and presentation of tenders and correspondence. Some 150-200 roofing contracts within or near to the M25 motorway surrounding the Greater

London area, were current, including major slating, tiling and leadwork on the Royal Courts of Justice, the new British Library and Westminster Chapel. The Sheeting and Cladding Department had a variety of, mainly industrial, roofing projects. There were two supervisors out on the sites, one for leadwork and the other for other types of work also functioned as labour master. 100 - 120 roofers worked out on the contract sites and two lorry drivers supplied materials to those sites from the yard and / or suppliers in the area.

The roofing company moved to a large, strategically placed site. The offices were then located in two houses which were being completely refurbished for the purpose in June. The amenities improved and smoking was discouraged, to some extent, in the offices.

### **3. Common processes in business.**

The way a series of common business processes were carried out in the two companies are selectively described. The features which are highlighted are those which demonstrate the action of information recovery controllers.

#### **a. Data processing**

Having arrived new at the megastore on the Monday the two directors (including the one who had set up the data processing system) were due to go to India for three weeks on the Thursday. The data processing manager had recently been sacked (and his brother the warehouse manager resigned) and no one else knew how to do the accounts processing. The author was asked to learn to do it, but was not shown how until the Wednesday. "This is incredibly dangerous", she said. With inadequate documentation and practice the inevitable happened. The system (BOS software on Pinnacle computer with TDI terminals) went down. Although different strategies were used to get it running it was down most of the three weeks. Who knows what information was lost? Later, a replacement data processing manager was sacked on the spot after three weeks, without debriefing, though he undoubtedly could have contributed useful insights. (See also : Staff turnover)

One problem was that the reset button on the back of the computer had an array of 25 pin 'D' connectors hanging over it, so when the connectors moved the reset button was likely to operate. The increased instability of the system arising from the absence of the director meant that the connectors moved. Dr. Stewart suggested application of a bottle top with a hole in the middle as a solution to the vulnerability of the reset button. A search in the authors' might



be 'useful sometime' hardware collection revealed a rubber towel holder, the type with cross cut in the middle. That was put to serve that purpose in a flexible way.

The author was not involved with the accounts data processing at the roofing company. However no budgeting information was available within the company. Contracts costing was only known historically, and that often after its conclusion.

## **b. Invoice processing.**

In any business where invoices are generated the procedure is related, and perhaps closely to the speed and efficiency with which money comes into the business. The invoices and the procedure associated with their generation is, however, itself non-productive, in that it has opportunity cost and financial cost, but no customers. Ideally the procedure would be so efficient that it has minimal cost and in no way hinders customer service and the other productive work of the organisation. Invoices were generated differently in the two young businesses, partly due to the nature of the business, but in both cases there was information leakage. The author was able to contribute substantially in reducing that leakage at the roofing company.

### **i. eg At the megastore**

At the megastore there were two systems of invoice processing, manual or computerised (BOS software). A description of some of the features of the computerised system is given.

First, only the 'Shop' terminal, and later another terminal were dedicated primarily to invoice processing. The terminals were linked to dot matrix printers, and for a variety of reasons the terminal / printer systems were unreliable leading to loss of invoice copies and other problems.

The system was set up so that the code of the product (2 alpha characters and six numeric characters) had to be keyed in before any other product information. The codes were designed in a reasonably logical way eg BS = BBC software; BF BBC firmware; and the first two numeric characters indicated the type of product (so batching related items). With any luck having found the correct code the right product and pricing information would appear. The product and pricing information was never up to date and if one did have to enter price information it had to be without the VAT (value added tax) included. With the majority of customers being private individuals the quoted prices usually included the VAT and for simplicity might be rounded

nearest whole number Staff stood by the computer using the calculator and customers muttered about the time delays. There were two 'blanket' codes, one for repairs and one for anything where no other code existed. The blanket code was unpopular because one not only had to enter the product name and price but often also to change the VAT code (involving several key strokes), so 'those who knew' chose the code for a similar product at the same price and just changed the product description. Journals didn't seem to have a code which lead to time loss and customer aggravation.

During the period as sales coordinator, from August, the authors' copy of the megastore 40 page Spring catalogue, was brought, and then kept up to date with price and other information for all the major products apart from software. Cross reference and index information was improved. Finding the computer system producing unexpected product information, the author discussed the matter with the director concerned. The director said that it would be wise now to abandon the catalogue for invoicing purposes and use an alphabetic computer listing. With around 2,000 products, many with arbitrary names and the pricing information inaccurate, the listing had considerable shortcomings.

Initially some products had the 6 numeric digits of the product code stamped on them. That was fine if one could work out or find out the appropriate alpha characters to put in front of them. The author researched to find a coder that would put the full code and price coder information on. The only one found, made by Pitney Bowes, was said to be very satisfactory and was ordered. It was received, taken into duty, and instructions lost, in the authors' absence. To use it part of the code was entered digit for digit, but other parts by following one of two different codes in the form H = D or 5 = 0. Setting the codes was so time consuming that it was impractical to do it unless there were, say a dozen things (batch) to price. The print on the labels and reliability of printing was inadequate. Fewer products had price and code information on. Even if they did there was danger that the computer system now had a different code.

Anyone who has tried to give efficient customer service and cut the unproductive sales order processing time to the minimum to give time to give to selling will realise the frustration of wasted time with such a system. They might not realise the profligate loss of information with implications far beyond the time loss, to the company. Such loss is termed by the author 'information leakage'.

**ii. eg At the roofing company**

At the roofing company the invoice processing was entirely different, in that the customer was never present during the process. Several people would be involved sequentially in the main part of the process, (usually estimator/surveyor for the job, the MD, the typist and then the MD and/or his PA). The author observed that estimator, typist, MD and PA were spending large amounts of time calculating, recalculating (using desk top calculator or mental arithmetic) and checking the invoices which were typed on the computer using WORDSTAR version three. Five, white, under-copies of each invoice were required and the typist made up the A4 carbon sets as they were needed. In this system the main information leakage occurred during the lengthy process due to errors being inserted at transcription, but the whole system, in general, and not just that part of it was ripe for rationalisation.

When the typist who had been responsible for the invoice typing left the author asked to take the task on with a view to seeing how the computer could be utilised to support the process, especially the calculations and checking.

Several word processors were examined for 'in text' calculation facility, with WORDSTAR favourite because it was already in use for tenders and general correspondence. It failed, because even in the newest version calculations are performed in a separate 'window' on the screen and would have to be transcribed from and to the invoice. SPRINT and WORD PERFECT were excluded, and the author, having recently worked through the tutorial, experimented with a demonstration version of Microsoft WORD and eventually found herself 'hooked' for both the invoices, general typing and database interface.

Initially a suitable style sheet had to be set up, and considerable time was spent at home working out the procedure on a full copy of WORD. Next a demo copy of WORD was installed on an IBM: XT at the roofing company and the author took on the multi-page invoices. Up to that time (end of 1988), nearly all the changes the author had suggested to office procedure or typing style had been vetoed by the MD's PA. With the first invoice produced using WORD the author changed:

the layout especially by lining up number of units, multiplier and amount;

the multiplication sign to an asterisk;

the 2 1/2% discount and 15% VAT to calculations of:

\*  $2.5 / 100 = -nn.nn$  discount =  $nn.nn * 15 / 100$  VAT  $nn.nn$ ;  
commas were omitted from sums over £1000.

The author expected to have to give away several of these changes, but all were accepted without demur. Additionally the author introduced the protocol that all calculable sums would be calculated and totals inserted by machine rather than transcribed. This immediately improved the reliability of the output markedly, but not completely.

As by that time the author had been able to take over the stationery buying it was a simple matter to get multi-part, continuous NCR invoice stationery with four different tints and white, and a redesigned layout approved. The PA and MD were consulted to exclude possible difficulties which would arise from the simplified layout allowing more space for the body of the invoices. They were both told at the same time that the copies would be different colours, and the MD left to pacify the PA on the point. Once the new stationery was used the author left the MD and PA to sort out where the different colours would go, just suggesting that whatever colour went into the contract files should be distinct from other material in those files. Once the value of the different coloured copies became evident there was complete acceptance of that feature.

After several long invoices had been done, and the author had been using WORD for various word and data processing functions at home, she decided that WORD would be more comfortable for her use than WORDSTAR for the general word processing and data functions at the roofing company. The MD approved purchase of a full copy of WORD. The process of getting the computer to support the production of invoices was then gradually increased, with a minor step forward taken when:

column underlines were put into glossary;

Single underline:

-----

Double underline:

=====

a column format was put into the glossary:

ie left justified at left margin; right justified at 3 inches; left justified at 3.2 inches; and decimal aligned at 4 other positions, the fourth aligning with the totals column on the invoice stationery. In use it might look like a wider version of the following:

Item A	34m sq *	12.90	438.60
Item B	10 No *	1.75	17.50
Item C nails	3 lb *	1.80	5.40
		-----	461.50

skeletons were developed for the various invoice and credit note forms and also put into glossary;

running heads were then automatically inserted on all pages by the computer;

automatic page number information was added;

At that stage the author changed to preparing the invoices as a continuous page with summary calculations in the right hand column at logical places according to part of roof or type of work. No 'carried forward' summaries were used, and page breaks were 'forced' (ie inserted by the operator in preference to the ones offered by the computer, the computer having the dimensions of the paper (as coordinates) to refer to) only when the natural page break would result in awkward division. No adverse feedback was received.

The credit notes had been printed on red printed stationery with white paper copies using red carbons. There was a strong sense with the PA and MD that red had to appear on credit notes. The cost of providing a short run of continuous stationery with five copies seemed to be prohibitive. No red printing undercopies or self carbonated continuous stationery was available. In any case when using automatic continuous printing the need to change stationery over was to be avoided where possible. The accepted solution surprised the author. Invoice stationery was used. Invoice was to be struck out (this appeared not to happen), and CREDIT NOTE typed in above the reference. The sums were marked so the total was negative. The MD had a stamp purchased to write CREDIT NOTE large in red.

By Spring 1989 the author estimated that time spent on invoicing had been nearly halved, and was well on the way to being halved again even before the bills of quantities are computerised. Macros (collections of individual computer instructions to form macro-instructions or small computer programmes) were made that enabled certain calculations to be completed automatically.

The author then struggled to enable staff not trained on WORD to be rapidly productive producing invoices, estimates and general correspondence without appearing to invest much time in learning. Later (from November 1989 especially), as staff were encouraged 'to do their own thing' and not be constrained by the computer, they did not learn the systems adequately resulting in information leakage and degradation of the system.

Invoices, however, continued to provide more information. Previously it had not been at all obvious to main contractors what was the actual sum they were supposed to pay, and it was confusing to the author. Later a calculation was included which precisely showed that sum and how it was arrived at. Later again the MD asked for a summary (as in a statement) to be included where appropriate. The invoice mask was extended to include this detail. Debtors then had far less obvious excuse for delaying payments.

Reduction of information leakage in this case was mainly by reducing the opportunity of excuse contractors for contractors delaying payment, and by improving the quality of management information. Substantial staff time costs were also involved.

### **c. Other database functions.**

Customer activity reports, sales plans and forecasts, and development of mailing lists (apart from a crude list (badly spelt and with few postcodes) of employees at the roofing company, used for wages) as well as management information generated from general or personnel accounting was almost non-existent.

"Inquiry handling is very much the sharp end of marketing. It is estimated that something like 50% of inquiries industry wide get lost and are never acted on. They may ... not be passed to a salesperson, or sent to a salesperson who has no time to deal with them." "PPA's turnover has gone up from £250,000 a month to over £400,000 a month ... because the company is being more effective in following up leads."  
(Network 1990 p35)

No evidence was seen of any reconciliation of time with activities at either company. However at the roofing company, the PA frequently said the MD was putting pressure on her to be doing productive work, and this was her justification for demanding it constantly from other clerical staff. It is clear the chief accountant at the megastore fully appreciated the importance of these functions and may well have done something preliminary along these lines. Once he was in post the author's direct information on these matters stopped, but it appears the accountant only had very limited information. The MD and PA at the roofing company had some idea of what was required from accounting but did not know how to get the accountant to produce it, or realise that without budgets the accountant lacked essential feed stock.

The author was enabled to recruit a PA for herself in late summer 1989. There was considerable ambivalence about the appointment and several very suitable applicants were lost. The main project for this PA was to develop a system for pricing the 'delivery tickets' ie records of materials delivered to contractors sites from stock or, that was how the MD saw it. It was obvious to the accountant the author and her PA that stock control, purchase invoice records and sales control were part of the same logical system. Considerable work was done towards this when the contracts manager and MD agreed that the computer systems had done nothing at all for them (denial of objective fact). After a major meeting it was agreed that a manual pilot system of stock control would be put into operation for the lead (metal) sheeting only, and that the authors PA would price the delivery tickets for a period to get the feel of it.

The author had produced a series of data files, information lists which strongly supported the contracting operations. These would have been much better in a good database handling system, but the MD was too ambivalent about information technology equipment for that to be purchased. The MD's PA insisted that everyone who used a microcomputer on the network had to have a local printer, which was a poor use of the resources available, and led to predictable, and unpredicted problems of printer compatibility. The two directors liked the look of fixed work benches as being more modern than desks, but would give no thought to cabling requirements and the facility of moving the high technology equipment.

Current "estimates of the price of moving employees' equipment around average £500 a head using conventional methods -playing by ear for the most part." (Network 1990 p22) Midland Bank abandoned an office move in central London due to cabling problems. (Network 1990 p31)

No specific consideration was given to cabling required in either the building moved into in 1988 or the one being refurbished at the end of 1989.

"Cabling is installed during construction and refurbishment, not afterwards."  
(Network 1990 p31 quoting Rodgers 1989?)

Lack of appreciation of database functions, and lack of appreciation of standards in database maintenance, acted as a potent controller in both companies. Information leaked away.

#### **d. Word processing.**

Having discovered the value of word processing in 1977 the author expected to be able to produce documents in that way at the megastore in 1987. The word processor on the main computer had help messages if you pressed <CONTROL> with another key. However, because the <CONTROL> key been vulnerable in causing the main computer to 'hang' (a term used to mean that the computer is no longer responsive to most input devices like keyboard or 'mouse'), it (the <CONTROL> key) had been disabled. The particular word processor, BOS WRITER, appears to have been capable of detailed configuration so that what was said in the manual information often did not apply. Suffice it to say, the only person who used it was the secretary who learned to use it as a memory typewriter without editing.

The Alpha microcomputer was available. There was a keyboard and cassette, but it was not connected to any printer, and no one wanted to connect it. The printer allocated for word processing was initially in the data processing room. It had only a friction feed requiring to be hand fed before the appropriate computer in the other office was instructed to print.

After the Alpha micro had taken up 1/4 of the authors' work table for six weeks it was banished to the warehouse. At other time there were an Amstrad 1512 and an Amstrad 640 both with WORDSTAR on. They were linked to a laser printer too at one stage. The author typed one letter in the nine months. Every time staff went to use the two Amstrads (and many times one went to demonstrate them) they would find essential components missing, or someone had wiped the data off the hard disk. When anyone managed to get the system working a customer would come, and of course, staff in the showroom had to give whole attention to the customer, unless someone else was providing that service.

At the roofing company the author was told in January 1989 that originally there had been an Apple and an Apricot computer, and that an IBM approved company had been asked to come in and install a network of compatible machines. The network failed to work and eventually two IBM XT's were left as stand alone machines. As far as the author knew before that, the two XT's had different versions of MS.DOS, the operating system, and WORDSTAR. One of them had and old IBM PC computer keyboard and the other an AT computer keyboard. The control key and caps lock were in reverse position on the two keyboards (WORDSTAR uses the <CONTROL> key for many of its functions as an option) and the delete key on the PC keyboard worked in reverse within WORDSTAR (ie deleting the character to the left of the cursor, rather than the one under the cursor coming from the right). The delete key on the PC keyboard also encroached half the size of the insert key. In WORD this becomes a major handicap since delete takes whatever is under the cursor or highlighted into a buffer which can be restored by pressing insert, but is replaced and so lost if delete is pressed again. Both the IBM XT's were slow, especially in saving and reading files, with a marked difference between the two. The hard disks were 10 and 20MB respectively. The Apricot had a different keyboard again, and an even older version of WORDSTAR. Its 3 1/2" floppy disc size meant that to update standard files across the three computers the author had to bring discs home and copy them on her own machine.

A non-dedicated network (ie one in which the computers can act as stand-alone machines or as part of the network) Ethernet network with Novel software was installed in May/June 1989. The file server was a new AST 386 machine with 150 megabyte hard disk. A new AST 286 machine and the existing XT's were linked in and later an AST Bravo 286. The accountants Tandon 286 was due to be linked in but this had not been achieved for technical reasons by the end of 1989. All the computers were capable of operating as stand alone machines using their own hard disks.

Against the authors' advice the company opted for a small local printer for each computer. The 'Epson compatible' Mannesman Tally printers proved to be very far from 'Epson compatible' as



far as Microsoft WORD printer drivers were concerned. Manual feeding of paper sets made up with carbons continued to be used for the majority of typing work.

Information leakage was an important controller in relation to equipment for clerical purposes. Information was lost as was valuable time. The systems were not adequate servants of the companies.

### **e. Correspondence.**

When the computer at the megastore was being used for correspondence the secretary was told to keep the copies on the computer without any paper copies. The authors' suggestion otherwise was not accepted. The capacity of the main computer or how the storage might be partitioned was not known to the author at that stage, but it was not physically big enough to have endless capacity. Sure enough, in due time the portion allocated to word processing was full, and the secretary carefully erased the files one by one.

Information was lost, most not needed, but including some critical material. If that critical material had been identified so that it could be 'batched' for separate handling the situation would have been quite different.

At the roofing company the numerical systems used for contracts, tenders and invoices made effective batching possible resulting in some control over what files were deleted to make space was possible. With version 3 of WORDSTAR not being well adapted to working with 'tree' directories the one directory had accumulated more than 500 files, and the user spent measurable time waiting for the computer to read and write it. By using the estimators' initials in the extension of the file name (ie the three places of the maximum of ten, of the file name code which come after the dot) some control and batching was possible.

Successive operators had not bothered to insert the date and time when powering up the computers each day (the Apricot and the IBM XT's did not have battery support for the clock) so date and time information relating to file names was invalid.

The author set up the network to have directories (called by the person's initials) for anyone who had work typed for them and a personal directory (called by first name) for direct users. There was also an invoice directory and latterly a 'READ' directory for database type files which could be read and manipulated but only saved to a new name if required. The protocol was set that documents were supposed to have the initials of the directory as first component of running head, followed by a slash and typists initials (where relevant), followed by another

slash and the file name. Normally the date also would be included in the running head. This meant that any page of any document should be well identified and any typist could locate the file. However, the encouragement of the MD and the PA antinomianism, (everyone do what they want in the way they want it, not following protocols) among clerks resulted in much time being wasted looking for files or duplicating them.

The controllers in relation to the correspondence included:

loss of information due to failure to keep copies of critical correspondence in paper or magnetic form 'information leakage';

considerable loss of time: due to failure to date and time computers on power up;  
lack of directory facilities in WORDSTAR version 3 resulting in overcrowding;

#### **f. Supplies and equipment.**

In both the megastore and the roofing company there was considerable problem in having continuous access to appropriate supplies and equipment, especially that concerned with paper handling. Staplers, hole punches, pens, scissors were a major problem.

In the megastore the children were a major part of the problem. They rampaged at will after return from school, and used whatever they fancied for drawing to destroy or use for destruction. At the megastore and roofing company staff used the nearest available tool and left it wherever used and in whatever state. In both the companies the author was eventually able to control the stationery purchasing. Over a period of time heavy duty punches and staplers which take a full length of staples at a time, were provided. The author regularly did a round ensuring adequate supplies were present. A modest loss continued, specially of scissors, but the situation was much more stable. A large rotary paper cutter was purchased in both cases and rapidly justified its cost.

The mechanisms for making 'stationery' tools unavailable at the point of need are controllers to be taken seriously. They lead to considerable information leakage.

#### **g. Staff turnover.**

##### **i. One hundred per cent a year?**

The megastore 'owner' told the author that staff turnover had been very high and that the data processing manager and warehouse manager had been asked to leave quickly, but that was only the

most recent. The sales assistant had been with the company for several years but was behaving in a very bolshy way, being rude to customers and being generally dangerous for the business. He was formally warned and the author dismissed him after discussion with 'the owner'. His potential for danger to the company became more evident after he left. The overall damage to the company including the effects of information lost was great.

The owner asked the author to recruit various staff. A summary of the outcome follows: The secretary was still there when the author left (three months later.) The data processing manager lasted about three weeks. He had been allowed flexible arrangements for time keeping because of evening duties, but he was hardly ever present at the time agreed and was repeatedly asking for time off for personal business. His car was also said to have malfunctioned several times. The valuable work that had been done starting to analyse various of the jobs was lost. Accounts went through ten different 'permanent' people including a very capable and imaginative chief accountant. The accounts department closed just after the author left. Four sales people and an experienced engineer came and went. The replacement warehouse manager recruited was there till three months after the author left. The packer was laid off in the summer.

The company had good relations with a variety of training organisations. There were many different trainees of youngsters gaining work experience usually not more than two at any time. One who took to answering sales calls without reference to permanent staff from his first day finished up being arrested on his last day when he walked off with a collection of goods.

The numbers of people involved and the lack of continuity led to serious problems as batches of historical knowledge were lost. The cost, including recruitment agency fees for people staying long enough to be charged fully but then leaving well under the year, like the chief accountant, was large.

The roofing company did not quite reach 100% in the first year the author was there.

## **ii. Interventions and modest results; .**

One major intervention was planned to try and change the social context at the megastore. The author assessed that if 'the owner' and herself, and ideally, at least two others, went on the Time Management International course that the owner would respond with useful change in her own time management, but also in re-evaluating her long term goals for her family and herself which would be likely to effect her relationships with other staff in a favourable way. She agreed to attend with the author, and for the secretary and the customer services manager to go

subsequently. The owner then opted out and it appeared that course time had been largely wasted as far as the company was concerned, though the author benefited greatly. Later the two male directors, the regional sales representative and the newly recruited experienced engineer all accepted invitations to a Time Management International taster at a BIM meeting but like the invited guests at the biblical wedding feast (Matthew 22:1-6) none turned up.

However, within six months, 'the owner' was using a 'Time Management' system and wondering how she had ever tried to manage without it, knowing the difficulty she had in keeping track of her varied work. All the key staff also had 'Time Managers', though only 'the owner', within the family, seemed to be able to use them effectively. There was also a big change in expressed family values and long term goals. The author was able to have several discussions with 'the owner' in relation to a strategy for change in the family, in particular in relation to the eldest son. The author was also able to tap into the group experience of those who had attended the Time Management course, often deliberately in the hearing of 'the owner', and pick up opportunities to implement some of the ideas of the course, and use the literature provided.

These changes did have potential for improving the social climate and resulting in improved staff relations, but the resistance of the family, apart from 'the owner', and to a limited extent her husband, may well be insuperable.

### **iii. Change and instability.**

(Written by Spring 1989)

The roofing company was about to move premises when the author joined the company. Because of the distance to the new location, there was danger of losing nearly all the office staff at the time of the move (the author's journey was much easier to the new location). In an intuitive way key staff were taken over and proudly shown the offices in the newly refurbished house and asked how they wanted them arranged. Lifts to and from work were fixed up so that difficult bus journeys were minimised and costs reduced.

Lunches were provided from a variety of take-away shops or from local pubs. We were assured that a beautiful kitchen was to be provided, and this materialised within three months of the move. The MD's PA wanted to change jobs but couldn't find anything with the status, attractive hours and pay. The accountant was made company secretary and given a place on the board. The credit controller and wages clerk (with maternity leave) also stayed. Several clerks and accounts assistants came and went but more senior staff stayed longer.

Recruitment of clerical staff was proving very difficult and the author suggested offering desirable employment packages, in terms of times and flexibility, that were not usually available. Currently two mothers come having taken children to school and go to collect them, and also have school holidays. Another comes to work from 1pm - 6pm and yet another has been recruited for three days a week. These arrangements have implications for how the work is covered, and we (the MD, the MD's PA and the author) are working on coping with that.

There was also a high turnover of roofers, but that was not particularly related to the move, since many of the roofers have no reason to come to the office. Sheeters and cladders seemed to have been with the company from the start four years before, and the lorry drivers a considerable time. The author was not sufficiently involved with this area of the operation to assess what was happening, except to observe that people handling skills were deficient, and many of the men had limited repertoire of response to difficulties. A string of cursing, swearing and abuse would often follow a minor frustration, but would subside and give way to reasonable discussion on the phone if one just waited until the torrent had well stopped, and the abuser would anxiously ask "are you still there?".

The difficulties of attracting and keeping skilled roofers are likely to increase with the general labour shortages. The company cannot afford the leakage of personnel resources.

One sixteen year old, trainee estimator/surveyor was recruited. The formal training aspect was only arranged as he left, and that was to be flexi-study without proper allocation of time. He tended to be asked to do everything that people thought of, though the estimator/surveyor he was formally assigned to tried to prevent it. In the climate of the office the author judged that it was not a suitable location for trainees. It was demanding enough for mature and experienced people.

The author aimed to improve the social climate by use of several strategies.

(1) Re the MD's son, director in charge of tiling and slating:

When the author first joined the company and she took his work to him he just sent her away. She got on with her work, knowing that ultimately he would have to come to her because she would generate what he could not do without. The MD's PA and others dived in to 'help' him, sometimes in his absence, and resulting in loss of critical material. The author gradually provided him with materials that could help improve his self image and people management techniques, and did whatever was possible to affirm him and support him, discouraging others, especially his father from disparaging him. By the end of the year he was being openly appreciative, and noticeably more confident, even in front of those he most feared.

By a year later the outstanding agenda still included time management, assertiveness and other people management skills training as priorities. The strategy has included effort to show that even quite small improvements in these areas are a good investment because they reduce pressure, and increase available time and energy.

(2) Re the MD:

Supporting the changes in the company and its social climate that will enable the MD to step aside within a year or two with confidence in its future, and his son's ability to carry it forward:

The strategy employed has been to affirm every move in desired directions, to encourage exposure to individuals and organisations who are advocating good strategies, and to develop functioning systems that are seen to work efficiently. A regular dialogue developed by November, though often the authors' recommendations were immediately grossly misquoted with a poor light being put on them. Notwithstanding those limitations the MD told the author several times before the end of the year that she could go and come as she liked and do what she liked;

The MD also did attend, at the authors' invitation, a small business club (a government scheme) and brought in some innovations as a result;

Alternative people handling strategies were proposed, and the problems likely to result from destructive confrontations aired, with noticeable improvement by the end of the first year.

(3) Re other office staff:

The author has affirmed others for worthy characteristics, whenever there has been opportunity;

Recruitment of office staff from the author's Church resulted in the MD asking the author to find more employees from her own contacts, and has acted as a leavening, discouraging smoking and swearing and affirming positive behaviour;

The MD's PA came with the author to a preview of training films, and two surveyors attended one BIM (British Institute of Management) meeting. Three of the surveyors also attended one of the Billy Graham Mission '89 meetings.

Independent of any intervention the surveyors would meet up to play squash, badminton or tennis from time to time.

(Written December 1989)

By the end of 1989 a rough and ready, but very competent contracts manager had been appointed leading to sacking of the two supervisors and replacement by two (brothers in law) from the contract managers previous company. Many of the roofing teams had been replaced.

The author's position in relation to management of the 'female staff downstairs' was constantly undermined by the PA, or the MD and PA, with the encouragement of the accountant, in collusion. This lead directly to some loss of staff.

Neither the MD or his son appear to have clear goals apart from a desire now to achieve British Standard quality assurance. The MD's undeserved anger has been observed in turn focused on his son, two of the estimator surveyors, and the author. In the authors case this was associated with giving others permission to rubbish the authors work and systems being produced.

The situation became incompatible with the succesful continuation of the company over the long term.

In public and private the son acknowledged the authors' contribution in terms that indicated far greater understanding of what had been achieved than had been evident to that point.

#### **iv. Factors involved in the high staff turnover.**

Factors in staff turnover observed included:

- lack of management control;

- demotivation of staff because grossly bad behaviour, stealing (in the roofing company) and so on not dealt with;

- management and staff indiscipline;

- inadequate information to fulfil the job;

- mishandling of staff related to culture (especially in the computer megastore) and place of family;

- general lack of people handling skills;

- loss of continuity and loss of, or lack of equipment to do the job;

- instability during relocating of company offices;

- failure to support non-family managers;

- change and completely disrupt staff jobs without consultation or consideration, and perhaps unnecessarily;

- lack of appreciation of the value and importance of training (more so in the roofing company than the megastore);

On examining, the following summary, from unknown source and authorship, it is evident that neither of the two young companies satisfactorily achieved more than Maslow's: physiological needs and Herzbergs: working conditions; salary and personal life.



Table II. E. 3. g. 1 A comparison of Maslow's need-priority model with Herzberg's motivation-maintenance model.

Maslow's need-priority model	Herzberg's motivation-maintenance model
.....	.....
Self-realisation and fulfilment	M .. Work itself . o .. Achievement . t .. Possibility of Growth . i .. Responsibility . v F.. .
.....	a a.. ..
Esteem and Status	t c.. . i t.. Advancement . o o.. Recognition . n r.. . a s.. . <u>l</u> .. .
.....	.. Status .
.....	.. Interpersonal relations- .
Belonging and social activity	.. - supervision . .. - peers . M .. - subordinates .
.....	a .. .. 0
.....	i .. Supervision - technical .. v
.....	n .. .. e
.....	t F.. .. r
.....	e a.. Company policy and . l I
.....	n c.. administration . a t
Safety and Security	a t.. . p e
.....	n o.. Job Security . p m
.....	c r.. .. i s
.....	e s.. Working .. n
.....	.. .. g
.....	.. conditions ..
.....	.. .
Physiological needs	.. Salary .
.....	.. .
.....	.. Personal Life .
.....	.....

(cf Maslow 1954, Herzberg 1968)

Meyer identified six common triggers to demotivation among employees (Meyer 1977 p15) The author wrote a formal essay relating how these triggers became evident in academia (Hibbs 1986a). All of these triggers were present at various times and in various degrees, for most of the employees, in the two young companies. In the academic context they were shown to relate to two individuals who both proved to be far more resistant to them than Meyer described.

Table II. E. 3. g. 2 Meyer's six common common triggers to demotivation.

Trigger 1. Inconsistent behaviour by supervisors or persons who directly affect success.

Trigger 2. Intrusion by supervisor, or other individual who comes directly affect the employee's success, into the identified responsibilities and authority of the employee's position.

Trigger 3. Denial of sufficient information resulting in delays and errors.

Trigger 4. Lack of psychological and behavioural support.

Trigger 5. Not respecting confidentiality and lack of sensitivity to individual needs.

Trigger 6. Lack of constructive feedback.

(Meyer 1977 p15)

#### **h. Filing: a special case of multi-level batching; .**

##### **i. At the megastore.**

The current box of 5 x 8 cards with suppliers details on was just the most up-to-date set at the megastore. 'Set' perhaps was hardly the word. They were kept more or less alphabetically, but it might be J for Joe at the Computer Company or under company name or perhaps under product name. There was no cross referencing. Certain ones would be in earlier generations of boxes. Addresses and phone number information was rudimentary and no note was made of the companies' reference number with suppliers so was not quoted for mutual convenience. The buying and recommended retail price of certain items was written on the backs of these cards but usually without date information and with no set order or position.

The resulting information leakage had lead to serious loss of differentiation, leading to expensively reduced options.

While acting as sales coordinator, during her last three months, the author made efforts to bring order out of that chaos without disrupting the working parts of the system. Cross references from products to suppliers increased the purchase options substantially. It was not possible to stop people replacing used cards at the beginning of the appropriate alphabetic section but one could re-sort them fairly quickly from time to time.

Filing cabinets were full of 'sales information' 'marketing information' or 'general material for filing'. The pattern seemed to be that once they were full and it became difficult to locate needed material they were abandoned and a new one started. There was no clear definition of what was 'sales' and what was 'marketing' and again the material would be put in the file under whatever category of product name or type, distributor, manufacturer or other handy name suited the filer at the time. Two or three 1" ring binders had product information in plastic folders and there were piles and boxes of specification sheets (spec sheets) and other 'point of sales' literature spread about shelves, floor and on tables (until the tables were used for exhibition and their contents distributed on top of the rest). The catalogue was referred to for most product information but detail on specification was erratically and expensively retrieved. The product knowledge of the family was great, so that major and expensive inaccuracies tended to be hidden by a highly confident and positive approach, especially by 'the owner'.

Over a three month period existing and new material was used to build six shelf feet of 'spec' (specification) sheets in polythene covers in lever arch files. Classification was modified dynamically to meet changing product emphasis. Products were specifically included even if they were unlikely to be sold, if people might ask about them in relation to products that were sold.

## **ii. principles applied for classification.**

The classifications were chosen with several principles in mind, like the groupings need to reflect the 'way in' the customer is likely to come. As product lines were changing fairly rapidly the classification had to be dynamic and flexible. Major categories reflected major product lines and types. So, if the customer is after a printer it is useful to have a category 'printer', but then a printer with a parallel centronics interface either dot matrix or daisy wheel printer could be driven by any of the computers being sold without particular concern about the software being used, whereas a laser printer, (at the time) had all sorts of unknowns, including its different technology, and system requirements as well as the buyer

expecting to pay three times the price, seemed better in a category of its own, so the salesperson using the file could concentrate on the one type of product.

Distinct categories of product were relatively easy to separate out when the overall volume of mixed material reached either the size of one lever arch file or were getting lost amongst the other material. The best way to handle overlapping categories was more difficult to determine, but there was considerable freedom to experiment when no other staff were using the system.

The main classifications ultimately were:

Acorn related hardware;

Acorn related software (but not PC compatible software);

miscellaneous;

monitors:

general information;

more than one manufacturers type described;

in order by manufacturer name (as far as possible by model name);

cards, buffers, networks, modems, cables and communications: (cables were a separate section which was only in rudimentary form.)

PC compatible hardware;

PC compatible software:

(i.) multiple programmes described (as far as possible) by software house, but if not by whatever label would be most likely to be retrieved (cross referenced where necessary);

(ii.) single programmes or packages described (usually by name of package or programme, but families of programmes with individual names like accounts, by the family name).

printer accessories: ribbons (a separate section only in rudimentary form); daisy wheels and print devices;

printers (daisy wheel and dot matrix) and plotters:

general information;

more than one manufacturers type described;

in order by manufacturer name (as far as possible by model name);

printers (laser) and scanners:

general information;

more than one manufacturers type described;

in order by manufacturer name (as far as possible by model name);  
storage.

Remaining spec sheets were put in similar order in polythene folders except where there were bulk supplies. These were very vulnerable to mixing, and it is unlikely that part of the system has survived to any extent. All 'spec' sheets were removed from the sales and marketing file draws. Sales was redefined as being anything that could be shown to the customer in the normal process of selling. Marketing was redefined as being anything relating to products, their advertising, pricing or availability that had some component which was not appropriate to show to customers in the normal process of selling. The files were rebuilt, using blue folders as code for marketing and pink for sales, and cross references made. Expectation of how long the system might survive after leaving was not high though it appeared to be sufficiently robust to last for some time, and for the reduced information leakage to date having already justified the investment. Previous file drawer contents had essential material extracted before wholesale destruction.

### **iii. At the roofing company.**

An alphabetic card file of organisations and people submitting tenders for pricing, with tender number and site details was being kept on 5" x 8" cards. It was badly out of consistent order, mainly due to the different way organisations describe themselves even within one letter head. Clerks responsible for maintaining the file had no guidance on the principles in operation. The author sorted the lot and cross referenced major categories, like 'London Borough of ...'.

The five invoice copies for internal use were all white. The copy in the contract files was very difficult to identify from all the other paper there. The author arranged for the copies to be coloured, as mentioned elsewhere. This greatly assisted retrieval when the next invoice was to be prepared, and will facilitate batching within the contract files in due course.

The key estimator surveyors needed current, and in some cases, historic price information. They had kept this in A4 display books with fixed clear page pockets. The author set about ensuring this material was retrieved from the post and made available for them. In accordance with the MD's sons instructions she separated out two main categories and then put in the updates as they arrived, having first shown them to him. He then decided he wanted it ordered in a different way but was not able to describe it. This meant that updates could not be filed for

him. They were not filed. Several months later the system was in complete chaos. He decided on an arrangement that was workable, but the author was unable to reorder them before leaving.

#### **iv. Failure in filing.**

The difficulties experienced in filing in the two young companies are due to problems which are well understood, but have not been adequately addressed in the general education system. In particular, the need for cross referencing was hardly considered in either company, but added considerable robustness to their filing systems.

'Calling out' for the name of a supplier, or a product type, rather than build and use a good listing or file, is intuitive and comfortable. Because others are involved in the choice, the individual having consulted, loses their responsibility for failing to have properly used the variety available. In 'calling out' systems, participants appear to have no awareness of the paucity of choice that results. They may have strong personal reasons for wanting to sustain that state of affairs.

Discipline and self-discipline is necessary in the successful development and use of filing systems.

The leakage in the system proved a considerable discouragement to staff in both companies.

#### **i. Ribbons: a case of the "I am an expert in this area and know all about it" phenomenon.**

The 'I am an expert in this area and know all about it' phenomenon came to the authors' attention while working at Cadbury Ltd at Bournville, which, as mentioned earlier is a site with some 9,000 employees. One member of staff was responsible for looking after the first aid aiders and the first aid boxes, seeing that they were being properly maintained. The geography of the site was highly complex. The documentation on box location was inadequate and it was not long before the author proved to her own satisfaction that the claimed full knowledge was not matched by the reality. Over a two year period a full survey of the boxes was made and the boxes numbered and their location detailed in relation to their orientation within building, room and other physical features.

The same staff member was also responsible for completing procedures associated with staff affected by possible food poisoning. here it was evident that if other staff tried to complete the procedure there were major omissions, but also that there were serious inadequacies in the

processing that was occurring, and the department was very vulnerable in this one staff member's absence. Again, eventually the procedure was analysed and reduced to three complex flow charts with a set of working forms. It was then possible even to have a new agency nurse carry out the procedure without fault.

Characteristics of this phenomenon appear to be

- (i.) the apparent confidence of the person doing the job, and their unwillingness to consider the possibility that it might not be being done adequately;
- ii. the apparent blind acceptance by other managers and staff that the job is being done adequately.
- iii. The job superficially appears to be simple but on examination involves complex information handling.

In the case at the computer megastore the job described involved the buying and selling of printer ribbons. A similar situation also concerned the computer cables. A brief note about this follows.

Printer manufacturers seem to have a powerful interest in designing different ribbon arrangements for their printers and ribbon manufacturers in selling their own brand. There are also nylon and other fabric ribbons, single and multistrike carbon ribbons and high and low density ribbons. The result is that there are thousands of different permutations and the identification information is very mixed. Where printers use an identical ribbon there may be uncertainty, and sometimes the cassette may appear to be identical but have some feature, like the high density ribbons required for 24 pin dot matrix printers. Successful batching in this context is a challenge.

At the computer megastore ribbons were stocked for the printer models that were sold, about a hundred permutations. They had variations of megastore code, brand and price information and sometimes said what printers they were suitable for. It became evident that although the frequently used ones were properly identified by the job holder there were many whose use was unknown. There were customers requiring ribbons which we might well have had in stock that were being turned away and sometimes two separate stocks of the same ribbon were being held. When stock came in there was little, if any attempt to keep ordering information associated with the goods. This was partly justified by non-family not being allowed to know how much was being

paid or where the supplies were being obtained. These justifications did not seem to be applied so vigourously with other products.

The system to overcome the problem was developed with difficulty and the author was not able to complete it fully. It involved collecting batches of information including a picture of each type of cassette stocked, on a card with a list of printers for which it was suitable, the megastore code, the 'Karma' code and unit pricing information with and without VAT (Value added tax.). The ribbons were put in 'Karma' code number order, except for a few without such number which were put at the beginning of the sequence in alphabetic order by the most suitable available name, in most cases the particular make and / or model of printer it was designed for. Two lists were then made, one in the same shelf order with the same information as the cards but without the picture and the other in printer make and model order with Karma number and price information. One was unable to chase up all the 'Karma' code and price information for some of the lesser used ribbons in the time available.

There was serious risk that while the changes were being made problems would arise from destabilisation. This was especially the case in relation to ribbons which appeared to be the same but were importantly different. The owner and job holder were kept in touch with the changes happening and encouraged to highlight problems that might be arising.

The computer cables posed a problem of a similar nature. They tended to be delivered in large quantities (in batches) and then be completely separated from specification information. The variety here concerns similar connectors that are wired in dissimilar ways as well as a wide variety of connectors and types of cable.

The main types of cable had been sorted into plastic bags and labelled by the author when it was thought to be more important to have them on display, unlabelled. It was not possible to complete a proper identification system in the time available.

The 'I am an expert and know all about it phenomenon' was nearly surely present in the yard manager at the roofing company. He put up very stiff resistance to nascent stock control system being applied to the lead. The potential was also certainly there with the stationery buying by one of the typists, but because the MD's PA checked all the orders going out the situation was prevented from developing. When she left the author took this over, and by agreement without the MD's PA checking. Back invoices were researched for useage levels and the system rationalised.



#### 4. The information leakage 'iceberg tip': controllers which emerged.

As indicated in its introduction, this case study exemplifies the controllers of information leakage, batching and classifying information. It shows how these controllers related to the achievements of the computer megastore and the roofing company. In considering the implications of information at the megastore it is worth noting that the leaked information was not collected by some other system, nor by active steps taken at the point of leakage. The information was lost permanently apart from occasional fragments, it was therefore largely not open to being recovered.

In respect to data processing there was unmeasured information leakage related to the sacking of the data processing manager, the director's departure to India and the inadequate briefing and preparation of the author at the last minute. One could say that the co-incidence of the sacking and the trip was an unfortunate accident, but on-the-spot sacking happened to the next data processing manager with no attempt at debriefing. Vulnerability to loss of knowledge of custom made routines is difficult to overcome where they have not been designed robustly with appropriate documentation and or support, the outcome of such loss of knowledge can be information leakage on a massive scale, as in this case.

The invoice processing system, beyond the rest of the data processing system at the megastore, was vulnerable to information leakage at: the terminal / printer system; the product coding system as implemented on the product and the related failure to keep pricing and coding up to date in the computer. The system suffered from inadequate planning and implementation, part of 'getting the act together' which is difficult with complex systems. In the roofing company the use of mixed manual and computer systems involving repeated transcriptions also lead to considerable leakage.

Other data base functions (customer activity reports, sales plans and forecasts, management information ...) being absent, represented large information loss in both companies. The effects were more immediately evident in the megastore, but insidious in the roofing company.

Problems of word processing represented large time loss in both companies. The policy of only leaving correspondence copies on the computer until the allocation was filled and then deleting them all resulted in loss of some important material at the megastore. There was similar potential at the roofing company.

Excessively high staff turnover accounted for considerably more information loss. Historic information, product and procedure knowledge as well as knowledge of other staff and customers is lost, especially where there is no hand-over procedure. Energy involved in recruitment and training and financial costs associated with recruitment also reduce opportunity for more productive activities. The intervention aimed to change to social context of the megastore did have some effect on the expressed values of the owner and her immediate family which should effect relationships in future, leading to the potential for being able to retain staff better. Improved people management should result in improvement at the roofing company.

The detail on filing arrangements exemplifies the controllers of information leakage again and the implementation of classification and batching. Various criteria for the 'ideal' size of a batch appear:

of file cards being not too many to re-sort quickly from time to time if users are indisciplined in returning them to the proper place (there are other possible solutions to the missfiling problem itself);

(of abandoning a file and starting a new one) when it becomes difficult to find particular contents;

(of product data sheets) when the overall volume of mixed material reached either the size of one lever arch file or were getting lost among other material.

With the ribbons information was batched on:

a card for each type of ribbon with: Karma code, unit price information with and without VAT, a picture of the cassette, and information about printers for which the ribbon was suitable;

a list in shelf order number with the same information as the card but without the picture;

a list in printer make and model number order with Karma number and price information.

In this case the batched information made a system which was easy to maintain and robust and that could be used by any moderately intelligent person without training and supervision. Having set up the system there was far greater potential for sales and customer satisfaction in this product area. Handling costs would also be substantially reduced.

The cables appeared to be suitable for a similar rationalisation, though the system required would not be parallel to the one for the ribbons because the variables and values follow different patterns.

Although it may not appear obvious from the state the various systems were left in at the end of the description here, the author believes that rationalisation of the various sub-systems so that the 'act is together' is possible. Such an act together, is relatively error free and invulnerable to staff changes. Because the system works staff tend to feel they are having success and doing a good job so benefits of job satisfaction accrue.

One can conclude from this section that information leakage, as a controller, is like an iceberg, largely unseen but highly dangerous to the system affected by it. Information leakage tends to occur when systems are fragile and vulnerable to change, in that state they are also vulnerable to error. Robust systems are likely to be relatively error free and invulnerable to external changes, (though they may suffer from inflexibility, and 'infection' by contaminated information.).

## **5. Similarities in a state bank branch**

In February 1990 the author worked as a 'Temp' in a branch of the state bank of a major 'third world' country. From the first morning she opened, and registered, all the incoming mail, typed most of the confidential correspondence and carried out a wide variety of other functions.

The author was asked to use an electronic typewriter, found the manual for it by the end of the first week, and typed umpteen copies of the 'Manager for UK Branches' address and other repetitive material.

Letter heads and forms were not designed to correspond with typewriter line spacing, or even to match each other. A4 letter head had the national language version of the branch address, but the author was encouraged to use a non-standard paper size version for most correspondence (including overseas). It had no equivalent for continuation sheets, no national language information or even the post code and country of the branch.

No masters were kept of various branch report forms. Some of them had degraded to be hardly legible. Because the photocopier was reproducing material out of true some vertical lines had migrated by 15 degrees or more.

'Irrevokable letter of credit' multipart forms must not have changes made on them. The forms were printed with UK main branch information without space designated for local branch information. The author spent hours putting X's over the unwanted and typing in the new. The variable print size and line spacing made this a suprisingly demanding task.

Stationery supplies are firmly controlled, kept under lock and key. One soft rubber is shared. No pair of scissors was found. Tippex, ruler, ball point pens, and the endorsing pad get 'borrowed' as in the two young companies. The author's functioned as a net user of paper clips but these were only available in small handful sizes, which might last a couple of days.

When asked to take all phone calls coming in to the branch only an incomplete skeleton of names, extension numbers and functions was given. Most incoming calls are to enquire the current exchange rate. There was no instruction as to where the information came from or when it was to be changed. The author went by the version on the notice board until she was told they had forgotten to tell her it was changed at 9.30 each day, further information was then forthcoming.

The dedicated typewriter word processor was standing unused for a year since no one knew how to use it, and the floppy disk was full.

## Case study F. The 'constipated computer' syndrome.

### 1. This case study shows . . .

This case study is presented here to highlight aspects of a complex information recovery problem where there are high numbers of variables and values involved. 'Constipated computer' syndrome, because the system will accept input, and allow its presence to be sensed, but fails to produce the required output.

By the time the incidents related in this case study occurred the author had owned a Superbrain computer (CPM operating system) for 7 years, a Nimbus XN system for a year, and a variety of printers, mainly using serial communication protocols. Although engineers and technically minded friends had coped with major problems, the author had got into changing over disc drives and the occasional 'chip', as well as being talked through various system compatibility problems. Also, for 9 months the author had worked in the computer megastore, with a variety of setting up, and 'trouble shooting' experience. What follows, therefore, happened to someone who is computer literate and reasonably experienced in computer DIY.

The commissioning of the Nimbus AX20 micro-system is described. On the one hand the system concerned is more specialised than commonly used home computers, and could be expected to be more complex, but on the other hand, the documentation has been very carefully designed and produced and there is the obvious intention that any reasonably intelligent person should be able to carry out the commissioning. Also, the AX20 was replacing a XN20, a recent system from the same manufacturer with many similarities.

So that the reader is not encouraged to think that the situation described is grossly untypical, a more recent commissioning of an NEC 386 Powermate computer with an NEC Silentwriter LED, POSTSCRIPT compatible printer with a multi-bin feed and using Microsoft WINDOWS, Microsoft WORD, Xerox Ventura, a communications package and modem has taken over six months to commission (Stewart 1989). Although some of the time has been taken up with designing and setting up styles for printed output, considerable time has been taken talking to hardware and software manufacturers about functions which were said to be available but could not be made to operate.

If, as one commentator claimed, nearly 20% of computer buyers never get the equipment out of the packaging and many more never get to the stage of using their computer in any substantial

way the 'constipated computer' syndrome must be partly to blame. This case study tells the early part of the story of setting up one micro-computer system.

## **2. The micro-computer system.**

The brand new replacement computer arrived. The Nimbus XN20 was to be replaced with a Nimbus AX20 and the 3.5 inch and 5.25 inch floppy disk drives, monitor, mouse and 'windows' software to go with it. Before replacement verbal checking was made that the author would be able to continue with the programs and data she was using, that it would have 3.5 inch and 5.25 disk drives and that one would be able to use fully compatible IBM PC programmes and that there should be minimal disruption of the work programme.

On examination, the 3.5 inch disk drive was in a separate box and needed to be mounted in the computer. Initially the computer was set up without it.

### **a. The monitor.**

Without a working monitor one can use the computer but the feedback modes are limited, and in this case, at that time there were no cables to printer or other computer.

The instructions about monitors for the Nimbus X series computers are quite detailed (24 pages). Monitor information however did not indicate whether what had been supplied was a TTL one. Various checks for other possible monitor specifications were carried out before carrying out what turned out to be the most complicated of the choice of set-up procedures. Two paragraphs explain about the monitor 'jumper' and one is referred to a whole page 'about jumpers' if required. The procedure for getting into the computer, removing ribbon cables (if necessary) and moving the jumper with "your fingers, a pair of long-nosed pliers, or a pair of eyebrow tweezers". As the jumper is located at the bottom of a 3" deep narrow hole it was fortunate that the authors' tool kit contains long-nosed pliers. One was supposed to remember which way up the jumper was fitted and be sure to fit it the same way up. This one seemed to look the same both ways so special effort was made not to drop it to avoid risking a change.

The manual said that with TTL monochrome monitors the Nimbus AX cannot be used in Nimbus PC mode. What did that mean in terms of expected compatibility? The author didn't know, and it was not obvious from the documentation. The new system was expected to run as a PC. The software installation of the monitor was concluded satisfactorily.

The computer and 3.5 inch drive was taken to a computer engineering friend to install (±20 + 20 miles and the authors' time). The author then set about getting cables to communicate with printer and other computers.

## **b. The cables and printer.**

The serial port on this machine has a 9 pin D male plug. The author's computer engineering friend had a 9 pin to 25 pin converter and the author a programmable cable programmed (using the wisdom of three engineers, and diagnostic equipment, by the leasing company after taking computer and printer the 15 miles to their depot) for an IBM XT computer to the TEC Star (C Itoh F10/55) serial printer. Wanting a permanent solution the author spoke to the cable manufacturer who supplies the computer megastore, who eventually said they only made bulk cables and could not do these specialist ones.

(The megastore cable buyer had insisted on such specialist supplies from this supplier without consideration of the suitability of the suppliers operation for the purpose, and apparent unwillingness to solicit or receive feedback relating to discomfiture at demands being made. This was especially noticable in failure to attempt to quote the megastore's reference number to suppliers "They should know that!")

The next distributor wanted lots of details from the various operating manuals, a presumably reasonable request but the manuals don't put it in the form they wanted it. Research Machines 'Tech Support' took details and said they would write. The author then tried to connect the 9 to 25 pin converter to the cable - both had male connectors.

Manuals, cables and connectors were then taken to Inmac. They supplied a male to female converter and an AT cable, which was understood to be a serial one. A hot line number was given for any further cable questions where the author was assured they have details of most computers and peripherals.

The converter was assembled with the other converter to cable (sticking out 9 inches behind the computer, an unstable and mechanically vulnerable structure) but after extensive efforts at configuring computer and software one could only get minimal response from the printer. Another computer expert agreed to come and get the communication to the printer going on Monday evening. However, on Monday morning Research Machines 'Tech Support' talked the author through re-routing the printer commands through the serial port and 'Yappari' it worked, though after several days the author kept getting 'printer error' messages and lost an important document en route.

After connecting the printer the Inmac cable was examined to see how that would connect from communication to the other computer(s) only to discover that it was a parallel cable and the ports were serial ports. It was put on one side for return to Inmac. However the author was reassured that it was the right cable, that it would function in the same way as her converter, converter, programmed cable either as a printer cable or as a communications cable and that the parallel, serial distinction was just confusing. It worked, for the printer anyway, but have not yet been able to try it for the other computer because of software incompatibilities. There were however, many more printer error messages which were eventually cleared by changing the protocol on the computer and cancelling it on the software.

### **c. The keyboard.**

The keyboard did not greatly contribute to the 'constipated computer' syndrome. However the escape key is placed in top right hand corner of the number pad rather than out beyond the 0 on the Qwerty board. The <HASH> is next to the backspace rather than near the <ENTER> or above the 3. (One uses the hash to get a <POUND> sign printed rather than alter all existing text files and the software control of the keyboard.) As a result some mistakes were made reducing efficiency in communication.

The keyboard could not be blamed for problems arising from delete modes in various different software protocols. A variety of such problems arose in connection with using different software or software differently installed.

### **d. The Mouse.**

Behaved perfectly!

### **e. Disks and disk drives.**

The disk drives were configured A: (5 1/4") B: (3 1/2") C: (Hard disk). One wondered how to do 'DISKCOPY'. Weeks later discovered that the drives can be configured eg A:/B: (5 1/4") D:/E: (3 1/2") C: (Hard disk). In the mean time high density 5 1/4" floppy disks had been purchased, and just as well. The 5 1/4" drive would read the double density floppies but refused to do 'DISKCOPY' on them or format them. There appeared to be no instruction in the manual to cover the case apart from using Nimbus PC mode which was not possible with the TTL mono monitor. Research Machines representative was less than thrilled when need to used Nimbus PC mode was explained so that the existing disks (and software, (see below)) could be used. He agreed to



come and talk through the problems with the machine. Before that happened part of the tale of woe was related to the authors' computer engineering friend who said that 'FORMAT A:/4' would probably work to format the discs. It did. 'DISKCOPY', however will not work for the double density floppies, a time wasting inconvenience that adds considerable potential for copying mistakes when making backups of programme master disks with subdirectories requiring all files present in the right place and order as the 7 set Advanced Revelation does (see below). Use "... diskcopy ... Don't use Copy\*. \* ..." (ICS 1988)

One had visions of the 150 odd double density disks being US but worse than that, not being able to provide double density disk copies of the development work for people with PC's. Although that eventuality does not appear to be the case it does appear that only new disks, or totally demagnetised disks, that have been formatted on a high density drive (preferably this one) should be used for preparing such disks. The narrow write head is said to clear an insufficiently wide path of previous data for a wider read head which then reads a mixture of new and old data.

Once the 3 1/2" drive was installed it worked alright... Until two weeks later when that refused to format disks and was erratically leading to read and write errors. One important disk was corrupted in the process while trying to change drive which it wouldn't do with an unformatted disk.

One more constipating effect in relation to the floppy drives: If one logs to a drive which doesn't have a disk in it the computer 'hangs' offering 'Abort Retry Ignore?' until it is fed. Depending on the software being used at the time this may be a safety factor because it may specifically require to be fed with the disk it was using, but equally if one has put that disk well away, or can't remember which disk was last being used putting whatever is in the workspace at risk by needing to reboot the system.

**f. The software.**

When first trying to use this computer the 3 1/2" drive was not installed. Main programs and most recent data was on 3 1/2" floppies. Where programmes used on the Nimbus XN were on 5 1/4" disks they had been put there before obtaining the 5 1/4" drive for that machine and had been uploaded via a Superbrain and communications link using Kermit. Ah, Kermit! Kermit for the XN won't run on the AX, nor with XFERCPM. Research Machines representative was unsympathetic about these as one should not expect to run Nimbus software on this machine which is supposed to be downwardly compatible. (It is if you have the right monitor.)

Trying to get a functional word processor was hard work. Microsoft Windows was supplied and already installed on the hard disk. One tried using Word, the word processor within Windows. It allows for the import of ASCII files so one tried with a Spellbinder file, noted for being straight ASCII strings. Carriage returns appeared as a bar. There appeared to be no instruction for searching and replacing characters that aren't offered on the keyboard, and one wasn't about to spend hours doing it manually, especially when it is likely that Word will put its own special characters in to remove when working in Spellbinder again.

The main reason for getting the Nimbus XN20 was to run a data-base as a data-base and not as word processing files. It is possible that with a PC board the XN20 would have handled the right software, but with its total unreliability, and the uncertainty of software which was going to be right for the purpose one had continued word processing. Now with the right computer and the right software all would be well, rapidly. The author would load Advanced Revelation and it wouldn't be long before it was developed for the database and was up and running. (see below.)

Once the 3 1/2" drive was installed one could use ones own familiar software. There were the usual hurdles of installation which were gradually overcome.

There have been loading problems. Advanced Revelation wouldn't load properly, though it seems to on other machines. The software was blamed and the distributor encouraged this by failing to give good feedback. After over a month a diagnostic programme supplied by the distributor locked or crashed out at least twelve times. Research Machines then discovered that the machine had been set to Mode 1 instead of Mode 5 which was said to mean that memory available memory could not be accessed. The remaining loading problems were sorted out for Advanced Revelation, though other generally available PC compatible programmes have not loaded and run, neither would the Advanced Revelation PR disc.

### 3. Difficulties of information recovery where high numbers of variables and values are involved.

The tale of woe above has been presented specifically to highlight the difficulties of information recovery where there is complex information with high numbers of variables and values.

On the one hand there are the communication complexities relating to the input and output of the computer and the many points where failure may occur, and these are analagous to communication complexities in many situations of information recovery.

On the other hand, in experiencing the frustration of the experience related there was awareness that by having a wide repertoire of access points to problems with commissioning the computer any given problem was unlikely to act as a complete block. Also, as the author worked through one part of the problem other parts become more tractable.

This 'wide repertoire of access points to problems' seemed to relate to the notion of the relative robustness of information. This both from the problem solvers' orientation where the problem solver has a robust network of alternative strategies readily accessible, and also from the problematic systems' orientation where the complex information within the system is in some kind of network of relationships even though those relationships may be unknown in detail to the problem solver.

To say that "computers are very unforgiving" (Elstob 1989) is to express in anthropomorphic terms that unless a protocol or setting is exactly right for the computer the information due to pass that point will be completely cut off or corrupted. The computer will seem to make no helpful effort. In most computers there is not been sufficient redundancy to allow adequate by-passing of protocols and settings by alternatives.

#### 4. Controllers contributing to 'constipated computers'.

Variety seemed to be the key controller in the constipated computer syndrome. Variety of protocols and specifications of monitors, cables, ports, drives, printers and printer ribbons all contribute. Manufacturers desires for exclusive designs contribute substantially to the variety unnecessarily.

Missing information proved to be an important controller, even in apparently well designed documentation as follows:

- the missing information about the type of monitor supplied;

- the implications of the Nimbus mode not being available;

- the lack of instruction on the way to format the double sided double density floppy discs;

Poor design features, ie the appearance of the jumper and its location down a 3" deep narrow hole, contributed marginally.

The available repertoire of access points to a problem also acts as an important controller. The variety of potential input and output routes and methods enabled the bringing of the system under control more easily than would otherwise have been possible. A functional monitor was a key output device in this system

Since writing up this case study the author was present when the computer network was installed at the roofing company. A similar report of 'computer constipation' could have been made about that, even though an 'expert' company was commissioned to instal it.

### III. Apologia: making connections between the mundane and practical, theoretic and general applicability.

The purpose of this section is to sketch detail from the case studies and appendices. This sketch is to show how what is related is not mere common sense, that would be carried out by any well trained administrator. The breadth of the case studies and appendices is too wide for that. Highly reputable organisations like the British Standards Institute (BSI), government agencies like HMSO (Her Majesties Stationery Office) have contributed their examples, as well as young businesses a massive State National Bank and a Mission organisation operating for over a century. The author could name many more. Common sense is necessary, but why does it seem to be applied so rarely in the kind of complex systems described.

The crisis of having information 'messes' all over the place is made worse by 'high tech', since this technology multiplies the variety available. The technology forces the information into formats which are different from those in printed information and may or may not be more suitable for any given use required. The purchaser or user of the 'high tech' system may be made to feel totally inadequate. The massive investment in money and time may never be paid back. The solutions are often contorted by the limitations of the software and hardware. For example "Desktop publishing has brought chaos to organisations large and small" (Which computer? 1989). There are, however, some glorious successes too. The appendix 'about online information' highlights some of the success and failure of massive information systems.

This thesis does not set out to answer all the issues in the 'world' raised by the case studies and appendices. One aspect which IS examined is 'information recovery' and related concepts. The author would not be naive enough to suggest that 'information recovery' is the whole story.

Information recovery is one factor in the understanding the case studies and appendices, but by no means the only one. Education, training, experience, supervision and work study clearly have their place. There is clearly need for the job of information recovery to be done properly, and far too many organisations and individuals have not got it right enough to be effective.

Most management consultancy has been said to go wrong because consultants assume people are competent and can make things work (Elstob 1989 31/1). A majority of scientists would probably

not want to think that the level of bumbling in administrative systems, as described in these case studies, exists. It would be embarrassing to many to think that science could be needed at such an earthy level.

The very earthiness of the contexts makes the ideas appear to not be very earth shattering, but like so many situations where there is a high rate of repetition, even a small improvement in efficiency can produce massive savings accumulatively. It is worth bothering because a large proportion of the administrative world is in a mess, and many people working in it do not see it. The examples are a sample taken from one persons' working life, but that has been in very varied contexts. Other examples could be given from that same one lifetimes' experience.

The author is not claiming high originality for the type of general observations. However, the fact that in spite of education, training, work study and other techniques, high quality administrative practices are so rarely practiced, points to the fact that the problems are worthy of cybernetics analysis. Cybernetics analysis is ideally suited to large, complex and general systems problems.

It may be that administrative training and education is a large component of what is needed. However, more guidelines are needed in coping with information recovery, not least to enable recognition of major and fundamental contributors to its success or failure. Giving a wider context a listing of concepts involved in information science, and relevant to the education of professional information handlers, is included as an appendix.

Human characteristics of learning, memory and recall which are especially relevant to 'asnegsist' and 'the way in' feature in the case studies, and later in the material on readability are covered within the thesis only in a diffuse way. Some are more clearly shown in the appendix 'Reporting and under-reporting in health history taking'.

The chapters in this section deal with evaluation of the case studies, the unrecognised aspects of information work highlighted by the case studies and, finally, the systems phenomena of information handling being displayed. There is a final summarising section at the end of each of the chapters.

overlooked at great cost. It is characteristic of failure of vision that the sufferer is reluctant to admit the extent of the problem even to themselves\*. As a response, the variety of case studies, and the multi-layered contextualisation is provided so that the observer will indeed see.

\*The author saw a patient coming into the medical department with obvious problem with one eye. She asked how long there had been a problem and eventually it emerged that the vision had been lost in it for at least six months, but not acknowledged. The tumour causing the problem was still contained within the eye ball and was removed satisfactorily.

The appendix 'A cybernetics example: a developing paper' gives another practical example of a cybernetics method for divergent, creative thinking which has been used in this research and can also help in improving vision.

**4. The case studies provide valid observations which are clearly identifiable. They are objective and rigorous.**

The purpose of presenting a thesis is to make a community of scientists and thinkers think differently by rational argument. A PhD thesis must refer to substantial empirical studies and usually that will be achieved by experiment. A series of case studies from which the critical reader can clearly identify the validity of the observations can be equally objective and rigorous. The post script case study utilises theory arising from the earlier case studies. It includes survey of demographic, objective as well as highly subjective matters relating to spiritual understanding. It shows the practical nature of results which can be obtained from applying cybernetics concepts, and the concepts which emerged in this thesis, in the real, complex, world.

**5. The case studies provide a platform for displaying concepts and clarifying them.**

To use one example, the concept of batching is introduced in a mechanical context in the 'spud bashing' study, it is developed and shown to be relevant to information handling in relation to the subscription records handling, and it then appears at various stages in subsequent studies. The concept becomes clearer as the studies progress.

## **Chapter A. Evaluation of the case studies.**

Evaluation of the case studies is necessary because the reader may have been tempted to think that what was being reported was so mundane, so easy to identify with, that the space taken for them in this PhD thesis is hardly justified. This chapter attempts to clarify what they are not and what they are, to show their validity.

### **1. The case studies are not action research projects.**

The case studies are not reports of action research projects, though they have some features in common, not least in that interventions were made and results observed. The case studies were not 'set up' with research protocols, research statements producing 'clean' data which could easily be collated and analysed.

As a result the outcome of the case studies, apart from bringing about change in the situations observed, is a series of vignettes which the reader can identify with to a greater or lesser degree. Having identified with the observed situations and noted in a new way controllers which were active in those situations, the reader is in a position to look at those controllers in a more detached and general way. The reader can then be introduced to the wider applicability of the controller and what may happen when it is manipulated, leading on to seeing and developing their own examples and interventions.

### **2. The case studies are not detailed descriptions of work places.**

The case studies are also not detailed descriptions of the different work places. They include only the components which are directly relevant to displaying the controllers of information handling. They are not intended to be exhaustive even in displaying such controllers.

### **3. The case studies are designed to stimulate observation, overcome functional failure of vision.**

The case studies, including the post script study, are designed to activate people's unseeing eyes, to help them realise that in the very common and mundane, important features are being



6. The case studies are designed for a good read, but are there to demonstrate a variety examples.

The case studies are designed to make a good read, but in no way justify their inclusion in this thesis on those grounds. The variety of case studies included is to demonstrate that there really are lots of possible examples. Others make a considerable contribution on which later ones have fed.

7. The evaluation summarised.

This chapter had attempted to clarify what the case studies purport to do, and not to do. It has explained that the case studies were not set up as formal research projects, although the later ones contain reports of interventions made and results observed as in action research. The objective of the case studies is to help the reader identify certain controllers of information to enable them to look at their wider applicability, leading to developing other examples and interventions.

The case studies were shown not to be detailed descriptions of work places, including only components directly relevant to information handling. Rather than being exhaustive they are designed to stimulate observation. To this end a multi-layered contextualisation is provided to enable the observer to see clearly.

The case studies provide valid observations which are clearly identifiable. They are objective and rigorous. They are intended to cause a community of scientists and thinkers to think differently by rational argument. Clearly identifiable and valid observations from a series of case studies can be as objective and rigorous as an experiment. The post script study utilises survey results and demonstrates the practical results obtainable by applying the cybernetics concepts developed in the thesis.

The case studies have provided a platform for displaying concepts and clarifying them. They are designed for a good read but justify their presence by demonstrating a variety of possible examples.

## **Chapter B. The many unrecognised aspects of information work.**

One only has to look at major information science databases eg ISA; LISA; to see that information work is being widely researched. The volume that is currently being concentrated on information retrieval is referred to in the early chapter 'Where does 'information recovery' come into it?

One might say that hypertext is the solution. High powered computer systems with access to multiple media enabling the user to merge information in verbal, graphical forms as well as sound and in some cases even smell and kinaesthetic sensations. Such information systems are powerful and of great interest. Hypertext too suffers from similar problems relating to concepts of 'information handling' developed in the case studies. In some senses it is more restrictive since the recyclability of its components, the ability to reuse them with the modifications humans like to make from prototype to reality will only work if the prototype is designed in a way compatible with the modification strategies available. This requires considerable understanding of the way the computer programmes work and is beyond many users. (cf Durham 1989 p27)

Perhaps digitisation is the real solution (cf Science Now 1989 30/12; 1990 3/1). Digitisation is making possible the storage, copying, and utilisation of graphic and sound material in magnetic form alongside textual material. This reduces the forms of storage media required for different types of material and ultimately will make those materials available and accessible to many more potential users. The Japanese made recordable CD ROM was suggested as being the contender for multi media recording in the domestic market in the 1990's (Science Now 1990 3/1). Again, the concepts of information recovery require attention if the full potential is to be realised.

The portability of personal telephones likewise has tremendous potential for access to information. Although its cost, and threat to civil liberties by precise location of caller and respondent etc. are potent controllers. (Science now. 1990 3/1) The concepts indentified in this thesis are relevant to this technology too.

### **1. Information recovery.**

The author rejected 'information retrieval' as being too restricted and called the expanded concept 'information recovery', because of what it can do. 'Information recovery' is critical

in how we act in working with and developing all sorts of information systems, and those information systems which support what we think is important. Recovering information is significant for effective action. Far too often it cannot be done because it was not designed in. Action is far too often inappropriate, wrong, because the right information is not available or not recognised as being required for future use at the right time. We must start at the right point.

Information which becomes available and which needs to be conserved for future use must be put away somewhere, or key components of it, so that it can be retrieved, or reconstructed. If all the retrievable type of information or its key components, is adequately stored it is available for retrieval or reconstitution there will still be need for 'recovery' since all the requirements could not be imagined, and in any case reconstitution is a 'recovery process' rather than a mere retrieval one. The Vickery's TOME online searching system (Vickery; Vickery 1988) ultimately fails for this reason. One can only search with it for concepts which have been determined in advance.

Information is only valuable if it is available in the right place at the right time for the right person and recognised. The case studies and appendices contribute to understanding how that can be achieved.

## **2. Robustness and batching.**

The author is not claiming that robustness or batching and dynamic classification are entirely new concepts. They have not been fully acknowledged or faced up to in a coherent way in relation to the variety inherent in information processing. As a result there has been a lack of methods to identify the need for them and a relative failure to use techniques which will bring about the benefits that can arise from them.

## **3. Information leakage.**

Information may be allowed to leak away to waste so it is no longer there to retrieve. This concept is not entirely new, though the name 'information leakage' is. Observations of the phenomenon have been informal and undisciplined, and as a result massive information loss can occur without being observed.

The concept is introduced and several examples are given in the case studies.

#### 4. 'Asnegsist'.

'Asnegsist' (as good as if it didn't exist) has been identified previously but not named. Innominate it has been insufficiently recognised and taken into account in teaching and by other measures to overcome it. The case studies again give concrete examples from which the concept can be perceived.

The insights from the appendix 'Reporting and under reporting in health history taking' give some idea of mechanisms of memorisation and recall that may be involved.

#### 5. The 'way in'.

Good book designers have known about the 'way in' but not with that name. The best architects of public libraries and similar buildings have known about the 'way in' and applied the principles in their designs. But until now there has not been the development of a concept of the 'way in' where the general principles are identified and displayed for application to a much greater variety of systems which contain complex information, which is to be available to a variety of users, with differing purposes. There is no strong example of 'way in' in the case studies so far since the concept was only beginning to emerge at the time. The more relevant parts of the work out of 'way in' is presented in the post script case study utilising the other concepts from this thesis.

#### 6. What is it that has been recognised?

This chapter has shown that in spite of all the research that has gone on there are very basic controllers of information handling which had not been recognised. The definition of 'information recovery' and delineation of its borders brings into focus a major area of difficulties which had not be well recognised.

Key partially or completely unrecognised concepts delineated include:

robustness and batching and dynamic classification;

information leakage, where massive information loss can occur without observation;

'asnegsist' where what is proximal can be completely overlooked;

the general principles of the concept of 'way in' applicable to systems like organisations and organisms as well as books and public buildings.

These concepts are worked out in more detail in the theoretic themes in the next major section.

**Chapter C. The emergent concepts are the systemic characteristics of information handling which are being displayed.**

If systems show characteristics, those characteristics are a systemic effect, and the systems themselves replicate or maintain those effects. (cf Elstob 1989 31/1) Systemic effects are systems phenomena and are worthy of study using the tools of a systems science on those grounds.

The case studies and appendices demonstrate a range of systems phenomena, the emergent concepts. It is therefore very relevant to study those phenomena using cybernetics, a systems science 'par excellence'. What follows in the rest of this chapter summarises the concept of 'system' and 'environment' which is implicit both in the case studies and in the following theoretic discussion. It uses examples from the case studies in its explanation.

**1. System.**

In this section the author provides one cybernetic definition of system which has utility for the purpose of this thesis. Towards the end of the section contrasting examples are given to clarify the definition. A brief survey major possible definitions of system is given for comparison and contrast.

**a. The system and its environment is here defined cybernetically.**

In referring to 'the system' here, the author is using the term cybernetically. This means that the system is any combination of entities interacting together in some way for some purpose (whether the purpose perceived by the entities themselves, or an arbitrary one of the observer). 'The environment' of the system is any other entities (including forces) which impinge upon the system and affect its behaviour in any way.

So, by this definition, 'the system' is not a combination of entities interacting together if there is no purpose perceived. It is only the entities directly involved in the interaction.

Entities, including forces, which do not impinge upon the system or effect its behaviour in any way are not part of 'the environment' of the system.

For example: In the first case study, one could identify the system as the operator and the potatoes, the environment would then be such things as the potatoe peeling machine, the water, earth and debris on the potatoes and so on. Alternatively one could identify the system as the potatoes and the potatoe peeling machine, with the environment being anything that materially affected those in relation to achieving adequately peeled potatoes in good time and without waste of other resources.

This way of defining the system is dynamic. The system changes according to the purpose and perspective of the definer at any given time.

#### **b. Alternative definitions of system and environment.**

The above definition of 'system' is consistent with that of Ashby who states that a system is "any set of variables 'the experimenter' selects from those available of the real 'machine'" (Ashby 1960 p16) and that of Tung who states that a system is "a set of things which have some relationships." (Tung 1983 p23)

Ashby quotes Pavlov concern about the dynamic characteristics of systems, he said "Every material system can exist as an entity only as long as its natural forces, attractions, cohesion, etc. balance the external forces acting upon it. ... Being a definite circumscribed material system, it can only continue to exist so long as it is in continuous equilibrium with forces external to it." (Ashby 1960 quoting Pavlov 1927) Pavlov's implied definition of system here is more like the author's understanding of organism or organisation, where both of those are systems, but not the only types of systems.

Beer identifies three stages of a system (1) an assemblage; (2) "a pattern in the set of relationships concerned"; (3) a purpose served by this arrangement"; He also states that there is a boundary and environment, and that there are relations between the system and its environment. (Beer) System, as used by the author would include these features.

'Systems analysis' is concerned with systems which for the most part appear not to be organisms or organisations per se. Sowa says Systems analysis "is the task of analysing some aspect of the world to determine meaning postulates. In AI (Artificial Intelligence) systems analysis is explicitly called knowledge engineering." (Sowa 1984 p18) The emphasis in these definitions is slightly different, but they are not inconsistent with that of the author above.

In epidemiology the environment is factors which interact with the host (patient) and the agent (the causative factor, organism, chemical etc. where there is one, of a disease state). The epidemiological environment would include other people and organisms (including animals). The 'environment' the current political football, where it appears to be any part of the planet or beyond that has potential to effect the life and wellbeing of humans and animals. It appears that for some it does not include other humans and animals, though it clearly does include their waste products.

Environment "... generally the physical surroundings of an object or area ... the natural surroundings of an organised human society, taking account of the effects of that society, reflected back on to its population in both quantifiable and subjective matters. It is recognised that civilisation implies consideration for all natural objects, living or not, and their interactions." (Collocott et al 1974)

In epidemiology and politics the use of environment is not altogether inconsistent with the author's use, but many people familiar with these uses and their general rather vague definitions might be expected to have difficulty with the more precise cybernetic definition, especially where it is applied to a discrete, local situation.

Identification of the system and its environment for any given purpose can have far reaching affects on the effectiveness of the study outcome. The system and its environment may be redefined many times as the purpose and research develops.

Examples of system and environment in the case studies include:

The case studies themselves:

(A) "A mucky wet job spud bashing."

Purpose: examining ideal batch size of potatoes to put through the peeling machine

System: (might be) the process of preparing the potatoes including the potatoes themselves as units of given size, the machine, the water used in the machine and the author as employee with task of producing peeled potatoes within given criteria.

Environment: (ought then to include) other people (mainly staff) whose attitudes and actions caused the author to react in relation to the process, but NOT other staff or consumers; hydration of the potatoes (affecting their flacidity) and their newness, tools (other than the potatoe peeling machine) for cutting or eyeing the potatoes, the general state of the drain with or without a collection of vegetable debris occluding it and so on.

Heat, light, ventilation and other physical aspects of environment would be part of the environment of the system ONLY to the extent that they potentially impinged on the author and altered her perception of values and priorities relating to the process, of the potatoe peeling process in the machine.



NOTE: a newcomer identifying this system would be very likely to overlook the flacidity of the potatoes, as well as other significant features.

(B) The author learns values of batching and interfiling.

Purpose: optimising the procedure for handling letters recording journal and donation information and creating a reference and progressive archiving facility.

System: (might be) the letters received from the Secretary, the author as employee with task to have donation and subscription information appropriately recorded and letters available for reference within certain criteria, the filing facilities

Environment: (would include) the Secretary, the permanent office staff member, the journal subscription records. (would NOT include) the lighting, heating and so on, because the author decides that for the purpose of the particular study they are irrelevant.

NOTE: in the actual situation the author did get the local lighting substantially improved with considerable perceived effect on productivity. However, lighting is not in this system / environment definition by choice as it might be expected to affect a good or bad system similarly until the basic procedures are sorted out.

(C) Information for the occupational health nurse.

Purpose: to examine location of a standard

System 1: the information along the search path of the nurse, the nurse herself and her perceptions.

Environment: (could then be) the locations or formats where the information is held and people who facilitate or make the search more difficult.

System 2: the clinical testing program, the nurse and her professional contacts, the research sources.

Environment: (might include) the nurses' own and her advisers' preconceptions and research patterns, money paid for subscriptions and access to the information.

(D) RESOURCES: an attempt to improve on the sources of information guide.

System: (as developed within the case study) the preliminary data collection, Gauvain's texts, the RESOURCES database and sources of information journal as well as the author.

Environment: (would include) all the other factors mentioned within the study which impinged upon the process of improving the information guide.

(E) The computer megastore and the roofing company: information leakage in young businesses.

The emphasis of the case study is NOT on the kind of company or its products, so they are NOT important for system and hardly even for environment.

Purpose: report the nature of an interesting problem.

System 1. the data involved in accounts processing.

Environment: the computer system including processor, printer, reset button and 'D' connectors, data processing personnel and director.

Purpose: report how a collection of factors can adversely affect a work procedure.

System for 'Word processing': the 'BOS writer' software on the mini computer, the secretary, the author, the remote printer needing hand feeding etc.

Environment: (might include) the disabled (CONTROL) key, the way BOS writer had been set up, and the lack of documentation of those details.

(F) The 'constipated computer' syndrome.

Purpose: to highlight the complex information recovery problem in setting up the computer associated with the large numbers of variables and values.

System: (might be) the parts of the computer and peripherals relevant to input and output of data.

Environment: (might then be) the author, tools, information and skills that were involved directly in the process of getting data in or out.

NOTE people might be moved up to be considered as part of the system and more people brought in as part of the environment.

(G) Information recovery from a complex system.

Purpose: to demonstrate how the 'way in' to an organisation may be analysed.

System: St Johns church incorporating its goals and purposes.

Environment: anything which might impinge upon the church affecting its ability to achieve its goals and purposes.

## 2. Variety in the environment including the systems within it.

This section is intended to show that both in 'systems' and their surroundings, 'environment' there is variation, a selection of variables and values. In cybernetics, those variations, variable and values are often referred to corporately as variety. The word 'variety' is used similarly to the way it is in normal speech, but in cybernetics variety may be observed in a far wider range of contexts than usual, and is the subject of interest and research.

Some examples of cyberneticians' use of 'variety' are given to show the breadth, scope and utility of the concept. An example the author used to demonstrate the variable perception of variety among students is reported, and some of the implications of the characteristics which emerged are pointed out.

Using the term 'environment' without reference to any specific system, Beer says (Beer 1985 p22) "... the variety of the environment" (the information in it) "greatly exceeds that of the operation that serves or exploits it" (the system, organism or organisation), "which will in turn greatly exceed that of the management that regulates or controls it." Put in other terms, Beer seems to claim that the possible number of states of the environment of any system, organism or organisation is far greater than the possible number of states of its management system.

Later, (Beer 1985 p29) he says "The problem of management itself ... is that of regulating ... variety ... (it is) the essence of viability." In other words, the viability of a system which is being managed depends on the management being able to effectively regulate the variety of the system.

The above statements by Beer will be taken as they stand without prejudice to the view that the variety that exists is a property of the system used to perceive it. Continuing the example of case study one, with the system defined as the potatoe peeler and the potatoes, the casual observer would not perhaps observe that potatoes change their consistency over time, whereas the experienced operative would know that not only the age of the potatoes but also their water content (perhaps not specifically by name, but by observing their crispness and flacidity at different times) affected their consistency and was material in determining the optimum time in the peeler and the amount of water required.

"Out of observed chaos, perception of complexity (ie of 'order')" which must have some connotation of 'variety' and 'information' (Hibbs) "is a function of intelligence applying a paradigm to the observations." (Banks 1988 p7) or, to put it in other words, the variety which is observed is not some absolute, finite and measurable amount. What is observed is dependant upon the observing intelligence, the concepts that intelligence can handle and the language it uses to separate the concepts out.

If this is the case, one can think of the 'management' of an organisation as a corporate observing intelligence, with a corporate language to describe the concepts of the organisation they manage. They are ignorant of what they cannot conceptualise, so for them it does not exist. This leads to the concept of the perception of the management determining the complexity, as opposed to chaos, of the system they manage. So one can say 'The variety you can perceive is, at one level, the variety that exists' and to that extent could not exceed what is perceived.

To go back to Beer's point, the inherent variety of the environment of an organisation, is far greater than the operation serving or exploiting it, or the management which regulates or controls it. But, the success of management in regulating that variety, is closely related to its viability as an organisation.

'Aspects of perception' was an educational activity run by the author with the aim that the student would know that any given item of reality is perceived differently by a given person whenever it is perceived, due to factors internal and external to them, and that this factor should be taken into consideration when teaching. Several examples of different perception were given including a series of photographs taken from the same window, where time of day, season and weather conditions produced surprising variation.

One main example was some pressed leaves which were laid out on a square white area on the carpet in as free a way as possible. Students were asked how many sets and / or variables and / or values they observed, and were asked to name as many sets / variables / values as they could. Later the students got into pairs to see if they could generate more ideas, and then into larger groups. Findings included those from three groups as follows:

(1) Domain: flat things;

Sets: leaves, cloth, carpet;

Variables: natural, man made, on the carpet, off the carpet, upside-down, rightside up, distribution;

Sub-variables: length, width, flatness, roundness, pointedness, colour, number of colours on each leaf, size, amount of stem relative to plain area, type of veining, sameness of colour within each leaf;

Sub-sub-variables: amount of points, different colours;

Tree: deciduous, flowering;

Flower: prehistoric (cyclamen). "I have started on a classification - but it has no purpose and is therefore very difficult to proceed." (A gem for the purpose of this thesis).

(2) atoms, molecules, folds, shadows, photons, elements.

(3) Set (The green heart-shaped leaf), (Leaves of the five pointed variety);

Variable:

physical location: on the ground, in the trees;

seasonal associations: autumnal vs the rest;

distinctivness of pattern: visible veins on the rest.

The results from the second group were entirely different from those of the other two groups which only overlapped roughly. The variety reported was very much a matter of perception, even surprising the author.

In general, we humans have problems because the variety in the environment of the systems we deal with is greater than we can handle, or even perceive. We fail to recognise the degree of change in perception that we can experience.

Regulating or controlling variety is a task of managing. Choice available to the individual, organism or organisation is directly related to the degree of successful management of the variety which is accessible.

### 3. What this chapter has shown.

This chapter has shown what a system and what its environment is, as used in this cybernetics thesis. Examples of system and environment are given from the case studies. The chapter has shown that where systems show characteristics those characteristics are systemic effects. In this thesis the concepts which have emerged in the case studies are systemic effects of information handling which are being displayed.

Explanation is included of the cybernetics concept of variety in the environment, and the systems within it. Again, examples are given.

#### **IV. THEORETIC THEMES ARISING FROM THE CASE STUDIES.**

The chapters in this section are presented to:

pull together the notions from the case studies and introductory material;

to locate the notions in relation to existing knowledge from various disciplines;

to show how the notions have general applicability.

The whole division develops theory which is illustrated by case study material.

## **Chapter A. A notion of robustness and batching: successful batching converse to leakage.**

This chapter develops the notions of robustness and batching. It also presents successful batching as converse to leakage. The chapter is divided into five main sections.

In the first section robustness and batching are set in the context of variety, and the need for reliability as a component of robustness. Batch and batching is also introduced here.

The second section examines the excessive energy or massive redundancy required if excess variety of information (which may just be inadequately batched information) is to be handled. Classification and batching are discussed and differentiated before ability to classify and use classification systems is identified as a natural and major means of coping with excess variety. Learning theory is related to this concept as is the way humans and other organisms use attenuation of variety of information by using classification as a basic and essential function.

The third section shows how information, of assessed validity and reliability, is made more robust by batching which attenuates the variety and reduces information leakage. One sub-section shows how robustness is promoted by error detection arising from multiple derivation and a second sub-section how the triangular form contributes to robustness of the information. Example is given of application of the theory in a directory of organisations.

Moving forward, the fourth section proposes that ability to optimise batching by effective, dynamic classification is a criterion by which the success of an organism or organisation can be assessed. This batching attenuates variety, in some cases 'heavily'. The following sub-section discusses whether this 'heavy variety attenuation' is a tool or a shackle. Using the example of habit the pros and cons of attenuation are briefly debated. An information model of business is proposed as a logical outcome of the theory in this section and the section concludes with some examples in buying.

The fifth section closes the chapter with discussion of the role of computers in batching and the robustness of information discussed earlier in the chapter.

### **Section 1.. Robustness, and batching in the context of variety.**

Holding a measure of robust (cf glossary), reliable (cf glossary) knowledge is essential for organisms or organisations to be able to function effectively. If this were not the case the volume of information to be processed would be beyond the capability of systems to perform. The following sections justify these statements.

### **a. Robustness and its component reliability.**

Here the normal concept of robustness is examined and is found to have the important component of reliability. The need for robust and reliable information is demonstrated as arising from the requirement handle excess volume of information, excess variety, in the systems we humans handle.

The word 'robust' is often used in relation to a person, the robust person is characterised by not being slender, delicate or a weakling. Conversely, the robust person has physical, mental and moral health and strength. The word 'robust' is also used of equipment which is strongly built and not easy to break. Intellectual robustness is not associated with easy confusion by subtleness. (Sykes 1976)

Reliability is taken for granted in contexts of robustness, in many aspects of normal human life, when the apparently robust chair does give way under us for no apparent reason we are shocked and carry out some kind of investigation to justify our lack of premonition or preparedness. There should have been a cue, visually, auditorily or kinaesthetically. It was 'below the belt', unfair, out of order. If the chair were a delicate toy the reliability expectations would have been very different.

Could we not rely on the general laws of the universe for most practical purposes, and were not those laws durable and strong, robust and reliable, with clear identity, the energy absorbed in responding to the changes and preparing defensive strategies for the unpredicted and unpredictable there would be little resource for other purposes.

For a machine, or a piece of information to be robust, it must be reliable, in the same kind of way as chairs are, in general, as possible. The particular machine or information might be dynamic systems with the robustness and reliability being dependent on the system maintaining time as well as other requirements.

Beer's statements about variety in the system (above) deal with the problem of the excess volume of information also referred to above, but not with the need for some of that



information to be reliable and robust. This latter is generally, implicitly, recognised to be necessary.

Loss of information and the energy drain associated with it may seem to be contradicted by Beer's statement on the possibility of controlling error. However, because there is a theoretical possibility of controlling error, that does not mean it is necessarily implemented, and certainly would not imply its ability to come into existence spontaneously each time there were such potential loss. Beer's possibility of controlling error may be achieved at a cost of 'enough redundancy' and that may prove to be insuperable:

"... it is possible to build a reliable machine with unreliable components and circuits, then it must be possible to build a reliable machine with arbitrarily connected components. In other words, a network with enough variety, joined together more or less at random, can be made to operate reliably in imitation of any given machine, providing it contains enough redundancy." That is to say "error can be controlled." (Beer 1959 p102)

Examples of lack of reliability and robustness from within the case studies follow. In each case, large amounts of energy were absorbed coping with the unpredicted and unpredictable.

(E) The computer megastore and the roofing company: information leakage in young businesses.

(1) The effects of the predations of the megastore children on office tools and equipment came into this category. On any given day one could only count of having the equipment that one had actually seen, and its working state might need to be checked. Unreliability led staff to go to the nearest visible source. The most reliable sources were constantly degraded.

Similar and equipment predation occurred at the roofing company but this time without the malevolent influence of non-workers. There were initially insufficient tools to go round, and people grabbed what they wanted and left it where last used (as at the megastore). Reliability was improved when certain equipment was allocated to named owner / keeper, and more so when sufficient was supplied. Initially the yard manager had no desk or proper facilities of his own. Special efforts were made to reassure him and other magpie-like employees that predation was unnecessary and that any properly required supplies could be made available on request, often immediately.

At the State Bank the situation was similar to that at the roofing company before intervention. Because the site was all on one floor and compact relocating the equipment was less problematic.

(2) Stock price and code data in the computer stock list at the megastore was not reliable, because the items might have changed price, or the code might have been changed. In this case the requirement is that the information maps dynamically to the current stock prices for it to be robust and reliable. Deviations need to be signaled at the point of need

and in well identified batches that staff can readily identify or in rapidly accessible look-up tables.

(3) Filing at both the megastore and the roofing company was unreliable with extensive loss of critical time. In the 5 x 8 cards of suppliers at the megastore and of tenders at the roofing company, both were kept more or less alphabetically. The greatest difficulty in improving the situation in both cases arose from the problem of filing organisations by name, one wants good, reliable rules that work both for input or retrieval. The cross reference system to products instituted in the megastore suppliers file reduced the options substantially, so improving the reliability beyond that possible by simple rules. The situation is more difficult with some of the contracting organisation names where letter heads are very confusing. Similar benefit could however, be obtained by mounting the file in suitable computer system which offered 'sounds like' selections of 'approved' names.

## **b. The batch and batching.**

A batch is a grouping of related components, eg a batch of potatoes. For a grouping of related components, eg potatoes, to be a batch there must be a minimum of two such entities, eg batches of potatoes, and these entities have in common that they are made to undergo some time related process, eg processing in a potato peeling machine, in sequence or at different times. Certain of the identification features of the components of each batch are normally retained throughout the time related process(es) eg they stay as individual potatoes, if they merged to form a homogenous mass of potatoe the batch nature would have been destroyed with the loss of individual identity of the potatoes. Batching is the process of forming batches and using the features of batch to enable the time related process to be carried out more effectively or more efficiently than if all the components of the batch were handled as individual units.

By forming components into a batch variety is reduced, information is attenuated, for the purpose of handling during the time related sequence, but the variety is inherently retained, for use later.

Examples of batches used in the case studies are:

(A) 'A mucky wet job spud bashing':

potatoes for peeling;

(B) The author learns the value of batching and interfiling:

(1) letters (reordered in various ways);

(2) optimum size of batch for sorting in the sorter;

(C) Information for the occupational health nurse.

(1) files in the word processor;

(2) quarterly updates of RESOURCES;

(D) RESOURCES: an attempt to improve on the sources of information guide.

(1) concept lists from applying cybernetic concepts to a machine (pencil);

(2) batching ...;

(3) RESOURCES updates in groups of pages;

(E) The computer megastore and the roofing company: information leakage in young businesses.

(1) product codes;

(2) pricing items;

(3) miscellaneous types of batches;

(4) word processing;

(5) identification and 'batching' of critical material;

(6) employees as batches of historical knowledge within an organisation;

(7) a group going on a course;

(8) filing - a special case of multi-level batching:

(a) batches for each alpha and / or numeric character;

(b) batches for different purposes eg address of supplier, employee, contractor ...;

(c) batches for topics, subdivided alphanumerically and then by date;

(9) collecting information about specific ribbons on cards;

(10) computer cables as delivered;

(F) The 'constipated computer' syndrome.

problems of communication with the computer associated largely with lack of batching in a 'one off' situation;

Section 2. Excessive energy or massive redundancy required to absorb excess information. Ability to classify and use classification schemes is a major alternative.

This section focuses on means to control variety. There is a general introduction which highlights human responses to excess variety, and this is followed by examination of learning theory and its attempts to enable humans to cope. A robust form of learning is the goal. Arising from that discussion classification is identified as a major form of batching. Batching and classification are brought together for comparison and contrast, then look-up tables which also have considerable advantage in reducing variety and provide justification for rote memorisation in certain circumstances are considered. Note is made that Humphrey sees classification as an essential function of organisms.

The cost of containing excess variety of information, in the case where it is not regulated, is excessive energy or massive redundancy (Beer 1959 p102) and Banks says "our brain randomness becomes used up ... organised into a network of preconceived notions" (Banks 1988 p8). Where this happens stereotyping, which might be expected to happen prematurely in those who have deficient classificatory skills, results. Common observation suggests it does happen to a proportion of individuals even during their school years. Factor analysis data which used the structure of intellect model (Guilford; Hoepfner 1971) and other psychological research results might usefully be re-examined for this effect. Spranger observed that "the uneducated classes" tended to have higher general boundaries in their thinking between such areas as education, law, politics, and morality than others. (Spranger 1928 p27) This seems to imply less dynamic classification (ie a more rigid type of classification perhaps based on some or several 'given' system(s) made by other(s) for some other purpose) and integration of information with the resulting need to attempt to hold more isolated 'facts'.

Information recovery as argued in this thesis, by contrast with information retrieval requires active

(ie not a passive process, rather one when the seeker (and assisting information specialist(s)) recognises that work is involved in specifying and then ferreting out the required knowledge),

dynamic

(ie the initial knowledge elicited leads to need for a reframing of the question in an iterative process; questions are changing continuously)

and process oriented responses

(ie the seeker changes the specification and method(s) interactively during the continuing recovery process),

but has the potential to reduce the variety to manageable proportions.

Sheen too claims that excess information in the form of change is the enemy of innovation and improvement as people can only 'accommodate a certain level of alteration in their lives' without their effectiveness falling. Changes use up 'the ration of tollerable alterations ...' (Sheen 1985 p43) absorbing energy and available redundancy. This mechanism provides some insight into the reasons for resistance to change and even to perceive new information.

Examples of the excessive energy or massive redundancy required to absorb excess variety of information and of the alternative use of classification schemes are provided in the case studies as follows:

(C & D) the Gauvain sources of information guide and RESOURCES attempt to improve on it;

(D) the use of the cybernetics concepts to apply to a 'machine' (pencil) and the resultant massive spider enabling identification of missing databases;

(E) filing (several examples there).

### **a. Classification and batching and their relationships.**

Here the relationship of batching and classification is briefly explained and exemplified.

The formation of batches arises from application of some implied or explicit classification system. Representatives of a class of entities are put together for some time related process. Traditional classification systems place animals, plants, birds and other living things into groupings with common features. Having been classed, selections of those groupings with common features can be cared for in similar location, fed in similar ways, cooked at similar temperature and so on. The classification system might be of groups of similar objects (like potatoes) where each batch of potatoes would be implicitly named: the batch to put through the

machine first; the next batch; the batch to put through with more water. This latter batch might belong to a sub-class of potatoes with more soil on them.

The more relevant the classification system to the immediate problem at hand the more appropriate is any batching arising from it likely to be.

### **b. Learning theory and variety: towards a notion of robustness.**

Here, from the discipline of education, material is presented which relates to variety and the way educators believe variety is best handled for learning. Classification and batching lead to robustness and coherence in the knowledge base, though these concepts are presented mainly in other language.

In human learning studies Marton and Saljo have written of surface-level processing and deep-level processing of information, saying that in the first the student concentrates on "the sign (ie the discourse itself or the recall of it)" whereas with the latter "what is signified (ie what the discourse is about)." If one examines the examples given one sees the process the surface-level students seem to be undertaking is concerned with memorising everything, or as much as possible whereas the deep-level processing involves "the principal ideas" "the point of the article" "what it was all about", (Marton; Saljo 1976 p9) which concepts have very little meaning unless the material is being related to an existing knowledge context.

Schmeck proposed that "Deep Processing; Elaborative Processing, Fact Retention and Methodical Study" are four factors in complex learning. "The deep processing is represented by" horizontal and vertical aspects with the horizontal elaborative processing involving the personalisation "of knowledge reflecting the extent to which the individual relates material to his own knowledge and interests; and vertical or deep processing" referring to depth of conceptual understanding." (Schmeck, in press, quoted in Biggs; Rihn 198? in press p2) This latter also, of necessity involves forging relationships to other concepts. "Getting experience requires understanding causes and consequences - seeing connection(s) ..." learning. (Swift 1918 p42,43)

The two types of learning have been variously described in Biggs and Rihn's extract as "generic and surface coding" (Biggs; Telfer 1981); "understanding and reproductive" (Entwistle; Hanley; Hounsell 1979); "deep processing and fact retention (Schmeck in press); internalizing and utilising dimensions (Biggs; Rihn" in press). Perry who studied student learning at Harvard found "a dimension of intellectual development from dualistic to contextual relativistic

reasoning" (Perry 1970 quoted in Entwistle 1982 p23) again suggesting that effective learning involves tying the new material securely into its context.

Entwistle (Entwistle 1982 p50) links the other studies on learning with those of Gordon Pask whom he says has drawn attention to "holist and serialist strategies of learning ..." On the one hand "Comprehension learning" involving developing an overview of what is to be learned relative to previous knowledge and experience and with links to similar ideas, enthusiastically using "analogy, illustration and personal experience" in a "style which is broad, tolerant of ambiguity and personal" and 'Operation learning' focussing on component parts with their logical interconnections. (Pask; Scott 1972; Pask 1976; Pask et al 1977 quoted in Entwistle 1982 p50)

With models of learning and change in group theory the role of feelings, interpersonal relationships, trust, identification, inclusion, affection, control, interpersonal perception and communication are strongly emphasised, but the experiential learning model also emphasises the need for integration of the concrete emotional experiences with the cognitive processes involving conceptual analysis and understanding. So learning involves "labelling or relabelling ... immediate existential experience." (Kolb; Fry 1975 p34) The conceptual analysis and the labelling and relabelling are very much part of locating the material in relation to other material, fitting it into the learners' dynamic classification scheme. The extent of the success in these procedures maps to the extent of the learning.

Kolb and Fry say that the effective learner needs: concrete experience; reflective observation; abstract conceptualisation and active experimentation. He must be able to fully, openly and without bias, involve himself in new experience "able to reflect on and observe these experiences from many perspectives, ... be able to create concepts" to integrate the observations into logically sound theories and be able to utilise them in decision making and problem solving. (Kolb; Fry 1975 p35, 36) These procedures all appear to involve, in one way or other, attaching the new knowledge to existing knowledge structures, or creating new frameworks into which to put the new knowledge securely. As Swift said only as facts have meaning in relation to other facts do they have meaning. (Swift 1918 p199)

Smith compiled various descriptions of learning:

'as a transformation that occurs in the brain;

problem solving;

an internal process that leads to behavioural change;

the construction and exchange of personally relevant and viable meanings;

a retained change in disposition or capability that is not simply ascribable to growth;

a process of insights, outlooks, expectations, or thought patterns." (Smith 1981 p34)

None of these would exclude processes of relating materials to each other. "... the construction and exchange of personally relevant and viable meanings" emphasises dynamic processes of classification centred in the individual and their need to interact with their environment effectively.

A selection of material on human learning has been shown to be consistent with the general thrust of the thesis in relation to the validity of handling of excess variety by creating dynamic classification systems and batching suitable material.

### **c. Classification, as a basic and essential function of organisms: Humphrey's contribution.**

Material from Humphrey's BBC radio 3 programme (Humphrey 1979) is now used to present the idea that classification arises from the basic necessity of organisms to divide their world into entities which are safe and those which are unsafe. The author develops from that idea the notion that the carry-over of the classification ability into other areas of existence affects the ability to optimise the resources available to the organism.

Nick Humphrey in 'The illusion of beauty', (Humphrey 1979) in a beautifully illustrated and finely argued presentation proposed that there is a basic and fundamental requirement for man and animals to be able to classify things if they are going to survive. At the most basic level the ability to classify things into safe and unsafe classes is required. He suggests that as the zoological taxonomist looks for 'rhymes' in which the same type of animal is no interest neither is one which is altogether different from all the others, what is of interest is "sets of animals" sharing a particular distinctive feature and other sets sharing a contrasting feature. So as the child learns to distinguish cat from dog, and rabbit by various shared and contrasting features and displays great pleasure at his growing ability, the taxonomist experiences pleasure as he extends the taxonomy. (Humphrey 1979 p10, 11)

Humphrey claims that what we perceive as beauty, arises from seeing likeness and differences, "we find" it "from the comparison we make of things with themselves." "All beauty may be by a metaphor called rhyme ... Rhythm ... is likeness tempered with difference. ... The essence of



rhythm is the fusion of sameness and novelty so that the whole never loses the essential unity of the pattern while the parts exhibit the contrast arising from the novelty of their detail." Mere repetition kills rhythm as does confusion of differences. A crystal has excess pattern to be rhythmical, "while a frog is unrhythmic in that it exhibits a patternless confusion of detail." (Humphrey 1979 p7)

If Humphrey is correct there is a natural propensity in humans and some animals to classify, which arises from a fundamental instinct. The classifications individuals produce will be unique, dynamic and functional, relating to their own experience and knowledge and will not necessarily be recognisable as a classical classification system. Nevertheless, for the individual's ability to survive, the 'safe' 'unsafe' classification is certainly vital. The author proposes that the carry-over of the classification ability into other areas of existence affects the whole ability to live efficiently within the resources available.

So we see that the ability to classify is not dependent on higher education and access to elaborate classification systems, but is innate and available for exploitation. The formal systems offered by educators may indeed have queered the pitch by suggesting that only those elaborate systems are valid, whereas for many purposes and at many times they are entirely irrelevant. Classification and batching is of tremendous practical utility and has been grossly under emphasised and utilised.

### Section 3. Making information more robust.

This section concentrates on making information more robust and reducing information leakage. By way of introduction the potential for information leakage is related to Beers' material on attenuation of information, which has different emphasis and implications. Robustness from batching may be limited and need to be complemented by other techniques.

The first sub-section looks at the effect on robustness of error detection arising from multiple derivation and examples are given. The second sub-section develops the triangular form as a concept relevant to robustness of information analogous to its use in engineering. The third sub-section develops an application of the whole section in detail.

The author proposes that information, of assessed validity and reliability, is made robust by secure linkage to other relevant information structures. As, for example, in the RESOURCES organisations list where any given organisation might be cross referenced to at least two other organisations or concepts, as is developed further in the later part of this section on 'the triangular form'. This moves forward from the earlier emphasis on batching into concept groups which of itself attenuates variety and by improving robustness reduces information leakage.

As explained earlier where information items are 'batched' (the components form sets, minimum of two, and with purpose of each undergoing some time related process) the information is put into (more or less) functional groupings. These information groupings attenuate the information, in the sense that the groups can be identified with a single identifier, and can be handled as a single unit, though they have a number of items within themselves, so that in some cases they may retain within themselves the total of the initial variety.

Not surprisingly, considering the potential for 'information leakage' Beer stresses the importance of planning the attenuation of information. (Beer 1985 p24-25) He also stresses the need to ensure that when information is transferred from one part of a system to another the interface between the parts must be able to transfer the full variety required.

When information of a given "variety crosses a boundary and undergoes transduction; the variety of the transducer must be at least equivalent to the variety of the channel." (Beer 1985 p53)

There are forms of batching that inherently permanently reduce (attenuate) the variety in a system. The filter of naming (Beer 1975 p230) appears to be usually such a many-to-one (as a surname referring to all the people in a family) code but coding can be one-to-one (as a unique personal name), or even one-to-many (where one person has a variety of names for different

roles he may play). The code itself also may be manipulated to extend its variety carrying capability. (As for example the ISBN referred to below where the single number conveys information about language / country (or countries) of origin, publisher, and title / edition, or the UK driving licence number which incorporates name, sex and age information.)

'It is the business of words to communicate  
but the more is  
not the merrier.

Some people  
notably poets and mathematicians  
use other tricks than words themselves can play  
to convey meaning.

Grouping is one of them

it cuts down

verbiage  
punctuation  
parentheses  
circumlocution  
and pinpoints ideas." (Beer 1975 p2)

And in his book with four different coloured pages Beer says:

'These colours and formats  
manifest the structure of the book  
which is also a system." (Beer 1975 p5)

Effective attenuation of information conserves the critical components and while reducing the volume prevents the gross wastage implied by the term, as the author uses it, of 'information leakage'.

#### **a. Robustness is promoted by error detection arising from multiple derivation.**

Here the 'principle of multiple derivation' as identified by Elstob (Elstob 1988), is related to the need for robustness of information, and as a facilitator of it. Serially, the need, an example, and areas of application are presented.

#### **i. More on the need for robustness of information.**

Need for robust information is well recognised in accountancy with the double entry book keeping systems, complimented by requirement to produce the invoices. This is one application of the 'principle of multiple derivation' where a system is designed so that if an error is introduced it will display itself in different ways in various locations and is therefore unlikely to be overlooked. (cf Elstob 1988 17/3).

## **ii. Attempted robustness in judicial systems.**

Theoretically the judicial system works fairly by utilising this principle, seeking evidence for a variety of different sources before convicting a individual, though, in the USA in the 1930's, Wellman (in his still available book) though recognising the fallibility of the memory (cf Wellman 1936 p160; 161, 173) assented to the notion that "cross examination ... has always been deemed the surest test of truth ..." (Cox quoted in Wellman 1936 p8). The degree of reliability and robustness of judgement achieved in practice is equivocal. Criminal conviction in major justice systems is theoretically never allowed to rest on cross examination. (cf 'The Guildford 4')

## **iii. Robustness in mixed systems involving humans and man made components.**

Error detection is especially feasible in computer systems which by there very nature are well adapted to complex calculations, whereas humans are not. From the simplicity of a parity check where bits in the sent material are all made into odd numbers for odd parity, so that if a package received is an even number it is immediately recognised as faulty, to the greater complexity arising for need for human processing of, for example, ISBN's (International Standard Book Number) where the computer manipulates the digits intricately.

The final digit (which uniquely may be zero to nine or X for 10) is multiplied by one, the penultimate one by two, the next one to that by three and so on to 10. The answers are added together and divided by 11. If the remainder is zero the code is valid.

Both parity and ISBN require transmission of a check digit, a redundancy to the primary information.

The arithmetic calculation of the ISBN is liable to pick up errors arising from transposition of digits which account for a major proportion of transcription errors in complex numbers. The calculation is in addition to grouping of the digits into four sets representing language

grouping, publisher number, particular edition and check digit. These groupings assist humans in visual checking, by producing patterns relating, for example, to size of publishers list. Multiple derivation is frequently invoked in this context with use of other components of a full bibliographic reference.

Here we have seen how the principal of multiple derivation can be set up and used in computer and manual systems. Used efficiently the quality of information, its reliability and robustness, can be increased substantially, without massive redundancy.

### **b. The triangular form.**

Theoretical cybernetics as being developed by D J Stewart, often looks for analogies to concepts from one domain to another. For example, a transducer in the physical realm might be seen to have an effect on electric current which is analogous to the effect a modem has on information carrying signals, or the cochlea both on the physical sound vibrations and the information carried by them in the ear. The author was playing around with concepts looking for powerful analogies and wondered what the information equivalent might be of the triangular form in engineering. Here the notion is explored and some practical applications considered.

The triangular form is known in engineering to be normally more stable than the corresponding quadrilateral form of the same material. As a result many engineered structures have the triangular form built-in in multiple places.

On first examination with information the more relationships established with other types of information within a system, if errors do not occur, the more robust it appears to become. That robustness is evidenced in retrieval, or recovery potential and in likelihood of updating and enhancement.

On further examination the effect on the robustness seems logically, and in practice, to be more substantial with the first two strong links in a logical network, than with subsequent linkages. Where those linkages are in triangular form, damage to any one link would not destroy any of the three nodes which would still be reachable by alternative route, or, loss of one of the nodes would still leave enough information to initiate some form of search.

For example, an organisation 'Hampstead Old People's Housing Trust Ltd.' is cross referenced to 'Housing' and 'Trust' which are cross referenced to each other. Loss of 'Housing', for example, would still leave the other two references with the pointers to 'Housing', or even without the pointers to 'Housing' per se, information from which 'Housing' could be reformed.

This triangular form is not necessarily easily to make.

In practical terms the author now tends to make far more cross references than previously, where possible in the triangular form. The cross references that are made are often about new information which may be taken down or received in written form, but then key components are put in other parts of the authors reference systems, and the originals filed or copied and filed. When messages are received for others, the author is now far more likely to date and time the note and add to it components like phone number and check the new information against existing records. At work copies of the messages are then filed in date order. Well used procedures like dating and timing messages make the information more robust and may well assist in forming triangular links, depending on other information structures around them.

Learning theory, as presented earlier, supports the notion that being able to see relationships and link the new material firmly to other concepts, pieces of existing material (an existing knowledge context), makes the retention and recall of it more likely. This notion of triangular form gives a stronger theoretic base for understanding that phenomena, and with that a simpler, and very powerful, model to work with.

The authors colleagues have dubbed this notion of the triangular form 'the Genevieve principle'.

The triangular form in information and how it came to be first observed have been explained. The effect of the form on the robustness of information has pointed out. The notion of triangularity in learning has been pointed out as a simple valuable and potent model consistent with modern learning theory. Colleagues recognising the potency and practical utility of the concept have named it.

### **c. Application of 'the Genevieve principal' in a directory of organisations.**

The triangular form in information, 'The Genevieve principal', has been used most systematically so far, in the RESOURCES database (See samples in Appendix G). This use is described here, along with other methods that have been applied to improve the robustness of that information. One unexpected finding, that perhaps ought to have been anticipated was that such a robust information structure is difficult to dismantle, perhaps more difficult to dismantle than to set up. In any case, to provide someone with a subset of the database is a major operation, the very network of inter-relations causing the greatest painstaking demand.

**i. Basic cross referencing and the triangular form.**

Within the RESOURCES database a minimum of two appropriate cross references, on average, seems to be required where the initial part of the name of an organisation is not identical to the main topic of its interest. Both setting them up and removing them has demands of decision making and implementation.

ie Arthritis Association is an example where the initial part of the name of the organisation is identical with its main topic of interest, whereas with ASR (Advanced Systems Resources) Ltd. ASR or even 'Advanced' give little clue to the main topic of interest, indeed, though the complete name gives some idea of its purpose none of the components is very instructive or likely to be found in even an electronic topic search.

**ii. Using the triangular form involves tight loops with three nodes and includes redundancy.**

Once the author realised the potency of the triangular form in information structures, she made more than previously. Intuitively one would perhaps think that such tight loops, the three node variety would be going 'over the top' including redundancy to an unnecessary level, but the very redundancy used in this way has high potential pay-off.

**iii. Logical networks formed by cross referencing even in the case of electronic pathways.**

Cross referencing of topics to topics and directories, databases related organisations and people, with strong location information (full address, phone number and other electronic link numbers) and possibly the electronic pathway preprogrammed, forms a robust logical network which is relatively resistant to breakdown arising from the dynamic changes inherent in such information. Even where an address has changed, for example, the presence of an outdated address gives more potential for discovering the new location or current status of the addressee through the new incumbents, the local library, or neighbours, than no address.

**d. 'Date of known validity code' The d-validity-code.**

What is also valuable in that type of case is to have a check when the data was known to be valid 'date of known validity code' d-validity-code. For this purpose a code was developed incorporating source information in the first digits, month in the penultimate digit (using A, B, and C for 10th 11th and 12 months respectively) and the ultimate being the final digit of the year number. This accommodates a ten year cycle. It is probable that alpha characters will be assigned for the year digit in future, but numerics may still be used for current years.

D-validity-code examples:

DO8 = Direct information from the organisation, published some time in 1988.

MC7 = Miscellaneous source of information published in December 1987.

BBC14 = BBC broadcast material in January 1984.

The d-validity-code can be used accumulatively ie several versions may be applied to the same data. The d-validity-codes leave a trail of data check sources. These sources are likely to contain additional material which may be required, or in their updated forms current checks. Because the purpose for having an address in a database is related to particular characteristic(s) of addressee whether for some service, supply, custom, information or whatever, and it is likely that the data check sources will have different purpose(s) checking of one against the other must include some intelligent selection process when divergence occurs. Indeed, because purpose is so important the RESOURCES data base carries addresses linked to databases, and addresses linked to journals which may overlap with those in the organisation listings (sometimes several in each case).

Variation of source validity is, trackable through the d-validity-code. That is to say the d-validity-code enables ongoing tracking of data check sources. The validity of various sources differs substantially, even when purpose is taken into account. For example, there are financial reasons why telephone company directories of subscribers tend to be up to date at time of publication. The telephone company needs the correct address for billing. However, ex-directory subscribers and subscribers who opt for misleading designations cause some degradation. Company and organisation entries in telephone directories can be much less straightforward.

#### **e. Accounting for other types of validity.**

Knowledge of the mobility patterns of the type of addressee is also useful. For example, voluntary organisations without full time staff or permanent offices are often addressed



through officers who may be in post for only a year or so. Past officers will usually point forward unless the requirement is antithetic to their current circumstances, or involves frequent and / or demanding and unwelcome involvement. By retaining previous generations of address in some form and cross referencing those of the same organisation together patterns of movement can be built up. Where one address replaces another a 'new address nn' or 'new phone number nn' code is added with the final two digits as for the d-validity-code. Organisations going out of business will be marked as such, with data kept if there is likely to be further need for it.

#### **f. Purging morbid information.**

On reading introductory parts of this thesis the question was posed as to the danger of corrupt information and how often we need to clear the library, brain etc. (Laichena 1989). A recent BBC radio 4 programme 'Science now' (1989 Jan.) was devoted to viruses in computers, self propagating information which corrupts and may 'devour' the normal programmes of a computer system, rendering the computer useless for its intended purpose.

From the extreme of the virus to the benign, passive degradation caused by dilution, information can be morbid ('unwholesome, sickly ... of the nature of, or indicative of disease' (Sykes 1976)). Infection seems to be an apt term to use for situations where, for example, in the roofing company if an incorrect 'standard paragraph' was in three 'stand alone' computer systems (with two incompatible disk drives) as well as on several paper copies, the effort to purge it was a major one. There might be three or more bad copies on any one of the computers due to the way the word processing and directory facilities had been set up. Any 'bad' copy remaining could be used in generating documents or for making other computer copies by an unwitting operator. Similar problems can easily arise from systems with incorrect addresses in them. How does a roofing Company make sure all the surveyors in all the contractors offices who might send a document for tender has the correct new address. Change of address notices are very unlikely to result in the change being made throughout the relevant parts of the organisations concerned. d-validity-code helps with internal validity but is difficult to export, and could not be handled in many information systems as currently organised.

**Section 4. Ability to  
optimise batching by  
effective, dynamic  
classification is a  
criterion for success.**

So, the author also proposes that the ability to optimise batching, with the related skill of dynamic classification to meet the current situation, is a major criterion in assessing the potential for success of an organism or organisation. This is a logical corollary to the proposition (Banks 1988 p8) about the deadening effects of attempting to process excess variety.

The point here is slightly different from the one made by Beer talking of management meetings where 'heavy variety attenuators', like standard reports, must be used in conjunction with the meeting design, like the agenda and protocol, for a productive outcome. (Beer 1985 p31)

However, the two points come together since the standard report is a batch of information, the agenda a classification of items to discuss, and the protocol a means of classification of what is and is not allowed.

**a. 'Heavy variety attenuation': tool or  
shackle. One example.**

Habit is a 'heavy variety attenuator', a batch function resulting from a classificatory process, which living organisms use. "Habit first reduces and then eliminates the attention with which acts are performed" (Swift 1918 p95, 96) which if the habit were well designed releases attention and energy for other purposes. Without habit, consistency, stability and conservatism everyone would be deserting his post, going off at a tangent. (Swift 1918 p109) The organism could not continue to function without it, though when because "thinking is a strain" habit which classifies ideas "into bundles, properly labelled. Then when a social or business proposition is laid before us we know at once which bundle to untie" a solution, or partial solution, which is quick, easy and functional.

But while considering the advantages of 'heavy variety attenuators' we must not forget the tool can become a shackle. Swift says the "only fault (with habit) is that it leads nowhere." (Swift 1918 p118)

**b. An information model of business.**

The authors' ideas on robustness, batching and chunking lead on to the proposal of an information model of businesses, useful for certain purposes, in which the capital and revenue

of the business organisation is its information. Its ability to effectively conserve, recover and appropriately market the information is directly related to its potential for commercial success.

Such a model contrasts with the views of organisations proposed by Weber (Weber 1948 ch.1ff) and the implications of the managerial theories of Taylor, with management bearing the main responsibility for analysing jobs and prescribing the way they should be performed. (cf Mouzelis 1975 p81ff) It also contrasts with the universalist school, which concentrates on the formal aspects of organisation and its structure view in terms of patterns of responsibility and prescribed relationships, (Mouzelis 1967 p90) as well as the 'Human Relations' school growing from Mayo's work and the Hawthorne experiments. (Mouzelis 1967 p97ff; 1975 p120)

The information model relates much more closely to the cybernetics views as seen by Mouzelis (Mouzelis 1975 p131ff) and extensively developed by Beer. "... the overall control system of the organisation can be seen as an information processing, decision-making network steering the organisation towards its general goals." Information about the effectiveness of the strategies being applied is "fed back through censor and information-processing centres (eg staff and intelligence department) to the governor or decision making centres (managers, board of directors ..." (Mouzelis 1975 p132). However, there is contrast again since information in these models is not seen as the main commodity, capital and revenue, rather as a special kind of substance generated and processed around the system.

The information model which is proposed has its main potential as complimentary to models like that of Beer in 'Diagnosing the system: for organisations.' (Beer 1979), would enable the observer to view the organisation from a different perspective and provide one way towards the development of the self-controlled system and its minimum components of detector or sensor, governor or selector and effector. (cf Mouzelis 1975 p131) An accounting system for information might be developed, with potential for identifying otherwise covert operations (as in the 'I am an expert in this area and know all about it' phenomenon) with their related redundancies, errors (another source of error detection) and unused assets, enabling improvement of the effectiveness of operations.

### **c. Examples in buying.**

The particular case that brought the importance of 'batching' and 'chunking' to the attention of the author was that of the computer megastore. Where the organisation had 'got its act together' (successfully batched, chunked and recovered information) it was functional, but

there were so many areas where information was pouring away, areas where successful dynamic classification (successful batching, chunking and information recovery) had not taken place, where there was no effective control.

The filing systems in the megastore are a clear and simple example of the point. When the cards were put in order with cross references to other places they might have been found there was a far greater chance of finding them when required. The number of options of suppliers for particular products, for example, was very low when the cards were all over the place, so that crucial buying and selling opportunities were compromised.

Although the systems were different at the roofing company, similar compromise of buying opportunities occurred. There were four 'Filofax' diaries for the surveyor / estimators in Slating and tiling, with pages of addresses neatly copied out by hand. These were complemented by about fifteen A4 sized lever arch files of product literature loosely classified. Outdated material had not been removed and some files had been abandoned or most recent material had been put in at the top irrespective of the theoretic organisational arrangement. The use of the 'Filofax' diaries and the lever arch files was complementary with the diaries providing clusters of organisations in crudely alphabetic order, and the lever arch files a crude product type classification.

In practice the buyers in both organisations tended to ask out loud where would be a good place to find product x, and would usually be prompted with a supplier name. The main leakage (significant loss of variety) appeared to occur where special criteria obtained, though bulk and regular supplies could also probably have been improved by systematic fact finding.

## Section 5. Role of computer systems in batching and the robustness of information.

Computer systems can substantially contribute to batching and robustness of information "... the computer system entirely eliminated errors in data collection" is claimed in one study of medical history taking (Vickery 1974 quoted in Shortliffe et al 1984 p41). More importantly, Beer already saw advantages of real time computer systems in a model of control for government, where government agencies are dealt with as 'esoteric boxes' (organic entities in their own right with hidden attributes), without detailed interventions (Beer 19775 cf p226ff; p348ff; p399ff). Beer also proposes that for effective government administration each individual have one computer record with many keys, each key giving access to only one part of the record. The

benefit of this type of batching is, Beer perhaps over-claims, to the extent that no longer need half of society be employed to regulate the other half (Beer 1875 p362).

## Chapter B. The retrieval and recovery problems.

### Section 1. Change in the facilities for retrieval.

Retrieval of information external to the individual, is now, in many contexts easier than it ever was before. There are directories and reference libraries by the thousand, there are massive databanks and electronic databases containing material which is chunked, batched and ready to retrieve to high degree, with round-the-world access round-the-clock, and even within the home of an ordinary telephone subscriber, for example there is an alphabetic phone directory as well as a classified listing. At the end of the telephone line there is a phone number enquiry service as well as millions of other potential information access points, or information gateways. This wealth of information is not all as accessible as one might hope. (See also Appendix F.)

"Journals in the online field continue to proliferate and transmogrify themselves, in a tireless attempt to find and keep their corner of the market. Just as 'online' became a standard topic in traditional library journals, CD-ROM came on the scene and was immediately seized on by any journals remotely concerned with reference services, cataloguing, computers in libraries and online files." (Webber 1987) How does one keep up with it all?

In 1984 "No current consultation programmes can accept data from on-line medical data bases although some data interpretation systems have been interfaced with patient monitoring devices." (Clancey; Shortliffe 1984 p11) In the nature of things bibliographic data bases would be unsuitable for direct input to artificial intelligence programmes. ERGODATA, the French ergonomics data base, or other databases with statistical and time-series data have more immediate potential.

### Section 2. 'As good as if it didn't exist' asnegsist.

The author proposes that there is another problem which affects information retrieval far more commonly than most people ever realise, and those who do only remember it spasmodically. It is the phenomenon where what is needed is available well within the resources on hand but we have forgotten its address, or have not yet discovered that it is, and has been, directly proximal to us perhaps for a long time. It is as good to us as if it did not exist - asnegsist.

The asnegsist phenomenon may be partly accounted for by the "psychological principle of conservatism and habit the tendency to minimum effort." (Swift 1918 p63)

"Knowledge gives the raw material for solving problems, but in addition to knowledge there must be a sensitive, open mind anxious to see things as they are, instead of as we would wish them to be. ... We ... stress unduly certain facts and ignore others. Partly for this reason thinking is diverted into wrong channels and at times, it is completely blocked. ..." (Swift 1918 p83)

Another important part of the explanation for asnegsist must be largely concerned with human learning and recall (See above), but alongside this " ... Facts do not exist for those to whom they have no significance ... knowing whether there are facts worth getting, whether everything bearing on the matter is not already known, is (indeed) one test of mental acumen." (Swift 1918 p63)

Cross referencing which gives robustness to information can clearly be helpful in reducing this problem of asnegsist, overlooking material which is close at hand. We need prompting at the right time, which may be when doing information surveys as when checking the current prices of fruit and vegetables in the market, or at a time when there is available memory processing capacity available to store the information for recall later. In the latter case, the more closely the new information is tied to existing patterns of information in the system the more likely it is to be retrieved when required. This principle of the benefit of having information closely tied to existing patterns of information is one which partly explains why those who already learned most are, in general, the most likely to do best in learning new material.

However, there are the successful memory practitioners who look for a unique address for every item of special information an arrangement which appears to contradict the above theory (cf Richard Heath's 'Big data spaces'; 'Method of loci' memory system; and William Powers 'grab bag of words' quoted by Wilk 1988 11/2; or Harry Loraine 'How to develop a superpower memory.' quoted Stewart 11/2) but unique address and data framework may well be complimentary requirements.

Within the RESOURCES database cross referencing between different types of materials, and of components of materials, like directories and algorithms from books, journals and other sources greatly contributes to the utility of the data, offering readers enquiry lines they would not have anticipated. But to the extent the facility is unknown, proximal as it may be, it will be asnegsist.

'Marking' has utility in attracting attention to information which is otherwise very likely to be overlooked. By 'marking' the author refers to the placing of a marker of some kind, for example, in a directory of organisations of a particular type, to indicate that such an organisation exists, but in some way short of a complete standard identification. The 'marker' alerts the user to the probable existence of this organisation so giving the option of researching for further information elsewhere. In the particular example of the development of the directory itself markers assist by enabling the compiler to identify that a record in another location is one which is required, where it could easily be overlooked.

Inertia cannot be overcome but the 'way in' to the material can be assisted by these techniques.

### Section 3. The 'way in' to material.

The 'way in' to a system is the route by which the enquirer is lead to whatever information destination he may discover within it. It is the early part of the navigation route which determines whether the enquirer gives up or finds the treasure placed for him. It is the access point from where signs point effectively or not at all, to the contents. (The section 'Readability and ...' includes a variety of pointers to effective ways in.)

Much important work is completely overlooked because the 'way in' is ineffective. That may not be because it is bad. As has already been said, it is well known that new material is frequently rejected, for example. (cf Hibbs 1986b)

The rejection of new material may be reduced by an effective 'way in'. A fellow student offering critique on the authors' early efforts at producing a self-instructional package expressed the idea that it was unintelligible as it stood because the new ideas were presented 'naked' as it were, what it needed was "layers of contextualisation" (Bramwell 1985) The author had difficulty in understanding the meaning of that phrase at the time. It seems to mean that the new words and concepts being presented need to be clothed with layers of context, as garments, in the mind of the observer, so that they can be fitted into the observers existing framework of understanding. With such a clothing of context the observer would know how to manipulate the words and concepts and how they related or did not relate to other material. So now the author sees clearly that it is indeed an important component of any well designed 'way in' and why that is so.



This thesis exemplifies 'layers of contextualisation' by its own preface and introduction and the way each of those, as well as chapters and divisions have their own introductions, conclusions and bridging material which repeats like an incantation (Dewhurst 1989 1.2 referring to Wilk) variations of the same message. The reader is then able to take on board the new material comfortably, while at the same time recognising the change in perspective that is taking place. The repeated themes, presented in slightly different ways and with different emphases, sound in the mental ear like a symphony which gives the discerning reader pleasure in the experience. Boredom is not a problem since the components are neither so unconnected as to require repeated mental agility for no good reason, nor clones that the observer feels to be merely repetitious. In a dynamic and arresting way the author is saying what is going to be said, saying what is said and returning again to say what has been said.

The reader WILL SAY 'we already knew that' to what he identifies with because unless it is linked to already known material it will not be recognised or identified with. By the time it is 'incanted' (cf Wilk 1989) in he will already have heard it in several different ways. An 'aha' experience is helpful to the person experiencing the phenomenon in identifying realisation of new information and especially a new integration of knowledge.

#### **a. Beer exemplifies a 'way in' in his books.**

Beer invested great effort to help people 'in' to his book in 1975. He attempted to overcome the phenomena of rejection of new material and motivation of his readers (cf Stewart 1989 1/6) in a powerful way. He called it:

"a new sort of book for a new world"  
and on the title page  
"Platform for change  
a message from  
Stafford Beer"

He uses colour to identify different aspects of his message and writes:

"Next  
you'll be wondering  
why I am writing like this.

No, it isn't meant to be poetry

I do write poetry  
and this isn't it.

"The

fact is

I have published four books already  
in the approved style.

They look like novels

but they aren't novels

...

'So

I'm trying in this message.

If it's tiring at first

sorry

the reason is  
that reading habits are hard to break  
and that's not all

reading habits

thinking habits

running-the-world habits

they are all hard to break. " (Beer 1975 p2

(see also his quotations in this style above.))

For me his 'way in' worked. But within it he also worked hard to promote the word 'eudemony'. This is a name for the type of commodity that flows round a network between citizens with social values who call in to complain, and directors of TV programmes, since it is frequency of negative response that causes the producers to change their programming rather than the information content of the message. 'Eudemony', was 'not known' in the last two years files of what claims to be the worlds largest full text online database, NEXIS. (Produced by Mead Data Central, searched 1988 7/4)

Beer's book 'Diagnosing the system' also reflects great attention to the 'way in'. (Beer 1985)

## **b. Hypertext. Another attempt at a 'way in'.**

Hypertext seems to be attracting interest today (October 1988) as CD-ROM did in 1987 (or is it?). It is an attempt to make available to the user "multimedia documents that are composed and viewed interactively using a computer screen. Unlike paper documents (and sequential computer files (Hibbs)) which are essentially linear, hypertext uses document structure to

provide powerful dynamic cross-reference facilities and new means of navigation for the reader." (BCS Electronic Publishing Specialist Group 1988).

Inevitably systems providing such facilities, both hardware and software, are expensive in capital and maintenance costs so that when one has direct access to the system there is great potential, the chances of having easy or frequent access to such a system are very low.

Hypertext has capability of providing a 'way in' through a wide variety of auditory (hearing), visual (seeing), locomotor (movement) and olfactory (smelling) stimulation. A combination that can produce a potent learning experience for the user.

### **c. The 'way in' to a task.**

One fairly complex example of the 'way in' to a task is given here. In a correspondence course students were asked: "Under the different areas of life, list the customs which show us what the culture of 'New testament' Christians was like. Give Scripture references."

The 'areas of life' concerned were: politics; religious observances; education; health; leisure; family; work and wealth; social activity. (Carey College 1987 p10)

One could adopt a strategy of:

trying to recall examples and then try to find the reference by use of a concordance or subject index;

searching through sections of the 'New testament' given to discussion of behaviour;

search systematically through the books dealing with the time from the foundation of the Church in Acts, onwards.

Only in this latter 'way in' is it likely that the student would pick up the real cultural flavour of the times, but that would necessitate investing far more time than that allocated for study of the whole unit. The writer(s) of the material need to provide a better 'way in' for the students, perhaps by suggesting specific references or passages which are likely to be fruitful. Without that or the very time consuming alternative, the most important customs, for the purpose, are likely to be missed since they are the ones which are most alien from our own, not fitting easily into own frame of reference, and so least likely to be recalled. The 'treasure' is not located.

### **d. A 'way in' to the file.**

As already said some files at the megastore were being kept in order of the most convenient tag (eg first name of the contact) with the last card out being put at the front of any alphabetic section and any given file set being abandoned when it became too difficult to operate. A 'way in' to the file was designed using cross references from the user chosen tags to more conventional organisation names and topics. This worked quite well in that any user could find the information when the cards were held correctly. It did not ensure correct filing, nor problems arising from all the extra cross reference cards.

#### **e. The 'way in' to an organisation.**

Later, and reported as a postscript, using the theories presented here, one case study looks at the 'way in' to an organisation, represented by a local church. Any analysis of the 'way in' to a system as complex as an organism of organisation cannot be exhaustive, but selection can be made of a 'most likely to be fruitful' techniques and topics. Material from the case study would be a useful starting point.

#### **f. Deterministic, sympathetic or ...?**

In considering the 'way in' the author found herself confronting the issue of the extent to which the system designer determines or desires to determine the way the system will be used or recognises the need and includes in the design the facility for the potential users to use the system in creative and unimagined ways. In relation the 'way in' to buildings 'Architectural determinism' (Open University 1989 2/9), the design features which the designer / architect includes that determine the way the building is used, may well be desirable in a hospital, for example, at least in the first few years of its working life, but by the time technology has changed may lead to premature redundancy due to that very determinism.

In as much as the concept of the 'way in' is capable of being used to describe existing systems it is not in itself deterministic. Users of 'way in' concepts for the design of new systems need to be aware of the deterministic potential and implications, and are likely to need powerful creative input if determinism is desired to be prevented.

#### **g. What works well as a 'way in' one time may not at another.**

One wouldn't go the whole way with Holme, who in a context where the first phrase was entirely unsupported said "Since routine equals powerlessness, then anything that is innovative and

research-like will catch attention." (Holme 1988 p133) But, it is well known that the nervous system requires change for stimulation, and that repetition can easily become boring, failing to produce a desired response.

Because a strategy for a 'way in' to a complex system worked once, there is no guarantee that it will do so always, or even frequently. One only has to listen to different individuals' testimonies as to how they 'came to faith'.

## Chapter C. The leakage problem: converse to successful batching.

'Information leakage' is a term used by the author to describe a common phenomenon visible in sharp perspective in a business environment. If, as proposed in the information model of organisations the capital of a business is its information, profligate waste of that information must be very damaging.

More generally, for example, one in 1,000 computer rooms are predicted to suffer a disaster. Of businesses hit by such a disaster only 10% of those not having a contingency plan would be continuing to trade after 18 months. Data has been used to show that in the insurance field "that after half a day without systems a company might be at 96% of its normal efficiency and after 112 days, it would be down to 9%" Most financial institutions would be crippled in three days but manufacturing users "might hold out for 10 days." (Network 1990 p39, 40 quoting Waterhouse 1989?)

In the computer megastore information was being lost in all the commonly observed ways, as well as in ones which are unusual in a company which had managed to grow to a multi-million turnover in four years. The 'commonly observed ways' includes such ways as the information loss implicit in expressions about lack of communication in 'this' organisation, and those associated with less than optimal staff turnover.

Other examples of information leakage in the computer megastore included:

(1) the database which was almost unused for:

- (a) monitoring customer activity;
- (b) follow up;
- (c) mail outs;
- (d) sales patterns;
- (e) forecasting;
- (f) planning;

(2) the word processing was in the centre of a major information loss area with:

- (a) lack of policy documents;
- (b) the idea to 'keep all the correspondence on disk';
- (c) the shortcomings of BOS WRITER as set up, and the TDI system with its disabled control keys and highly vulnerable reset button;
- (d) the printer for word processed materials by, its location, and having friction feed only added to the information waste.

(3) One can continue to talk about:

- (a) the on-line accounts;
  - (b) the invoice processing;
  - (c) the product codes for computer input;
  - (d) and the arbitrary 'forget the catalogue' when the director had put more in without reference to the existing ones, or any of the other staff involved;
  - (e) then the non-approved telephone and the selection process for the new one without reference to materials that the director had commissioned to be collected, leading to the statement 'We have ordered this one';
  - (f) lack of team effectiveness;
  - (g) work experience losses including 'Steve' whose failure of self control and supervision lead him to a police cell;
  - (h) lack of effective delegation;
  - (i) recruitment of expensive staff like the accountant, but then not allowing him the information needed for the job;
  - (j) the family and the position of 'the rest', who made all the mistakes and were addressed like small children or animals at times;
  - (k) the high speed turnover of staff;
  - (l) the lack of any notion of time accounting;
  - (m) the families three children who were the jokers in the wastage pack.
- Once they came home from the nursery or primary school they were let loose to rampage. They accounted for most of the stationery tools on staff desks, they rushed around with trolleys, climbed on stock and wrote or sprayed furniture cream wherever they fancied, and found the Stanley knives, attracted as if by beacons, to use as desired. The author estimated hundreds of pounds of damage regularly. It appeared that parents and cousins thought that it was amusing if the children did naughty things, they were boys after all. The only time they could gain attention was when they did something worse than last time, disturbed customers or brought down the wrath of staff. After the birth of the second baby it became evident that the owner and her husband were coming to have a more responsible attitude to their child, though he had been left to his own devices far too much. A remedial programme was worked out with the staff of a new nursery school including plans for him to spend regular fun time with his father. The trauma of the change showed that it was not just stock and equipment that had suffered loss.

With the occupational health nurses training and the authors' contribution as tutor, in the institute of higher education, the major leakage appears to have been brought about in response to the pressures on academia to bring about major reductions in staffing and costing, and the competitive interest of the validating body whose main remaining courses were in the occupational health field. The author explored some of the mechanisms and their effects in 'On demotivation in academia: theory and reflections.' (Hibbs 1986a) Most dramatic was the destruction of morale in the final group of students and the resulting loss all round.

In the first of five terms the author asked this group of students to produce logical spiders and formal outlines for all the short practical papers they did. They were also introduced to the concepts 'all possible uses' and 'all possible cases' and the work of their peers and examples of previous students' work as well as other material in RESOURCES. They were a cohesive group and by the end of that term produced publishable work showing sophisticated understanding of some occupational health nursing problems.

Four terms later, at the normal low point in the course, when there was always a tendency to panic about the forthcoming exam, the author was told that a student had been visited by a tutor from the validating body and asked to complain about the course with a report to the validating body. The particular student had undergone severe personal stress during the course, and was at that point not in a good position to evaluate the course. She was also in a position where being given a plausible reason why she might not do well in the exam was quite a bonus. Other interventions were made with the students and there were aspersions cast on the authors' credibility as a nurse - how could one be a real nurse when one was a researcher involved in cybernetics and interested in the technical aspects of toxicology and so on. The result was dissintegration of the cohesiveness of the group, great stress on the students and poor examination results.

'Constipation' also causes its own form of leakage. The 'constipated computer' syndrome case study illustrates the constipating effect of large numbers of variables and values with a highly complex input and output system with many potential information failure points. In the megastore notable examples included:

- (1) filing cabinets of correspondence etcetera filled and then abandoned. They contained a small amount of critical information which though proximal and perhaps known about, was also in the state 'as good as if it didn't exist';
- (2) piles of invoices stuffed under the stairs, and in other crowded locations were not only inaccessible if needing to be referred to but required moving for fire safety;



(3) the sales and marketing files had vital information on the products including specifications and price data. The major part of it was unusable due to the congestion;

(4) lack of organisation in the warehouse, and the tendency to put unwanted materials on top of items not immediately required resulted in time wasted searching, or reordering of items already in stock and other waste;

## Chapter D. Algorithms, flow charts and heuristics in classification and batching.

Algorithms (see also in glossary) are particular types of interactive information pathways. In important respects they correspond to dynamic classification systems. Along with flow charts and heuristics they assist in batching procedures. All three forms provide ways of reducing chaos, and if they meet expectations pleasure is a likely side effect. (cf Humphrey 1979; Agnew 1988 referring to Kelly's notion that personal psychological processes are channelled into what he predicts.)

The authors' occupational health nursing students challenged to produce either algorithms or flow chart relating to a clinical problem in their work place produced a whole series and gave personal reports of recognition in their workplace and pleasurable sense of achievement. Some of the results were published in RESOURCES (eg Burgar 1983 v3 n1 ff) and a listing of the most interesting ones, along with others useful for occupational health practice (Hibbs 1984 V4 n4) was also published.

How can one defend such statements? In any case what are algorithms, flow charts and heuristics?

### Section 1. Algorithm.

An algorithm is a type of flow chart conforming to rigid criteria. Various definitions of algorithms (see glossary) suggest that they are a mechanism for calculation using a series of two state operators

(representable in the push-down, two storage automata." (Glushkov 1969 p53)). The calculation is in the nature of an evaluation of a function 'Is this a case of 'a' or 'b'?', through a given set of arguments. (If it is a case of 'a' then is it a case of 'c' or 'd', or if it is a case of 'b' then is it a case of 'e' or 'f';? and so on.) (cf Stewart 1988 11/2).

Loops appear in some algorithm representations where additional information is required before the states can be determined, they are not a part of the algorithm proper but belong to the wider category of flow charts.

In as much as the algorithm is a mechanism for sorting into categories it is a classification system because the outcome is discrete groupings of items with shared and / or contrasting features.

Wilk (Wilk 1988 11/2) suggests that before classification can take place a taxonomy locating the address at a pre-specified level is required. Loops could not be a component of such a scheme. Wilk also suggests that how one gets to the address doesn't seem to matter, there is no memory in a classification system, no loops, it has no process. The author contends that the algorithm (without loops and therefore without memory as Wilk suggests) appears to map to the taxonomy, even though the particular taxonomy concerned may be only of transitory interest. There is no inherent requirement for a classification system to conform to a 'given' or permanent taxonomic system.

On reflection, an algorithm could be described as: a classification machine (a machine in the cybernetic sense), for eliciting yes or no responses sequentially, in relation to a complex management\* problem. (Hibbs 1990 12/2)

\*Management in the limited sense that dependent decisions (ie decisions which are dependent on other decisions) are involved. (Hibbs 1990 13/2)

## Section 2. Flow charts.

Flow charts include algorithms with their two state operators. They are characterised by providing prompts for the collection of information and algorithmic functions for determining what to do with it. Normally they appear to provide for a progressive processing of the information into a form which is useable for some practical purpose. Apart from algorithms they would not normally produce a classification system, but they are functional for batching.

Shortliffe et al accept the view of Shermen et al (Shermen et al 1973 referred to in Shortliffe et al 1984) that "Clinical algorithms, or protocols, are flow charts ..." Protocols which "usually allow decisions to be made by carefully following the simple branching logic ..." but with referral to experts if the situation is unduly complex.

## Section 3. Heuristics.

Heuretics is the study of the "processes of trial and error that supposedly occurred in the mind of Archimedes while he was in the throes of a problem" which led to his cry EUREKA. "Thus heuretics studies ways of solving problems where there is no algorithm." Heuristic "refers to any such solution to a problem by means of trial and error guided by reference to a predetermined goal." (Akkumen 1988)

The heuristic is goal directed, and the heuritic is inherently an information handling process. Although, if successful, the outcome will normally not be a formal classification scheme conforming to a particular taxonomy, information recovery will have taken place with new groupings of information into potentially useful chunks. For example, expert physicians use heuristics to combine factual and procedural knowledge with experience to form "a rich repertoire of ideas of the form "if x is present and y is absent, then a good trial hypothesis is D. ... By remembering large numbers of such patterns or rules, they avoid search to a large extent." (Gorry 1988 p29, 30)

## Chapter E. Readability and - - -

In 1987 the author carried out a study on readability for the National Information Forum. (Hibbs 1987) The main areas of recommendation were intended to be practical for the voluntary sector lay pamphlet designer. They were to be related to: user; layout and design; language and production. (See Appendix D for notes on the material searched for this study.)

### Section 1. The user.

Many of the sources examined emphasised the need to know and understand the attributes of the user. (cf Burkett 1974 PS 142; Davison 1980 LLBA 75; Pejterson 1983 LI 5; LLBA 27; LLBA 28; LLBA 33; Rush 1985 PS 13; Samuels 1983 PS 74; Siegel; Smith 1985 LLBA 4)

The matters to consider include:

- (1) the materials the user can and does read;
- (2) the language the user utilises and understands (cf Schwartz-Turler 1981 PS 86);
- (3) the way in which the material the reader normally uses is presented;
- (4) current issues for the user relative to the new information;
- (5) the needs the user is aware they have relative to the new information;
- (6) the knowledge the user already has relevant to the new topics (cf Entin; Klare 1985 PS 4).

### Section 2. The layout and design (bait and hook features).

#### a. Raising motivation to the desired level.

Where necessary use design features which first obtain the readers' interest and then draw him into key areas. (cf Fass; Schumacher 1978 PS 127; Fisher; Coyle; Steinmetz 1977 LA 73; Schlieff 1974 LA 98) As the reader needs to be able to analyse before he can comprehend, the 'lead in' must be well matched to the readers' capability. (cf Roseberry 1985 AAC853341).

#### b. Presentation to lead to desired action.

The presentation should catch the attention, raise questions in the readers' mind and ultimately lead him to the answer when he will be able to accept it and act appropriately. (Schwartz-Turler 1981 PS 86) The presentation must honour the readers' aesthetic and linguistic codes. (cf Dubois 1975 LA 93) The reader can be helped in 'reading for a purpose'. Give attention to "concepts (present); time order; comparisons; facts; interpretations" (Aschermann 1976 LA 84)

### **c. Accessibility and overview lead the reader to understanding of relevance.**

Initial key material must come to the attention of the user when the user is likely to be receptive, it must be accessible. (cf Fisher; Coyle; Steinmetz 1977 LA 73; Smith 1985 LLBA 4) Sufficient overview must be available initially for the reader to identify short, medium and long term potential the material may have. By looking at whatever he is drawn to, the cover, first page or something first hidden and then revealed, the reader should be able to understand the basic concept of what the material is and does. There reader needs 'advance organisers' to prepare him for what is ahead. (cf Fisher; Coyle; Steinmetz 1977 LA 73)

### **d. Prompts to stimulate medium and long term use.**

Prompts which stimulate ongoing use facilitate retention of the material in a suitably distinct way for it to be readily at hand physically. There is need to design its probable location, how it appears on a shelf among other literature, or mentally by memory prompts, for its medium and long term uses. Appropriate graphics, including pictures, improve recall. (cf Reid 1983 LLBA 29; PS 29).

### **e. Aids to navigation.**

Consistency in presentation often aids the user. (cf Rose; Welsh 1982 LLBA 51).

Enable the user to find their way around by use of signposting, colour, illustrations, format (such as columns of specific width (cf Reynolds; Spencer 1979 LA 28; LI 23)), headings, typefaces and other graphic features. Functionality for the reader should determine the choice of such features. (Fisher; Coyle; Steinmetz 1977 LA 73; Friedman 1973 LLBA 127; Olsson 1983 PS 46; Reynolds 1979 LI 25). Examples may be helpful. (cf Funkhauser; Maccobi 1971 PS 154). Summaries may also act as navigation aids. (cf Fisher; Coyle; Steinmetz 1977 LA 73)

Entailing words like 'murder' which implies a killer and a victim, or 'fishing' which implies a fisherman and possible fish, help in navigating text. (Roseberry 1985 AAC8523341).

#### **f. Batching.**

Related material may be physically batched together to assist the reader. The batch layout should assist the reader in locating logically related material. Where the variety of information is high and batching is insufficient to cope, other navigational aids are required. (cf Campbell, Marchetti; Mewhart 1981 PS 100; Frase; Schwartz 1979 PS 128).

### **Section 3. Language.**

#### **a. Vocabulary, word complexity and sentence length.**

The readers' own familiar written vocabulary will be most effective. Words from the readers' 'spoken only' vocabulary need introduction. (The reader of this thesis will have come across a name written down that was not recognised when spoken or vice versa.)

Metaphoric phrases tend to be remembered more clearly than their literal equivalents (Pearson, Raphael, TePaske; Hiser 1981 PS 98) but people from different cultures recognise different metaphors. Simple, clear language has a limited place, (cf de Jardon 1983 LLBA 20; Portef 1985 AAC803569) but, don't write down to the user. (cf Patyal 1978 PS 119)

The use of readability formulae which count syllables per 100 words can be misleading especially in technical writing and non-text book material. The use of the same word or related words repeatedly is part of the explanation of this phenomenon. Sentence length is not as important as sentence structure and punctuation (cf Araman 1977 LA 66; Cohen; Steinberg 1983 PA 59a; Davison; Kantor 1982 PS 90; Duffy 1982 LLBA 45; Riffe 1963 PS 63; Selden 1977 LLBA 92) except for readers who were retarded from birth or who lack the reading tradition. (cf Fisker 1979 LI 27)

#### **b. Typography.**

A combination of upper and lower case characters with upper case used for beginning of sentence and proper names with few exceptions is better for many purposes than upper and lower case only. (cf Fryser; Stirling 1984 LI3)

The character size and shape needs to match user requirement. Visually normal, visually handicapped and those in transition, for example to the use of bi-focals, need special consideration. (cf Adebini 1984 DAD AAC0558628; Pastoor PS 64)

Relatively high density of text on the page may improve readability. (cf Duchnicky; Kolers 1983 PS 54; Ronnberg; Ohlsson; Millson 1983 PS 44; LA 14)

Orthography (use of spelling conventions), the instruction quality, the use of print conventions, writing style and clarity all interact in the readability of material. (Samuels 1983 PS 74)

### **c. The writers' sensitivity.**

The writers' general sensitivity towards the readership has been found to be more important than readability criteria in some contexts. (Davison 1980 LLBA 75)

## **Section 4. Production.**

### **a. Physical attributes (size, shape, weight etc.)**

The characteristics of the user may determine the maximum weight, size and handling criteria of the production. Use of standard paper sizes, such as A4 or A5 often leads to relatively economic print runs.

### **b. Characteristics of paper or medium.**

In choosing the quality and characteristics of the paper or medium the points for consideration include; colour, weight, absorbency, rate of deterioration, type of printing process to be used, price and availability. (cf Aschermann 1967 LA 84)

### **c. Binding and finishing.**

If it is important that the material stay open at a required place the types of suitable binding and finishing are limited. The purpose of the product needs consideration when durability of the binding is at issue.



V. An emergent example. Information recovery from a complex system. Or, or the 'way-in' to an organisation, an organism.

This case study differs from the previous ones:

firstly in that it results from a theoretical theme arising from other case studies, that of the 'way in'. Emergent 'way in' theory has already been presented. In this study it is developed further and applied;

secondly that only the components of the study directly relevant to this thesis have been included here.

The main report of the 'way in' study is 'The way in to a system, an organisation: general components of way in design.' (Hibbs 1990a) being prepared in parallel with this case study and are substantially based on research reported (including copies of the various survey forms) in 'The church which is an island: parish appraisal: the parish of St John with St James West Ealing: report on surveys undertaken in Autumn and Winter 1988/1989.' (Hibbs 1990). The feedstock of tables and transitional analysis is unpublished and is referenced as: (Rust; Hibbs et al 1989). A preliminary unpublished literature survey examining census data for the relevant area is referenced as: (Hibbs 1988).

In this case study the reader is asked to suspend judgement where examples are taken relating to values which are not his own. He is invited to search for and substitute analogies he is more familiar with.

Now, before plunging in to the study, a restatement. 'Way in' is the term the author has used to describe this topic of access. This, whether it be access into a reference book of some sort, a building, like a public library or any kind of system which is designed for, or has as key to its chief purpose, information dissemination. Achieving access to a desired destination within a system is an essential component of information handling and 'information recovery' and is too often overlooked as a key to 'information retrieval'. The 'way in' focuses on how such access may be achieved.

Concern about access, the 'way in', but without using any specific term to cover the overall concept, was highlighted in two radio interviews as this section was being written:

(1) in 'In Touch' the programme for the visually handicapped where the access features of a resource centre were described, as a model for 'way in' design for people with visual disabilities (Embry 1989);

(2) where alternatives to a super-abundance of labels in airport terminal were discussed. (Consuming Passions 1989).

More recently (September 1989), the precise term was used: "When you start a life drawing you are looking for a way in ..." You are wanting some way of making a start. (PM 1989 9/9)

How is an organisation, an organism, a building, a publication designed to enable its users and its component parts access the necessary information to fulfil the purpose(s) for its existence and continuation? What maps and markers exist to guide the user to the focal area(s) of their interest and concern, and are these entities significant in every type of information search? What barriers, whether intended or accidental, are there to prevent access or full utilisation of what is on offer, do these have the same nature in this context as in information recovery in general?

The 'way in', in common with information recovery, has components which could also be categorised as 'marketing'. Within the full case study of the 'way in' there is a section specifically devoted to marketing. Both marketing and 'way in' have common interests and each can benefit from examination of the other. Marketing, in essence, goes to the market place to "determine what additions should be made, topics deleted or coverage reduced, examples added and the like." (Kotler; Green 1977) The 'way in' focuses on characteristics of the system itself and its environment, which would normally include 'the market place'.

The choice of subject for this case study proved to be fortunate. The complexity, the unpredictability, the vibrancy, the energy of the organisation lead to a cascade of insights flowing out from the analysis. The organisation, an organic entity, which formed the focus of the case study is a local church, the parish church of St Johns with St James West Ealing.

Motivations and resistances relating to the way in to this local church would also be fruitful areas for consideration (Stewart et al 1989 1/6). Cybernetically, consideration of systems which are designed to produce the opposite results, ie in the case of a local church, systems for exclusion (eg weapons factory; Trappist monastery) at points where this one is aiming at inclusion, would also be expected to be fruitful. (Owen 1989 2/6) These particular lines of analysis were not developed in this study (marker).

In the full case study (Hibbs 1990a) some observations are made without written analysis of the utility of what is observed, or only a marker was placed for observations that could be made. The content and potential relevance to 'way in' is left to the reader to imagine. In other

cases the analysis is taken much further. Occasionally pointers, markers, are placed to types of systems where different questions may be relevant.

## **A. What this case study shows.**

An organisation, its physical plant, buildings, organisations, groupings and personal relationships, is a complex system. The goal implicit in the system's / organisations description determines its boundaries (Boundaries in organisations 1989 19/8).

Organisations like many other types of system with main or subsidiary purpose of making information available, are amenable to having their 'way in' examined. A systematic examination of such an entity from this angle could be expected to highlight aspects of its existence and effectiveness which are critical and are likely to be overlooked in more traditional types of analysis.

A local church has been chosen as the organisation for this case study because of the authors' involvement in this particular church. It is a representative, complex organisation, designed for the dissemination of information.

The author's involvement in the church arose from the time the vicar announced the intention of the church conducting a demographic survey (cf Hibbs 1990). This survey was to provide information to support decision making in relation to a church in another part of the parish and an evangelistic effort focussing in a parish mission and Mission '89, Billy Graham mission, in a years time (ie Summer 1989).

With the survey, the theme of 'way in' for this thesis, and the purposes of the leadership of the church in mind the author observed with open and receptive senses her own experience of the church and that of other people from the start.

The case study here and in its fuller form (Hibbs 1990a) utilises findings from the survey. It is by no means exhaustive. Markers are placed where further fruitful exploration might be carried out.

## **B. Purposes.**

The way in to a system must of necessity be related to purpose, whether that of the originator(s) / designer(s) of the system or of the user(s). What are the many purposes to which the 'way in' might be directed. What is the agenda, what is the hidden agenda?

Specifically, as an organisation, a truly Christian church would expect to examine the Bible. Additionally the church corporately and members individually, would seek the guidance of God by prayer through the Holy Spirit, about what it should be doing and providing. Any pure 'marketing' it would do would be expected to be 'under the umbrella' of understanding of God's revealed purpose. What might be seen as a commercial marketing approach would, be considered by many to cheapen the church (cf Rust 1989 20/6).

In the application of the 'way in' in this study the goal is not a physical feature like a jumbo jet at the airport waiting to transport you, in which case the aeroplane itself would be the primary information (Consuming Passions 1989). The goal of a church is spiritual and metaphysical so the physical 'way in' features are secondary information affecting access to that goal.

## **1. An organisation existing for those outside it.**

A primary characteristic of the chosen organisation is that it exists for the sake of those outside itself. That is to say that the key purpose of those who are within the chosen organisation is to reach out to those who are without. However, the individual potential and actual motivations of those within the church are likely to be very varied, as are their resistances, so that response is not just a matter of the message being understandable (cf Stewart et al 1989 2/6). All who are believers are to be accepted and cherished as part of the body of Christ, irrespective of their individual personal characteristics, functionality and place in that body. (cf Rust 1989 20/6)

Although it is true that the gospel

(good news of salvation from sin and death through faith in Jesus Christ, God and man, who was crucified and rose from the dead for forgiveness and eternal life).

is for all people it is not true that all people would be equally welcome in the local church of St Johns here and now. Those who just want to disrupt, proselytise to other faiths, or promulgate Christian heresies, for example, would not normally be welcome. That is not to say they would not be offered the good news, or that they would be written off without opportunity for change. Preliminary outreach to them would normally be planned elsewhere and in other

contexts than that of the local church building, or where the church members are meeting for worship and fellowship. Such excluded groups which are not clearly identified are at risk of just being overlooked and forgotten. (Stewart 1989 2/6) It is also possible that some who should be welcomed, but would require specific provision, as perhaps some who are mentally retarded, are excluded as part of the unrecognised.

These situations being the case, the 'way in', ie the way an individual from outside becomes fully identified with and a full participator in the work and outreach of the Church, or any given local church is crucial to its ability to fulfil its purpose.

## 2. Prescribed goals for individuals within the organisation / organism.

The likelihood of prescribed goals for individuals within an organisation must depend on the purpose and nature of that organisation. Many commercial organisations would not have such goals overtly, or even covertly, as in the cases of 'our computer megastore' or 'the roofing company' described elsewhere in this thesis. In the example of St Johns prescribed personal goals are considered by the leadership to be crucial, though it is true to say they would be variably valued in churches in general, to the extent of complete denial even in some 'Christian' churches.

The biblically stated purpose of membership of the Christian Church is maturity, Christ likeness, and demonstration of the fruit of the Spirit ("... love, joy, peace, patience, kindness, goodness, faithfulness, gentleness and self-control ..." (Bible 1973 Galatians 5:22-23). One result of this Christ likeness, will be that those who are without will be attracted to come in. Another result is that becoming increasingly like Christ believers find their place in heaven to be heaven indeed as they join in the praise and worship of God there.

A sensitive and dynamic interaction is required as the newcomer comes to the Church. The expectations of that newcomer are part of what is to be interacted with. (cf Rust 1989 20/6)

How are the personal goals of leadership and members communicated to people on their 'way in'? What proportion of people are aware of them? Are the methods of transmitting the goals effective? If not why not? How can the methods and results be evaluated? What can or must be done to improve matters? These questions are all open when considering the 'way in' where prescribed personal goals are important. (education/training need/opportunity)

## **C. Physical environment : geographic location and topology.**

When considering the 'way in' to any physical system the physical environment of that system need to be assessed. In the case of an organisation in a particular location the geography and topology of that location need to be examined for the bearing they may have on the 'way in'.

Geography is concerned with physical characteristics and relationships, and topology the spatial relations of fixed features in a landscape (Sykes Ed. 1976). Both could be viewed at macro or micro level according to the components of the system under consideration.

### **1. Physically**

In an organisation which is primarily associated with a particular geographic location like a building, the local geography of that building and how it fits that locality is significant. Its external appearance may invite or discourage interest of people who pass by in the course of other activities. If entrance to the building is required, the way those passers by move (eg on foot, by car, by train), and the opportunity they have to explore without feeling exposed, required to make commitment, or be identified is significant.

#### **a. "The church which is an island"**

A statement about the significance of the organisation being in its actual locality, in this case, the physical location and its statutory relevance is appropriate.

The particular local church, St Johns, Mattock Lane, West Ealing is on an island site with roads around it. It is a parish church. That is to say it is the local Church of England church with a defined geographic 'parish' within which it has limited statutory responsibilities, and its council, the Parochial Church Council and electoral roll form the lowest tier of local government. The whole of England is divided into Church of England parishes, many of which have now been amalgamated (cf Hibbs 1990 p3, 5ff) ...

#### **b. Ealing borough and beyond.**

The wider geographic location and its significance to 'way in'.

The fact that this local church is situated in Ealing Borough in 1989 (cf Hibbs 1990 p6-11) and that Ealing Borough is part of Greater London in Great Britain, which is a member of the European Community, NATO etc. all has practical implications for the Church and its congregation at Mattock Lane. Employment, taxes, educational opportunity, cost of living, availability of goods and services are all effected, and in turn effect who will be in church at a given time.

## 2. Socially and culturally.

The social and cultural context of the local church and its community is very relevant to the 'way in' for others of similar or differing background and experience.

A preliminary literature search to the St Johns survey provided demographic and some social and cultural information (Hibbs 1988) (cf also Hibbs 1990 p6-11).

## D. Physical realisation.

According to purpose the physical realisation will provide constraints on the 'way in'. The physical realisation may involve property, physical plant and equipment as well as film, paper, and electronic based representations.

If 'all outsiders' are to physically come in freely, physical and psychological barriers need to be reduced or removed entirely. This will not ever be completely possible, but can be worked at. Barriers will probably selectively exclude, their effects need careful assessment in relation to their selectivity.

In the case of the local church a building is usually taken for granted as being essential. However 'house' churches existed from Biblical times

("... They broke bread [ie had communion services; remembered the broken body of the Lord Jesus Christ, and His blood shed for (them as) sinners] in their homes ... And the Lord added to their number daily..." (Bible 1973 Acts 2:46-47)

What is a suitable building at one stage of growth and development of an organisation may be entirely unsuitable at another.

The external appearance of the physical realisation of information source and the non-verbal communication of that physical realisation is directly relevant to its 'way in'. This tends to

be less important as a 'way in' if users are already committed, although they may be a 'hygiene factor' or a 'maintenance factor' (cf Herzberg 1968; Lewin 1977 p37)

ie if surroundings are poor and uncongenial they have a negative effect on the committed, but if they are good the committed don't tend to become more committed as a result

after that. Due to human sense organs being primarily geared to noticing change, the physical features become less noticeable to the extent of being invisible to many of the people who regularly use them. As one member of St Johns said, when one has been inside and it has been 'nice and peaceful' and a good experience one tends to forget the outside. (Rust 1989 20/6) Constantly changing components like a working fountain, fish in a tank, or a waterfall are popular architectural features partly because they tend to overcome the loss of sensitivity due to familiarity. The sound of water splashing is often inviting and intriguing.

Many successful organisations give considerable attention to 'house style' and public appearance of property and artefacts. They recognise the significance of these features to enable the right people to find the 'way in'.

## 1. The church building and its surroundings.

The church building provides information which is secondary (cf Consuming Passions 1989) to the purpose of the church as an organisation. Report can be made of fences, hedges, gardens, paved areas etc. and their potential as facilities as well as maintenance requirements.

And another feature:

Before main services church bells can be heard in the immediate vicinity of the building...

The church is especially blessed with not being under a low aeroplane flight path. There is no major noise making industry or function in its vicinity, even the roads around it tend not to have heavy and fast traffic. The nearest railway line is about half a mile away.

## 2. The building itself.

Objective description of a building may or may not be particularly illuminating in relation to the 'way in' to an organisation. In buildings used for multiple purposes by employees and 'the public' the building will place considerable constraints on what happens within it and the way



it happens. In the full report (Hibbs 1990a) description is given, but all the implications are not worked out.

### **3. Inside the building.**

A detailed description of the inside of the building, prepared in the context of considering 'way in', as in the full report (Hibbs 1990a) is likely to lead to awareness of a range of significant features which have been overlooked to that point. The author found herself going back 'to have another look' several times, because of the implications of features which had or had not been noticed.

#### **a. Visual appearance and illumination.**

Visual appearance, including illumination plays an important part in the 'way in' to any information which is not transmitted only aurally. Use of colours and contrast of colours can provide important visual cues even to visually handicapped people (Embry 1989) but can produce undesired effects as in mental hospitals and old peoples' homes where strong colours reduced available light and increased the sense of gloom and doom (cf Stewart et al 1989).

One feature that the author did not expect emerged in considering illumination and visibility. Some (mainly very new) members of the congregation choose to sit behind pillars so that they cannot see those who are leading the service.

The 'Aspects of coding: human modelling, sign posting, language and language surrogates.' section below is also relevant to visual appearance and illumination.

#### **b. Sound, acoustics and PA (public address) system.**

Sound and acoustics are important not only in so far as they influence person to person communication directly or indirectly, but for all the information about mechanical, electronic and electrical as well as living sub-systems within or impinging on the main system. We humans are not often aware that there is a 'local soundscape' with which we become familiar. We do notice it when it is suddenly different or when it goes wrong. (Rust 1989 20/6)

For example: a primary school age English child came with her parents to Tokyo and was found by the author in the garden, expressing intense interest and preparation for a quick retreat to safety, in response to the sounds. The author joined her and explained what some of the noises represented, like the squeak of bicycle brakes. The child noticeably relaxed.

The 'soundscape' of the physical realisation of a system and its environment has significance. Acoustic information from systems and their subsystems often gives critical information about the normality or otherwise of their functioning.

Splashing water, referred to earlier, or the sound of cups being moved (Embry 1989) provide directional cues that may be particularly helpful to people with visual handicap. The sounds arising from contact with floor surfaces (cf Embry 1989) so that as people walk, for example on the stone floor leading to stone stairs inside and outside St Johns, give cues to significant, or for the blind potentially hazardous, change of environment from the lounge or main worship area.

Sound insulation of the building itself, the PA system with its facilities, effectiveness and limitations, the ability of participants in public worship to hear adequately and the acoustics all feature in the full report (Hibbs 1990a). Music is discussed as a separate feature.

### **c. Other sensory messengers.**

Other sensory messengers which were identified in the church included: food smells wafting in at the end of a morning service which reminded the author that there are a variety of other sensual inputs associated with the physical realisation of a system which are significant to the 'way in'. Smell(s) are one and kinaesthetic sensations another which may easily be overlooked.

Garden flowers, and floral decorations provide sweet fragrance which was noted. Artificial perfumes with associated chemical carriers are not used to 'sweeten the air' at St Johns. Air additives have their potential for pollutant effect and possible droplet transmission and hence inhalation for their effect. Perhaps because of the authors' own low sensitivity to smell St Johns seems usually to have a relatively neutral smell level.

Consideration of kinaesthetic sensations lead to note that the organisation is not in an earthquake zone, the absence of close train line or major source of noise, or its associated vibration, nearby. Aeroplane noise is usually not problematic. Percussion and timpany in the music group and the organ, especially when in full voice, contribute some low frequency noise, vibration, which one would hope is found to be pleasurable and aids inspiration. Its disturbance potential to people using the building for other purposes at the same time is noted.

Pressure (cf Embry 1989) can also have effects that relate to the 'way in'. 'Popping' due to pressure change was not a feature at St Johns but the phenomenon would generally be an unwelcome feature as part of 'way in' to transport systems, for example, where susceptible customers may suffer middle ear inflammation as a result.

#### **4. Physical facilities for ancillary events including the crypt and their utilisation.**

The need for facilities for ancillary events depends partly on the type of community the organisation serves and its other infrastructure. Detail could be given as for other parts of the building.

Unexpectedly, in its crowded urban setting, St Johns was found to own a two court lawn tennis club.

#### **5. Access including transportation.**

Access, the means by which potential user(s) of the system get from where they normally are to where the system is, or whereby the system gets to them is obviously closely related to the 'way in'. The means of physical access to the church building are described in the full report (Hibbs 1990a). The church congregational survey addressed methods of getting to church (Rust; Hibbs et al 1989 cf Table 18).

The significance of lack of transport was shown to be only more important as a reason for not attending church at both Sunday services than going out after dark in the 30's age group.

That only 15 (5%) use bus, and no other type of public transport is used suggests that the members are antipathetic to public transport. Reasons might be sought.

#### **E. Aspects of coding: human modelling, sign posting, language and language surrogates.**

In any information system sign posting, language and materials with graphic representation of realities or language are likely to be essential components.

The survey noted that in a Christian church language, including musical language, plays a large part, orally and in written forms. However, more important, in an organisation which is primarily concerned with human behaviour change, the human modelling, that is to say, the interpretation of that desired behaviour in human role models, will be used for navigating unexplored behavioural territory. Leaders will usually be used by others as role models.

## **1. Signposting and navigation aids.**

Signposting includes what one finds, or used to find 'at crossroads etc. with arms showing names of places on each road ...' but is widened to include other graphical verbal equivalents. Navigation aids include signposting, but also non-verbal representations, including other signals which give location and direction information including pointing to physical and logical locations.

Among navigation aids there is need for examples to be given and summaries made. Use can be made of entailing words / names like 'Administrators' Office', implying(entailing) an administrator and administrative function which may be utilised. Batching of relevant types of information is also helpful.

### **a. Physical navigation aids.**

Physically, there might be a notice with the name(s) of facilities reached through a particular door, navigation aids might show the route within the building might be marked by colour coded carpet, strip or other decor as in some hospitals or public libraries. As mentioned earlier there were no direction notices on, or associated ground level entrances at St Johns. There are 'push' and 'pull' notices on the internal lobby doors at the West end.

Other navigation aids might use colour, fabrics, furnishings, texture, temperature, contrast of light and shade or darkness; movement and stasis; sound (whether of particular patterns or dynamics) and silence. At Kings College, London University, the author needed a human guide. No map was on show, and directions to the room were too difficult for those asked to describe.

So, people can serve as significant navigation aids. St Johns, uses welcomers for main services, and informally members reinforce that.

Banners (ie similar to posters but made on cloth and traditionally portraying a spiritual message) in the church act as navigation aids to non physical purposes of the church.

## **b. Formal and informal welcoming.**

Welcoming can be overlooked as a significant function in an organisation. If people are to be recruited in a competitive situation, analysis of procedures and facilities is likely to show significant features. The survey results (Rust; Hibbs et al 1989) led to improvement.

## **c. Formal hospitality.**

Detailed analysis of this function lead to change.

For example: the home group leaders survey showed the impression of lots of meals eaten together to be more favourable than the reality. Ten groups reported one meal together during the past year and three of the 14 groups reporting, said they occasionally eat meals together on group evenings. (Rust 1989a)

## **d. Navigating texts.**

Ease of navigating a text is dependent upon physical attributes, including the characteristics of the paper or medium and its binding and finishing, as well as its language and typographical attributes.

Signposting in a document like the loose leaf (printed on light cardboard) service book 'For His praise' at St Johns is by coloured sections of the various parts, however, because it is a loose leaf book the right hand edge of pages, even sections are not always easily seen. Tabbed and labelled dividers, or a front page which explains the coding system might help. As it is visitors have been observed to have difficulty even in finding 'the green section' when it is announced. Further detail is given in the report (Hibbs 1990a), however, one sees that was a thoughtfully planned tool with desirable attributes has its utility sabotaged by a combination of factors which may or may not be directly related to its own realisation. (This example is significant to 'way in' in general.)

## **e. Directories and indices.**

In the organisations where the author has been employed since her training as an occupational health nurse, she has been increasingly aware of the need for internal directories and indices to available information resources, tools for 'way in'. Types of directories observed to be needed are in the nature of resource directories:

People with phone number, room number, and perhaps car number, home address...

Department members.

Skills, job functions or services.

Suppliers.

Types of supplies cross referenced to suppliers.

Customers / clients (whether internal or external to the organisation).

Organisations and services to which the organisation belongs and has users rights and facilities.

Such directories and indices are codeings, cut down models of reality, which bring examples into close proximity for easy handling and reference. The author has never known an organisation which has a good directory of the organisations and services to which it and its component members belong and to which it may have users rights and facilities directly or by proxy. The author has sought to incorporate parts of such information along with the suppliers listing at the roofing company. There are elusive components that are difficult to fit in commonly used listings.

Without high quality indices of this type there is massive loss of useful material, information leakage. Examples in the church are given (Hibbs 1990a) where the importance of indices and their signposting functions is also shown.

#### **f. Indexing material to be sung.**

Signposting is an issue in the finding of the right transparency for the overhead projector in time, especially, but not only, when an item is spontaneously chosen. Indexing is by first line only. There is also a high chance of mislocating a transparency leading to considerable embarrassment to the OHP operator.

In the music edition of one of the best hymn books (author's personal preference) there are nine indices:

##### Christian hymns

Contents;

Index of authors, translators and sources of words;

Index of composers, arrangers and sources of tunes;

Alphabetical index of tunes;  
Metrical index of tunes (with first line of tune printed);  
Index of metrical psalms and hymns based on psalms;  
Index of biblical references and allusions;  
Index of first lines of verses (except the first verse);  
Index of first lines of hymns with tunes;  
(Cook; Harrison Eds. 1985)

An American hymn book offers seven indices to hymns including a topical index to hymns:

Hymns for the living church

Contents;  
Scriptural allusions and quotations in hymns;  
Alphabetical index of tunes;  
Metrical index of tunes (no tune samples);  
Index of authors, composers and sources;  
Topical index of hymns;  
Alphabetical index of hymns;  
(Hustad Ed. 1974)

The author has spoken with key people about indexing the OHP transparencies. The response was disappointing. There would not be need for other than the existing very simple indexing.

Reasons for this response are complex. Possible ones include:

the respondents couldn't imagine the potential needs of others' or even their own because their perception of possible needs was limited by what they had experienced with the facilities currently available;

the respondents couldn't perceive the richness of the material or how it could be exploited, so had no 'way in' to it;

(education/training need/opportunity)

## **g. Utility of the standard operations manual.**

Standard operations manuals or other document(s) may be central to the key purpose of the organisation. (marker) The difficulties people have in navigating the Bible are perhaps more overt and easy to observe than manuals in other situations, but the difficulties are likely to be similar.

Effects of different editions and page numbering, unfamiliar classification of sections, unclear references given and typographical confusions are reported (Hibbs 1990a).

(education/training need/opportunity)

## **2. Human modelling.**

Where life change, including education and training is part of the purpose of the system human modelling, that is to say, the example of humans living out, or not living out the change or acting it out well or badly can determine the outcome. Leaders effectiveness as role models and 'members' contribution is probably generally understood to be significant.

In the Christian church, for example, human modelling has strong biblical support:

"For I (Jesus Christ) have set you an example, that you should do as I have done for you." (Bible 1973 John 13:15)

Peter says "... (Jesus) Christ suffered for you, leaving you an example, that you should follow in his steps. ..." (Bible 1973 I Peter 2:21)

Paul says "You know how we lived among you for your sake. You became imitators of us and of the Lord;" (Bible 1973 I Thessalonians 1:5b-6)

One current view, which would be acceptable at St Johns, of what this involves follows:

"The pastor must lead the congregation to give and receive ministry from one another. He models this by receiving ministry from the laity: their prayers, care, counsel, correction and encouragement." (Steinbron 1987 p23)

### **a. Leaders as role models.**

It is appropriate particularly to ask about the role models provided by the leadership. How are the leaders the same or different from others in the organisation? The equally valid follow on question 'How are those in the organisation the same or different from others in the community?' was not pursued explicitly in the report (Hibbs 1990a). General demographic



differences between church and community were pursued in the general survey research report. (Hibbs 1990 p5-11)

For analysis leaders may need to be categorised in one or more ways. For the purposes of the survey leaders were categorised as: Elder / pastorate leader; member of PCC (Parochial Church Council); home / discipleship group leader; leader of any other St Johns group. The author did not fit any of those leadership categories at the time of the survey (1989 18/6) but did perform leadership activities from time to time, as did others among non-leaders. Such facts tend to blurr the distinction between leaders and non-leaders and may need to be clarified.

#### Sexual distinctions in relation to leadership.

Sexual and other significant classifications may or may not be obvious on superficial examination. In the report (Hibbs 1990a) the biggest discrepancy between the sexes in the leadership is in the PCC (Parochial Church Council, the statutory, governing body) (15 males and 4 females). The data does not show that two females of eight are elders. However, probably the most significant difference was displayed in the multiple leadership category membership by sex.

Table V. E. 2. a. 1 Members of multiple leadership categories by sex. Members survey 1988.

Leadership category	Totals					
	M	M	M	M	M	F
1. Elder / Pastorate Leader	1	3			4	3
2. Member of PCC (Parochial Church Council)	1	5	2		8	0
3. Home/Discipleship Group Leader	1	3	5	2	11	5
4. Leader of any other St Johns group	3				2	2
	3	9	10	4	23	10
					4	2
					2	2

Percentage of leaders \* categories of leadership: male n62 female n20

Total leaders involved in more than one category of leadership and percentage leaders of that sex Male 11 (30%) Female 5 (10%)

(Rust; Hibbs 1989 Questions A12; F1)

A total of 26, 35% of males and 59, 47% of females claimed no leadership role past or present (Rust; Hibbs et al 1989 cf Table F1). Over one third (49 (39%)) of the female members at St Johns have current leadership roles and nearly half the male members (36 (49%)) (Rust; Hibbs et al 1989 cf Table F1).

#### Age in relation to leadership.

Age, role modelling and leadership must be significant in any organisation with aim for continuation and development over a year or two. Image and PR factors may make it crucial for even a one-off event. (cf Hibbs 1990a)

Marital status in relation to leadership.

The relationship of marital status to leadership and role modelling is likely to be covert. The differing needs of social support for achieving full potential and effects of the demands of, living on your own, being 'newly wed', the insomnia relating to 'the new baby', teenagers tussles, caring for very dependents may be significant. (cf Hibbs 1990a)

Occupation and leadership.

Given the ways leaders emerge irrespective of leadership titles, analysis of occupation, leadership and role models may well be more relevant than at first appears in commercial organisations. In the case of the church study, and in many voluntary, or 'part time' organisations occupation has a different relevance. Professional expertise may be required upon. In these days of individuals' switching profession during their working life enquiries about previous occupation types might be fruitful. (cf Hibbs 1990a)

Academic background and qualification.

The range and distribution of qualifications (type and level) may be examined. In the report (Hibbs 1990a) it was shown that leaders had just under one third of the nursing qualifications with 5% of leaders having such qualifications against 8% of non leaders. It might be that the under-representation of practicing nurses or whoever, needed special attention.

Turnover in leadership and commitment elsewhere.

Policy makers may need to be aware of patterns of leadership turnover. The commitments of leaders elsewhere is noted in parliamentarians, but is significant in voluntary groups, and also to commercial organisations to a greater extent than is generally realised. Exploitable resources, or 'fifth column' may be hidden. (cf Hibbs 1990a)

Recruitment: decision, attraction and attendance.

Recruitment of leaders and non-leaders is significant in any type of organisation. Research into the reasons people come into an organisation would be very susceptible to inaccurate reporting in certain types of organisations. It may well be the case that psychological factors make true reasons and motivations very hard to find out.

The report (Hibbs 1990a) showed leaders (83%) more likely than non-leaders (77%) to have made a definite decision to attend, and to know that they had done so than non-leaders. Of thirty named reasons why people first came to St Johns there was little marked difference between leaders. 'Heard about the: preaching; worship and music' was the main area of difference with higher ratings for non leaders than leaders. (cf Hibbs 1990a)

### Expectations of 'results'.

As with recruitment, the real levels of expectation of results may be difficult to ascertain. 'Results' in the report (Hibbs 1990a), were used only in the sense of evidence of people coming to faith\*. This might be analogous to one type of result in another organisation.

\* Abraham proposes (Abraham 1989 p164) that given a definition of evangelism "in terms of proclamation of the gospel... the primary criterion of success will be faithfulness to the gospel message" proper evaluation consists in "finding out how well the proclamation under review reflects the content of the gospel. Thus, results - as measured in terms of baptisms, conversion, increasing church membership, and the like - will be excluded as means of evaluation. If however, we define evangelism in terms of church growth, we shall have an entirely different strategy, and ... criteria of evaluation."

The survey asked "Suppose you were asked, in a letter from a non-Christian friend, to explain what the gospel is. What would you reply - in no more than THREE sentences!". The results were analysed and are commented on and summarised in the main report (Hibbs 1990 C19; p38-40). Only 3% met the authors' strict criteria of 'adequacy'.

Strikingly more leaders said they hadn't thought about expectations of results 10 (12%) than non leaders 6 (5%) a disturbing model given the purpose of the organisation.

(education/training need/opportunity)

### Experience/ evidence of 'results'.

Methods appropriate for measurement of results of individuals and the contribution of that in role modelling would vary substantially according to the nature of the results to be achieved. Self reporting in the St John's survey showed 38 (45%) of leaders either haven't experience of leading others to faith or don't know they have it (Rust; Hibbs et al 1989). Such lack would

not be freely admitted in more cut throat environments. This category of factors must be of concern in role modelling.

(education/training need/opportunity)

Initiative in seeking 'results'/recruitment.

Intuitively and from the obvious evidence of results it appears that many people, in many different kinds of organisations are not as active in recruitment as their leaders would hope. St Johns leaders (9%) claim less activity in seeking recruitment opportunities than non leaders (12%). However, it is not possible to know from the data what individuals were describing as 'active seeking' or 'opportunities'. Leaders in a church, especially the salaried, may be expected to have more opportunities 'placed in their laps' through daily pastoral contacts.

Less than half of leaders and non-leaders marked more frequently than 'at least once' inviting individuals to any Christian event, and leaders a third and non leaders less than one quarter inviting people to St Johns events. (education/training need/opportunity)

Priority of 'results'.

One would expect individuals, for example, in a commercial organisation to be extremely reticent to admit to anything other than priority of results in a direct question, however confidential a survey was said to be. In that context the open admission by 8% of leaders (non leaders 6%) in the survey (Rust; Hibbs et al 1989) that they thought evangelism quite unimportant and 1% (non leaders 4%) very unimportant may seem especially surprising. However, Christians have radically different ways of looking at the purpose of a Christian church, as employees well might of their employing organisation.

Change in achieving 'results'.

Change in ability to achieve results over time must be of general significance. How that is to be assessed may be problematic. In the survey (Rust; Hibbs et al 1989) approximately a fifth of leaders and non leaders claimed they have become less effective during a five year period. The authors' spontaneous response to that finding is to ask to look at correlation of age groups to 'less effective'. The author would expect that a major proportion with that response are individuals who have moved during that time from tertiary education into employment. The reason for this would then be the openness to religious and philosophic ideas of peers in tertiary

education, or nurse training, contrasted with the relative closedness of working people (relating to relative investment in the status quo perhaps).

Table V. E. 2. a. 2 Leaders by reported perceived change in effectiveness in personal witness in the past five years compared with members. Members survey 1988.

Change in past 5 years	% of Leaders now	Leader	% of not leader	Not leader
More effective	45	38 (40%)	50	57 (60%)
Less effective	27	23 (55%)	17	19 (45%)
About the same	24	20 (54%)	15	17 (46%)
Don't know	02	2 (33%)	04	4 (67%)
Wasn't Christian before	02	2 (11%)	14	16 (89%)
	---	--	---	---
	100	85	100	113

Percentages in brackets add to 100% horizontally  
(Rust; Hibbs et al 1989 of Table C17)

The reported level of dissatisfaction with the state of affairs would suggest reasonable potential for change given appropriate intervention.

(education/training need/opportunity)

Barriers to achieving 'results'.

The preparation for the survey (Hibbs 1990 p4, 5) included development of specific alternative responses for this and other questions. The strategy seems to have born fruit. The table below highlights the differences in the two groups with the leaders reporting relatively increasing proportion of barriers through the chart.

The idea of 'forcing beliefs onto others' is less of an issue for leaders. That evangelism is seen in that way seems to reflect the universalist 'live and let live', 'lets all be tolerant' attitudes of the past twenty years. The 'good news' is not something the Bible teaches should be 'forced' on people against their will.

Leaders express more concern about being thought odd, being embarrassed, of being made to feel foolish and of loosing friends as well as being able to express themselves. Are these sex related concerns?\*

\* Patterns of being embarrassed were age (20-39's especially) and sex related "... when a non-Christian friend has come with you to a service at St Johns ..." of 167 male responses and 252 female ones 22 males and 13 females were embarrassed by length of sermon, and 24 males and 17 females by length of services, whereas 2 males and 15

females were bothered by subject of sermon and 3 males and 24 females by the preacher. (Hibbs 1990a p47, 48)

Table V. E. 2. a. 3 Leaders by reported perceptions of barriers to Christian witness compared with members. Members survey 1988.

Key to table below:

A to G are variables

L = Leader

NL = Not leader

\*A Variant = Variation of leader from mean as a percentage  $((B+E)/2)$  multiplied by percentage of members responding to the question  $((L+NL)/(C+F))$  divided by 100. (This variable seemed to weight responses helpfully for this analysis.)

Barriers to witness	A*	B	C	D	E	F	G
	Variant	C%L % of leaders now	LNn Leader	C% C+F now	F%NL % of not leader	NLn Not	F% C+F leader
Shouldn't force belief on others	-3.06	15	13	(36%)	20	23	(64%)
Don't really want to	-3.00	9	8	(35%)	13	15	(65%)
Don't know what to say	-2.99	20	17	(37%)	25	29	(63%)
Not good enough Christian	-2.08	14	12	(39%)	17	19	(61%)
Not relevant to person	-2.00	6	5	(33%)	9	10	(67%)
Couldn't answer questions	-1.98	18	15	(35%)	24	28	(65%)
Would let God down	-1.96	12	10	(37%)	15	17	(63%)
Don't know how to	-1.95	13	11	(38%)	16	18	(62%)
Don't mix with non-Christians	-1.02	5	4	(36%)	6	7	(64%)
Don't want to upset	-1.00	21	18	(45%)	19	22	(55%)
Can't express in everyday words	-0.30	12	10	(33%)	17	20	(67%)
Haven't got necessary gifts	0.00	14	12	(43%)	14	16	(57%)
Fear of rejection	0.00	26	22	(42%)	26	30	(58%)
Not an evangelist	0.00	18	15	(43%)	17	20	(57%)
Fear of succeeding	0.00	7	6	(43%)	7	8	(57%)
Other	+0.30	13	11	(55%)	8	9	(45%)
Fear real hardship	+1.00	5	4	(57%)	3	3	(43%)
General fear/anxiety	+1.86	29	25	(40%)	32	37	(60)%
Don't know non-Christians	+1.98	8	7	(58%)	4	5	(42%)
Can't express myself	+3.12	27	23	(48%)	22	25	(52%)
Fear of losing friends	+4.00	20	17	(53%)	13	15	(47%)
Fear of being made fun of	+4.03	35	30	(49%)	27	31	(51%)
Lack of faith	+5.04	33	28	(50%)	24	28	(50%)
Embarassed/foolish	+6.09	27	23	(55%)	17	19	(45%)
May be thought odd	+11.02	40	34	(59%)	21	24	(41%)

Percentages in brackets add to 100% horizontally

(Rust; Hibbs et al 1989 cf Table C7)

(education/training need/opportunity)

## b. Members as role models.

In many cases the most powerful role models will be those in the natural family, associates or peers. This is true in many different types of organisations. The continuously changing groundswell of this effect will be difficult to tap in many circumstances. One area of human modelling which might reasonably accessible for this purpose would be relating to individuals

values and experiences in use of time. Some objective measures would also be available as controls.

In the survey (Rust; Hibbs et al 1989) most was not identifiable by demographic data or by relating that of leaders and others. The data used came from a section of the survey relating to individual reports of subjective and / or spiritual experience (Hibbs 1990a; Hibbs 1990 p52-66)). This very specific subject area has not been well researched elsewhere.

#### Experience of positive feedback.

One of the most frustrating things the author found in working in the National Health Service (NHS) (1954-1959; 1967-1969) in the United Kingdom was the sense that information went up but never came down again. As a staff nurse or staff midwife one was working in the dark as far as management thinking about what was going on, and there were some pretty awful things. That was also true at Cadbury Schweppes in relation to the author's personal situation as the companies' senior occupational health nurse (1971-1978) but not relating to wider department matters.

In the church, answers to prayer might be considered an important potential vehicle for positive feedback. In the event (Hibbs 1990a p52) members were quite ambivalent in their responses about their experience of answers to prayer. The author has observed a general reluctance to encourage one another and make one another accountable in any way about answers to prayer or other evidence of Christian learning and growth. Not being so accountable and living in a secular society which discounts such experience may well lead to forgetting and denial. These ideas and possible explanations need testing.

In many different organisation types there is room for role modelling in this respect. Leaders to encourage sharing experiences, and to increase mutual accountability for such sharing.  
(education/training need/opportunity)

#### Expressing altruism: practise; purpose.

In any healthy organisation there will be expressions of altruism. Where highly intelligent workpeople are cooped up with relatively little to do unless there is an emergency, in isolated nuclear establishments, for example, scouting and similar adventure activities in the area can provide a wholesome outlet.

On average members at St Johns were able to name two or three ways in which they could express altruism (specifically 'love and service') to others in the church (Hibbs 1990a p52).



It seems probable that if the respondents were given general exercises at increasing awareness of variety in situations the average number of ways identified might be increased by a factor of three or four quite irrespective of any actual change in behaviour, though given that ability one would also expect a resultant change in behaviour. (education/training need/opportunity)

Strong role modelling in this area could also be expected to produce results. Some of what doesn't happen doesn't because people are scared to try, and don't know how to make first contacts (find a 'way in'). (education/training need/opportunity)

Recognised barriers to specific experience.

Within an organisation there may be areas of experience that are considered to be desirable, but acceptable results are not achieved. Examples might be obvious in an educational establishment, where certain types of examination results are not achieved. Leaders or members of the organisation may be aware directly or indirectly of the cause or causes.

In the survey (Rust; Hibbs et al 1989) the following two questions were asked in relation individual or personal barriers being put up which might prevent the work of the Holy Spirit:

(1) "Do you think you have put up any barriers or 'blocks' to the Spirit working through your life? If so, can you say what they are?"

(2) "Why do you think the power of the Spirit is not more in evidence in our life as a church?"

35% agreed clearly that they had personal barriers and 40% identified their own barriers with those of the church either directly or by naming the same ones both for themselves and for the church. 41% identified barriers in the church 'them' which they did not identify with. However, respondents claiming no barriers for themselves were more likely to claim 'the rest' have barriers. A slight tendency to be able to be more specific about ones own barriers than those of 'the rest' is also noticeable.

There is awareness and ability of individuals to identify specific barriers in their lives (Hibbs 1990a). For those who have the ability to identify their own shortcomings, the remedy is other than telling what those shortcomings might be. (education/training need/opportunity)

Language -

Language serves to exclude those who do not know it and include those who do. Language can be of major significance in relation to the 'way in' to a system forming external and internal boundaries. Words used in special ways like 'salvation' 'born again' are code words for important truths which the 'in people' know and the others don't. They exclude. Also an individuals' 'read / write only' and 'listen / speak only' vocabulary may be far more significant than is often realised. (cf also Hibbs 1990)

A timely reminder about language is included in a textbook concerned with using the Bible in drama (Stickley; Stickley; Belben 1980 p49).]

"Remember audiences are more than just "kids" or "church", they are types of kids, types of churches. They have ages, backgrounds and levels of understanding.

"It may help you to think of yourselves as Bible translators. You are taking words and concepts that not many people understand. Only about 40% of people in England regularly read books. That leaves 60% who might watch or listen to films, music and plays, but for whom the Bible would be a closed book, because all books are closed books. This means that clarity is more important than cleverness. (Stickley; Stickley; Belben 1980 p44)

While writing this section 'Brain of Britain' quiz team (BBC Radio 4 1989 2/6) knew neither the name of the longest season in the Church of England year, ie Trinity, nor the story of the origin hymn 'Rock of ages' written after its author, Toplady, who hid in a cleft in a rock from a thunderstorm. This would have been unusual ignorance thirty years ago. Such change in use of language and familiarity with it also needs to be taken into account.

Memorability of language varies according to its precise current environment, as well as its medium: written; spoken; sung; acted etc. Metaphors tend to be memorable, where the metaphor can be readily interpreted by the listener.

The authors observations on 'way in' showed little specific language provision at St Johns for people with special needs like the mentally retarded, and those with short attention span like the alcoholics. Efforts have been made during the later part of 1989 to get alongside the soup kitchen clients, including alcoholics. (education/training need/opportunity)

In relation the 'way in' to printed text see the earlier section in this thesis on readability. The surveys at St Johns (Rust; Hibbs et al 1989) did not specifically address these issues.

(marker)

## Music .

Music is very similar to language in its relationships to 'way in'. Music is important in the leisure industries but is being used in many commercial organisations at telephone reception (Good Lord deliver us!) and 'while you work'. It has more potential in office environments than seems to be appreciated (marker).

At St Johns the music group, including choir (all voluntary), includes several professional musicians. Material is often composed or arranged especially for the group, sub groups or individual soloists. A wide variety of musical instruments are used in versatile ways. In the St Johns members survey respondents chose music / singing (from a list with 11 options) to mention as having an especially positive or negative effect when they first came to St Johns. Positives exceeded negatives by a factor of ten.

Table V. E. 4. 1 Music/singing reported as having made an especially positive or especially negative effect 'on the first few occasions you attended St Johns'. Members survey 1988.

Response to music	%Yes	Yes	%No	No
Positive	48	95	52	105
Negative	4	7	96	193

(Rust; Hibbs et al 1989 cf A5, A6)

For a group, like a local church, to become or stay musically literate the musical notes of what is being sung should be available to the congregation, even if only those who are interested. In a number of countries words and music of what is usually used in the local church is printed in the same book. In the United Kingdom words only books have tended to be used by congregations, but music editions for choir members and people who bought their own. The author, being more comfortable singing contralto than soprano, learned to read music over the past ten years, finds there is hardly any opportunity to maintain this skill at St Johns unless she join the music group. Even music which has been written by one of the Church members for the new 'Gloria' and is supplied for congregational use, only comes in soprano line.  
(education/training need/opportunity)

The provision of TV monitors and large screen, which is under consideration, would enable this deficiency to be overcome, but 'words only' are quite likely to be all that is considered necessary.

## **F. Participation and identification.**

Participation and identification are both possible in a variety of systems. The reader may be invited to participate in a book by writing answers to questions, colouring the pictures and so on. There is also often invitation to identify with the author or people in the text. The sort of mix found in the survey (Rust; Hibbs et al 1989) is probable in many institutions.

The level of participation and identification of ordinary members in organisations identified as 'a local church' is valued differently, and is enabled or disabled differently in each case, even within the same denomination or association.

Within St Johns the leadership team value and encourage a wide range of participation, however they do know that they are not equally successful in enabling it. (cf Hibbs 1990a)

Participation is closely related to identification, though they are not mutually inclusive ie one can occur without the other. Without one or other it is difficult to see that 'membership' other than in a nominal sense can exist.

(education/training need/opportunity)

## 1. Corporate activities.

The 'way in' for people to participate in the corporate activities of an organisation is potentially fruitful for examination. The opportunity / demand for such participation will vary according to the individual and their status in the organisation as well as the organisation itself and its purposes. (marker)

### a. In i n-house activities (spontaneous).

'Involvement' of 'members' is valued in many different types of organisations. Areas of desirable control and constraint need to be identified.

St Johns allows and encourages a wide range of spontaneous (member) public participation in public services in addition to that prescribed by the Church of England liturgy. Participation is not encouraged at all points in the services equally, or in the same variety. Members of the congregation desiring to contribute in certain types of ways are asked to speak to one of the elders first. These ways tend to be ways which could easily be abused.

(education/training need/opportunity)

### b. In in-house functions (pre-arranged).

Who in the organisation takes the lead in in-house functions? Is it always the same people or person? Is that desirable? What views do people have about it? Are valuable resources being wasted?

At St Johns preaching at the main services is not limited to men, the ordained clergy or licensed preachers. Service leaders are usually clergy or elders, including women (occasionally), and 'worship period' leaders are a small team of men who are musical and play guitars. This latter is the most restricted and the author views as being the most stereotyped. Members of the congregation are invited to participate in the public reading of the Bible and in 'leading the prayers'.

The 'way in' to such participation is variably signposted. (marker)

The way in to the actual participation was off putting once one was on the reading rota, for example (cf Hibbs 1990). With this particularly large rota administrative 'high jumps' could lead to unintended selection of readers. Preferable selection criteria would not prejudice the way the task is performed.

(education/training need/opportunity)

### **c. Rotas.**

Rotas seem to be a particular feature of voluntary communal life, as opposed to business and commercial organisations. A rota is a logical list of people and tools, designated to take part in, or fulfil an activity which is often a duty. The logical list often has a written equivalent which is often referred to as 'the rota'. The fact that organisations paying people to fulfil functions use rotas as little as they do suggests they may have serious deficiencies.

Some advantages of rotas:

- enable a succession of people / tools to take part;

- 'spreading the load';

- enabling a function to be fulfilled that no one person, tool or group would want to do or could do regularly;

- seems relatively easy to ask / require a person to do something less frequently than regularly;

Some disadvantages of rotas:

- difficulty in forming the habit;

- loss of continuity;

- high relative cost of fulfilment due to handover, and 'learning' time;

- in handling humans using a rota, the humans can learn to manipulate the succession of 'leaders'.

In a previous local church the author was involved in the 3-5 year olds were cared for during the second half of the morning service for adults, by a rota. They became experts in subversion. The leadership declined to take note of warnings of the danger in the first instance and of the evidence when it had occurred.

Detail about the coffee and 'soup kitchen' rotas at St Johns are described in the report (Hibbs 1990a).

(education/training need/opportunity)

#### **d. Offices.**

The offices held by officers lay and professional, clearly have important relationship to 'way in' in an organisation. This is not analysed here (or in the report (Hibbs 1990)). (marker)

## **2. Subsets, formal and informal. Cliques, organisations and activities.**

Within any organisation there are groupings, sets and subsets, whether departments or divisions or human groupings. Such groupings are significant in relation to the effectiveness of the organisation. In a church the formal and informal groupings, the cliques, organisations and activity groups all play an important part in including or excluding individuals, and in enhancing or restricting their Christian growth and development.

There is great potential for analysis of this aspect at St Johns. Some of the survey results relate to these features (Rust; Hibbs et al 1989; Hibbs 1990a p24, 25).

## **3. Access to people.**

In any human organisation the quality and facility of access of individuals to key policy makers, executives, bosses, supervisors is significant.

The survey at St Johns (Hibbs 1990) did not address this issue directly. It will not be developed here.

## **G. Development and reproduction.**

### **1. Recruitment.**

#### **a. Evangelism.**

(cf Hibbs 1990 p34-40)

- b. Ordinances relating to birth, marriage and death.
- c. Other.

## **2. Marketing.**

- a. Friendship activities.
- b. Social service activities.
- c. Other.

## **H. Components.**

### **I. Tools**

Components of these sections have not yet been worked over. (marker)



## J. Methods.

### 1. Strategic planning.

This section is only briefly sketched. (marker)

The following is a strategy for management against which an analysis might be made:

Five principles surrounding the practice of management:

- planning;
- organisation;
- control;
- leadership;
- climate setting.

The development of a 'vision statement', moving from vision statement to strategic plan. Communicating the strategy, encouraging involvement and commitment Use of annual plans and action plans, their relation to budget and control. Assessment of performance of management against the planning process. The need for built in 'satisfaction and reward for those involved in outworking the plan.' (MARC 1989)

### 2. 'PR' - publicity and public relations in the commercial sense.

Contribution of publicity: community, media, newspaper, local, free, national, religious, secular. (cf Getz).

This material was not addressed in the survey (Rust; Hibbs et al 1989). It provides further material for research. (marker)

(education/training need/opportunity)

## K. A classical cybernetics analysis.

In this section a preliminary view is taken of the 'way in' by subjecting the 'information tight system or machine' (material under analysis) to Ashby's cybernetics processes (Ashby 1956 see also in Case study D section 3 and Appendix A) to see what results, and note how it differs or is similar to the perhaps more familiarly structured, but still cybernetic, analysis in the previous sections. Overlap has not been totally excluded.

## 1. Represented by transformation

In thinking of an organisation, of which St Johns is one representation, and considering how it is being or may be transformed, one is likely to be impressed by the fact that it is in continuous change. Concepts like 'variety', 'choices', 'change', 'potential', 'stress' and 'decay' are associated with continuous change. Rapid change must make it hard for an individual to find their 'way in', and to feel that they are being kept in touch with what is going on. Members (up to) five descriptive words of the church reflecting 'variety', 'choices', 'change', 'potential', 'stress' and 'decay' included:

modern (12); progressive (4); trendy (2); forward thinking; forward looking; dynamic; superficial (4); growing (2); vibrant; alive (12); exciting; expanding (2); active (10); busy (8); easy going; live, lively and similar (65); living; extrovert; interesting (2); open (5); outgoing; supportive (4); warm (13); free, freeish (5); unfriendly; comfortable; relaxed (3); anxious; apraising; awesome; bright (3); friendly (90); happy (3); joyful (5); maddening; business-like (admin); (well) organised (4); sometimes disorganised; informal (18); crowded; full; adaptable; diversified; fluid; varied, variety etc. (4); various format; affluent; moneyed; prosperous; rich (2) (Rust; Hibbs et al 1989 PA1C)

'They don't tell us ...' has been heard by the author a number of times. The leadership also find the 'way in' to know the continuing state of members of the congregation difficult, hence the survey.

(education/training need/opportunity)

People, groups and places subject to change.

Many organisations are made up of people, who themselves are changing continuously, whether it be in relation to their:

age;

(ie the people who were born at the same time as them and therefore have certain experiences in common);

history and current events:

education and training;

health;

family;

community, country and world;

church: denomination, national, international;

other denominations, cults and religions;

economy;

lifestyle;

sociology:

home and family;

neighbourhood;

school / work;

church;

mission;

psychology:

inherited personality;

acquired personality;

experiences / learning (ie what has been made of those experiences);

The people also change in relation to their roles (cf Hibbs 1990a).

leaders;

members ...

group(s):

organised groups:

home groups;

special interest groups ...

families;

actions on groups;

groups interacting;

group life over time;

group cohorts;

Transformation acted on by coordination.

The significance of this category may become evident by examining the St Johns example:

Transformations affecting St Johns may be acted on by coordination of local and national government, by the national church and diocese, and by PCC (Parochial Church Council) and the eldership among others. Speed of transformation may be increased or decreased in certain respects by these coordinating activities.

Whether the coordination of transformation produces beneficial or deleterious effects is likely to depend on the perspective of the observer at the particular time. In some respects it will assist certain people to find their 'way in' but in others, by forcing change may reduce it for other people.

Transformation acted on by regulation.

Many transformations affecting St Johns are regulated. For example, St Johns being within the Church of England makes it subject to the national laws that govern this realisation of the established church, the rules of the Church of England itself and the regulations of the diocese.

As in many different kinds of organisations women at St Johns have been greatly hindered from finding their 'way in' to leadership by such rules.

Transformation acted on by control.

Transformations, and associated 'ways in' are acted on by a wide variety of controls. Those in the case of the church are relevant to other organisations:

Property: belonging to the church and belonging to members. The heightened relative cost of property especially around St Johns leads to serious difficulties for members wanting to live near the church and contributes to a turnover of 20.9% per year in the 16 to 24 age group and 15.5% in the 25 to 44 year olds in the borough each year (Ealing Borough Council 1982 Table 1.3 from 1981 census; 100% SAS + Table 68 and 30).

Homes ...

Work places ...

Facilities, infrastructure ...

Transport ...

Economy ...

Language and language materials ...

Politics ...

War, peace and civil unrest ...

What are all possible behaviours transformation can produce?

This question will not be explored. One way to start to do so would be to go systematically through the items above, like age, and imagine the age effects in the various activities of the organisation. (marker)

## 2. Stability.

Considering the massive potential for transformation in many organisations like, it is well to consider what factors are stable, and can be used to provide a sense of identity and security in a society where change is rampant. It is often easier to find the 'way in' to stable systems provided those systems are not exclusive. Catastrophic breakup of the whole system could easily occur if there is a very low level of stability.

There are certain features at St Johns which are stable, and have been so for many years. One might expect these features to tend to be those which make it like any other parish, or like any other religious organisation in Ealing, for example. Things like it having a vicar and a vicarage, a PCC and Church wardens, as well as a church building. Functionally it carries out baptisms, marriages, confirmations and funerals. Bans of marriage are read in its Sunday morning services. To the extent the church follows familiar, stable patterns, the 'way in' is more obvious for people coming from other similar traditions.

Stability acted on by coordination.

Coordination of activity from 'big brother', the recent multinational 'parent body' tends to reduce stability. In the report (Hibbs 1990a) it is noted that reduced stability has come from national changes in the liturgy for example. Coordination of activity within the organisation itself may lead to change, rather than stability. Nevertheless the cohesion of functional directors and their mutual support in their coordinating roles tends to produce stability from which change can be encouraged without destabilisation.

directors and their mutual support in their coordinating roles tends to produce stability from which change can be encouraged without destabilisation.

Stability acted on by regulation.

Stability is acted on by regulation that demands change. The main features which have been identified as stable are not under immediate threat by regulation, but many of the controllers of transformation above have arisen from previously stable features destabilised by regulation. The person familiar with the regulation system must have a head start in finding the 'way in' to a stable system, and systems destabilised by familiar regulation.

Stability acted on by control.

Controls which affect the stability of systems in the church example include:

internal factors:

- vicars' personal characteristics and churchmanship;
- other personal characteristics and leadership style;
- organisation and administration;
- organisations and facilities available;

external factors:

- alternatives available;
- housing;
- employment;
- war, peace, conscription and civil unrest;
- travel and transport;

### 3. Ultrastability.

An ultrastable system, is a system which persists despite transformations going on all around it and even within it. Beer says ultrastability is "the capacity of a system to return to an equilibrical state after perturbation by unknown or unanalysed forces (against the intervention of which the system was therefore not explicitly designed)" (Beer 1985 p403)

The example of the universal Christian Church.

St Johns is a local realisation of an ultrastable system, the universal Christian Church. It has survived two thousand years, in spite of persistent and infinitely varied effort for its

destruction. Successive members have died. Its leaders have all changed. It exists in many different cultures, and in many different realisations, but the core truths of salvation by grace through faith in the Lord Jesus Christ, God and man, who lived a perfect life and died for the sins of the world are common. The Bible, the written word of God, is translated into more languages than any other literature and still sells more copies.

The ultrastability of the Christian Church enables a very clear 'way in' to St Johns's for Christian believers to come and be and feel accepted. However, such welcome cannot be taken for granted throughout the church, and not all people coming to St Johns feel equally welcome.

(Hibbs 1990 p20 Appendix 4)

Ultrastability acted on by coordination.

Coordination affects the potential for ultrastability of all types of organisations whether of units of multinational organisations, or of individual entrepreneurs.

The ultrastability of the Christian Church has been affected by earthly coordination to a greater or lesser degree by leaders of its main divisions. In one sense these divisions have contributed to its ultrastability by counteracting divergencies, and in their different ways emphasising truths which others had neglected. (cf Hibbs 1990a)

Ultrastability acted on by regulation.

Governments have tried to regulate the Christian Church out of existence. Other organisations have experienced similar threat. (Cf Hibbs 1990a)

Ultrastability acted on by control.

History reports on the effects of control on ultastable systems. It has much to say about the effect of control on the Universal Church. These reports have not been explored in the report (Hibbs 1990a) (marker)

What are all possible behaviours ultrastability can produce?

Ultrastability tends to produce less, rather than more behaviours, but to produce them consistently and persistently. Ultrastability is very resistant to change and variety. (cf Hibbs 1990a)

## 4 . F e e d b a c k .

There must be masses of examples in any large organisation.

The St Johns survey as an example of feedback.

The survey at St Johns (Rust; Hibbs et al 1989) was one attempt to get systematic feedback. The need for the survey arose from recognised limitations of existing feedback sources. The leaders found they did not know the highly mobile congregation well enough (Hibbs 1990 p1).

The survey (Rust; Hibbs et al 1990) has major limitations for feedback. (marker) For example, it does not reflect the dynamic state of the Church. It is just a cross section at one time. However, one of its major contributions was the feedback it generated to members as they completed it and to leaders and other groups as they corporately developed the questions to be asked, refined by the survey team (Hibbs 1990 p2, 4).

(education/training need/opportunity)

Feedback acted on by coordination.

Feedback was coordinated in the survey. This coordination resulted in the set of data (Rust; Hibbs et al 1989) which still has enormous potential for analysis and useful learning. (marker) It is also largely comparable with other major data sets.

Feedback acted on by regulation.

Fulfilment of provisions of the 'Data Protection Act' has not markedly limited the survey (Rust; Hibbs et al 1989) in any ways those conducting the survey were not happy with. It has, however, restricted comparison with other potentially valuable data sets where the data subjects had not been specifically asked for permission for that particular use. To that extent feedback has been restricted by legislation.

No exploration of other regulators has been made. (marker)

Feedback acted on by control.



time of those who would like to have the results;

the high demand of processing for open ended questions;

the volume of results;

the questions asked of the data;

(marker)

What are all possible behaviours feedback can produce?

The possible behaviours of feedback are almost endless. Those of the feedback of the survey (Rust; Hibbs et al 1989) are also very many. Systematically answering this question would be very worthwhile for some purposes. (marker)

## 5. Independence within mechanism.

Within a local church like St Johns there is great potential for independence within mechanism. Only personal independence will be addressed, and then only in a limited way. Personal integrity and independence is attractive on the 'way in' to many people, though the highly dependent may find it threatening.

Personal independence of function within the mechanism.

Relative autonomy is highly valued in many types of organisation. The assessment of it would not normally be expected to be difficult to achieve.

At St Johns the vicar says he views himself more like a bishop with pastoral oversight enabling and encouraging the other elders and formally appointed leaders as well as the members to have a fair degree of autonomy and responsibility in their individual functions. In general people are allowed to get on with their tasks with support where required and training and instruction, but then relatively without interference unless they 'fall flat on their faces, in which case they are picked up, dusted off, and encouraged to get up an go again'. In practice the administration inhibits full expression of this freedom.

The insecure and dependant might find such a 'way in' highly threatening.

Independence within mechanism acted on by coordination.

Independence of function is enabled by coordination. First class information systems are essential to effective coordination in complex organisations. Failure of information systems clearly inhibited independence of function at St Johns (Hibbs 1990a).

Independence within mechanism acted on by regulation.

Functions within most organisations in modern society are acted on by statute. Few can operate, for example without a bank account of some sort, and such cannot be opened for an organisation per se without some kind of constitution linking it to statute and the legal requirements of the country. Handling money links into taxation requirements and this again is under statute. Commercial organisations are accountable to the registrar of companies and so on.

The functionaries in the local church are regulated by the constitution of the church. In the case of St Johns, by statute affecting the Church of England and the role of the parish church, the Parochial Church Council (PCC), and by the diocese. People must be licenced by the diocese for certain functions relating to the public ministry, and ordained to be allowed to officiate at a communion service. The vergers also have constitutional responsibilities in relation to the ordering of the church. The 'way in' to public office in the church is fenced, but by generally knowable and defined criteria.

Independence within mechanism acted on by control.

Finance, for example, acts as an important control on individuals and their 'way in' to stable parts of an organism. Social, psychological and formal processes of discipline also act as controls.

In the case of the church the diocese has financial control on parts of the churches' income, according to the number of members of the church electoral role, communicants at Christmas and Easter and other factors. It also provides housing and stipend for a given number of full time church employees.

Members financial contributions are an essential control for many of the activities of the local church. In the case of St Johns nearly all the income is by direct giving, though SNIPS (the second hand children's clothing and equipment shop) makes a profit. If the members

disagreed with the activities of the church leaders their hands could be tied by lack of income. As it is the church contributes also large amounts to other Christian outreach and social work.

Controls on unbelievers activity, and hence the 'way in' within the church are present, but not necessarily in overt way.

What are all possible behaviours independence within mechanism can produce?

Independence of function of individuals can produce a very wide range of behaviours that it will not be explored here. (marker)

## 6. Coupling potential of mechanisms.

What in relation to this organisation could be coupled or uncoupled, and what would be the likely results?

Coupling examples in an organisation.

Organisations may be coupled and de-coupled by formal mergers and splits or by less formal groupings and divisions.

In the example at St Johns, since the 1988 survey (Rust; Hibbs et al 1989) St Johns has been linked loosely with St Paul, Northfields, which has now been de-coupled from St Mary's. Ealing Parish Church. St Johns itself was decoupled from Ealing Parish Church in 1876 (Kennett-Brown 1989 11/6). It is not obvious to the author what the effect of this will be.

Within the church there is a lot of coupling and uncoupling of individuals and groups, especially in relation to home groups and the five pastorates.

Table V. K. 6. a. 1 Coupling and uncoupling of individuals and groups in relation to home groups and the five pastorates. Members survey 1988.

Length of membership of the 185 who were potentially in home groups:

Not members	15 (7.5%)
Under 6 months	39 (19.5%)
7 months to 3 years	83 (41.5%)
More than 3 years	63 (31.5%)

(Rust; Hibbs et al 1988 cf BHDUR)

This rate of coupling and uncoupling seems to lead to instability and uncertainty, with high energy cost and personal insecurity. Alternative couplings might reduce strain on the home group structure.

This rate of coupling and uncoupling seems to lead to instability and uncertainty, with high energy cost and personal insecurity. Alternative couplings might reduce strain on the home group structure.

For the remaining subsections relating to coupling potential only the St Johns home groups will be considered. (marker)

Coupling potential acted on by coordination.

Coordination of coupling and uncoupling of home groups is the responsibility of the vicar's wife and of members into and out of home groups by pastorate leaders.

Coupling potential acted on by regulation.

Coupling and uncoupling of the home groups and of people in to them is regulated by the eldership through the vicars wife and pastorate leaders. Individual members and potential members needs, characteristics and personal preferences in relation to home group membership are assessed by pastorate leaders but placement is normally by direction. (cf Hibbs 1990a)

Coupling potential acted on by control.

Coupling and uncoupling of home groups and people into them is subject to a variety of controls in addition to the coordination and regulation discussed above. Controls leading to absence on particular evenings include:

health (11);

where people live, distance;

holidays (3);

transport;

particular home(s) of members and suitability for meeting (0);

family commitments (50 (25%));

bereavement (1);

childminding requirements (6);

school events (1);

social events (15 (7.5%));

conflicting St Johns commitments (14 (7%));  
 conflicting other Christian commitments (11 (5.5%));  
 other commitments (26 (13%));  
 shift work (16 (8%));  
 pressure of work (44 (22%));  
 too late home from work (36 (18%));  
 fatigue (50 (25%) 'too tired');  
 need for evening off (39 (19.5%));  
 find it too much of a chore (6 (3%));  
 overseas trips (1);  
 disenchantment/frustration with home group (1);  
 felt was learning more on own in studying Bible and prayer (1);  
 weather;  
 other reason (4);  
 (Rust; Hibbs et al 1989 cf B12)

What are all possible behaviours coupling potential can produce?

The potential is immense. It will not be explored here. (marker)

## 7. Statistical modelling (of large complex systems).

How does the system change over time, what are the trends, what are the results. A statistical model might be predictive a model, showing what is relating to what. (cf Stewart 1989 8/6)

Statistics, as those produced from the St Johns survey (Rust; Hibbs et al 1989), for example, can be used as statistical models of aspects of the organisation under examination. Limited examples, in the form of statistical tables, are shown elsewhere in this case study (cf also Hibbs 1990; Hibbs 1990a; Rust; Hibbs et al 1989). (marker)

## 8. Black box.

Treating a system as a black box one is concerned only with the inputs and outputs, not with what brings those changes. Most organisations can be examined in this way, as 'machines' for producing their own thing. So, conceptually one might see St Johns as a machine for processing people. How are they when they come in and how are they different when they come out? Such 'black box' analysis is helpful in avoiding getting bogged down with multiple complexities and trying to identify particular causes, when many causal processes are involved.

Examination of any complex organisation as a black box is another massive agenda which calls for separate systematic analysis. (marker)

## 9. Coding.

Coding is the representation of one reality by another. It is a model of a sort, a proxy for the real thing. Or, as Ashby sees it 'packing information into recognisable packets.'

Those aspects of coding to do with sign posting, language and language surrogates at St Johns are partially developed elsewhere in this case study, and in more detail in the report (Hibbs 1990a).

## 10. Noise.

'Noise' in the sense used here is those signals which are present in a system which are extraneous to the requirement or purpose of the system, those which prevent or obscure the intended sound, the signal, of the system being clearly communicated. Noise can arise spontaneously from within a system or come from the outside. Humans have a tendency to degrade a system, so effort must be made to keep them above the critical noise level.

Examples of 'noise' at St Johns

The intermittent 'whoosh' of the PA (public address) system is 'noise' in this sense. It distracts from the communication of the user of the microphone, often embarrassing him and distracting him from his purpose, as well as preventing the congregation from hearing clearly what is supposed to be being communicated.

The entrance or exit of John in his rags and tatters during the service acts as noise to those who are not familiar with this wanderer of short attention span. It certainly acts as noise to the leaders when it happens during a key and sensitive point of the sermon.

Socialising after the service can act as noise, to take away the impact of the teaching. Having the sermon half way through the service rather than near the end probably helps in reducing this affect, an active revue of the sermon points again at the end of the service might assist in putting the teaching into long term memory, reducing the effect of noise.

Wilk suggested the topic 'sin is noise: discuss!' (Stewart et al 1989 9/6). Sin can certainly act as noise, deflecting attention and reducing the 'good news' signal. There are times when sin, 'noise' and a high number of decibels are coincidental.

Noise acted on by coordination.

According to the particular 'noise' identified, coordinated action might be reduced or eliminated.

Noise acted on by regulation.

Particular noise might need to be controlled by regulation. (marker)

Noise acted on by control.

Any specific type of noise may be amenable to control. (marker)

What are all possible behaviours noise can produce?

This was not fully explored but some obvious behaviours include:

- obliterating the desired signal;
- causing the desired signal to be misunderstood or not understood;
- causing annoyance;
- throwing the communicator off their balance;
- causing members of the congregation to go elsewhere;
- causing seekers to go away without having hear the good news.



(marker) (education/training need/opportunity)

## L. Cybernetics analysis using concepts developed in this thesis.

In considering what examples belong in this section it became evident that the most obvious examples would relate to the administration. The survey had not directly addressed those issues. The author has not had direct entrance to that administration. That it was deficient had been observed.

### 1. Robustness, and batching in the context of variety.

There are administrative functions that are deficient due to lack of batching. For example;

the author, as already mentioned, is informed that there is no current address and phone list even available to the clergy (as of January 1990);

on several occasions relating to the survey, particular skills were required. On each occasion the one or two people named were already overloaded, and there were estimated to be several more who were being overlooked, and including some who would have valued the opportunity;

(education/training need/opportunity)

### 2. Use of classification in reducing need for massive redundancy.

Much of what is listed in the section 'directories and indices' relates to classification.

(education/training need/opportunity)

### 3. Robust forms, triangular structures and the purging of morbid information.

As in 2 above.

(education/training need/opportunity)

#### 4. Success arising from ability to optimise batching, using dynamic classifications.

The author believes that a large part of the 'drag', the failure of members to participate in services, prayer, and activities is due to difficulty in this area. It is open to remedial action which is focused on these skills increasing the use of the knowledge base rather than increasing the knowledge base per se.

(education/training need/opportunity)

#### 5. Asnegsist.

Information sources which should be available to clergy and members are not being used.

Components of 'For His praise' are virtually never used, not even explored.

(education/training need/opportunity)

#### 6. Leakage.

People are coming and going with no one following them up.

Serious leakage is arising in the loss of information about people and the resources they can offer. By May 1990 effort has been made to overcome this with some improvement.

(education/training need/opportunity)

#### M. What this 'way in' case study has shown.

In this section the author has shown that 'way in' theory can be applied creatively in many ways and at many levels. The designer, systems analyst, company chairman, and 'man on the 37 (Clapham omni...) bus' has valid questions they may ask about 'way in' in a systematic or ad hoc way. A full and systematic 'way in' analysis would be the equivalent of a financial audit where the data for it had never been kept before, and the results as unpredictable. Whether they are as valuable, which may well be the case, is yet to be tested. (marker)

## VI . F I N A L I T I E S .

### 1. A summary of further work required.

Markers have been placed within the thesis to locate missing material. The majority of the 'missing material' is so because of further research required. Markers are indexed.

Potential for further development from this thesis arises particularly from the theoretic themes. The following appear to be important:

(1) To attempt to disprove the thesis that brain randomness does become used up in those with deficient classificatory skills results in stereotyping due to the randomness of the brain being used up with excess information. Reexamination of existing factor analysis (Guilford; Hepfner 1971) and other psychological research results might be expected to be fruitful.

(2) To develop and test a prototype module of an accounting system for information, to assess the economic potential of use of a full accounting system applicable to the information model of an organisation. An important component which might be operable on its own, perhaps as part of a more traditional audit, would have the capability of identifying information leakage points. Such a component would have the potential of leading to large cost savings.

(3) To test the effects of making and breaking triangular form linkages across a range of different types of system, (real world, living (eg effect on learning), computer and mixed).

(4) To quantify the 'asnegsist' phenomenon. To evaluate the reduceability of wasted resources that might be attained by reducing it.

(5) To integrate and review existing material on what can be done to enable the tapping of information which is accessible, but not sought because forgotten, or never found, or its use never imagined? The related problem of gaining acceptance for new ideas has similar research potential.

(6) Promotion of the application of algorithms, flow charts and heuristics and the place they hold in classification systems and information pathways, now that this relationship is clearer, so more readily explicable to everyman.

(7) Research to assess the potential of extending existing maps of information networks, and developing new maps to fill identifiable gaps. Also, make those mappings accessible to users in

the form of information pathways\* where predictable information needs exist and solutions are available in economic chunks.

\*Examples of information pathways:

(1) as in computer routines that dial the phone number, log on to the host computer, enter information about the database to be accessed and the appropriate file automatically. Extension and development of what has become available during the time of the development of this thesis.

(2) as in conventional 'hard copy' 'yellow pages' but with more specific choice about services being offered at the user end of the pathway and more precise targeting of the best information provider for the type of service needed within the organisation at the service end, and where once the user has specified his requirement and had it agreed the system does the rest. As might a good secretary.

## 2. Conclusion

This thesis, as required for a Doctorate of Philosophy, has attempted to make a community of scientists and others think differently by rational argument. It has referred to substantial empirical studies. Using the systems science of cybernetics as basis, a cybernetic definition of system and its environment have been used\*. Alternative definitions of systems have been acknowledged. (Further details and examples of systems are included in chapter C of the apologia).

\*System as used in this thesis: the system is any combination of entities interacting together in some way for some purpose (whether the purpose be perceived by the entities themselves, or an arbitrary one of the observer). 'The environment' of the system is any other entities (including forces) which impinge upon the system and affect its behaviour in some way. The system and its environment are dynamic. The system changes according to the purpose and perspective of the definer at any given time.

The purpose of this thesis has not mainly been achieved by experiment. Case studies within which the reader can clearly identify the validity of the observations and assess them to be objective and rigorous have been used. The final case study, however, combines demographic survey, objective as well as touching on highly subjective matters relating to spiritual understanding. In this it demonstrates the practical results obtainable from applying the emergent cybernetic concepts to 'variety' in the real, complex world.

This thesis has shown that during a cybernetics examination of information handling systems in representative practical situations many systemic effects, unrecognised aspects of information work, emerge and develop into a series of concepts. These concepts embody characteristics which information dependent systems themselves replicate or maintain so have been properly identified as systemic effects (cf Elstob 1989 31/1). Formerly unseeing eyes have been shown that these systemic effects map to concepts, and some individually, are of sufficient practical significance to be worthy of wide-scale consideration. However, all the issues in the 'world' raised by the study have not been addressed. 'Information recovery' and related concepts are addressed, but there is no naïve assumption that 'information recovery' is the whole story. Education, training, experience, supervision, work study ... also clearly have their place.

The breadth of the kaleidoscopic case studies and appendices is too wide for facile dismissal. The crisis of having information 'messes' all over the place is exacerbated by 'high tech' which multiplies the variety available. The technology also contributes by forcing information into formats which differ from printed equivalents often irrespective of utility. Purchasers and users of 'high tech' systems may be made to feel totally inadequate, with investment never

repaid. Solutions are often contorted by technical (hardware and software) limitations though glorious successes have mixed with chaos and abysmal failure.

Using concepts from the theory presented within the thesis and to enable the reader to overcome any possible difficulty in seeing the relevance of the case studies a multi-layered contextualisation is provided, in other words the reader can experience a 'user-friendly' 'way in', according to their own background, stance and choice. The following have been provided:

an **abstract** which marks out the key conceptual themes;

a **preface** in the form of a personal historical review of relevant experience;

an **introduction** to the rationale, theoretic content and structure of the thesis;

a section on '**conventions used in this thesis**';

the **case studies**, designed as a good read (though not only for that!);

a section of '**apologia**' relating case studies to theory deriving from them;

a detailed **table of contents**;

**introductory and concluding notes** in each division (down to chapter size) to focus the attention on key points and examples;

(unusually in a thesis) an **index** which selectively highlights title and sub-title content, markers, definitions, and areas with education/training potential along with a few concepts the author believes may be sought which are not already covered;

a **supplementary glossary**;

(multi-page) **bibliography** structured so that all entries are in alphabetical order by author (or author proxy) in one listing (ie not separating out books, journals, electronic sources, personal communications ...) so that references from the text may be found in one expected location;

this **conclusion** (in the nature of an executive summary);

**appendices** to give complementary information without overloading the core of the thesis:

'A cybernetics example: a developing paper.'

'Reporting and under-reporting in health history taking.'

'Information science' and 'information technology components.'

'About online information.'

'A functional 'low tech' pamphlet filing system'

'Samples from the RESOURCES database.'

The thesis has shown that 'information retrieval' embodies an inadequate concept to cope with the realities of research requirements. It has shown that 'information recovery' with its dynamic synthesising and reworking, constructing and reconstructing connotations offers greater potential for meeting the real requirements of serious users, without incalculable losses.

Information handling, as developed in the case studies, had been primarily concerned with information systems, organised activities in which information is a main or key component. Within the case study systems, it has examined what makes them work well or what hinders, or prevents them from working. Cybernetics analysis (ie aligning cybernetics concepts alongside the system under consideration and examining the interaction which results) has been used to display the thesis topic of information handling, reducing the poverty of lack of choice, and replacing it, for example, in the case of 'way in' theory, with an explosion of ideas and concepts, which then had to be culled, still leaving a widely representative set.

A wide variety of the governors, or controllers of information handling in organised systems (activities) have been explored using a cybernetic analysis method in various degrees of complexity and application:

- (1) in the case study 'Information for the occupational health nurse';
- (2) in the appendix 'A cybernetics example';
- (3) in the post script, emergent, case study on the 'way in'.

The thesis was divided into five main sections:

- (1) the foundational and key theoretic aspects;
- (2) the case study context;
- (3) an apology (in the Greek sense, an explanation) which connected the practical and theoretic;
- (4) the theoretic themes arising from the case studies and leading into:
- (5) the emergent case study of the 'way in';

and enrichment material is provided in the appendices. The real life examples enable the reader to relate to his own experience and discard what is redundant for his own purposes at any given time.

The case study method was used initially because of the authors' increasing awareness of connections between a variety of her experiences, and their relevance to the information handling demand upon her. Opportunity for scientific report was offered by describing the key experiences, which offered a 'way in' for the uninitiated to identify with the concepts. A form of 'action research' where the researcher intervenes and monitors results, enriched the later case studies. (However, the case studies were not 'set up' with research protocols and research statements producing 'clean' data which was easily collatable and analysed). The final case study arose from considering the 'way in' which itself emerged from the thesis research. Only case study material which contributed to the development of the 'information handling' theme and the concepts, identified in the thesis, which govern or control the process of information recovery in systems which are like organised activities, has been allowed to remain. They cover systems, mainly in the workplace, and include mixed systems where humans, machines and information interact. Many of the inherent psychological and political factors have not been developed, though markers (marker) have been placed, and indexed, to highlight where further development is clearly possible, but would have been impracticable if the key thesis topics were to remain in focus.

The topics of the case studies included learning about batching and critical path and efficient working by repetitive potatoe peeling, to applying those lessons in batching and interfiling in a general office. They have included experiences relating to the information needs of occupational health nurses, and observing how the authors' first explorations of cybernetics suggested a way forward. Two young business organisations, and at the last minute, a state bank with some 3000 branches provided observations posts for significant information controls and a test bed in which the effects of manipulation could be examined. Systems with great communications complexities were examined in one analogous example, ie the information recovery problem where large numbers of variables and values are included in the input and output of a computer.

In the general theoretic section the concept of information recovery was introduced and differentiated from ideas of retrieval, restitution and salvage. 'Recovery' and 'information' are shown to be appropriately linked as a dynamic concept where new information poses particular problems of acceptance and where quality "is the central problem of" this information age (Brown; Weiner 1984 quoted in Out of context 1984).

The breadth of 'information handling' which may have been considered too general to consider in a PhD thesis, is shown to be appropriate for a cybernetics thesis since cybernetics traditionally has dealt primarily with the comprehensive and general. The thesis topic is



explored through cybernetic concepts like 'governing', 'controlling', 'purpose'. 'logical nets', 'negative feedback' and '"systems that are open to energy but closed to information and control" with all the components of information and control to be examined' (Ashby 1956 p4)  
That general theoretic discussion has been linked with the case study information and the theoretic themes which arose from the case studies, in the transitional section, 'apologia'.

As the theoretic themes from the case studies were picked up and examined cybernetically, beyond the restraints of mere 'information retrieval' newly identified concepts, or newly applied concepts emerged:

a notion of robustness of information arising from the linkages of information of assessed validity to other relevant information structures (a logical network);

and leading to:

the formation of batches;

the authors' suggestion that the ability to form, and use, information batches successfully is a major criterion for assessing the potential for growth and stability of an organisation or organism;

the phenomenon of 'asnegsist', information being 'as good as if it didn't exist' (newly named and displayed, not a new concept);

(the above concepts are) related to:

practical development of a database;

learning theory;

the 'way in' (a subset of 'design' named in this thesis, and its generalisable features highlighted):

to material in any kind of storage system (or);

to any kind of system which has information as a component exemplified in the post script case study on the 'way in' to an organisation or organism and demonstrating some of the potential of the analytical methods proposed;

the 'leakage' problem;

algorithms, which may be thought of as dynamic classification systems, flow charts and heuristics:

forming information pathways (networks);

creating vital structures for information handling and

within which information recovery may take place;

practical ideas on the preparation and presentation of (primarily written) communications so that recovered material will be able to be used as intended;

Suggestions have been made for further research located both in the specific section and via the index under 'marker', and 'education/training potential' (indirectly).

In this data saturated society, what response will there be to THIS information?

## Glossary

Choice of content in this glossary is different for the various words presented. This is because it is merely intended to supplement what is presented elsewhere in the thesis and is otherwise commonly known. Where definition has been given in the text it is marked alongside the appropriate word or concept in the index. Consistency of presentation has been followed as far as possible.

(Abbreviations from dictionary quotations have been spelled out)

+ation: "Suffix forming 'nouns' denoting (1) verbal action, (2) instance of this, (3) resulting state, (4) resulting thing ... [from or after French or from Latin '-atio -ationis' from verbs in '-are' (see -ION)] (Sykes 1976)

+algorithm:

(1.) The word 'algorithm' comes from the name of a 9th century mathematician. It refers to "Arabic (decimal) notation of numbers." and "Process or rules for ... calculation etc." (Especially when it is done by machine.) (Sykes 1976) Sykes predecessors called it "an erroneous refashioning of algorism." (Murray et al 1933)

(2.) "Set of steps to be taken in operations to effect a desired calculation" (Collocott 1974). "A process or set of rules, usually one expressed in algebraic notation, now used especially in computing, machine translation and linguistics." (Burchfield 1972)

(3.) "Alphabetic operators stated by a finite set of rules are usually called algorithms ... The concept of algorithms comprises that of equality for alphabetic operators corresponding to them, but it also calls in addition, for coincidence of set of rules stating these algorithms." (Glushkov 1969 p56)

"All the constructively determinable alphabetic operators (algorithms) are representable in the push-down, two storage automata." (Glushkov 1969 p53)

(4.) "... any sort of procedure which can be carried out by a mechanical device or 'purely mechanically' ie according to fixed rules, without the use of intelligence or initiative by a human computer." (Schuh 1969 p1) The term 'algorithm' includes procedures which terminate and those which don't. (Schuh 1969 p4)

(5.) "A finite sequence of instructions for solving a specific problem." Cosmos Inc. 1987 p3)

(6.) "A predefined sequence of steps which lead to the solution of a problem or show in a finite time that no solution is possible." (Hibbs (D) 1987 quoting unknown source)

(7.) "Evaluating a function for a given set of arguments." (Stewart 1988 11/2 quoting.) It is an effective procedure. It is limited to a number of computable functions. Any idiot could do it. (Stewart et al 1988 11/2)

+asnegsist: pronounced: 'as' 'neg'ative 'exist'ence with the 'eg' of negative and the 'ex' of existence overlapping. A composite word developed by the author in May 1988 to denote the concept of the phenomenon of 'as good as if it didn't exist'. It serves to denote a reality, of potential informational value, being proximal to an observer but being completely overlooked, with resultant loss of benefit to the observer. This loss may be indirect.

+batch A group of entities being treated in some way as a set at a particular point in time. For such a group of entities to be a batch normally requires that there be at least one other similar group. Batching is concerned with forming entities into suitable groups enabling them to be processed as a set rather than individual items.

Batch "the process of baking" (obsolete) and concretely "A baking; the quantity of bread produced at one baking." In a figurative and transferred sense "The sort or 'lot' to which a thing belongs by origin (as loaves do their own batch). (Obsolete) Batching and batcher did not appear in the 1933 Oxford English dictionary. (Murray et al 1933) Batch "Transitive. To treat (bundles of raw fibre of jute, wool etc.) in batches for various purposes. Hence batching '**verbal substantive**' the action or process by which this is done; also '**attributively**'. Also batcher, an operative who does this." "... fibres matted together by a resinous constituent and ... subjected to the preliminary treatment of batching. This consists of moistening the fibre with ... oil." "Calico- printing and dyeing. To collect into a 'batch' or mass. Hence batching '**verbal substantive**'. (also 'attributively'.) (Burchfield 1972)

+chunk: "Thick lump cut or broken off (wood, bread, cheese, etc.)" (Sykes 1964) Whereas batching is concerned with forming entities into suitable groups for processing, chunking is more concerned with separating off parts of existing wholes to make them more manageable in some way. A chunk does not require other chunks for its existence. The existence of a chunk has no particular relation to time. The content of a chunk tends to be undifferentiated and amorphous.

The Oxford English dictionary says a chunk is "1. A thick, more or less cuboidal, lump. Cut of anything, eg wood, bread, cheese, meat, etc. ... 1888 **Berksh. Gloss.** (E. D. S.) ... Chunks, . split pieces of firewood of more uniform thickness than chumps. ... Figuratively ... 1860 '**New York in Slices**' Theatre .... Now and then a small chunk of sentiment or patriotism or philanthropy. is thrown in. ... 1876 Besant & Rice '**Gold. Butterfly**' xxi x 219 Pay out the information in small chunks. 2. '**Attributively**' and '**combinations**' as chunk firewood; chunkhead (U.S.), a serpent of the rattlesnake family ... Hence chunk '**verb**' U.S. colloquial ..." (Murray et al 1933) The 1972 version adds examples like "... a man got into a chunk of a fight ... A fair - or a large-sized specimen of an animal or person." (Burchfield 1972)

+code: "'**noun**', and '**verb transitive**' 1. '**noun**' Systematic collection of statutes, body of laws so arranged as to avoid inconsistency and overlapping; set of rules on any subject; prevalent morality of a society or class (especially '**code of HONOUR**'); persons standard of moral behaviour. 2. (Military etc.) system of signals, especially used to ensure secrecy; system of letter or figure or word groups or symbols with arbitrary meanings for brevity or secrecy, or for machine processing of information; (Biological) **GENETIC 'code'**. ... 4. '**verb transitive**' Put (message etc.) into code; hence coder '**noun**' [Middle English from old French from Latin CODEX]" (Sykes 1976)

code: "Substantive Add (since 1933 edition) 3c. Cybernetics. Any system of symbols and rules for expressing information and instructions in a form usable by a computer or other machine for processing or transmitting information. ... The machine having been properly briefed by means of a code punched in a paper tape ... Orders to ... the machine ... expressed ... as numbers in some arbitrary code. ... holes are punched ... according to some pre-determined code. ... d. Extended uses in '**Biology**' and '**Linguistics**' ... the chemical code which embodies the

instructions. ... 1964 *Language*. xl 243 The central concern is how the bilingual speaker becomes 'inputted' for two language codes. ... 1965 *Canadian journal of linguistics*. Fall 41 Number and pattern (or 'code' - a favourite term in linguistics.) ... 1965 *Listener*. 2 Sept 332/2 The conceptions molecular codes, and the chemical storage of information which have arisen from work on reproduction, have stimulated fascinating speculations about the mechanism of memory and the mystery of dreams. ... 5. code-bearing, -breaking -checking -switching; code-book ... code-name ... code-number ... code-script ... 1959 E. Pulgram 'Invol. Spectrogr.' *Speech*. xi 82 The hearer is able to perform what communication engineers call code switching, a process of adjustment to the articulatory habits of the speaker which permits the listener to learn quickly certain types and degrees of phonemic deviation." (Burchfield 1972)

'code. 'verb' Delete 'rare' and add: (The forms coded '**participial adjective**' and coding '**verbal substantives**' are common in all uses.) ...b. To prepare (a message ) for transmission by putting it into code words ... c. '**Cybernetics**' to put into the form required by a code ... d. In extended use ... carry in coded form..." (Burchfield 1972)

code: "(Computing) Variations in a unified pattern which represents relevant pieces of information on a one-to-one basis. Thus numbers in a '**binary**' or '**decenary**' scale of numbers can represent letters or numerals, money, stocks etc., as data for processing. Such numbers can then be coded into, eg a 5-unit code for manipulation." (Collocott 1974)

coding: "'**Computing**'. Programming of a computer, whether by written instructions on a coding form, by pseudocode, or in machine code. ..." (Collocott 1974) See also: pseudocode.

+constraint: NB constraint is related to practicality

+derivation: "A derived product; a derivate, a derivative. ... 1669 '**Gale Crt. Gentiles**' 1. 1. i. 6 All human Arts and Sciences are but beams and derivations from the Familiar of Lights. ... a. 1680 Glanvill (J.) Most of them are the general derivatives of the hypothesis they claim to ..." (Murray et al 1933)

+inform: "'verb' 1. '**verb transitive**' Inspire, imbue, (person, heart, thing, '**with**' feeling, principle, quality etc.); impart its quality to, permeate, tell (person '**of**' or '**about**' or '**on**' thing or subject. '**that**', '**how**', etc.) whence: informant (noun). 2. '**verb**' intransitive Bring charge or complaint ( **against** 'or '**on**' person). [Middle English from old French '**enfo(u)rmer**' from Latin IN ('**forma**' from '**form**' form) give shape to, fashion, describe]" (Sykes 1976)

+information: "'noun'. Informing, telling; thing told, knowledge, (desired) items of knowledge, news, ( **on**, **about** ); (Law) charge or complaint lodged with court or magistrate ( **against** ); information retrieval: tracing of information stored in books, computers etc.; information theory: quantitative study of transmission of signals etc. informational. '**adjective**'. [Middle English from old French from Latin '**informatio -onis**' (as INFORM; see -ATION)]" (Sykes 1976)

+'**information leakage**': a composite term developed by the author to denote: loss of information from some collection or renewable source in such a way that unless active steps are

taken to salvage it, or it is salvaged by some independent system, near the point of loss (leakage) it will never be recoverable.

+**'kubervèw'**: is used in the first century AD Greek New Testament (I Corinthians 12:28) where Paul says that the Church has been given first apostles, secondly prophets, thirdly teachers, then miracles, then gifts of healing, helps, **'kubervnèseis'**, generation of language. (Free translation Hibbs 1985 25/3 reference to British & Foreign Bible Society 1954, Strong 1890, Analytical Greek lexicon. Undated). This is translated: 'administrations' (Bible 1960); 'administrators' (Bible 1952); 'governments' (Bible 1611) 'governments' or 'wise counsels' (Bible 1901); 'those who can get others to work together' (Bible 1971) 'those who ... direct them (others)' (Bible 1961)

**'kubervnètn'** is also used in that form in the New Testament (Acts 27:11) referring to a ship's master. In which case the meanings helmsman, governor and controller are implicit. (Hibbs 1985 25/3 reference to British & Foreign Bible Society 1954, Strong 1890) The 'governor' of the ship is not providing the crew with their motive power, he is responding negatively to their behaviour so getting them to behave in the desired way. Equally as helmsman he responds negatively to the 'controllers' (wind, waves, current, effects of the oarsman's work) which cause the movement so getting the ship to move in the desired direction. The negative feedback, and the concern with controllers relating to biological or physical systems are characteristics of cybernetics that this name **'kubervaèw'** was intended to emphasise.

+merge: **'verb'** To blend two or more sorted batches, to form a larger sorted whole.

+multiple derivation: "The principle of multiple derivation. Briefly, this principle says that a belief or idea about an aspect of the world becomes more solid and real the more ways that it can be derived, or the more ways in which its effect or presence can be detected." 'Examples include:

double entry book-keeping;

where three computers are used to work things out and only if two agree is action taken;

in court evidence where two independent witnesses are sought;

in journalism where two independent sources are sought for a story;

in verifying physical effects like temperature;

in assessing the intelligence of a person;

in the social sciences in general, where measurement and apparatus may be observation specific and distinction between theoretic constructs and empirical observations and measurements must be continually taken into account.

(Elstob 1988 p19,20)

"The degree of belief or trust in truth tends to increase as the number of different ways we can get at it." The ability to learn of a concept is often increased when we can consider it from another angle of are presented with a different application. (Elstob 1988 16/6)

Multiple derivation is like the French word 'assurance' where a multiplication sum done in two directions should produce a result worth zero difference. (Savashir 1988 16/6) It is cross tallying - as a clerk or 'What I say three times is true' (Dewhurst 1988 16/6 referring to Lewis Carroll), reminding us of our human feet of clay, however we intervene in a system.

How vocabulary is learned is by multiple derivation, but in that case the target is a moving one, as the concept and vocabulary are brought together relationships are formed with other concepts and vocabulary, and from that new relationships and concepts can grow. It isn't enough to have many tags to a concept however without a word to describe it - without a word, a label, it is very easy to lose or overlook. eg this very concept of multiple derivation which is well known but appears not to have been labelled before Elstob did it. (Elstob et al 1988 16/6)

Aimless naming of concepts doesn't work in helping to keep tabs on a concept. cf Richard Dawkins book: 'The selfish gene.' and the way special terms are used in certain language communities eg Freudian psychologists; certain religious communities; Cockneys; some cyberneticians. Negatively, if computer programmers, for example, spend too much time away from 'the real world' they have too few derivations for their ideas and may become detached. (Elstob et al 1988 16/6)

Multiple derivation is linked to 'redundancy' of Shannon's theory and the means of sending messages effectively involves having enough redundancy to ensure their safe arrival. (Dewhurst 1988 16/6)

+NATO coding system: a system of thirteen digits divided into a group or class prefix of four digits, two digits for country of origin and a set of three and four digits divided by a hyphen for the item identification number. (NATO Coding System information from Defence Codification Authority, 73-75 Strand LONDON WC2)

+paradigm: "a domain to which language gives access" (Thomas 1983 Oct.) "... the process of scientific inquiry could be described as the translating of the 'language of nature', by an inductive process, into a language which is already understood by us. We can, in fact, regard this as a paradigm case of learning" (George 1967 p81) "paradigm (-im) noun Example or pattern, especially of inflexion of noun, verb etc.; hence paradigmatic 'adjective' (from late Latin; from Greek 'paradigma' from 'para' ('deitnumi' show) show side by side" (Sykes 1964)

+practicality NB practicality is closely related to constraints

+pseudocode: "(Comp). Instructions written in symbolic language which must be translated into an acceptable program language or direct into machine language before they can be executed." (Collocott 1974)

+recover: "'verb and noun' 1. 'verb transitive' Regain possession or use or control of, acquire or find (out) again, reclaim ('has recovered ... the meaning of the hieroglyphics ... metal from scrap ...' (Sykes 1976)

+quality: goodness; good quality; excellence; merit; fineness; superiority; first-rateness.

-reliable. "That which may be relied on; of sound and consistent character or quality ..."  
(Sykes 1976) A measure of reliability is the probability a given function will produce the same results given the same conditions.

Of reliability Beer says, that "if it is possible to build a reliable machine with unreliable components and circuits" it must also "be possible to build a reliable machine with arbitrarily connected components ... a network with enough variety, joined more or less randomly capable of being made to operate reliably in imitation of any given machine, providing it contains enough redundancy." That is to say "error can be controlled." (Beer 1959 p102)

+retrieve: "**verb transitive**", and '**noun**'. (1.) '**verb transitive**' (Of dog, especially of special breed) find and bring in (killed or wounded game etc., or abstract); hence retriever '**noun**'. (2.) recover by investigation of effort of memory; find again (stored information etc.); restore to knowledge or recall to mind. (3.) regain possession of. (4.) rescue from bad state etc.; restore to flourishing state, revive. (especially ones fortunes etc.) (5.) make good, repair, set right. (loss, disaster, error, situation) (6.) hence retrievable '**adjective**', retrieval 2 '**noun**'. (7.) '**noun**'. Possibility of recovery (beyond or past retrieve). ..." (Sykes 1976)

+robust: Robust is used of a person with strength and health who is not slender, delicate or weakly. It is used of equipment which is strongly built and will not easily break. Intellectually, one who is robust "is not given to or confused by subtleties; ... Latin '**robustus**' firm and hard ('**robus**', '**robur**' oak, strength)." (Sykes 1976) Information which is robust can be taken to have characteristics of durability, strength and clear identity. It is not ephemeral, easily confused and easily lost.

Words related to robust which may be helpful in relation to the building of the concepts used in the thesis:

strong; strength; inherent power; hardiness; ruggedness; stamina; guts; fortitude; endurance; hardy; hard as nails; vigorous; sturdy as an ox; strong as a lion, horse or ox. In relation to health: robustness; ruggedness; hardiness; strength; vigor. (Roget 1963) Validity; soundness; solidity; substantiality; cogency; authority; weight; force.

Reliable (see above)

Quality (see above).

Multiple derivation;

Check digits;

Verification.

+sort: '**noun**' "Group of things etc. with common attributes, class, kind, species, variety ...  
2. = kind (nothing of the sort; ... what sort of tree? ... '**verb**' "To separate into sorts according to size, quality, destination etc." (Sykes 1976) In this thesis and in computer usage 'To order into sorts according to some classification.'

+Universal Decimal Code (UDC): developed from the Dewey Decimal system of Melvil Dewey in 1873. A multifaceted library classification system. The English language version is a British standard. As the different language versions use the same concept codes, concept translations are potentially very accessible via a computer system holding them. (eg BSI 1961)



+variety: The variety of a set is not an intrinsic property of it. To clearly define the variety "the observer and his powers of discrimination may have to be specified ..." (Ashby 1956 p125) For example, a 50p piece to a gambler tossing it has two varieties, head and tail, for a buyer of 1p stamps it has 50 varieties, to the counter of its physical facets it has five flat edges as well as head and tail. (Stewart et al 1985 16/4) There are mathematical techniques associated with calculation of variations "calculus of variations" Wiener 1948 p17)

## Bibliography

### Note:

- (1) In this research of information recovery from a wide range of 'standard' and 'non-standard' sources has been used.
- (2) To enable the reader to locate material easily, in relation to references in the text, this bibliography is put in alphabetical order by reference name (authors name or next best substitution) irrespective of the type of source.
- (3) The readability research was based on abstracts only, and is referenced with the form (LA 1987 24) and (DAD AAC0558628) (see Appendix D).
- (4) Reference to other non-standard sources is indicated following its bibliographic entry.

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## APPENDIX A

A cybernetics example: a developing paper.

By Genevieve M Hibbs

1983 (Edited 1988)

Note: The author wrote this paper over a period of weeks as a developing paper. Apart from what is clearly marked there have been no changes in content from the original form. Editing has been done to remove duplication and for presentation purposes.

On starting to study cybernetics the author was recommended to read Ashby's 'Introduction to cybernetics.' (Ashby 1956) Having read and made notes on the first three pages of the introduction to Ashby's introduction and slept on it. The author constructed this chart (later additions are included as marked.):

Subjects	Concepts	Acted on by			Leading to	
I N F O R M A T I O N  T I G H T  S Y S T E M  M I A N C F H O I R M E A T I O N	Represented by transformation ---	C O O R D I N A T I O N	R E G U L A T I O N	C O N T R O L	W H A T  A R E  A L L  P O S S I B L E  B E H A V I O U R S  I T  C A N	P R O D U C E
	Stability ---	D I N A M I C S	L A S T I C S	R O B U S T N E S S		
	Ultrastability ---	A D A P T I V E	I N T E L L I G E N C E			
	Feedback ---					
	Independence within mechanism ---					
	Coupling potential of mechanisms ---					
	Statistical modelling (of large complex systems) ---					
	Black box ---					
	Coding ---					
	Noise ---					
28.4.83 Uniqueness (Other solutions to basic problem) ---						
28.4.83 What is it preventing ie if it was not there what would happen? ---						
3.5.83 Other 'machines with similar characteristics. ---						
3.5.83 Parameters. ---						
18.5.83 Effects of trauma.						

Chart of cybernetics processes to apply to information tight systems / machines developed from the ideas in the introduction of 'Introduction to cybernetics.' (Ashby 1956)

It seemed a good plan to choose a simple machine and to process it through the chart.

A \*lead pencil was chosen because the author thought it had few variables and therefore would be simple to work out. After a few minutes she redefined the lead pencil as: "lead pencil, plain wood with paint". (\* see below redefinition as graphite)

Note: From this point subsequent processing (as dated) is intermixed with the original to avoid duplication.

28th April

Dr. Stewart asked whether the uses suggested were logical from the facts available. ie could one write a computer programme so that people would come up with all the answers or was the process a 'creative' one that others could not necessarily follow. On the spot the author answered that ultimately it was a logical process.

The knowledge base required for identifying 'all possible' uses obviously has to be incredibly wide. During the initial stages of developing the idea of "all possible uses for a pencil" The author did not follow up the: lettering; paint; glue; chemical specifications and implications of the chemical composition or the structure of the wood; even the graphite was left with open ends for possible uses because of the size of the potential.

It would be possible to go a long way on 'all possible applications' of, for example, many chemicals by using such sources as CHEMLINE, TOXLINE, MEDLINE, and a variety of other data bases as programmed steps in compiling the specifications, and then use product information data bases over the whole range of disciplines to match with the specifications. Examination of logically related words in a good thesaurus could also help. (The author had looked up some precise words that had escaped her, in the earlier stages of this exercise, something she had only done rarely.)

The information collection would be massive, but if the steps were followed through systematically only information needed for further processing would need storing, because the steps could be followed again to get to the same place. (Provided the information in the data bases had not materially changed. Changes in data base content might not matter, as it might be improved, but that might block identical findings by subsequent searchers.)

I will go through the April paper and comment on the logical jumps with a view to identifying the information needed for someone else to follow the same process:

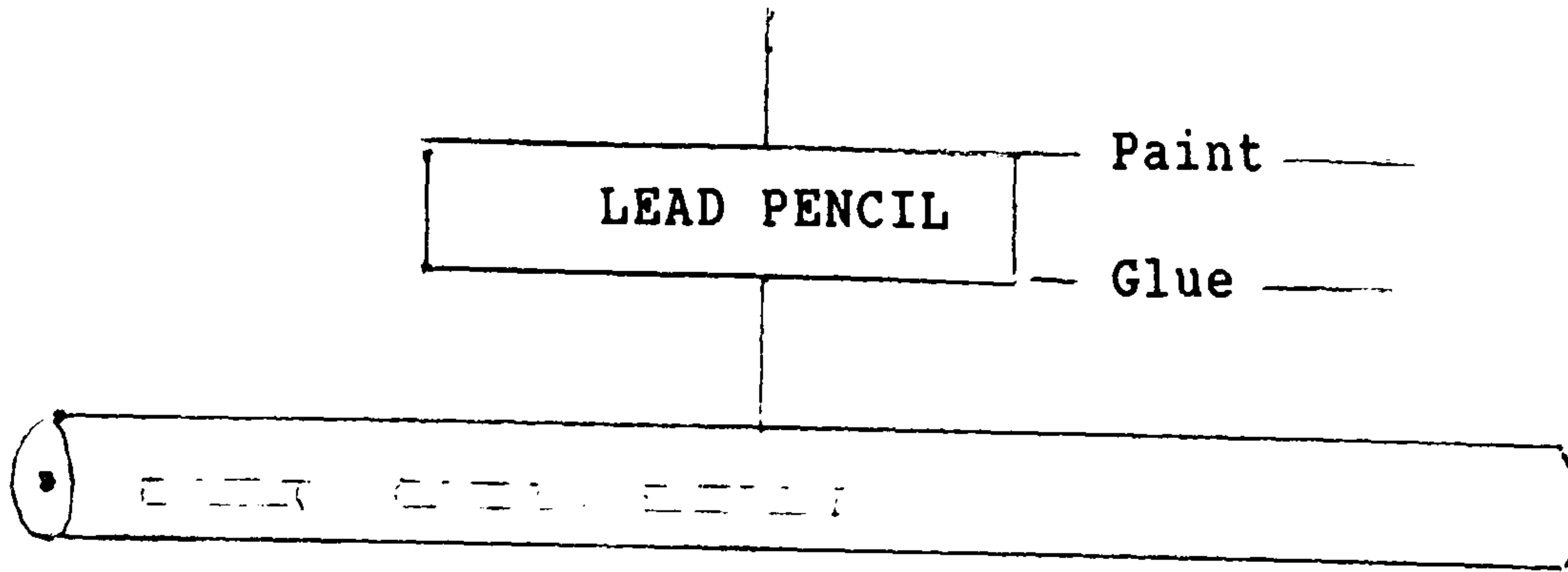
Comment on the lead pencil in relation to the application of cybernetics topics:

1. Represented by transformation. Don't understand this sufficiently to apply it to a lead pencil.

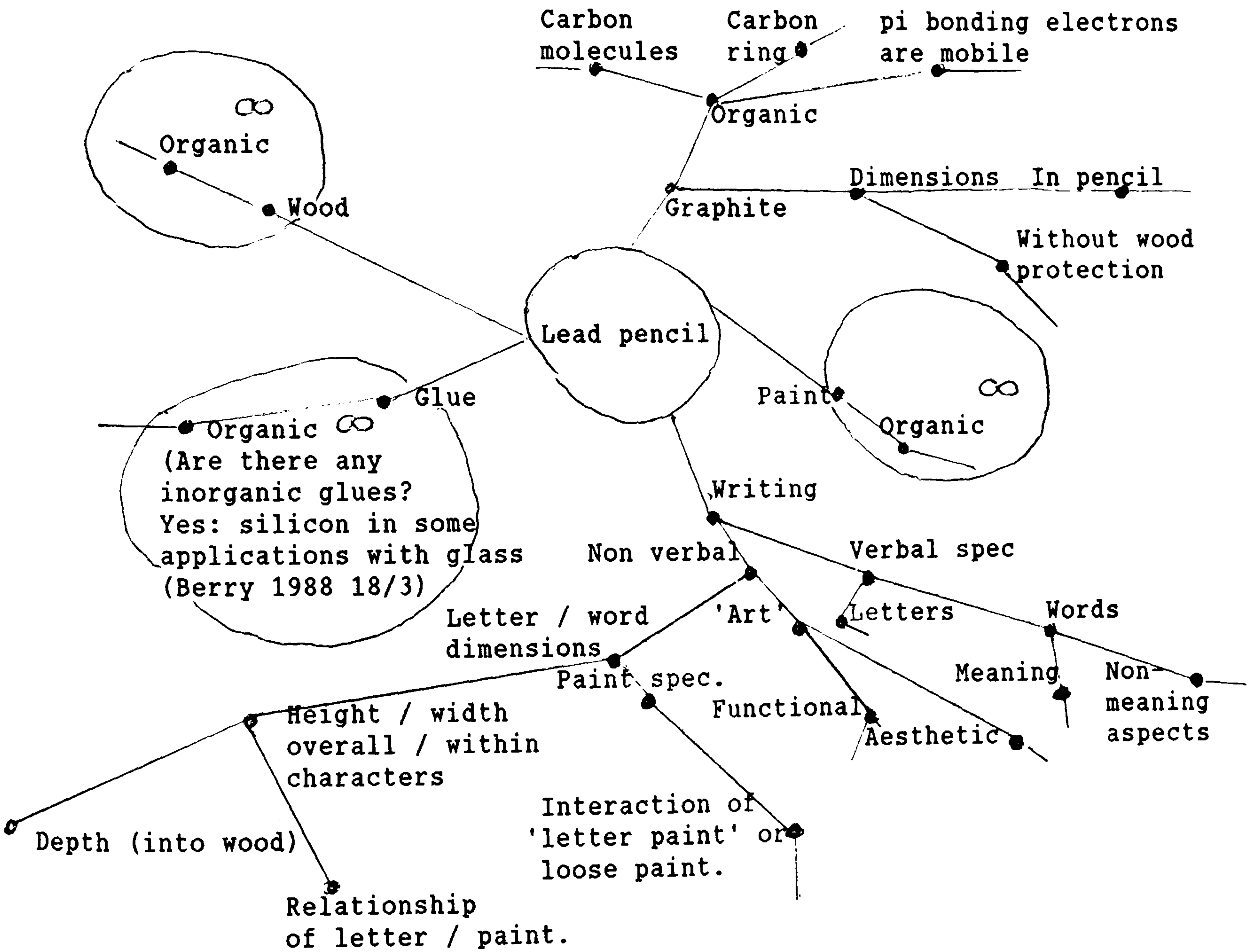
Towards: all possible uses of a pencil.

Note: These logical spiders were jotted in rough form in 1983. Structure and content have not been changed except where indicated.

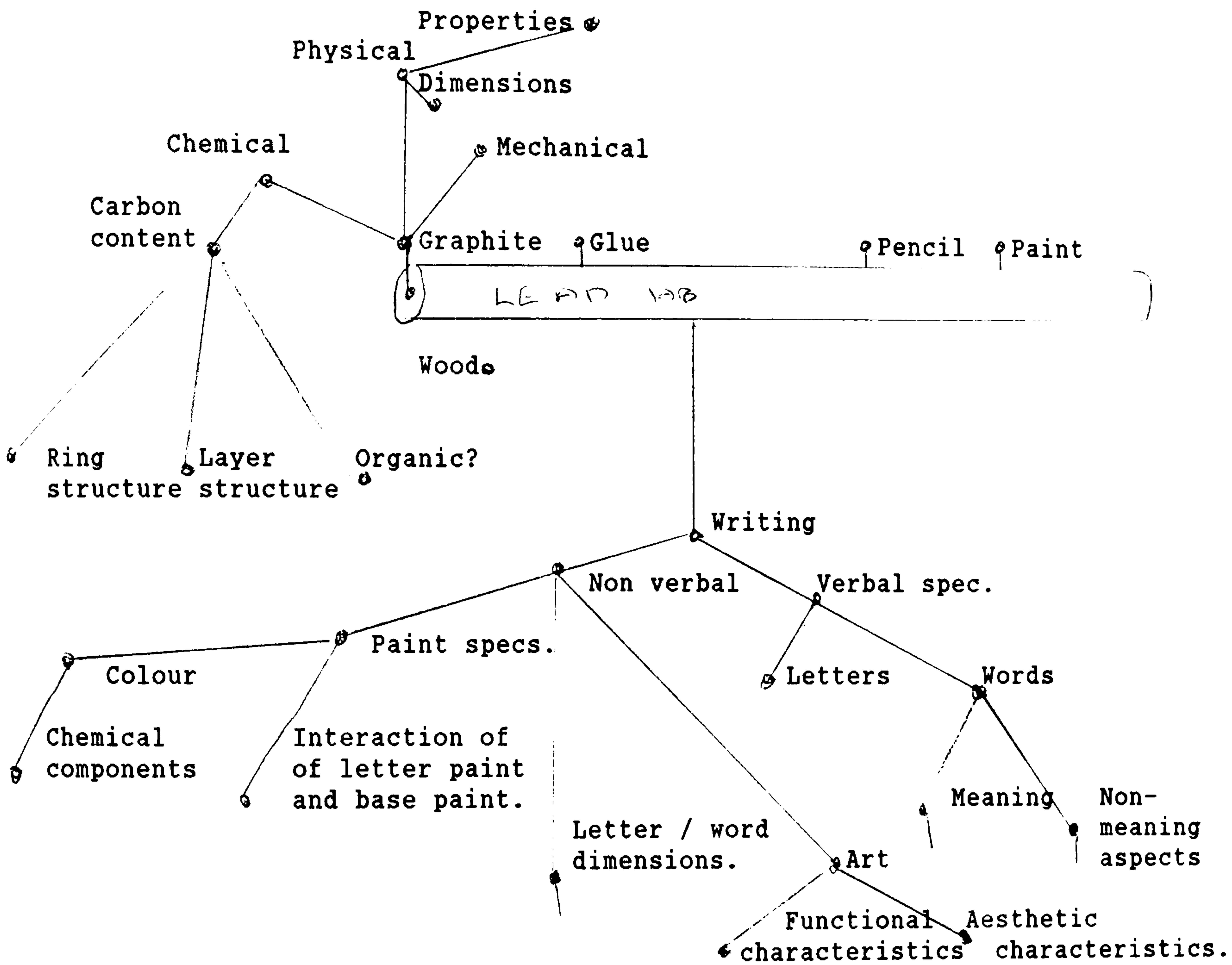
1. Start.



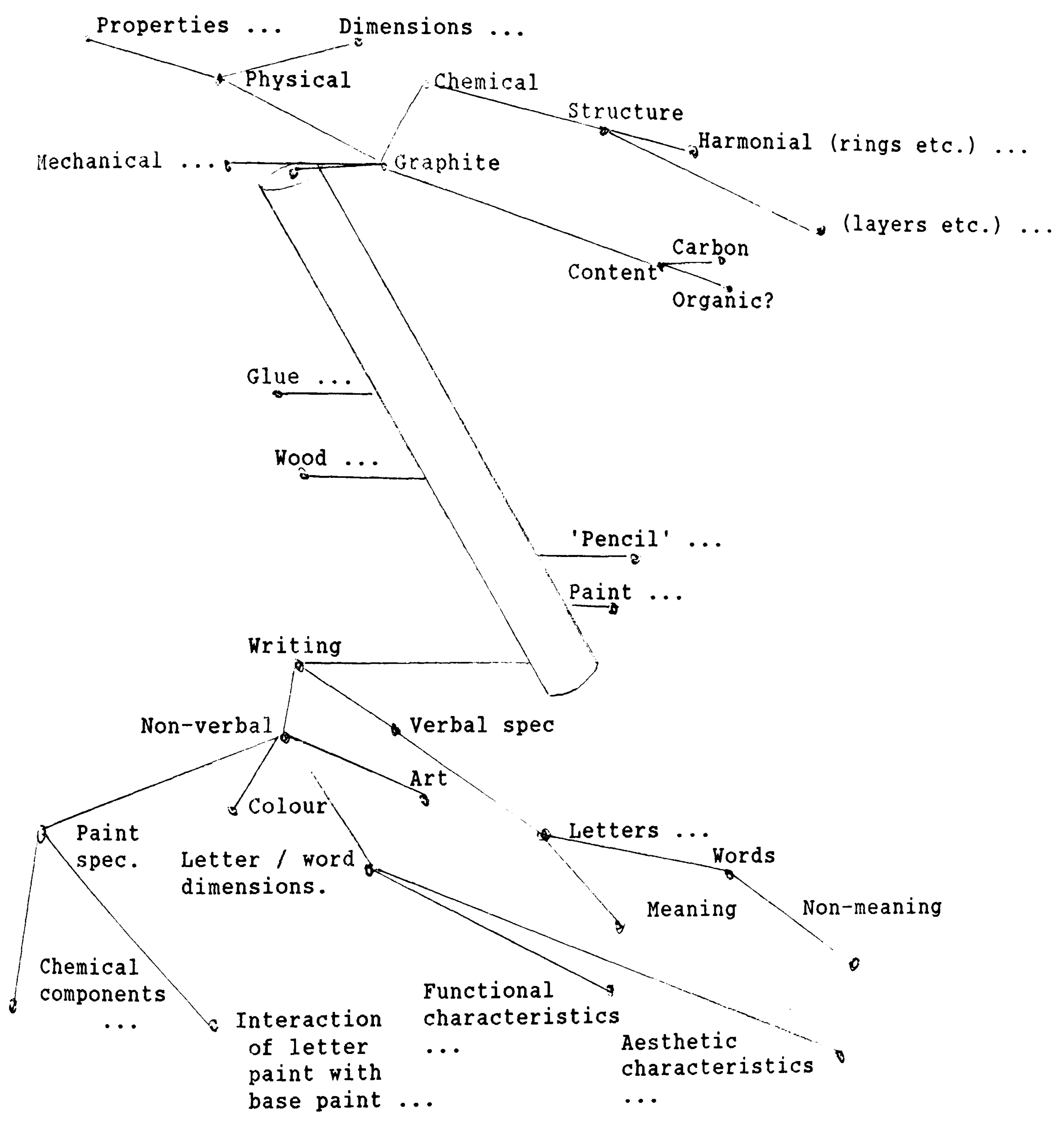
2. Components and specifications (spec(s)). (a)



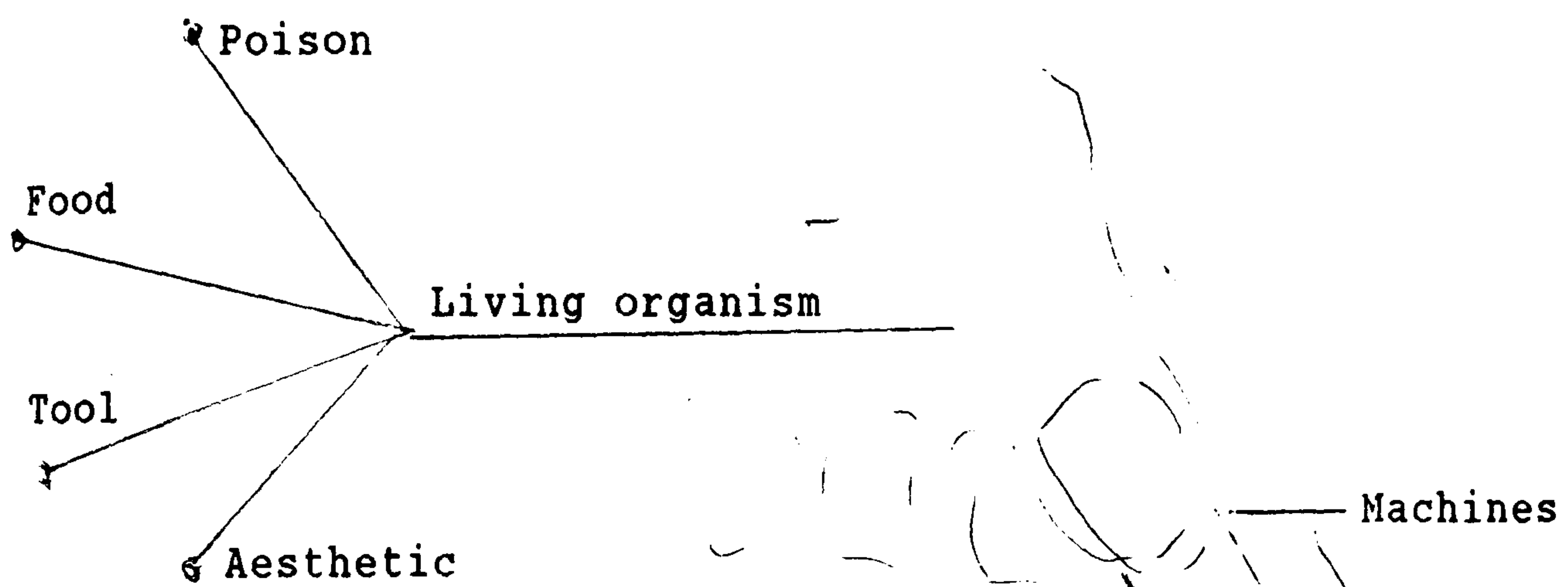
3. Components and specifications. (b)



4. Components and specifications. (c)



5. Coupling potential.



23.4.83 Without reading further on cybernetics decided:

That whatever the 'represented by' meant, the transformation could refer to transformation to other states or the effects which would be present if the material contents were substituted.

If the first is true then one could think of the wood being transformed into charcoal, the paint into molten paint drops etc. (see under 2. Stability.) Then there are all the possibilities of using parts of the whole for unusual purposes eg building blocks, dice, cog wheels, wedges.

3.5.83 Building blocks depends on knowledge of child's building blocks. The pencil would make small ones. The author did have in mind the game where one has about 6 small blocks of wood (Chucks?) and a ball and has to pick up the blocks in a particular order with one hand while using the same hand to throw and catch the ball. On toying with their name the author thought of the child's building blocks. Dice are very related in size to the pick-up blocks.

Cog wheels - thinking about pencil chewing and tooth marks suggested the possibility of using the pencil as a temporary cog. The length of the pencil then suggested the possibility of its use as a worm gear.

The cog wheel jump is not very easy to programme unless one says 'what would produce similar shapes in the wood to those made by teeth' then one also gets to other types of 'teeth' etc.

18.5.83 One has to have first asked questions about what trauma occurs to pencils accidentally, non-accidentally and with what effects on the various components etc.

3.5.83 The shape of the sharpened pencil end suggested a wedge. Examination of shapes in profile is a useful step.

If the second is true substitution of the wood by plastic and the 'lead' by other materials eg coloured 'lead', rubber and so on, which have been done and: delivery system for: medicaments, minute quantities of substances in chemistry, laboratory work and manufacture, which haven't been tried to the authors' knowledge.

3.5.83 The delivery systems for ... In this case the lead substitutes were redefined as fillings to be consumed, perhaps in measured, but in any case, in small doses. The particular delivery applications locations are generalised categories which one could search as by going through MIMS (the monthly pharmaceutical directory supplied to all doctors in the National Health Service) to find medicaments that might usefully be delivered in that way, such as cortisone skin creams which are normally grossly overused by patients. That does imply practical knowledge of compliance problems which wouldn't normally be in a convenient data base. Need new data base on compliance.



## 2. Stability:

3.5.83 The specifications here are fairly straightforward. The greater the range of specifications covered, for example by including the biological effects, the greater the range of possible uses likely to be seen.

Chemically stable at normal temperature and pressure. Becomes unstable in presence of fire or heat above a certain temperature, when the paint melts, leading to burning of paint, leading to wood beginning to smoulder and then burn. (Lead becomes unstable at high temperature Melting point 327°C, burning point 1740°C.) (Graphite melting point is 6040°F)

(Lead: substitute graphite see below) wood, paint and glue become unstable in presence of certain active chemicals. (Graphite is active with very strong oxidisers eg fluorine, chlorine, trifluoridem potassium peroxide (NIOSH/OSHA 1978 p106)) (Graphite changes some of its characteristics in vaccum when its layers do not slip over each other easily, and therefore it does not act as a lubricant. (Sisler, Dresdner, Mooney 1980)

Stable to minor trauma but lead is abraded and transferred on to paper and similar surfaces which are not microscopically smooth.

Will not transfer to surfaces with wax or fat on their surface.

(Lead: substitute graphite see below) is abraded by shaving. Impact fractures it, as when dropping the pencil on to a hard surface from more than about a metre. It is brittle.

The shape of the pencil is stable until cut, shaved, shortened, or compressed, as by chewing.

The wood may be attacked by mould, wood boring / eating animals or deteriorate following exposure to high humidity or water. (Graphite dust inhaled causes cough, dyspnoea, black sputum, reduced pulmonary function and fibrosis. Masks of different specification are recommended for use at 75 mppcf; 150 mppcf; 750 mppcf; 7500 mppcf (ie mppcf millions of particle per cubic foot) (NIOSH/OSHA 1978 p106)

3. Ultrastability - no application seen here, perhaps due to insufficient understanding of the concept.

## 4. Feedback.

Feedback - a protective mechanism is provided by encasing the lead in wood which absorbs a lot of the trauma, producing a stable casing for the fragile, brittle lead.

External feedback to user by:

- a. observing lead end is broken or short;
- b. by observing written marks;

- c. by hearing it break;
- d. by feeling it break;
- d. by seeing it break.

3.5.83 Presumably some feedback mechanisms have been classified. This is likely to be an information area that needs developing onto the data base. A new data base is needed on feedback mechanisms. The exercise physiology section at WLIHE (West London Institute of Higher Education) has information on this.

#### 5. Independence within mechanism.

Not dependent on external supplies 'food' 'oxygen' etc. Finite life depending on use, trauma etc.

3.5.83 There must be a scheme of dependence factors which maybe needs developing onto data base.

#### 6. Coupling potential.

Use in cooperation with:

##### a. human hand:

as writing instrument;

as pointer;

as straight line;

as circle to draw round;

as punch;

as carrier of small quantities of liquid;

as paint printing tool:

small circles from blunt end;

small marks from sharpened end;

as source of:

wood;

lead;

paint flakes;

coloured paint flakes;

as a coloured object;

as a stirrer ...

3.5.83 The coupling potential examples are largely from use and experience. The logical jump to 'punch' used the authors' experience of carpentry but could perhaps have been programmed for, in the new 'uniqueness' or a new category 'other machines with similar characteristics'.

The 'carrier of small quantities of liquid' comes partly from the similarities in shape to a small paint brush combined with the practical problem of applying Mandles paint to mouth ulcers. The answer the author found was to supply the paint in an eye dropper bottle and instruct the patient to dip the dropper in the paint without sucking any up, and then touching the dropper to the affected part. The dropper could then be washed before being put back in the bottle. The paint printing tool comes from potatoe printing and trying out alternatives.

b. machines (such as):

compass;

chart recorder;

drawing mechanisms.

c. person / animal:

psychological comfort / satisfaction from chewing or playing with it;

Potential for lead poisoning. NO not Pb!

7. Coding: Don't think this is applicable to the pencil per se.

8. Black box. Evidence for contents as pencil is used and reduces in size. If hadn't seen one before might infer shape of contents from shape of object, especially the similarity of both ends, and the wood grain and join of the two pieces. Don't know lead is intact, or indeed that it runs throughout, stays the same shape etc. until opened or used. Might infer use from experimentation if other types of writing instruments have been used.

3.5.83 There must be a system for examining a black box, maybe it needs developing for data base use.

10. Noise.

Contaminants in the lead, or breaks / weaknesses in the lead / wood.

3.5.83 There must be potential for a classification of 'noise' for a data base.

Having got the bulk of the above information together the author realised a much tighter specification of the pencil was required.

A Lead pencil:

In two pieces of wood glued together to form a cylinder, app. 7.2mm diameter x 176mm length. (The author used an engineering measurement tool here because it seemed desirable to have a precise measurement. This tool was purchased five years previously for applications expected to arise. This was its first use.)

It has a central cylindrical hole of app. 2mm diameter x 176mm length.

In the central cylindrical hole a piece of bonded lead app. 2mm diameter by 176mm is fixed. The external surface of the cylinder of wood is painted with a shiny smooth surface.

The colour of the paint is red, (what shade?)

The ends of the pencil are unpainted and the lead visible as a 2mm circle surrounded by a circle of grained wood in which the joint line of the two pieces of wood can be seen.

It has writing punched in to depth of app. 0.25mm, and painted, thinly, in off white paint, Gothic, sans seriph style.

"ENGLAND Berol NEWSTYLE MEDIUM HB."

The HB is app 1.25mm from one end of the pencil, and ENGLAND is app. 8.1mm from the same end;

ENGLAND and MEDIUM are app. 2.1mm high;

NEWSTYLE and HB 3.1mm high;

Berol is app.2.1mm and 3.1mm high.

3.5.83 A scheme of specification of data could be followed - but then the data would have to be collected using data bases. The analysis requires great precision in specification of the machine being observed. 18.5.83 Measuring instrumentation and proficiency is necessary, however, with computer facility to make holograms of objects (as in grocery check out - IBM equipment) and then manipulate the shape to work out dimensions, the actual measurement of the original solid object in certain parameters might not be so important. The facility of computers to take a digitised image and manipulate it in many ways would also give facility for further exploration of possible uses.

What are all the possible behaviours that the pencil can produce? (Going through items 1-9 in same order)

1. (See also 2.)

charcoal;

building blocks;

dice;

wedges;

gears of various types including worm gear;

various missiles.

3.5.83 'Various missiles' was suggested by a friend the author was discussing it with who suggested one type of missile. This suggests the need to go from specifics to their general categories to lead to more specifics. (This is exactly what Duncker suggested (Duncker 1945 quoted in Hibbs 1986) Hibbs 1988 18/2)

2.

a fuel for fire;

a source of smoke;

fume (including lead, glue and paint fume);

a source of molten paint;

an experimental substance for acting upon with chemicals;

a tool for making marks on paper and certain other substances;

for not making marks on certain microscopically smooth surfaces and surfaces with a wax or fatty finish.

3.5.83 During the process of working out applications one needs to systematically apply principles such as what will it do what won't it do to the findings already made. What are the parameters?

A tool for testing paper and certain other substances for suitability for writing with lead pencil. (Will not go into details of possible types of marks it could make ...)

A source of lead, graphite\*, powder which is usable as a lubricant without degradation, and danger or freezing up, for certain metals such as door locks.

A lubricant which is not effective under conditions of vacuum - so the machine using it could be exposed to vacuum for processes when stability of the otherwise lubricated parts could occur.

(\*At this point the precise chemical composition of the 'lead' was questioned. The author had been happily calling it 'lead' and giving it the characteristics of Pb, but if it was that it wouldn't have been so very brittle that bonding was necessary. It would also be more malleable.)

Graphite: is an organic form of carbon (C).

"an intermediate between nonpolar molecular and equivalent network crystals" (Sisler, Dresdner, Mooney 1980 p287) It

"consists of layers made up of fused hexagonal rings of carbon atoms." (Sisler, Dresdner, Mooney 1980 p298) (Benzene rings, but without the hydrogen molecules) "The layer structure of graphite which allows one layer to slide over the neighbouring layers, explains the use of graphite as a lubricant in heavy machinery." The electrons which are used to bind the hydrogen to the carbon in benzene "act like glue to hold the planes of carbon atoms together in graphite." (Hammond, Osteryoung, Crawford, Gray 1971 p202)

"There is some evidence that graphite is not a good lubricant under conditions of high vacuum ..." Its ability to act as a lubricant depends on the fact that O<sub>2</sub> and N<sub>2</sub> and other molecules are absorbed between the layers and "act as submicroscopic 'ball bearings', which allow the layers to slide easily over each other." (Sisler, Dresdner, Mooney 1980 p299) "The layer structure in graphite requires only three sigma bonds to be formed by each carbon atom ... This makes available one valence electron from each carbon atom to form pi bonds between carbon atoms. These pi bonds may be formed between any two carbon atoms but each carbon atom may be involved in only one such bond at any given time, and only one third of the bonds in the layer can at any given time involve pi bonding ... these pi bonds can resonate among the various positions in the benzene ring, resulting in an extended network of overlapping molecular orbitals extending throughout the layer of carbon atoms. The result is that pi bonding electrons are mobile and can move through the graphite layer. Thus, graphite is a moderately good conductor and is widely used in electrical equipment." (Sisler, Dresdner, Mooney 1980 p300)

Graphite is similar to diamond in that both are crystalline forms of carbon. They show very different physical properties and "slightly different chemical properties". The "amount of heat evolved when one mole of each is burned to CO<sub>2</sub> under the same conditions" is very different. Diamond is a much more solid network than graphite. Diamond vapourised at 3500°C and condensed results in the carbon atoms recombining to form graphite. Very high pressures at high temperature, for lengthy periods are necessary for diamond crystals to nucleate and grow. "Gem quality synthetic diamonds are not available." (Sisler, Dresdner, Mooney 1980 p365)

Graphite sublimates around 3950°C as compared with diamond that melts above 3500°C. They also have very high heats of fusion. (Hammond et al 1971 p204)

A graphite rod is placed inside a dry cell battery. A layer of MnO<sub>2</sub> (Manganese oxide) and carbon surrounds it. It acts as an anode. (Sisler, Dresdner, Mooney 1980 p639)

Structural arrangement of atoms in a graphite crystal. (Sisler, Dresdner, Mooney 1980 p299)

can also be used in powder form for graphics, or to dirty paper etc.;

can be used on paper as a test to see how effective a rubber is;

a source of wood and lead shavings, and paint flakes;

a compression test piece;

a door stop;

a holder down of paper, for example when a book doesn't want to stay open at the right page. Not very efficient for the purpose as it tends to roll, and is not heavy enough in strong draught or wind;

a play thing to roll down a slope and interact with other items on the slope;

a shape which can be altered by reduction;

a source of gratification, when chewed and /or manipulated;

a universally known instrument that is useful for this type of exercise;

a food for mould, wood boring / eating organisms;

a sample which by its state of degradation would give information about its exposure to high humidity and water.

3.

4. An example of:

one substance being protected by another;

the use of wood as a shock absorber;

the use of wood to provide an instrument which can comfortably be held in the hand for writing;

use of glue in the manufacture of a useful tool;

a test piece:

for demonstration of a brittle substance;

a non-brittle substance;

a combination of both;

a writing instrument in which one can clearly see that a certain minimum potential for writing is present (as many ball points where, either you can't see the ink supply, or even if you can you don't know whether the ink will come onto the ball);

a writing instrument:

which does not depend on the presence of water or other solvent;

that does not give off water or other solvent;

that would presumably still work under deep freezing conditions;

a writing instrument that indicates in an observable way when it needs sharpening;

a blind person could know it was working;

a deaf person could know it was working;

one that needs sharpening:

by abrasion;

shaving;

cutting.

it may have its lead broken in pieces making it impracticable for writing.

5.

an instrument which is expendable;

it is relatively cheap;

it cannot be refilled;

it is usually ready to be used or made ready for use;

it would not survive fire or great heat;

3.5.83 The logical jump to realising that the substance was graphite and not lead occurred when the author started to think of sharpening the lead and a possible use of the powder. She remembered that pencil lead shavings could be a source of graphite powder which was recommended as a lock lubricant because of its failure to degrade over time. A detailed chemical specification of graphite would indicate its potential as a lubricant. The chemistry book used certainly mentioned it.



a writing instrument which:

does not depend on the presence of water or other solvent;

does not give off water or other solvent;

would presumably still work under deep freezing conditions.

3.5.83 but perhaps might not under deep vacuum.

6. (See also examples given in b above.)

as a measuring tool / guide;

as two channels for directing a fluid in a desired direction;

as a splint for human;

plant or machine fracture.

3.5.83 The splinting potential idea came from using matches to splint something. The author can't remember what now. One could logically come up with splinting ideas when searching manufactured products.

7. Black box:

Some useful ideas about examining a black box could be demonstrated from a pencil. eg that if you look at it as if you cannot know that the lead shape continues throughout.

inference;

logic;

types of experiments could be demonstrated.

9. Noise: a pencil with its lead broken in many places is useless as a pencil and can be better used for non-writing uses. The use of a pencil as an indicator of level of trauma to a package, especially when sending computer components through the post etc. would be possible. (A pencil would not be best for this but there must be something that would be suitable for that application which would help carriers to improve their performance and users of carrying services to know what forces had been applied in transit.) 18.5.83 The idea of the pencil as a trauma gauge comes logically from an understanding of how the pencil responds to trauma and then looking at the potential good and bad results of this.

New data bases possibly needed:

Compliance;

Feedback mechanisms

Dependence factors;

System for examining a black box;

Classification of 'noise'.

Development of data bases already in existence:

Data bases (I have an embryonic one. British Library and ASLIB, and probably others have ones at varying stages of incompleteness)

Algorithms and flow charts (I have one on those relevant to diagnosis, treatment and occupational health)

19.2.88 No there are 3.8 megabytes of information on several hundred data bases and nearly five shelf feet of literature in my files about data bases, as well as app. 330 algorithms and flow charts listed mainly relating to occupational health and safety, it is almost unbelievable that the previous two sentences represented the state of things at that time.

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## APPENDIX B

### Reporting and under-reporting in health history taking.

A paper developed by G Hibbs in 1979 updated in 1983. Edited 1988.

While employed as Senior Occupational Health Nursing Officer at Cadbury's Bournville factory, one of the authors' first assignments was to rationalise the process of pre-employment health assessment.

The first edition of a self completed form for pre-employment health assessment was introduced in 1971 at the Cadbury Bournville Factory.

During the process of rationalising these pre-employment health assessment procedures it was noted that hourly paid, male, shop floor workers admitted no history of morbidity, or only a small proportion of their history, whereas graduate trainees seemed to admit a whole range of morbidity and then argue that it was insignificant or 'everyone has had it'. When the preliminary data collection was made on the findings of 251 pre-employment health assessments for Master of Public Health thesis in January 1979 the gross nature of the reporting difference was quickly evident and the author posed the following questions:

- a. To what extent does anxiety about not getting the job if morbidity is disclosed affect the reporting of it?
- b. To what extent does ignorance in recognition of names of types of morbidity effect reporting?
- c. Do lower social classes always tend to report less morbidity than others in medical history taking?
- d. Is the tendency of lower social classes to under report morbidity equal in all morbidity areas or is it selective and if so in what ways?
- e. To what extent is morbidity accepted as inevitable in certain social groups and so not worthy of note?

At that time the author had noted when conducting examinations that memory cues seemed to be a factor, especially in the reporting of fractures and operations, in that the apparently honest would contribute items, not acknowledged initially, as the examination progressed. The need for fundamental understanding of the personal history reporting process was exposed.

Information was sought from a wide range of sources, and the available data from pre-employment health assessments at Cadbury's were expected to, and indeed did give some clues.

A. The DEHW study for improving the health interview survey.

The United States Department of Health and Welfare (DEHW) conducted an extensive study with a view to improve the health information reporting in the "Health Interview Survey of the National Centre for Health Statistics." (Laurent et al 1972 p1)

#### 1. Reporting of hospitalisations and doctors visits.

Reference was made to research on reporting of hospitalisations. In 1,800 episodes 2% were under-reported in the five weeks nearest the interview but 22% for forty weeks prior to the interview rising to 43% in the 52nd week. (Laurent et al 1972 p1) The pattern was replicated in another study, (Laurent et al 1972 p2) as with reporting of doctors visits with 15% under-reporting in the first week. (Laurent et al 1972 p1)

The nature of the event, its importance and impact for the individual are shown to be related to the likelihood of report. Surgical episodes are more accurately reported than non surgical and hospitalisations under five days were under-reported at over twice the rate of those over five days. (Laurent et al 1972 p1)

#### 2. Effects of interview techniques.

Laurent reported that "Methodological results from some of ... (the) studies (mentioned above) plus others suggest that the reported material is not repressed or deeply suppressed but ... not elicited by standard interviewing procedures." Different sets of questions, different techniques by different interviewers can produce markedly different results. Half of hospitalisations not reported at first were reported in a second interview. Extra questions, more explanations of purpose and a mail follow up also produced increased reporting. Probes to major questions about doctors visits reduced under-reporting from 30% to 23%. Check-lists also seem to help reporting of chronic conditions. (Laurent et al 1972 p1, 2 also referring to other research)

#### 3. Under-reporting is a recall problem subject to improvement by motivation and simplification of task.

The DEHW study concluded that under-reporting of health information in household surveys is similar to typical memory loss and so can be treated as a problem of recall, to some extent. Role performance might be improved by improving motivation to work in the role as reported and simplifying the task and a strategy "to facilitate recall and the reporting process through the use of cognitive devices" recognising "the possibility that a strictly cognitive approach can also increase the respondents' motivational level." (Laurent et al 1972 p2)

#### 4. Memory theory discussion.

In relation to the DEHW study the following issues of memory and recall are relevant to this discussion:

- a. There is a tendency "to think of forgetting as a loss over time of once known information."

b. The suggestion is that information has a half-life and that loss occurs at different rates.

c. Modern theories indicate that forgetting is an active rather than a passive process.

d. When discussing forgetfulness interference becomes an important concept.

"Interference theories state that forgetting is not a result of the mere passing of time, but is determined mainly by those actions or events preceding or following the initial memorisation ... it is probably harder to recall the names of persons introduced if an immediately preceding or subsequent meeting has also required the learning of new names ... While this interpretation (of interference) has been largely substantiated through classical laboratory experiments dealing with nonsense syllables, its direct transposition to real life situations remains somewhat questionable." (Laurent et al 1972)

Interference could be seen as competition in memorisation and recall process, interference could also act as reinforcers of material to be recalled. The example of an illness being better remembered because of a host of diagnostic procedures, pain or disability is quoted, where the reinforcers may act by giving the illness more meaning or impact. Material with meaning is usually easier to learn. The interfering events might even provide cue points to help elicit the central material. (Laurent et al 1972 p2; Hill 1071 p45)

##### 5. Interference and reinforcement.

The relationship between forgetting and organisation is also discussed in the DEHW report. Mannis is quoted as saying "... material that is well structured and tightly organised will generally be recalled far more successfully than that which does not possess a meaningful structure. ... As Bartlett stated it, the memory process becomes an active "effort after meaning." People reconstruct and schematise events to make them fit with past experience. Finally, consistent or not with these viewpoints, some laboratory experiments suggest that recognition of learned materials yields higher scores of retention than free recall." (Laurent et al 1972 p1-3)

##### 6. Forgetting and memory organisation.

Recall, then is seen as an active reconstructive process and not merely a simple process of reproduction. Stored items interact according to some meaningful patterns. The interaction may block or facilitate recall and in any case will result in some distortion. It is reasonable to assume that rather than being stored in some directly available form as it was experienced, the material might be "integrated into one of several constellations of other events according to some meaningful organisation." Interviewing could then be "designed to stimulate recall through

questions which would 'sample' these organised clusters and frame of reference." (Laurent 1972)

#### E. Discussion of DHEW discounted repression and suppression.

The DEHW paper discounts repression and suppression as probably contributing to memory failure. Perhaps the authors assumed a household survey was neutral in terms of individuals declaring health history. Household survey might be accepted to be more neutral than pre-employment health screening, where there may be particular advantage seen in not declaring. Even so there would be some information that the individual was too ashamed to mention or had suppressed from his own consciousness. In any case "the social nature of interviews biases towards the 'I am a good subject' response" resulting in the suppression of material perceived to be trivial, insignificant or likely to give the interviewer a poor opinion. (Dingwall 1976 p27)

#### F. Desire to cooperate.

In addition to the bias to 'I am a good subject' arising from the social nature of interviews, there is a more general desire to cooperate in many interview situations. The subject has a view of the purpose of the meeting and in many cases will tailor his responses accordingly. This is especially likely in, for example, the pre-employment health assessment, where the assessment is not primarily for the benefit of the subject. The author found herself under-reporting when she had a painful neck one time. The doctor asked if she taking any medication for it and she answered 'no', understanding the doctor to mean medication for pain. She was in fact taking B vitamins with a view to optimising the nerve recovery. Later she realised the potential of interpretation of purpose to affect reporting and under-reporting.

#### G. Examples of repressing and suppressing.

Numerous examples of repression and suppression exist. A few samples are given:

a. Mothers advised about smoking in pregnancy reported higher levels of smoking retrospectively than when questioned at the time, an effect which was less noticeable in the control group. (Rose 1978 p2 quoting Donovan 1977 p612) In the authors' own data only one person (of 251 Hibbs 1979) reported smoking more than 40 a day out of 45 self reported smokers. He claimed not to be a current smoker.

b. Rose mentioned that in the US Multiple Risk Factor Intervention Trial, with intensive personal counselling 30% of men claiming to have stopped smoking had levels of urinary thiocyanate which were inconsistent with the claim. (Rose 1978 p1)

c. Morrison said that routine history taking would not uncover information about occurrence of disorientation in pilots but would be acknowledged quite frequently once

they realised that the enquirer takes a reasonable view  
dissorientation. (Morrison 1979)

H. Cultural and sociological factors affecting reporting of health history.

1. Cultural and language effects.

Cultural differences undoubtedly result in differences in reporting health history.

Rose sees the possibility of successful cross cultural comparisons of disease rates based on medical histories as uncertain because of this difficulty. (Rose; Blackburn 1969 p79) The findings from the data studied by the author for the Master of Public Health thesis (Hibbs 1979) support this view.

Bearing in mind the differences of usage within one language , it is perhaps surprising, that Rose says it is preferable that only one version would be used in any one language and exact wording should be followed. (Rose; Blackburn 1968 p18) Since there must be local usages that would produce the very differences that it was hoped to avoid.

2. Cultural classification of deviance.

Modern Western cultures increasingly classify deviance as either crime or sickness and the other possibilities of "witch-craft, spiritual intervention, sin, bad taste, poor manners and the like - are less and less frequently available." Other cultures may absorb some sickness by labelling differently with the effect that control agents of deviance are diverted from trying to bring about correction of the "patients deviance by reclassifying it as non-theoretic and not open to patient oriented intervention. (Since) ... then there is no ground for holding the 'sick' person responsible." (Dingwall 1976 p94, 95)

3. Sociological differences in perception of illness.

If Dingwall is correct "for the sociologist there can be no such thing as 'essential illness'; rather there are sets of socially organised events organised by members of a collectivity into categories of experience to which identification 'illness' is accorded. Biology ... fall(s) into a separate domain of explanation governed by a corpus of knowledge in which life scientists have particular rights." (Dingwall 1976 p26)

An important task for study is how both lay persons and professionals theorise about the human body and its operations and managements. (Dingwall 1976 p26)

4. Language poverty.

Rainwater describing America's Lumpenproletariat, the very poor, says that "In particular, they held their bodies in low esteem and had low levels of scientific knowledge about medical events. For them poor health was just one of a number of everyday crises."

(Dingwall 1976 p27 quoting Rainwater 1968; cf Carmichael 1977: Dingwall 1976 p59, 60)

Frank absence of vocabulary contributes to some lack of reporting. It is easy to envisage an illness which the doctor comes to treat but he doesn't label to the sufferer since he assumes, perhaps incorrectly, that the individual would neither know or be interested in anyway.

##### 5. Biographical influence.

Dingwall rightly points out that each individual's version of biological and health knowledge is unique because of his own biographical "experience and plans, so the the application of socially shared knowledge is problematic in any particular situation." (Dingwall 1976 p59, 60) "This results in considerable variation in what any diagnosis might be, (depending on) ... the priority given individual clinical experience ..." Placebo effects also modify the view of both patient and physician leading to the ready sustenance of a wide range of possible diagnoses.

Both the practitioner and client are subject to selection processes as to who will consult with whom on what matters. This affects the definition, presentation and interpretation of results. For these reasons Friedson is suspicious of the value of true incidence studies which "are based on categories generated by medical practice rather than social functioning." (Dingwall 1976 p32 quoting Friedson 1971)

##### 6. Social status and coercion.

Certain groups and people in society have the right to coerce others in relation to health and sickness behaviour. "Parents have the right to define their children as ill and impose treatment regardless of the children's views on the subject." (Dingwall 1976 p104)

The strength of social ties and the position of the individual strongly effect the individual's knowledge of their health experience. (cf also Pritchard 1978 p59-61)

##### 7. Normalisation tendencies.

There is a strong tendency for people to normalise symptoms, by identifying them as related to normal experience, unless unable to do so by their severity or overt nature, or they have other reasons for not normalising, such as the need to validate absence from work. (cf Dingwall 1976 p113-119) It is not surprising that experiences so normalised do not have appropriate morbidity labels attached.

##### 8. Technical contribution.

Technical factors can cause inaccuracies in reporting that may give the impression of under-reporting. Such inaccuracies may result from design faults in the measuring tool. Ambiguous wording, layout changes demanding change of position of response



after a pattern had been learned, for example requiring 'Yes' the first position for a string of questions and then without strong visual cues requiring it in second and third positions.

Technical words that may not be understood can also cause mistakes. (Bailey 1974 p181)

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PERSONAL COMMUNICATION

Rose, Geoffrey A 1978 Nov.

## APPENDIX C.

'Information Science' and 'Information Technology' components.

I. The following is included as an appendix in this thesis to survey the topics in information science which one might properly study in relation to information recovery. Basic familiarity with the whole vocabulary included in this list, is desirable for any professional information scientist now, so they have a have markers which can act as prompts for further exploration. New vocabulary is being added dynamically continually. Continuous personal and professional development is necessary.

II. The Institute of Information Scientists has a leaflet (ISS 1982) which names criteria in information science for corporate membership, which it is hoped are open enough to allow for the inclusion of new and unanticipated developments. These criteria have been taken into account in the following.

A. Nature of information.

What is information? Technical and non-technical definitions.

Coding, a central concept in information:

surrogation;

language as code;

numerical systems (including: binary, octal, hex, and conversion between them); other types of systems.

Standards: principles and purposes.

B. Need for information:

environment, internal and external, in which information is required;

user groups:

people in general;

people with special needs;

government;

trade and industry;

services;

education;

research;

special interests;

unimagined user groups.

evaluation of need especially cost benefit and effectiveness analysis;

objectives, structure and implementation constraints.

C. Communication systems.

Technology needed for information:

acquisition;

analysis;

creation;

dissemination;

evaluation;

improvement (including correction systems (editing, proof reading, automated spelling checks, validation checking, use of check digits))

organisation;

management;

retrieval;

storage;

transmission.

1. Animate.

Human communication:

psychological;

sociological and practical aspects with special reference to the corporate environment.

User needs and behaviour in:

generation;

seeking;

transfer;

use of information.

Causes, effects and implications of:

historical;

social;

psychological;

technical;

other factors including:

value systems:

aesthetic;

algeodonic;

cosmic:

ethical;

philosophic;

religious;

legal

copyright;

health and safety;

privacy;

secrecy;

security;

economic;

political;

social;

theoretical (study for its own sake);

inclusion (individual's need to be known and recognised);

reward;

romance;

immortality;

convergence;

divergence. (cf Hibbs 1984a Value systems)

Types, patterns, and analysis of users.

Knowledge:

Its creation;

quantity;

quality.

Knowledge and information flows:

nature;

properties;

characteristics.

Information pathways:

algorithms;

flow charts;

heuristics.

2. Inanimate. Analogue and digital.

Data units (including standards):

size;

characteristics;

processing;

storage.

Storage devices and systems (including standards):

manual (eg card indexes (traditional, carousel vertically or horizontally));

files (vertical, lateral, horizontal, rotating, shelving) strip indexes;

mechanised (eg laser, magnetic (various types and characteristics); mixed (eg file (rotated by engine), microfiche / microform systems).

human.

a. Hardware:

Classification of types of equipment (including standards):

computers (maxi, mini, micro);

Characteristics of equipment:

dedicated and general;

single user;

multi-user;

shared time systems.

Components (including standards):

input including:

optical;

'mouse';

infra red field;

video scan;

digitising;

laser readers;

output:

printers (dot matrix, laser, daisy wheel and other systems);

speech;

braille;

facsimile;

graphics;

banda;

stencil systems;

photo lithography;

half-tone;

'camera ready';

photocopy;

carbon and carbonless paper copying;

silk screen;

microform (computer output microform (COM)) and display devices;

processors:

types and implications;

storage:

volatile and non-volatile;

RAM (including: bubble, virtual)

ROM;

disc (compact, floppy, hard (including Winchester), laser disc (WORM));

tape (sound cassette, computer tape reel);

b. software (including standards):

principles of software design and evaluation (aesthetic, cosmic, economic, political, reward, social, theoretical);

programmes and packages (including operating systems) with special reference to information handling and retrieval, programming principles.

c. processing:

record layout and handling, files and file handling, database systems, searching and updating;

text handling, editing systems (word processing, text processing, correction systems);

electronic markup, publishing and document delivery; automated translation.

d. communications:

communication hardware: (electrical including modems and multiplexers, optical);

communication software;

protocols;

interfaces;

networks (local and distance including telecommunications systems (cable (metallic and ceramic) including telephone and television);

package switching;



public and private;

satellite;

teletex;

viewdata;

videotex;

communications software:

types and purposes.

e. system development:

approaches (including cybernetics, operational research, ergonomics);

feasibility studies;

specification;

design;

implementation;

documentation;

evaluation.

f. applications:

Special requirements:

bibliographies;

evaluated information reports;

SDI (Selective Dissemination of Information);

other current awareness matters.

3. Combined animate and inanimate.

Networks, systems and services for retrieval:

internal;

external.

Actual communications systems:

theory;

design;

evaluation.

#### D. Information sources.

Media sources of recorded information for example:

audio-visual materials;

computer files;

on-line machine readable databases and databanks;

textual material;

videotex;

and other records "their information content, occurrences, distribution and use";

Information collectors, extractors and disseminators:

national and international;

individuals and organisations for example:

individual experts;

information brokers;

consultants and centres;

libraries;

major information services.;

primary and secondary sources;

sources in general and specific fields;

other language sources and their use;

characteristics and contents of secondary sources for example:

abstracts;

computer files available to the public;

indexes;

journals;

library catalogues;

#### E. Information handling.

Theory and practice of information collection, storage and

retrieval,

Information problems:

characteristics and coping strategies;

Information types:

abstracts;

audio-visual material;

full text;

numeric data;

tabular data;

combinations.

Information collection:

regularity;

systems available;

sources used.

Information storage:

organisation;

methods and rationale for choices;

Information resource exploitation:

methods;

strategies and economics, with application to primary and secondary sources and references;

criteria for input, indexing and output for effective retrieval.

Evaluation of storage and retrieval systems:

aesthetic;

economic (effectiveness and efficiency);

utility.

Indexing, classifying and coding information content (theory and application):

cataloguing descriptively;

classification systems for example;

    alphabetical schedules;

    enumerative;

    synthetic types.

indexing schedules:

    subject heading lists;

    thesauri;

    pre - and post coordinate indexing;

    natural language and controlled vocabularies;

    sources content analysis.

F. Management related to information systems.

General management theory and techniques including:

    financial control:

        costing;

        budgeting;

        controlling;

        forecasting;

        policy-making;

        planning (including strategic planning;

    staff management and industrial relations;

    research methods, proposals, purposes and evaluation;

    systems approach for management and techniques including:  
    cybernetics, organisation and methods, operational  
    research;

    organisation of small and unique collections of  
    information;

    marketing and selling information services, internally and  
    externally;

    management of transborder flow.

G. Information analysis:

    use of information sources for regular and systematic collection

of information;

evaluation and validation of information;

appropriate technology for use in building specialist files for storage and retrieval of evaluated information;

analysis for discovering:

novelty;

trends;

patterns;

for making hypotheses;

trend projections;

forecasts.

state of the art:

reports;

reviews;

overviews and scenarios concerning the state of the art.

H. Relevant skills not covered systematically above.

Selected mathematics including:

discrete mathematics (This is particularly relevant to machine processing. See more detail at end of section);

finite series (arithmetic, geometric and binomial)  
(Elliman, Gray, Johnson 1985 p32)

statistics and economics.

Linguistics:

languages:

natural, including implications of dialects and unfamiliar ones;

formal;

linguistic and phonetic classification;

"semantics, syntactics and pragmatics";

"relations of semantics and linguistics, psychology, logic and philosophy";

computational linguistics;  
development of language;  
reading and comprehension of unfamiliar languages;  
translation;

Note:

Discrete mathematics.

Two sections are relevant "one based on the concepts of modern algebra as applied to sequential machines and computer system design, and the other based on graphs and trees as applied to data structure and algorithms" (Elliman, Gray, Johnson 1985 p18)

Modern algebraic components (See Elliman, Gray, Johnson 1985 p18ff for full development):

introduction to symbolic logic;  
set theory;  
algebraic structures;  
sets and operations;  
graphs;  
paths;  
circuits;  
trees;  
reachability and connectedness;  
lattices;  
Boolean algebra;  
canonical expressions;  
finite fields (applicable to error-correcting codes);  
computability.

## APPENDIX D.

About online information.

1. Authors note. From 'Practical ideas on readability for people trying to produce results.'

This material was culled from searches done in 1987 in the following databases:

'Dissertation Abstracts on Disc' (DAD)

'Linguistics and Language Behaviour Abstracts' (LLBA)

'Language Abstracts' (LA)

'LISA' (LI)

'PSYCHINFO' (PS)

In the latter four databases the search used was: READABILITY AND (TEXT OR PRINT OR INFORMATION), in the former, READABILITY.

The material retrieved was incredibly dense with valuable information, as a result only basic analysis was completed. There were many more references relevant to the points highlighted in this brief paper. I have attempted to reflect the key ideas faithfully.

(The research sponsors set up the initial search on the four databases.)

2. General notes.

a. Arising from the volume of material.

The volume of material retrieved on a specific topic search may be immense. Narrowing the search terms makes the output more manageable but at cost of exposure to related ideas and risk of missing essential material that relates conceptually but uses different vocabulary.

This problem becomes very significant in cybernetics since it is concerned with types of system ("a set of things which have some relationship" (Tung 1983 p23) "any set of variables" (Ashby 1960 p16)) so the vocabulary which shows that a system has been considered cybernetically or is of special interest cybernetically may be quite varied. (cf Hibbs 1984)

The 'Manual of online search strategies.' addresses ways of achieving high precision, or high recall which are helpful, as a start, in overcoming this type of problem. (Armstrong; Lange 1988)

b. Completeness of sets.

Where a database covers a particular journal in full text one might expect to have all the editorial material on the file.

However, one needs to know the data base editorial policy because, for example, with 'McCarthy Online Press Cuttings File' 68 journal sources are listed (16 reference only) (McCarthy Information Ltd. 1987), but the primary source is 'The financial times'. So, articles on the same topic in other journals will only be included if they add what the editors consider to be significant in relation to industry and commerce, to what is already on file. (FT Electronic Publishing 1988) The user may well have a different agenda, and could well be lulled into thinking a search covers his topic areas in those sources when the reality is very different.

Armstrong and Lange include criteria for selection of database and selection of host which complement this material on completeness of sets. (Armstrong; Lange 1988 p16ff)

c. Frequency of update and up-to-dateness of material being input.

Updating policy and practice is very variable. For some files the standard updating arrangements may be reasonably reliable. Files of the same data base on different hosts may have different updating practice. This is the case with Embase which is updated in-house by Excerpta Medica weekly but the 5 hosts' updates vary from weekly to once in every two months. (Excerpta Medica 1983 p9) The processing of material before it can be included in the update also varies considerably in files like this. Editorial policy interacts with availability of sources and processing required. (cf also Armstrong; Lange 1988)

d. Presentation.

Presentation of material in different data files can lead to vastly different research results. Some files like 'Information Science Abstracts' (DIALOG 1987) use upper case letters only and right justify the text (so that the right hand side of the text lines up at right angles to the lines of text) leaving spaces (cf Abedini 1984 DAD AAC0558628) of up to at least four character widths between words, whereas 'Language Abstracts' (DIALOG 1987a) uses upper and lower case throughout but again right justifies. These features affect readability, the ability to locate particular information (cf Coe 1975 ISA 107) and, where upper case only is used, the ability to distinguish such features as proper names, especially where unfamiliar language is being used.

The presentation on screen will be constrained by the type of terminal and its visual display (cf Abedini 1984 DAD AAC0558628; Duchnick; Kohlers 1983 PS 54), and any printout by the equipment used to generate the print, and these features will interact with the protocols used throughout the system.

In searching some whole text files one can request to see just the search term in its context. The search term will probably be highlighted in some way, and the context may be the complete paragraph or a text segment before and after the search term.

The 'Manual of online search strategies' points out that the search software used is also material in the production of varying search results:



ORBIT allows left hand truncation of search terms so that one could search for '-aemia' and recover words like leukaemia, anaemia;

flexibility of output is possible in BLAISE, BRS and others;

a formatting facility is available on ESA/IRS. (Armstrong; Lange 1988 p16ff)

e. Representativeness of content.

In bibliographic databases, apart from those containing 'whole text' materials, the relationship of the database content to the original can be very variable. This is especially true of abstracts. Many are designed to be very informative, but a proportion give little idea of the content and probable value of the source. The abstract may or may not be the authors' original. Key words, similarly are of variable quality, which is difficult to assess.

## APPENDIX E

A functional 'low tech' pamphlet filing system.

By Genevieve M Hibbs

### 1. Notes:

- a. This system of pamphlet classification is based on one taught to students on Christian education courses by the late Harold Garner and his wife Avril Garner of the Moody Bible Institute, Chicago in the early 1960's.
- b. The system has the major disadvantage that all its components are not uniquely identified and indexed, which arises from the major advantage that the system has a low labour maintenance requirement.
- c. The system is not recommended where access and refiling is not well controlled.
- d. The author's system has had revisions of categories and major subdivisions of three categories since it was set up in 1971.

### 2. The system:

- a. Suitable classification categories are sorted out.

The classification needs to be closely related to the materials to be filed and the purpose(s) they are to be used for. One way to work the classification out is to sort the material that has already been collected into functional categories, then to check these categories against the headings or index of text books in the subject area or a thesaurus.

- b. Chosen headings are put in strict alphabetical order and decision is made as to which ones are the key ones under which items should be filed and which ones should be cross referenced into the key ones. It is important to try and avoid overlapping categories as far as possible but where it is not possible a : see also : cross reference can be made.

- c. All headings under which items are to be filed are give a letter - the first letter of their name, and a number in sequence starting with the first occurrence of each letter for example:

A1 Administration  
A2 Aged, welfare of  
A3 Alcohol

B1 Bacteriology : See Also : C4 Communicable disease  
Barrier cream : See : S2 Skins  
B2 Bibliography

- d. If new key names are added in later they are given the appropriate letter and the next available number, but are written in the list in strict alphabetical order, for example:

A1 Administration  
A2 Aged, welfare of  
A4 Air travel  
A3 Alcohol

e. Items for filing have the code letter and number written in the right hand top corner. This coding is probably best done by the person with the greatest investment in retrieving the material efficiently.

f. If there are more than one or two items to be filed it is useful to put them in alphabetic and numeric order before filing. (See below for a functional alphabetiser.)

g. The file is kept in strict alpha-numeric order, with most recently filed items at the front of their section unless any particular section is better in some other order for example:

The author keeps lecture notes in W7 Writing and then in alphabetic order by computer file name.

h. Standard office file folders can be used and a lateral filing cabinet is ideal for storage.

### 3. An alphabetiser.

An alphabetiser is a practical help in ordering pamphlet and similar flat printed material. To make one:

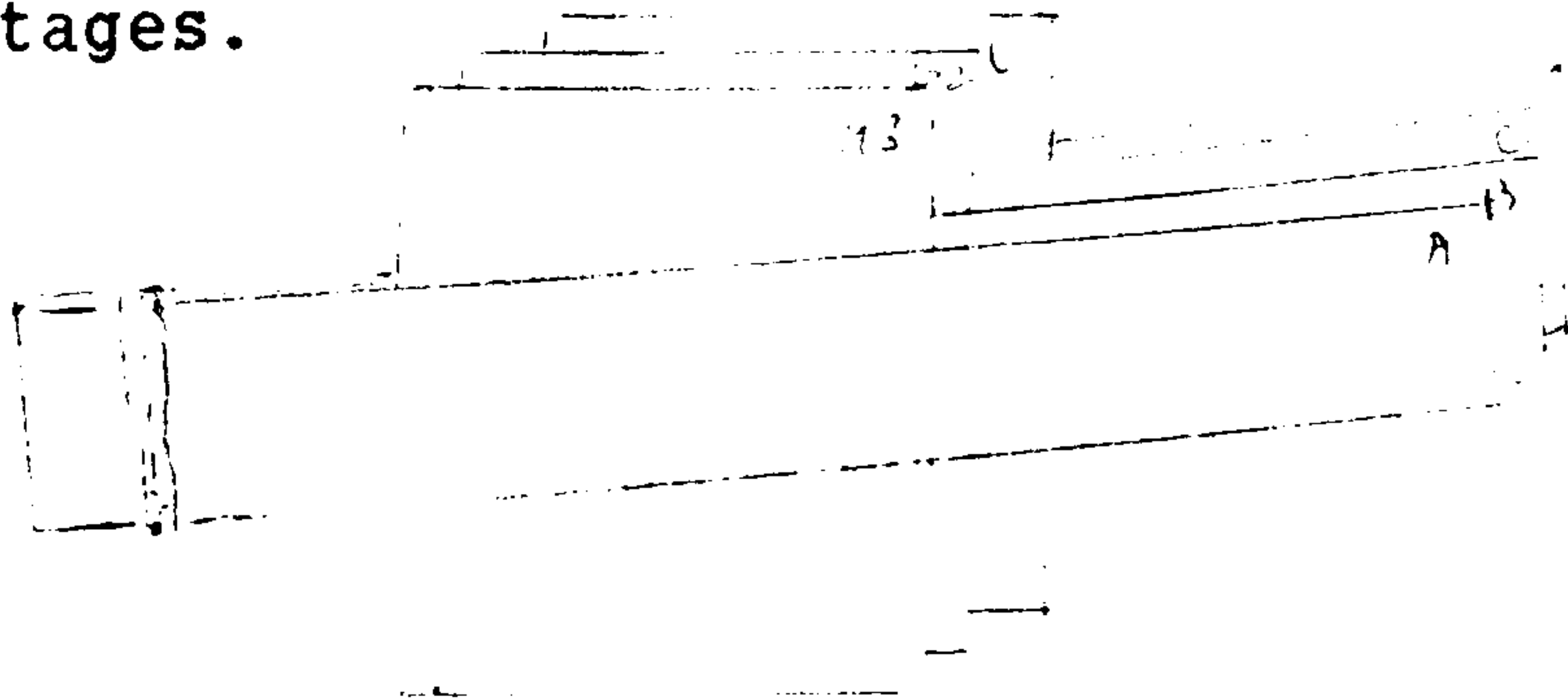
Cut 20 soft cardboard strips (file folder card is ideal) 13 to 14 inches in length and 3 to 4 inches in width.

About one and a half inches in from one end cut small v shaped pieces out top and bottom.

Put strong rubber bands to hold the strips together using the v notches.

At the far end of the strips from the rubber bands label each strip one of the letters of the alphabet, except I and J; P and Q; U and V; and X, Y, Z which share their respective strips. Turn the set over and in similar position on the other side number from 1 to 10

If there are only a few items for any given letter they may be placed in strict numeric order as they are added. Larger quantities may better be sorted in two or more stages.



4. 'Awaiting coding' and 'Awaiting filing' folders can be kept at

the front of the file. This enables processing to be done at a convenient time and in suitable batches. It also reduces risk of loss by missplacement.

## Appendix F.

The material in this appendix is to give a sample of material in RESOURCES database. to complement Case study D.

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### Samples from the RESOURCES database.

+CAA : See : Civil Aviation Authority.

+CAB : See :Citizen Advice Bureau.

+M03

X@,,CACI,Market Analysis Division,59-62 High Holborn,,LONDON,WC1V 6DX,GB,,@  
Phone 01 404 0834

\$\$Information on ACORN and all ACORN related services and project.ACORN is a mail marketing strategy based on postcodes, census and electoral roles.

\$Direct Mail qv

+CADCAM Advice : See Also :Institution of Mechanical Engineers.

+CADCAM Centre

X@,,CADCAM Centre,,PO Box 222,,MIDDLESBROUGH Cleveland,TS1 2LZ,GB,,@  
Phone Middlesbrough (0642) 226211

+CAD Centre : See :Computer Aided Design Centre.

+CAD Source Ltd. : See :Institution of Mechanical Engineers.

+CAET (Certified Accountants Educational Trust)DB5

@,,CAET (Certified,Accountants Educational Trust),PO Box 244,,LONDON,WC2A 3EE,GB,,@  
Phone 01 242 6855

\$\$

\$Certified Accountants Educational Trust qv

Education qv

Education Foundation qv

+CAF Publications Ltd. : See : Charities Aid Foundation.

+CAI Feedback (Confederation of Ariel Industries)

@,,CAI Feedback,,Suite 106,Grosvenor Gardens House,Grosvenor Gardens,LONDON,SW1W 0BS,GB,,@  
Phone 01 828 0625

\$\$

\$

+CAL (Computer Aided Learning) : See Also :AUCBE (Advisory Unit for Computer Based Education).Computer.Interactive.MAST Learning Systems Ltd.Video.

+CALL (Communications Aids for Learners in Lothian) : See :Call Centre.

+CALIP : See :Campaign Against Lead in Petrol.

+CAM Foundation (Communication Advertising & Marketing)MO4 OA4  
@,,CAM Foundation,,Abford House,15 Wilton Road,,LONDON,SW1V 1NJ,GB,,@  
Phone 01 828 7506  
\$\$CET Contact Mr N A Bain OA4(Institute of Public Relations is a member organisation)  
\$Communication, Advertising & Marketing qv  
Direct Mail qv  
Education qv

)+CARE : See : Cancer After Care & Rehabilitation Society.  
Rehabilitation qv

)+CARE : See :CARE (Cottage & Rural Enterprises).

)+CARE : See :Care (Christian Action Research & Education) Campaigns.

)+CARE : See :Care (Christian Action Research & Education) Trust.

)+CARE : See :National Institute for Medical Research.

+CARE (Cottage & Rural Enterprises Ltd.)MO4  
X@,,CARE,,9A Weir Road,Kibworth,,LEICESTER,LE8 0LQ,GB,,@  
Phone Kibworth (053) 753 3225  
\$\$  
\$CARE qv  
Cottage & Rural Enterprises Ltd. qv  
Employment qv

)+CASE : See : Campaign for the Advancement of State Education.

+D87  
@,,CASSU,,Arundel Road,,UXBRIDGE,UB8 2RR,GB,,@  
Phone 01 561 6820  
\$\$D8 76 branches with workshops - Barking, Bristol, Falkirk, Manchester, Birmingham, Uxbridge.  
3rd party maintenance Co, Amstrad, PC's, printers etc. 24 hr. callout  
\$Maintenance qv  
Service qv

)+CATS : See : Children's Aid Team.

+CATES (Centre for Alternate Technical Systems),  
@,,CATES (Centre for Alternate,Technical Systems),Poly. 6F North London,Holloway  
Road,,LONDON,N7 8DB,GB,,@  
Phone 01 607 2789  
\$\$Services community groups on employment and unemployment  
\$Databases qv  
Employment qv  
Polytechnic of North London qv

+CBD Research LimitedB55  
@,,CBD Research Limited,,154 High Street,,BECKENHAM Kent,BR3 1EA,GB,,@  
Phone 01 650 7745  
\$\$-0 900246-  
\$Board qv

Research qv

>+CBI : See :Centre for Business Information.

>+CBI : See : Confederation of British Industry.

>+CBU : See :Clearing Bank Union.

+CCA Micro Rentals Ltd.

@,,CCA Micro Rental Ltd.,,Unit 7/8,Imperial Studios,Imperial Road,LONDON,SW6 2AG,GB,,@

Phone 01 731 4310

\$\$

\$Hardware qv

Rental qv

+CCCF (Caravanners & Campers Christian Fellowship)D16

@,,CCCF,,PO Box 100,,ENFIELD Middlesex,,GB,,@

D95

@,Keith Hyden,Secretary,CCCF,,Emmaus,46 The Street,Barrow,BURY ST EDMUNDS Suffolk,IP29

5AN,GB,,@

Phone Bury St Edmunds 810294,

@,,Newline Editor 2,CCCF,,53 Avery Road,,SUTTON COLDFIELD W Midlands,B73 6QB,GB,,@

Phone 021 355 3038

\$\$Evangelical and interdenominational.Journal: Newline

\$Camp qv

Campers & Caravanners Christian Fellowship qv

Caravan qv

Christian qv

+CCMS (Committee on the Challenges of Modern Society) (UK)D95

@,,C/o Mr. D Perridge,CMMS (Committee on the Challenges,of Modern Society),Dept. of the Environment,"Room A3,15 Romney House",Marsham Street,LONDON,SW1,GB,,@

Phone 01 212 8029

\$\$CCMS Study on Health & Medical Aspects of Disaster Preparedness Current in 1985 ff

\$Disaster qv

Grants qv

NATO qv

Research qv

+CCN Systems Ltd.DC7

X@,,CCN Systems Ltd,,Talbot House,Talbot Street,,NOTTINGHAM,NG1 5HF,GB,,@

Phone Nottingham (0602) 415415; (0602) 410888

\$Tx 377646

\$Lists of consumer names and addresses selected by ACORN type from National Consumer File

\$Direct Mail qv

List Broking qv

Post Code qv

(DMPA: ABCDEFGIK)

>+CCTA : See : Central Computer & Telecommunications Agency.

+CDMSDC7

@,,CDMS,,J M Centre,Old Hall Street,,LIVERPOOL,L70 1AB,GB,,@

Phone 051 235 3298

\$Tx 628501 SPINN  
\$Nigel Knowles DC7  
\$Post Coding qv

+CEDAR (Computer in Education as a Resource)M03  
X@,C/o Mick Rushby,or Judith Morris,CEDAR,,Imperial College,Computer Centre,Exhibition  
Road,LONDON,SW7 2BX,GB,,@  
Phone 01 589 5111 Ext 1160 or 1197  
\$\$Enquiry service including on-line KWIC database Library.Seminars etc. on educational  
computing.Journal: CAL news,  
\$Computer qv

)+CEF : See :Child Evangelism Fellowship.

+CEGB (Central Electricity Generating Board) Scientific Services Nottingham  
M00  
X@,,CEGB,Scientific Services Department,,Ratcliffe on Stour,,NOTTINGHAM,NG11 0EE,GB,,@  
Phone Nottingham (0602) 830591  
\$\$Asbestos analysis and some environmental monitoring. Dr Graham.  
\$Hygiene Services (Occupational, Environmental) qv

)+CET : See :Council for Educational Technology.



## Index

Generation of an index needs to be considered in relation to the purpose of the material of which it is part and the purpose for which it, itself is expected to be used. The index is an important component of the 'way in' to the material.

"Each index is considered in relation to the book of which it is part, and to the use required of it - which may vary from the simple Name and Place index to the multiple special indexes of research publications and learned journals. Works of history and literature ... (... General Index) acting as a clearing-house of the information spread ... The following recommendations" not rigid instructions, just "a starting point for designing an individual index." (Hart 1986 p20)

Arbitrarily, this index has concentrated on using heading material (which is capitalised), other main concepts, markers and educational/training need and/or opportunity (lower case entries).

This index has been generated using Microsoft Word version 5.0 however a number of controls have had to be overcome:

the facility to generate the index from a wordlist would not operate;

the methods suggested for linking files to generate one index for a work even less than a quarter of the length of this thesis would not operate without serious risk to the files, or the programme 'falling over' in the middle of the sort, in spite of 1MB Ram on the computer, 'clearing all' before running the sort, using textand not graphic display ...;

the programme would not sustain restarting the paging sequence after the introductory matter. To overcome this:

the text was first paged with 'hard' page breaks to match the printout;

the not-to-be-indexed text was stripped out under manual control;

between the end of the Roman numeral introductory section and page 1 'hard' page breaks were inserted to bring page 1 to be page 101;

Search and replace was used for:

<space>1 change to <space>

<space>0 change to <space>

<space>2 change to <space>1

<space>3 change to <space>2

The Roman numerals were changed to lower case by search and replace under manual control (the lower case ones wouldn't operate);

and so on ...

The indexing process brought benefits including the following:

a clarification of where concepts were located within the thesis, and the appropriateness of using markers where potential development material was missing;

a view of the relative consistency and location of terms used for concepts.

(This occurred, especially, during a much more detailed indexing exercise, which was not used in the final presentation due to length and failure to highlight key concepts.)

the closing of a loop relating to location of text and page numbering. This brought to light inconsistencies in page numbering which were then able to be corrected.

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