The Development of a conceptual framework for understanding people's requirements for an information service

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Abstract

The aim of this research was to see whether a conceptual framework could be developed that would help conduct:

- studies of people's interaction with information;
- user requirements analysis for information services and systems.

The following questions were addressed:

- could the accumulated past research in user studies and information seeking behaviour now provide a good basis for the development of a conceptual framework for understanding people's interaction with data, information and knowledge and
- whether a conceptual framework could be developed that:
  - ➢ indicated those factors that influence the individual's interaction with information
  - ➢ indicated and helped explain those factors that influence each other and the individual's experience when interacting with information and information systems
  - ➢ helped to derive data that enabled the researcher to identify user requirements for an information system that relates to their needs

and also whether:

- the conceptual framework would help to identify an appropriate research methodology and techniques for studying people and determining their requirements for information services and systems?

As a result of the research a framework, that encompassed earlier models and frameworks, was developed. The framework evolved through an inductive analysis of the literature and was then applied to two communities. This led to modification of the framework. The resulting framework, and the levels of analysis that were considered significant, identified categories of data that were important and indicated the relationships between these variables. The communities were postgraduate students and informal carers. Insights were generated into the information experience of the two

communities and their requirements for an information service. With regard to methodology and techniques it was concluded that, although the framework did help to identify the data that one can collect, many techniques, such as observation or task analysis can be applied and are likely to vary, depending on the research context. However certain techniques were shown to be more effective than others for gathering different types of data, such as behvioural or psychological.

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Chapter 1 : Introduction

Area of research

This research was concerned with the development of a conceptual framework that would help one to undertake studies of a target community so that their requirements for information service(s) provision could be understood. The phrase conceptual framework was interpreted as meaning a set of significant variables that are interconnected and influence each other. Other authors have used the term theoretical framework to describe such phenomena, such as, Newman's 'orientations or sweeping ways of looking at the social world. They provide collections of assumptions, concepts and forms of explanation' (Neuman, 1997, p56). Wilson uses the term model to describe 'a framework for thinking about a problem and may evolve into a statement of the relationships among theoretical propositions' (Wilson, 1999, p250). Modeling, in this thesis, was seen as one application of the conceptual framework.

There is dissatisfaction (Kuhlthau, 1991, Wilson, 1994, Belkin, 1995, Borgman, 1996, Nicholas, 2000, Hepworth, 2001) with information services and systems that have been designed to help people find information and learn about topics. Current techniques for understanding people's information needs and requirements for information system design have not drawn on the rich body of research into information needs and behaviour that has evolved in Information Science. As a result of this situation the following questions were researched:

- could previous research into this area, particularly that from Information Science, help develop a conceptual framework that will enable the following:
  - an understanding of both the individuals' and groups' experience and needs when interacting with data, information and knowledge when finding out and learning about a subject;
  - the identification of the interacting variables that will have an influence on the individual's experience with data, information and knowledge, such as their own knowledge and the characteristics of the source, and

- a framework to gather and interpret data that would help to identify useful ways for people to have access to and interact with that data, information and knowledge and recommend information service solutions.

This framework could therefore provide a useful guide and help label and categorise the data that needs to be collected to gain an understanding of the user requirements for an information service. The researcher could choose whether to capture data on all aspects of the framework depending on how much they knew about the target community and also on their objectives in terms of the kind of information service they wanted to implement or the problems they were trying to resolve. Information solutions would depend on the needs identified and the remit of the service developer. For example, findings and remit could result in a portal facilitating access to information, a discussion list that enabled information to be shared or a complex information service that satisfied a range of needs.

From the Information Science perspective the research resides in the area of user studies where researchers try to understand and model information needs and information seeking behaviour. To a lesser extent it is also related to information audit studies which are concerned with the respondents' need for and use of information. As Wilson, (1994), has pointed out there are others concerned with this area such as software engineers, media and communication researchers and also psychologists and ergonomists.

Context of research

Due to the increased emphasis in society on the systematic use of information, as well as the dramatic increase in available information, a great deal of effort has gone into the design and development of information systems. However, software systems in general and information systems in particular have been criticised for their lack of correspondence to the requirements of users. For example, in the late 1980's in the United States it was found that 'in only 20% of the systems studied was the new system judged a success, with 4% producing only marginal gains and 40% resulting in failure or

rejection of the system,' (Hill, 1995, p2). Wilson notes that there is a 'division between the meanings embedded in information systems and the highly personal meaning of the information seeker's problem' (Wilson, 1994, p32). Kuhlthau states that 'information systems ... traditionally view information use from the system's perspective and have concentrated retrieval on questions that best match the systems representation of the texts rather than responding to user's problems' (Kuhlthau, 1991, p361). Belkin, on similar lines, has said that 'involvement of the user with the information retrieval system is minimal and interaction, (in the form of judgement), is seen as ancillary' (Belkin, 1995, p2). Borgman, (1996), reaffirms these statements in relation to the online public access catalogue which she argues is still difficult to use and relates this difficulty to a lack of understanding of the information seeking behaviour of the user. In general information systems are arguably still crude and are particularly inadequate at helping to support relatively unstructured information needs (Hepworth, 2001).

It is perhaps too easy to criticise information retrieval products. It is evident from the numerous studies and plethora of information need, information retrieval and information seeking and use models that developing an understanding of users and their requirements is a complex problem. Taylor gives an insight into the complexity of the process whereby users move from the stage of 'visceral need' to one of stated 'compromised need' (Taylor, 1963). Historically Library and Information Studies courses have spent time alerting students to the problems associated with defining user needs and have emphasized the range of skills associated with the reference interview where needs are defined. Despite this, information professionals are still criticised for their lack of commitment to understanding needs (Nicholas, 2000). It is not surprising that this domain continues to be a significant area for research and debate.

Attempts have been made in recent years to develop user-oriented methodologies to capture user requirements. Examples of these include the Goals Operators Methods Selection (GOMS) model (Nielsen, 1993), and the efforts to incorporate theory from social science into 'user-centred design', (Heath & Luff, 1992, Simonsen & Kensing, 1997). Urqhart, (2001), draws attention to the use of case studies, critical incident

techniques and vignettes to understand user requirements. These 'new' approaches have been driven by the increase in information intensive roles and hence greater demand for information systems as well as raised expectations from users for easy to use products. In addition, there is an appreciation that the fault of unsuccessful software systems lies in a lack of time spent on analysis and understanding of the problem context of the user. It has been found that a significant source of major errors in systems development has been in the requirements analysis stage, (60%), followed by the design stage, (25%), and coding, (7%), and yet only, 25%, of the time and resources have been devoted to the reguirements and design stage, (Hill, 1995). Furthermore it is recognized that it is cheaper to make corrections during the 'requirements analysis' stage of analysis rather than during the later stages of the systems development life cycle, (Byrd, Cossick, Zmud, 1992). An awareness of these problems has, to some extent, stimulated the adoption in recent years of ethnographic methods by software designers. In the area of software engineering, usability engineering and human computer interface (HCI) design, the objective however has primarily been to develop a user-oriented approach for software development in general, rather than specifically in relation to the development of information retrieval systems. These changes that are taking place in software engineering in terms of user orientation and emphasis on understanding the context of the user are positive developments. However, it is proposed that in the area of defining the needs for information services previous work in Information Science provides a rich base from which a useful contribution can be made.

This is not entirely a novel idea. In Information Science, over the last forty years, the needs of users of information have been studied extensively. Various conceptual frameworks and models have been put forward to help identify aspects of information need and information behaviour. However, the emphasis has generally been placed on modeling and understanding particular aspects of the user's interaction with information systems rather than creating a framework for information needs analysis. This is particularly the case of authors who have a background in information retrieval research, for example, Oddy, Liddy, Balakrishan, Bishop, Elewononi, Martin, (1992). Other authors who have developed more holistic conceptual frameworks, for example Wilson,

(1999), Ingwersen, (1996), Spink, (1997), and Saracevic, (1996), have not attempted to link the framework to specific methodologies for eliciting requirements for the development of information systems and services which is one concern of this research. Nevertheless their attention was directed at understanding needs and modeling interactions with information. Some authors, however, have linked a theoretical framework to a methodology for understanding needs and requirements. These include Dervin, (1992), Hert, (1997), and Nahl, (1998) and Nicholas, (2000). Previous works are fundamental to the formulation of the framework proposed in this thesis, however, it is argued that the cumulative research suggests that a more holistic view could be taken and that previous work has tended to highlight specific aspects of the users and their interaction with information. The framework proposed nevertheless initially stems from this work. It is argued that as a result of this legacy of research we are now in a position to integrate previous work and develop a broader conceptual framework that will help guide the researcher when gathering user requirements data. This is the primary objective of this research.

Secondary to this primary objective, it is argued that this framework will help to identify specific techniques that will help elicit data on the various categories of data. These techniques would be drawn from those used in social science as well as those used in software engineering and human computer interface design and information needs analysis.

However, the primary concern is the development of a comprehensive conceptual framework for understanding information interaction and defining user requirements for information systems.

Research agenda

The objective of this research is, therefore, to investigate and test the following assumptions:

Primary assumptions:

- that the accumulated past research in user studies and information seeking behaviour now provides a good basis for the development of a conceptual framework for understanding people's interaction with data, information and knowledge.
- that this framework will help to determine the phenomena that we need to study to understand the respondents and their interaction with information.
- that the conceptual framework
  - ➢ will indicate those factors that will influence the individual's interaction with information.
  - ➢ will indicate and help explain those factors that influence each other and the individual's experience when interacting with information and information systems.
  - ➢ help derive data that will enable the researcher to identify user requirements for an information system that relates to their needs.

Secondary assumption:

- That this holistic conceptual framework will help identify appropriate research methodologies and appropriate techniques for studying people and determining their requirements for information systems and services.

Research strategy

To conduct this research the following strategy was taken:

Identify core concepts (chapter 2)

- Review of the literature concerning user studies and research into information seeking behaviour. This literature was primarily from the discipline of Library and Information Science. In addition a review of work from other related discipline such as HCI design and software engineering was also conducted. An inductive analysis of this literature identified the range of phenomena that researchers were trying to explain.

Formulate framework (chapter 2)

- Drawing on the range of phenomena that previous researchers had identified as significant an initial attempt was made to formulate a conceptual framework that

could underpin the study of users' requirements for information services. The framework evolved, to some extent, during the literature review.

Decide upon methodology (chapter 3)

- The next stage in the research was to identify an appropriate methodology to test the conceptual framework. It was decided to test the usefulness of the framework by using it to study a community of people while they undertook information intensive tasks. It was expected that the conceptual framework would change and develop due to applying it – which is an accepted part of exploratory qualitative research where the researcher through empirical study moves closer towards finding an explanatory framework for a particular research question (Miles & Huberman, 1994). Students were chosen because they provided a community that could be studied who were engaged in information intensive activities. Also, because students have been studied on previous occasions and because these studies were well documented in the literature. Therefore it was felt that the findings of this research could be compared with previous research to indicate whether the methodology was efficient at deriving insights about information needs and information seeking behaviour. In addition whether it did help to gather, organise and explain data. The first study therefore provided an indication of the validity of conceptual framework. Techniques chosen were designed to find data on the concepts in the conceptual framework. It was expected that the proposed methodology should, at minimum, identify similar insights to those evident in previous studies of students' information needs and information seeking behaviour. Ideally it would provide a more comprehensive view than any one study. The same methods were applied to two cohorts of students. During the study, and as a result of the study, both the framework and the data gathering techniques were modified.

- Initially, however, prior to the pilot and first case study an inductive review of the literature concerning research methodology was conducted. This was important in terms of identifying appropriate methodology both at a high level i.e. the researchers' theoretical orientation and at a low level i.e. specific techniques for eliciting data. This included a review of related literature in the disciplines of software engineering

and HCI. This was necessary because, although spanning a short period of time, these disciplines have a history of trying to understand the requirements of the respondent so that systems (not necessarily information systems) can be built. In addition, due to the pragmatic nature of the task i.e. building working systems in the commercial environment, this literature demonstrated a need to use repeatable systematic approaches that could be completed in realistic time frames and hence emphasise the development of method, a concern shared by the author. The objective here was, therefore, to identify specific techniques that supported the capture of data that would help to see whether the underlying conceptual framework was useful.

Apply framework (chapters 4-7)

The framework was then applied and the students' studies took place as follows:

- *Preparation and pilot*: Techniques were identified and tried out and modified. This was an iterative process. Initially a pilot study of a small number of Computer Engineering students was conducted.

  First case study: The framework and associated techniques were then applied in a study of sixty postgraduate Information Studies students at the Nanyang Technological University, (NTU), in Singapore. Two studies of students were undertaken while they were involved in information seeking and gathering situations. As a result of the study the framework was modified.

  Second case study: To further test the robustness and transferability of the framework it was decided to try out the framework on data gathered on completely different community, informal carers, and where the data had been gathered using different techniques and without the conceptual framework in mind. This approach was taken to help ensure that the data captured in the first case study and the findings were not a product of the methodology which had been developed to gather data on those elements specified by the framework. The objective here was to see whether the conceptual framework would prove useful in analysing this data set and whether a large body of data would fall outside the remit of the conceptual framework. This study, although not changing the broad categories that made up the framework, led to further refinement and a clearer definition of the conceptual framework.

Summary and conclusion (chapter 8)

- The final stage in the thesis was to critically reflect on the final conceptual framework and to compare and contrast it with other conceptual frameworks and models concerning information behaviour. On the basis of this and the research experience and findings it was possible to evaluate the usefulness of the conceptual framework. In addition, a critical review of the methodology was done and areas for future research identified.

The thesis is structured along the lines indicated above. More emphasis is given to the analysis and findings of the second case study because it was felt that the framework was more robust and warranted more substantiation at this point in the thesis. This was done through the extensive use of quotations that illustrated and helped to give meaning to the components of the conceptual framework.

Chapter 2 : Literature review and the development of a conceptual framework

An overview of the initial conceptual framework

This chapter starts with a brief overview of the development of the conceptual framework that was applied in first case study. It is followed by a discussion of the elements of the framework showing how these are grounded in the literature of user studies, information seeking behaviour, human computer interface design and software engineering.

This first stage of the research tackled two questions. What should we be studying when we gather user requirements? What is it about the respondent and their interaction with their (information) environment that we need to know? There is currently a great diversity of approaches to help answer these questions and a long history of research, particularly in the area of library and information science. However, it is only within the last two decades that researchers have started to develop a holistic view of the remit of user studies.

To help answer the questions outlined above a number of papers were reviewed. These texts came from the fields of user studies, human computer interface design and software engineering.

On the basis of this literature four common domains were identified as significant to understanding information needs and information seeking behaviour:

- The *sociological* which highlights the significance of the social context and its effect on the information behaviour and needs of the respondent. This included roles, tasks and norms associated with the social context.
- The *content* domain which encompasses the knowledge content and the physical environment and tools or artifacts that the respondent interacts with, such as books,

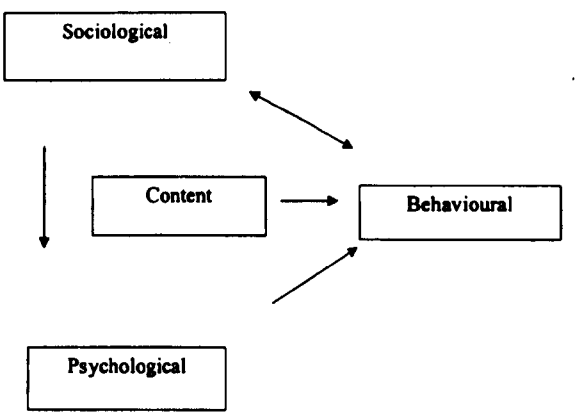
databases or people and aspects of the interface between the respondent and source of information.

- The *psychological* which encompasses the cognitive and affective phenomena associated with the respondent.
- The *behavioural* which focuses on the actions of the respondent.

These four fundamental themes persisted throughout the literature. As the literature review progressed a fuller understanding of the meaning of these domains and how they are interconnected developed as well as an understanding of the various levels of analysis that need to be represented . Each broad domain was broken down into constituent parts.

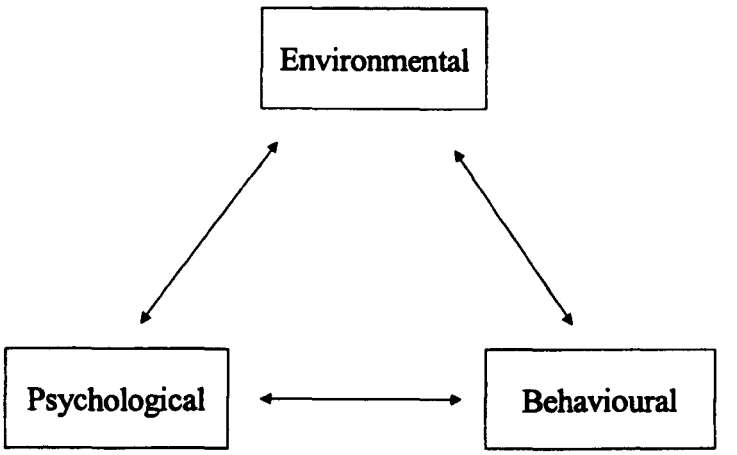
An initial model was developed to represent the relationship between these various elements and is shown below in Figure1. This was the first model of the conceptual framework and the areas that needed to be studied. However this first framework was felt to be too deterministic and did not adequately visually represent the various elements associated with user requirements. Nor did it adequately reflect the interaction between the various elements. This first framework did however demonstrate that the sociological environment, for example the type of organisation and associated tasks would determine, to a great extent, the psychological tasks of the respondent, for example the cognitive problems that they had to resolve. Furthermore, it implied that the content available to the respondent would influence behaviour but that behaviour would also be influenced by the psychology of the respondent as well as the sociological environment. This model did, therefore, recognise the broad categories of data that it was thought necessary to understand.

Figure 1 First representation of the conceptual framework



Bandura's, (1986), triadic framework was later adopted and modified to help to better conceptualise the relationship between these themes. Part of this 'adoption' involved the combination of the sociological and content domains under the broader heading of *environment*. This was because the roles, tasks and norms and the content including the artifacts the respondent interacts with and their form and subject matter are determined by the social environment of the individual. The diagram overleaf shows the triadic relationship between the various dimensions and indicates the interaction between them.

Figure 2 Intermediate conceptual framework: a modification of Bandura's schema



The diagram reflects a realization of the dynamic relationships as well as the unique role of the individual in making sense of their environment. This framework is less deterministic and reflects an appreciation of the dynamic interaction between the various factors. The information behaviour is not solely directed by the environment; the psychological profile and the state of the individual will also have impact on the behaviour of the individual and their response to and interaction with the artifacts that they use. Behaviour itself will also be a driver, in the sense that certain behaviour will have consequence. But this behaviour will be driven to some extent by the nature of the environment and psychological situation of the individual. Further analysis of the literature led to development of the model as shown in figure 3 where individual

categories of data were broken down further. This framework was applied in the first case study.

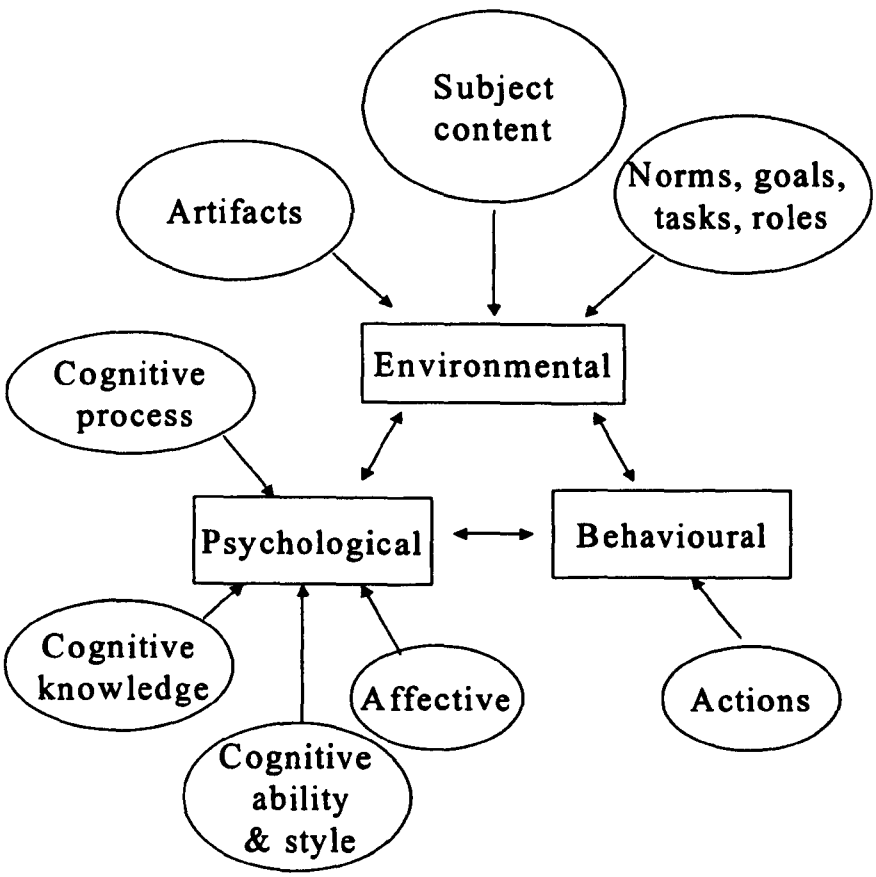


Figure 3 Conceptual framework applied in the first case study

A detailed description of this framework follows. The broad categories (environmental, psychological and behavioural) and the sub-categories are used to structure the literature review.

Review of the literature: grounding the conceptual framework

The objective here is to show how the framework stems from previous research but at the same time to provide an explanation of the constituents of the framework. Few studies

fall solely into any one domain. Many studies focus on which artifact and what content is used by whom and how. In other words, focusing primarily on the environmental and behavioural aspects of people's interaction with information.

The Environmental domain

There has been a long tradition of studying user communities. Generally these studies have concerned what I have termed 'the environment of the individual'. However, different researchers have tended to concentrate on different aspects of the environment. In Library Science great emphasis has been placed on the subject matter needed and used by groups of people due to the concern with collection development. In the late 60s these tended to be groups of academics (Line, 1969) but later attention turned to other communities such as social workers (Wilson, 1977) and journalists (Nicholas and Martin, 1997). This focus on communities is still prevalent today.

The environmental domain refers to the nature of the respondent's social and physical environment. This includes the norms, roles and tasks associated with the social and organisational environment of the respondent. It also includes the physical world that the respondents interact with when seeking or gathering information to resolve problematic situations and conduct their day to day tasks. Therefore this includes the artifacts and their associated subject matter, form and content.

Data on subject content

To develop an information system or service it is necessary to have an understanding of the subject domain that the user is concerned with. It is, after all, the function of the system to provide data and information that help the users resolve problematic situations concerning specific knowledge domains. It may, for example, help resolve gaps in understanding, provide data to support actions or proposals, help refresh the knowledge base of the user and so on. A necessary part of understanding user requirements is understanding the subject content of relevance to the user since this will form the 'content' of the system. Content is used here in the sense that it is to content, which is

made up of data, information and knowledge, that access is provided. The actual content may of course be widely distributed and held in many forms.

The definition of subject content of relevance to the user has a long tradition in user studies. One example is the research undertaken in the early seventies into the characteristics and composition of social science literature during the DISISS, (Design of Information Services in Social Sciences), studies (Hogeweg-De Hart,1983:1984). An important part of studies that focus on the needs of a specific community has been to determine the subject matter of relevance to the community. Examples of such studies include the study of the information needs in local authority social services departments (Wilson, Streatfield and Mullins, 1979) or Chun Wei Choo's, (1994), study of the information needs of chief executives where the topics of interest to the users are defined.

Other areas of Library and Information Science are also concerned with identifying the subject domains of interest to the end user. Historically citation studies have been used to help determine the boundaries of a particular subject and determine the content of a collection. An important part of information audits have also been to conduct information needs analysis to determine what information people need in the organization (Ellis, Barker, Potter and Pridgeon, 1993). Pejtersen, (1992), in her innovative design and development of the interface to an online public access catalogue, (OPAC), emphasised that 'database content must be rich enough to support users' information needs and that data content must match and be tailored to user's goals and needs' (Pejtersen, 1992, p360). Pejtersen goes on to argue that indexing vocabulary and retrieval language should emerge from the context of the users' problem domain. The current concern with metadata and also knowledge mapping can also be seen to reflect the information professional's concern with defining content. The former builds on the long history of the classification and indexing of information that may be of use to the user for both mapping and accessing subject content. Users of information retrieval systems have great difficulty in defining the question in terms of placing it in a specific subject domain. This makes it difficult for them to derive appropriate terms and concepts to look for. As a result systems have evolved to facilitate exploration of the subject domain, for example,

Influo software (found at http://www.influo.com). Similarly, the Ovid software allows the user to enter a query that it then maps onto subject terms and descriptors are then displayed for selection by the user. However, the point being made here is that to develop such systems at some point an understanding of the subject content that is significant to the individual and the relationship between concepts within the subject domain needs to be understood.

In addition, to the more obvious attributes of subject content Cool, Belkin, Frieder and Kantor, (1993), highlighted other aspects of content that would effect relevance judgement. These included 'topic' (how the topic relates to a person's interest) including whether the subject matter defines the topic, on/not on the topic; focus (directly on the topic, part of the topic, treatment such as deep or superficial). At present I am not aware of information retrieval, (IR), systems that incorporate such distinctions to facilitate retrieval. However, this situation may change if 'rules' can be defined that enable automated characterisation of texts in this manner. Nevertheless, I would argue it is necessary to collect data on situations where aspects of artifacts are important and useful to the user, to help understand the type of subject matter that is relevant in specific cognitive or task related situations and the way it can be presented.

Researchers working in other disciplines concerned with the development of information systems also recognise the need to specify subject content of relevance to the user. These include software engineers who, when designing systems, undertake user requirements analysis (Browne, 1994). Part of user requirements analysis is to document the various contents of the planned system. These are represented through Task Hierarchy Diagrams. For example, a flow chart of tasks may include 'quote price' identifying prices as an important element of system content. Verbal protocols may also be analysed to derive knowledge representation grammars that as well as indicating process also identify content. For example 'I check exchange rates' converts into Check/Exchange Rates i.e. object (content) follows action. This content may eventually be recorded in the data store. Data flow diagrams will show the processes associated with this data and the input and output (Robinson and Prior, 1995). Emphasis on user requirements analysis has

grown over the last fifteen years. In the U.K. far greater emphasis has been placed on understanding the requirements of the user and have incorporated it into version four of the Structured Systems Analysis and Design Methodology recognised by the U.K. government. It is perhaps surprising that this has not always been the case. However, this is partly explained by the fact that originally software systems to a great extent automated existing predefined paper based systems.

Designers of expert systems also expend considerable time and energy understanding the subject content of the system. This activity falls under a number of headings. These include knowledge elicitation or acquisition (which tends to refer to the process of understanding and capturing the knowledge of relevance to the user of the system) and knowledge representation which concerns the conversion of knowledge into systematic structures that could be emulated by a machine. The overall objective is to understand the 'problem space' (Byrd, Cossick and Zmud, 1992) and knowledge structures including the conceptual and procedural knowledge of the respondent.

Subject content is, therefore, an area on which we need to gather data when defining the user requirements for an information service or system and it is an important component of the environmental domain that we need to understand. Different environments, such as domestic or work related, will have a specific subject content associated with them. Different roles and tasks, as well as specific psychological situations, are likely to have specific content associated with them and distinctive behaviours will be enacted by the user to retrieve them. Specific behaviours will be associated with specific subject content and specific cognitive processes will be associated with manipulating different types of content. For example, journalists may need to identify news stories that have covered similar incidents to a current event. Financiers will trawl through company statistics to identify acquisition targets. In other words, depending on the user's situation particular content will be relevant, valued and useful.

Data on artifacts

The word artifacts is used intentionally to indicate the range of sources of data, information and knowledge and also their component parts that can be important to the

user. Traditionally in Library and Information Science these have included primary, secondary and tertiary sources of electronic and paper based information. These would include books, journals, reports, Web based sources etc. However, it could also include people and the full range of media that can be used to access or convey data, information and knowledge e.g. advertisements, broadcasts, oral data etc.. An approach generally called information mapping that illustrates this perspective is the methodology of Burke and Horton, (1988), and also Orna, (1999), which identifies the need for information resources, ('information resource entities'), in the organisation. The phrase 'component parts' alludes to the features of these artifacts, for example, the query entry dialogue box associated with the graphical user interface of a database system, or the chapter or article headings and sub headings or contents page and indexes found in books and journals.

Historically, in Library and Information Science, studies of user communities have gone to great lengths to document the types of sources that the users need, want or use. This has been the most common form of research concerning users and their needs, particularly amongst practitioners, and tended to indicate which types of sources users valued or used e.g. journals or reports. This is understandable since the results of such studies can help guide the collection development policy of the librarian. This type of study is often combined with studies of the subject content described in the previous section. One of the earliest studies reported in the *Journal of Documentation* was by Earle and Vickery which analysed a sample of citations in the 1965 UK social science literature (Wilson, 1994). Early studies such as DISSIS, mentioned above, epitomise early research into those artifacts used by a specific community. A clear indication is given as to the types of information required, such as time series or ephemera. An early study by Garvey, Nan Lin and Nelson, (1971), examined the different kinds of information needed by scientists and social scientists at different points in their research by studying the flow of information dissemination through various artifacts such as reports, manuscripts and journal publication. Such studies became less popular in the 1980s, partly because researchers became more interested in explaining how and why people used information and tended to focus increasingly on the process of interaction with information artifacts. It was also felt that a listing of titles or types of sources, although useful, did not

adequately reflect underlying needs. However understanding what artifacts the user requires and the components of those artifacts that they find useful or not remains an important part of the user requirement analysis process as can be seen in recent studies such as that by Spink, Bray, Jaeckel and Sidberry, (1998).

In addition to understanding the types of artifact that the user requires it is necessary to understand which component parts are useful. User studies have traditionally focused on what these artifacts are and not studied how specific elements of artifacts are used by respondents. However, due to increased interest in the design of electronic information systems, studies are increasingly evident of how people interact with artifacts whether they be OPACs, Web based resources, bibliographic databases or hard copy sources. Belkin, (1994), for example, studied scholars in the humanities and their interaction with texts. He was able to identify the text characteristics that were salient to the respondents and also the parts of texts that were used by people and related this behaviour to specific cognitive goals. For example, where the relevance of a text was not obvious scholars frequently examined footnotes or acknowledgements to identify the author's point of view or reference group. These insights would enable the design of the future information system or service to incorporate such features that could help the user to navigate through the artifact or help to highlight areas of interest. The work of Cool, Belkin, Frieder and Kantor, (1993), provides a description of these features. The following categories have been expanded and adapted, to some extent, but fundamentally, these reflect the original authors' list of features and the type of artifacts required. These include,

- What is in the document i.e. basic concepts; facts; explanation; examples; definitions; connections; description; reasons; ideas; tips; guidelines; case studies; technical knowledge; interview; point of view; survey; history; level of detail.
- Characteristics of the document i.e. lists; diagrams; statistics; text; numbers; pictures; class text; book review; title; introduction; footnotes; division in topics; contents page; index; cover; citations; section headings etc.

- Presentation of the document i.e. organisation; matter of factness; precision; writing style; understandabilility; technicality; scientificness; simplicity/complexity; readability.
- Values associated with the document i.e. degree of interest; usefulness; 'goodness'; entertainment value; precision; authority.
- Relationship of the document to the user i.e. it informs them; teaches; supports understanding; use to which the document will be put e.g. references or quotes.

Similarly Nicholas, (2000), argued specific characteristics of artifacts will determine usefulness and relevance to the user. These included their nature, complexity, quantity, quality, authority, date of origin, currency, speed of delivery, origin, language level, processing and packaging. Ideally an information system would be able to 'understand' what the user needs in terms of these characteristics or the user should be able to define their needs to this level of detail and retrieve appropriate material. It is likely in future through the use of embedded codes such as extensible mark up language (XML) and the use of metadata raw data could be dynamically formatted and presented to the user in an appropriate way. Research has been undertaken to see how various structures within artifacts can be presented to the user to facilitate interaction. These have included dynamic scatter/gather table of contents and the three-dimensional visualization of citations in bibliographic records (the Butterfly citation browser), (Rao, Pedersen, Hearst, Mackinlay, Card, Masinter, Halvorsen and Robertson, (1995), and also Hearst, Kopec and Brotsky, 1996). Recent work on the PROPIE project found that various interaction and visualisation techniques could enhance the user's interaction with electronic documents (Chern Li Liew, Foo and Chennupati, 2001). The work of McKnight, Dillon and Richardson, (1991), also explores how the structure of artifacts, in this case journal articles, can be represented in the electronic domain to enable user interaction. In the area of digital library research there is a recognised need for users to be interact with documents at various levels of 'granularity' so that 'illustrations, graphs, or sections of code might be located not just whole documents by title, subject, or author', (Fox, Lucy, Brueni, Wake and Heath, 1993). Research by Borgman, Gilliand-Swetland, Leazer, Mayer, Gwynn, Gazan and Mautone (2000) as part of the Alexandria Digital Earth

Project, (ADEPT), is currently exploring similar issues. 'Granularity', that is of relevance to the user, therefore has to be defined. The Dublin Core initiative is an attempt to describe electronic documents providing this kind of 'granularity'.

Artifacts would also encompass those 'tools' in the environment not directly associated with the sources of information or documents that were useful to the respondent. For example, the use of a notebook, whiteboard or software that helps capture bibliographic references would imply the need to capture and store and organise the information that the respondent had found. Use of these artifacts implies certain cognitive and behavioural needs that need to be supported by an information system that is designed to facilitate information seeking and use. At Xerox Park research has been undertaken for some time to see how physical artifacts in the user's work environment are used so that their functionality can be 'extracted' and to then see whether these facilities and 'functionality' can be incorporated into the electronic environments that enable the manipulation of information. '

Other disciplines that are also concerned with this area include those involved in communication studies and media research where information about preferred channels of communication can be used to improve the effectiveness of information delivery and retrieval (Wilson and Walsh,1996). In the area of software engineering and user requirement analysis there has also been a perceived need to record the artifacts, (forms, reports etc.), that the respondent interacts with. The processes associated with these artifacts and their structure often form the basis for building up a picture of the flow of information and input and output of data in the system.

In the area of software engineering traditionally concern with artifacts has focused on their subject content or data elements as described above. An understanding of these data elements may then be presented to the user as fields in the record. For example, the title page of the book may be represented in a record format with separate fields for author, title, date of publication etc. This, however, provides a very abstract representation of the artifact. Although these data elements reflect significant aspects of the object and help

identify the book the 'real' structure and form of the book is lost along with the functionality associated with the original object. Exceptions to this approach have, however, evolved with the development of graphical interfaces that try to emulate the physical real world object. The use of these 'real things' metaphors recognises the richness associated with artifacts that users interact with and the need to incorporate these features in the system design.

It is therefore argued that when studying the respondent it is necessary to capture data on the artifacts that they interact with and help them solve problems. It is also necessary, however, to identify how the use of artifacts relates to specific cognitive psychological situations and how people use them i.e. the user's behaviour.

Data on norms, goals, roles and tasks

These elements of the model draw attention to the social context of the respondent and the norms, goals, roles and tasks associated with that environment. To some extent these provide the context within which subject content and artifacts are generated and used. Although early user studies in Library and Information Science studied communities, little attention was paid to the social dimension. It was not until the late 70's and early 80's that the influences from social science, particularly phenomenological and constructivist schools of thought and methods associated with ethnography, started to influence user studies. Streatfield's, (1983), article captures these changes and their influence on user studies. One effect of these influences was an increased emphasis on the influence of being a member of a social group. The other focused on the individual and their experience and felt that to relate needs to group membership or task underplayed the constructivist nature of people's interaction with information (Dervin and Nilan, 1986). In this thesis both stands are given equal weight and although the respondent is perceived as interacting and coping in individualistic way, and in some cases will change and mould their context, the norms, goals, roles and tasks are prescribed and will impose needs.

Norms in this case are interpreted as social or organisational norms such as commonly accepted expectations in terms of information seeking behaviour. For example in certain

environments the degree of rigour associated with information retrieval may be very high, for example, preparing a PhD literature review, checking for patents or finding out about a company prior to acquisition. There may also be norms associated with role that could have an effect on information behaviour such as degree of collaboration. Solomon, (1997), is one of the few authors who have explored how organisational norms influence information behaviour.

The term tasks is used in this instance to refer to both macro level tasks such as completing a research project as well as micro level tasks such as defining a topic. Descriptions of tasks could of course be confused with the underlying psychological processes or with the behaviour associated with the tasks since the same words are often used to describe both. For example 'defining a research topic' is one of the tasks of a researcher but it is also associated with cognitive processes, affective states and behaviour such as browsing, (behavioural), the shelves to develop a mental map, (of the subject), and orientate, (task), oneself to the topic.

Historically user studies did not originally focus on the roles, tasks and norms of the respondent. The focus of attention was primarily on subject content and artifacts. However, by concentrating on the needs of specific communities researchers have indirectly recognised that needs were influenced by the environment in which the respondent worked, albeit the emphasis was on the 'universe of knowledge' they operated within rather the specific roles and tasks they generally performed. The influence of the organisation and social environment of the respondent was, however, highlighted in the work of Wilson, Streatfield and Mullins, (1979), which placed the needs of respondents firmly within the working context of the respondent. Furthermore Wilson et. al. pointed out that the information service is inseparable from organisational communication practice. They went on to show how specific roles such as directorate, advisers, line managers have specific needs associated with them. This type of research has continued. Julien, (1996), showed that between 1990 and 1994, 70% of information needs and use studies focused on a specific community. A small number of examples are given here to indicate the range of communities studied. Chun Wei Choo, (1997), for example, focused

on the roles of chief executives; Kuhlthau, (1993) on securities analysts and their need for information about their business environment; Nicholas, (1996), on journalists and politicians; Marcella and Baxter, (2000), on citizens.

Other studies have focused on specific communities and their information seeking in relation to the situations, (tasks), they confront. An example is Dervin's, (1983), work on sense-making where the author studied people involved in specific contexts such as cancer patients experiencing screening. To some extent, however, the fact that the tasks studied were particular to that community was not made explicit. In Dervin's case this is because the author was primarily interested in identifying high level categories of cognitive situations associated with problematic situations. In Library and Information Science two of the most common groups to be studied are students and academics. This is partly because of ease of access and also because they are involved in information intensive tasks and hence prime targets for research. Research by authors such as Kuhlthau, (1988), and Eisenberg and Brown, (1992), and Ellis, (1993), focus on the behavioural and psychological aspects of information seeking behaviour during the research task. Kuhlthau's seminal work looked at the students' progression over time through the research project task and identified cognitive, affective and behavioural strategies and phenomena associated with the task. These works have provided significant insights into information behaviour. However despite the influence of constructivism and phenomenology there has been a tendency to generalise findings beyond the group. In some cases this may be justified. Hert, (1997), for example, argues that there is sufficient similarity of research findings into the academic research process to accept transferability of results to other academics. However specific information behaviours such as 'footnote chasing' (Bates, 1984), are less likely to be applicable outside the academic context.

Many studies have focused on the academic research task. These studies have tended to concentrate on part of the task, that is accessing and finding information, rather than the research task as a whole. This has been because the primary concern has been with specific aspects of information retrieval interaction, for example, with online systems, or

intermediaries, or CD ROMs or OPACs. Researchers working in this area have included Saracevic, Kantor, Chamis and Trivison, (1998), Saracevic, Mokros, Su, and Spink, (1991), and also Hancock Beaulieu, (1990), who primarily explore specific cognitive issues associated with IR. Hert, (1997), although concentrating on IR interaction did explicitly place the 'information retrieval interactions' in the wider context of the work environment and the ongoing task. Hert's work also helps to distinguish between the different levels of abstraction associated with information seeking behaviour. In particular it makes a distinction between the macro level completion of a task determined by role, for example writing an essay, and the micro level task associated with IR interaction while searching a database or reading a book to gather data.

Attention to macro level tasks has been the focus of software engineering, in particular, human computer interface design. This is because the objective of the software that is being developed, such as office management software, is to provide software support for particular office tasks in the office context. HCI design owes its origins to a number of disciplines including ergonomics. The objective of HCI design is to produce systems that are easy to learn and allow users to work efficiently, effectively and comfortably. As a result significant effort has gone into understanding the tasks that the user wants to undertake and also ensuring the interaction with the computer to undertake these tasks is intuitive. This has resulted in the development of a number of methodologies such as SSDM version 4, COMPACT and Multiview. To date though, there is no accepted standard methodology. Recently considerable debate amongst HCI professionals has concerned the use of ethnographic methods for studying respondents (Simensen and Kensing, 1997). Central concerns of HCI include the following (Hill, (1995), Preece, Rogers, Sharp, Benyon, Holland and Carey, (1994)):

- Equipment: application area and functions, hardware and software and user interface.
- User: skills, knowledge and personal attributes, motivation, satisfaction.
- Task: goals, frequency, duration, physical and mental demands
- Environment: working conditions, organisational attitudes and culture, health and safety factors, job design, comfort factors, pragmatic constraints, productivity factors.

Emphasis is placed on the use of equipment, modeling the user, (in what may be viewed as a rather deterministic fashion), understanding the nature and impact of tasks as well the environment within which these take place. The emphasis on health and safety reflects the influence of ergonomics.

HCI research shares areas of concern common to those of the researcher into the requirements of respondents for information systems and services. The focus on the tasks of the respondent and the use of associated methodologies by HCI researchers can contribute to the understanding of respondents. Focusing on tasks provides a means of helping determine information needs and use which ensures that these needs are placed in the day to day context of the respondent. The influence of this approach is evident in the work of Sebillotte, (1988), Evans, (1988) and Bystrom and Jarvelin, (1995). From a pragmatic point of view, when interviewing, asking people about tasks they undertake tends to be more productive than asking people about their information needs.

Returning to norms, the study of organisational norms in terms of communication patterns has also proved important in understanding the flow and content of information in an organisation as well as the 'blockages' associated with this flow. This formed an important element in Soft Systems Analysis (Checkland, 1981), which has been applied to the information needs context and the development of information systems in the library by Underwood, (1996). The importance of the social aspect of information seeking, in particular the collaborative nature of this process amongst undergraduates, has also been highlighted by Twidale, Nichols and Paice, (1997). Tasks and norms influence the amount of data, information and knowledge that an individual requires. The impact of norms on information interaction and behaviour is an area that deserves more research.

HCI design and systems analysis methodology and their theoretical concerns are therefore relevant to the study of user requirements for information systems and services, primarily because they highlight the importance of understanding tasks goals and norms evident in the respondent's social context. In terms of this thesis and the derivation of the conceptual framework, this body of literature helps to emphasise the importance of these

elements. However, due to the focus of HCI on generic human computer interface design, the work associated with it has contributed little to our understanding of information seeking and use. Furthermore, in comparison to Library and Information Science research, less time has been spent on the significance of subject content and information artifacts and their complexity and importance in information service design.

The study of the environment of the respondent and its various parts, (artifacts, subject content as well as norms, goals, roles and tasks), is therefore proposed as a key element for understanding the respondents' requirements for information systems and products. An appreciation of this has implications for the methodology that is used to study respondents. These implications will be explored in the next chapter. The following sections explore two other fundamental domains, the psychological and behavioural.

The Psychological Domain

Over the last twenty years, research amongst academics in Library and Information Science has concentrated to a great extent on the psychological domain and less emphasis has been placed on the environmental 'context' described above. This is partly explained by the increased influence of cognitive psychology, as well as disciplines such as anthropology, linguistics and sociology, and also the emphasis on the individual and their unique experience of reality. To some extent this change in focus was also driven by a realisation that systems were not sufficiently user-oriented i.e. they were systems driven and not user-driven. This was partly because these systems were designed to replace existing paper based systems and the needs of the users were not in the forefront of the developers' mind (Hill, 1995). Researchers therefore tried to understand the user at a 'deeper' level so that they could better understand the complexity of the information retrieval interaction and also derive models of the cognitive processes of the user (Belkin, (1984), Belkin, Cool, Stein and Theil, (1995), Sutcliffe and Ennis, (1998)). The objective was to incorporate this knowledge into system design and make systems more intuitive and effective.

Allen's, (1991), comprehensive review of the cognitive research, in Information Science, distinguishes four key elements in the psychological domain: knowledge and cognitive models, cognitive processes, cognitive ability and cognitive styles. These form the basis for research into this domain. Another term that could describe this domain is 'cognitive behaviour', however this has a danger of confusing the actions of people with the thinking process. One of the difficulties associated with this domain is that behaviour such as physically browsing the shelf is associated with the cognitive task of browsing (scanning, identifying, defining etc.). As a result,the two domains get confused because authors use the same descriptive term to describe the two or do not make a clear distinction between behaviour and thought.

Cognitive knowledge

In the area of knowledge and cognitive models, Allen, (1991), highlights the research that has gone into the influence of 'knowledge about their world', 'knowledge about the topic', 'knowledge about the task' and 'knowledge about the IR system' in other words knowledge about the environmental domain described above. It is the impact of this knowledge or lack of it, that results in specific behaviour and the selection and use of artifacts and subject content when people are trying to navigate through a particular context. Where knowledge is lacking the person is 'blocked'. These blockages are, I would argue, instances of the anomalous states of knowledge described by Belkin, (1980), and result in 'uncertainty' (Wilson, 1999), problematic situations and the need for sense-making (Dervin, 1983). In HCI research great emphasis has been placed on the level of expertise i.e. novice and expert, (in either the system or the subject). Marchionini, (1995), in his work on information seeking in electronic environments, also highlights similar factors including domain and system expertise which relate to the individual's ability to navigate through problematic contexts.

Cognitive processes and affective states

A great deal of work has gone into the study of cognitive processes associated with information retrieval. This research has generally been done in the academic context and hence has looked at information retrieval primarily while people are conducting a piece

of academic research. However, a few authors such as Ellis, (1997), and Cheuk, (1998), have extended this to the cognitive research in the industrial setting. Cognitive processes that have been associated with conducting research tend to fall into the categories of initiation including problem definition and exploration, task definition, development of information seeking strategies, locating and accessing of material, identifying and collecting material and information use and publication. Each of these and their component parts are associated with cognitive processes and cognitive problems. Many authors have contributed to the definition of this list of events associated with cognitive processes including Bates, (1984), Saracevic, Mokros Su and Spink, (1991), Kuhlthau, (1991), Eisenberg and Berkowitz, (1990), Ellis, (1993), Marchionini, (1995), Hert, (1997). Different authors have used slightly different terminology to describe similar phenomena but these generally concur on the major cognitive processes. Some provide greater depth of research into particular aspects of the research process. Authors have also studied the research problem at different levels of abstraction, for example, at the micro level research has involved the study of specific information seeking incidents and interaction with a particular system, for example Saracevic, Kantor, Chamis, Trivison, (1988), Hancock-Beaulieu, (1991), Ingwersen, (1996), and Hert, (1997). At the more macro level longitudinal studies such as by Kuhlthau, (1991), have been done that look at the research process over time and the cognitive and affective states associated with different stages in the research task. Hert, (1997), makes the important distinction between the more macro level task and that of a particular micro level IR incident. Kuhlthau, (1991), as well as identifying cognitive processes, also identified affective states that were associated with these processes and stages in information seeking. Recognition of the affective states can have a bearing on design, for example, if a particular stage is correlated with unease, confusion etc. suitable support could be provided at the interface.

Dervin's research, (1983), throws a different light on information need and yet falls within the remit of the investigation of cognitive processes. The distinctive nature of this research is due to a number of reasons, one of which is that Dervin does not focus specifically on the formal research process. Furthermore, the respondents are not

explicitly involved in information seeking situations. Rather they are involved in situations such as donating blood or undergoing chemotherapy or experiencing difficulties at college. However, exploration of these situations identifies information needs and information behaviour. As a result of this context and the detail, which results from the micro-time line exploration of situations specific cognitive states are identified such as choosing between two or more roads ahead ('decision'), or not having a road ('spin out'), or knowing where to go but being blocked ('barrier'). Dervin identifies 'gaps' associated with these cognitive states including when, where, why, how, who and what type questions/needs. When, where, why and how relate to the knowledge of the subject content; who and what relate to knowledge of the artifacts. The need for 'good', 'bad' and 'neutral' solutions are defined and whether the 'gap' concerns the self, another, an object, or a situation and also 'movement focus' for example focusing on movement from past to present or the future. Finally 'gaps' are described in terms of their 'descriptive focus' which concerns the subject content of the need. For example the need to know about the nature of tests. Further descriptions are given of factors that have impact on the gap, for example, the importance of the answer, the completeness of an answer, the actual strategies taken such as reading or thinking. In addition to situations and gaps Dervin focuses on and identifies uses. The latter includes states such as 'got started, got motivated', 'got control', 'got support, reassurance, confirmation', 'got connected to others' which indicate underlying needs.

From my perspective, i.e. defining user requirements, Dervin's work is important in that it indicates the depth that needs to be explored and hence has methodological implications. On the one hand, it provides an indication of the complexity of broader cognitive processes associated with information seeking, such as the definition of information seeking strategies. That is during the process of defining search strategies depending on the user's knowledge and the structure and content of artifacts retrieved 'uses', for example, 'got control', may be the consequence. On the other hand situations, such as, 'being dragged down a road not of one's choosing'; gaps such as 'wondering whom to turn to' about a particular topic and uses such as 'completeness of answer', can

also be seen to be drivers for further cognitive processes and behaviour associated with information seeking.

Cognitive ability and styles

In addition to cognitive processes it has been argued that cognitive ability and style influence information behaviour and information seeking success. Allen, (1991), cites research that links logical reasoning skills and visual memory and induction to a user's ability to use logical operators. Vocabulary skills are also linked to degrees of success in using online systems (which traditionally are highly dependent on the user thinking of and identifying appropriate search terms). Borgman and Hirsh, (1995), recognised these difficulties in relation to children's ability to conduct keyword searching. HCI designers also highlight the importance of cognitive ability in terms of the characteristics of memory and how people learn and as a result design accordingly. Educators have for some time recognised that individuals learn in different ways. Logan, (1990), and Saracevic et.al., (1988), found that differences in online searching performance were associated with different learning styles. Ford, (1995), and Ford and Miller, (1996), also explored how learning styles and individual differences may influence their use of information and information systems. Distinctions such as field dependent/independent or holist/serialist do seem to have a bearing on an individuals general approach to learning and research as well as to how they would prefer to receive information. Other authors have noted a distinction between 'monitors' and 'blunters' where monitors tend to actively seek information when in a problematic situation and blunters tend to avoid information (Miller and Mangan, 1983, Baker, 1995). Recognising individual differences may therefore be significant in defining user requirements for an information system. However I am unaware of an information system that attempts to cater for such differences.

Understanding the psychology of the individual and its association with goals, roles and tasks, (both macro and micro level tasks), and how it may be influenced by and influence the respondent's interaction with artifacts does therefore seem to be a necessary part of understanding user requirements. However, the extent to which one can explore these dimensions will depend on the time and resources available since it will require a deep

knowledge of the individual's information behaviour which, when dealing with a large community, may be difficult.

The Behavioural domain

The behavioural domain is concerned with the observed actions of the respondents. During the analysis of user requirements for an information system or service one indication of need is the information seeking behaviour of the respondents. This type of study has a long history in Library and Information Science where the use or non-use of artifacts, such as Web pages or books or the information service in general, are interpreted as indicators of demand or need. Information behaviour has also been used to show how aware people are of an information service. This has taken various forms such as the measurement of the frequency of use of books in a library. In the electronic library arena database vendors expend considerable resources on the measurement of the amount of time spent in a particular database or the use of specific functions associated with that database or service. These statistics are used, by these organisations, to help plan the development of the system or service. Within the last five years there has been an increase in these types of studies due to the availability of large data sets concerning the usage logs of Web sites (Nicholas, 2001), and also the usage logs of information kiosks (Nicholas, Huntington and Williams, 2001). These studies primarily provide data on what is accessed and navigation through the service. In addition, in the case of kiosks, what is printed and time spent viewing elements of the service is also recorded.

Some confusion does exist in the literature concerning the distinction between behavioural data and cognitive data. This is because researchers have used the same terms to describe both cognitive processes and behavioural processes. For example Allen, (1991), places the work of Ellis under the heading of cognitive process research and yet Ellis, (1989), describes his own approach as behavioural. Ellis classifies observed information seeking and use activities under the headings of starting, chaining, browsing, differentiating, monitoring, extracting, verifying and ending. In fact the same terms could be used to describe both behavioural and cognitive data. However starting, chaining, browsing, extracting and ending seem more obviously descriptions of

behaviour. Whereas differentiating, monitoring and verifying would perhaps generally be associated with cognitive processes. Nevertheless, chaining describes the behaviour of following a link in the artifact to another, such as a citation – which used to be called pearl growing, and yet there are associated thoughts that could be defined and labelled using the same word. From my point of view, I think it is important to be clear about which kind of phenomena one is describing so that when identifying user requirements we can make informed choices about the data we intend to gather. From that basis we are then aware of what we have and have not investigated.

Behavioural studies, as I have mentioned, have a long history of research and provide an important source of data on what people do and by implication what they want and need. Patterns can also be found in the data that can stimulate further research. The underlying psychological processes, that help to explain why people did what they did, can still be explored with the respondent by asking for their explanation of why certain activities took place and what they hoped to achieve and their feelings at that time. In the field of HCI observing behaviour has been an important source of data for both designing and modifying information systems. In our own discipline a logging of actions, (as well an exploration of the cognitive domain via verbalisations of thoughts), has been used to propose design improvements for IR systems (Hancock Beaulieu, 1990). Nicholas, (2000), has taken a behaviourist approach to provide an insight into what journalists and parliamentarians actually do when searching online retrieval systems. These results raised useful questions about why individuals behaved in certain ways. Task analysis mentioned earlier is also a behavioural approach to understanding needs i.e. it is a method used to highlight what people do, or perceive that they would do, to help define the content and functionality of a proposed system. One of the most attractive features of behavioural studies is that it does result in quantifiable empirical data that can be manipulated statistically which implies an 'objective' understanding of phenomena. In comparison data on cognition, for example, tends to be textual (i.e. transcriptions of verbal accounts) and tends to be open to a wider range of interpretations which implies 'subjectivity'. In addition how people perceive things varies widely and is also contextually very specific which again implies subjectivity. It also tends to be very time

consuming collecting psychological data that in itself makes behavioural data attractive. A combination of these distinctions between behavioural and cognitive research has meant that the majority of research into information needs has been behavioural.

Summary and further reflection on the framework

The objective of this chapter was to put forward a conceptual framework and to show how this was grounded in the literature. At the same time it was possible to review the literature that relates to this thesis and to show the context within which the work has been undertaken. Different approaches to studying people's interaction with information and need for information services are evident. It is the underlying argument of this thesis that recognising these approaches and what they tend to study helps to identify the various aspects of the individual or group that need to be investigated when trying to understand their interaction with data, information and knowledge. On the basis of which requirements, for an information system or service, can be specified. The conceptual framework provides a structure which determines how we look at and think about researching people's interaction with and need for information, helping to identify concepts, basic assumptions, directs us to important questions, suggests ways for us to make sense of data and provides a guide for research design. In this sense the three domains *environmental, psychological*, and *behavioural* and their sub-categories provided an initial framework for studying respondents and their interaction with information. The framework identified aspects of these domains, (subject content, artifacts, norms, goals, roles and tasks as well as cognitive knowledge, cognitive processes, cognitive ability and style and affective states and in addition actions), about which the researcher needed to gather data. Other labels could have been used as long as they alerted the researcher to these types of data.

A model of this framework is shown in figure 3. Although this model provided a high-level view of the framework and identified the key elements, it did not make clear that the framework can be applied at various levels of macro or micro analysis. As a result, the following figure 4 was developed to try to distinguish between the various levels of abstraction. At this point in the research the main distinction was between the wider

'macro' data which included the norms, tasks that the group was involved in and also the psychological characteristics, such as domain knowledge, that the individual brought to the situation. Whereas specific situations were perceived as 'micro' and concern at the moment of interaction between the individual and the artifacts around them.

Figure 4 Macro/micro levels of analysis

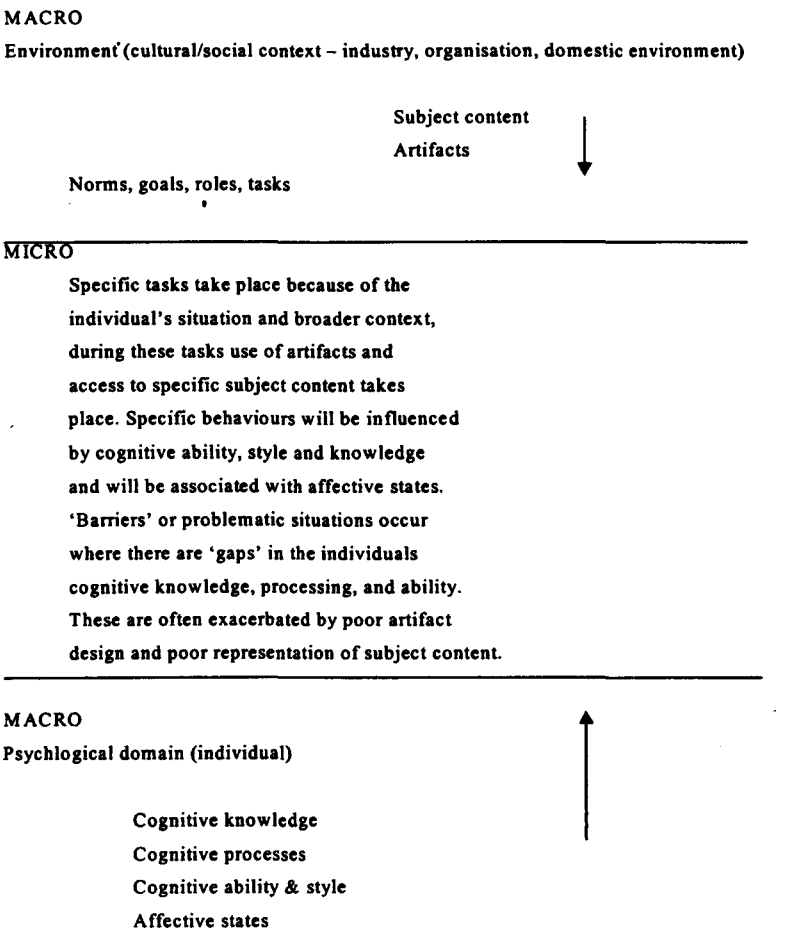
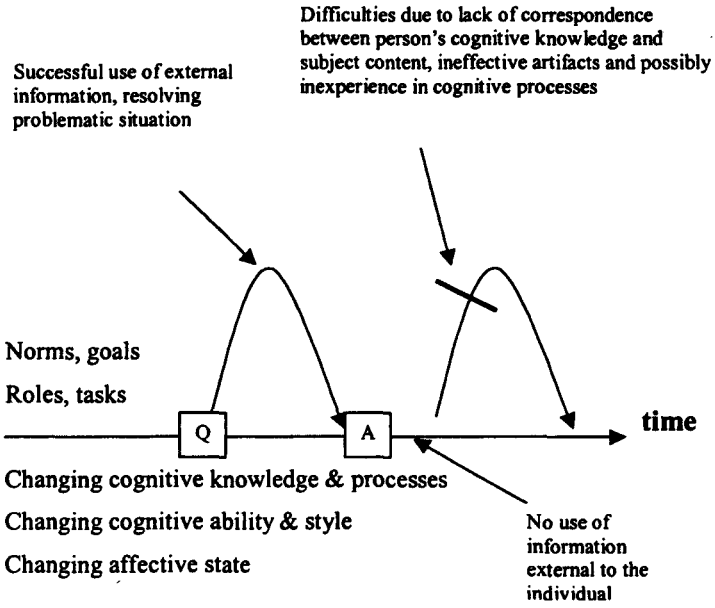


Figure 4 shows, at one level (macro), the wider social context of the individual including the cultural and social context. Also at the macro level the context that the individual brings to the micro situation. At the micro level the individual is involved in tasks that involve cognitive knowledge and processes. Gaps in their knowledge of the subject domain and of relevant cognitive processes, as well as of artifacts cause problematic situations.

A further diagram, figure 5 (shown overleaf), was also developed based on the conceptual framework (figure 3). The reason for this was that the earlier diagrams did not seem to adequately show how the various elements of the conceptual framework came together at a point in time. Therefore, figure 5 attempts to show how information seeking problems experienced by the individual and barriers to learning, can be described in terms of the conceptual framework.

Figure 5 Applying the framework to information seeking



Q = question

A = answer (or sufficient information to continue or complete the task)

The following scenario provides an illustration of how the initial conceptual framework could be applied:

An individual may be involved in a particular task, such as deciding on a commercial strategy, as part of their **role** in the organisation. Questions requiring data, information or knowledge arise. The **tasks** would involve specific actions. Some of this **behaviour** would be associated with the use of specific **artifacts** including books, articles, people, systems etc. [assuming they require the use of external information] that would help navigate **subject content**. The use of these **artifacts** and the completion of these tasks would, in turn, be associated with specific **cognitive processes** and depend on **cognitive knowledge and ability**. The **cognitive style** of the individual would affect how they conduct this process and would be associated with specific affective states. The **artifacts** available and their character, as well as the **subject content**, would also influence the interaction as well as the nature of the **cognitive processes** and **affective states** of the individual. Furthermore, the **goals and norms** of the social context as well as those associated with the specific **task** would affect **behaviour** and pragmatic judgements of the individual. These judgements would determine what information was considered useful in specific situations.

This chapter has documented the derivation of a conceptual framework that, it is proposed, would help to highlight what it is that we need to study when conducting a user requirements analysis for a new information service. The framework has the following advantages:

- It provides a holistic framework that pulls together the various dimensions of importance to understanding user requirements;
- It builds on the rich legacy of research in Library and Information Science and, where appropriate, draws on the fields of systems development and human computer interface design;
- It helps to generate research questions. For example, about how the various domains influence each other e.g. how does the character of the artifact affect cognitive processes or behaviour or how different tasks or roles or norms influence the

cognitive processes and knowledge associated with information interaction or artifact demand;

- It helps to demonstrate the complexity of information retrieval interactions

Having completed the first stage in the research, that is the development of a conceptual framework based on previous research, the next stage was to design a study that could effectively test the validity of the framework in terms of whether it:

- enabled the researcher to focus on meaningful categories of data that helped to understand the respondents' interaction with information;
- ignored data that was significant;
- enabled the identification of common experiences and situations that need to be supported by an information system, in particular, the barriers to information seeking and use which need specific support;
- led to the recommendation of information solutions;

and also the robustness and transferability of the conceptual framework.

Alternatively if the conceptual framework did not achieve any one or all of these it would have to be modified or abandoned. To implement the framework and test it a methodology was developed so that the framework could be applied. This is the concern of the next chapter.

Chapter 3 : Development of the methodology

Methodological orientation

Debate about methodological stance revolves to a great extent around the degree researchers think they can generalise about the world around them and also about what exactly they are trying to explain. To some extent this has led to the distinction between quantitative or qualitative research. Increasingly in Information Science a combination of qualitative and quantitative methods are used. At their most extreme quantitative researchers follow positivist assumptions and try to identify 'truths' or 'laws' that apply to a large number of people and situations. These 'laws' can be used to predict the result of 'objectively' defined interacting variables that have been identified in the 'concrete world' that we have direct access to. At the other end of the spectrum researchers following the qualitative route study people and situations in depth to highlight specific themes or processes that are perhaps unique to the situation and may be seen as reflections of changing mental constructs. Claims, however, may also be made about the transferability of their findings to other similar situations. Numbers tend to be used in qualitative research only to indicate the possible significance of events rather than to make statistically valid generalisations. Qualitative research may lead into quantitative research to see whether the models or explanations derived via qualitative research can be validated statistically across a larger population. Alternatively patterns identified through quantitative research may be explored through qualitative research.

In user requirements analysis understanding is sought to help determine features, functions and content of an information system or service that will enable the target audience to find information, answer questions, and learn about subjects. Ideally not only does an information system or service cater to the general needs of the user community but it can be responsive to the specific needs of the individual and individual interactions. Once it is understood how the community interacts with data, information and knowledge it should be possible to develop a system or service that will be help people:

- locate useful data, information or knowledge and

- learn about a subject and
- resolve problems.

In the past studies of respondents have tended to focus either on the group and how they interact with information or on the individual and their interactions. The different orientations tend to result in different research techniques and highlight different issues. Studies of individuals may, for example, concern the users' interaction with features of system design. This is of particular concern to the work of HCI studies and the study of individuals' interaction with information retrieval systems. Agreement on the degree to which the individual experience can be generalized or used to predict the outcome of 'similar' situations with 'similar' people depends on the theoretical orientation of the researcher and the methodology deployed, as indicated above. Researchers, for example, with a positivist orientation using quantitative techniques tend to assume that their findings can be generalised to the larger population, particularly when research has been done in an experimental situation where variables are thought to be understood and controlled. The interpretist, using qualitative techniques would not make such claims. However, they would claim they had a better understanding of that specific situation and may suggest that these may be transferable to other similar situations but would not claim the possibility of generalising statistically. In this research a qualitative approach was taken because it was thought to be appropriate for gathering data on the respondents' perception of situations as well as understanding what they did and with what. Also because the research is exploratory a qualitative approach would be more effective at eliciting patterns or themes whereas a quantitative approach would have been more useful if the 'variables' were already well defined. It was also thought a qualitative approach would provide data that spanned the various dimensions of the framework, for example, both behavioural (actions of respondents) and psychological (thoughts, knowledge, feelings etc.). Furthermore, it was felt that one indication of the usefulness of the framework would be to show that the user requirements and recommendations for system/service design that were developed were grounded in the data that reflected the perceived reality of the respondents. Qualitative methods also tend to be appropriate where there is little consensus about what should be investigated or what methodology should be applied, which could be argued to be the

case in user requirements analysis. Despite this qualitative orientation, in this study where, for example, a phenomena occurred often, such as common statements by respondents, it was felt that it did indicate that the phenomena had some added significance. Later, in this chapter and in the conclusions, the possible benefits of incoroporating quantitative techniques in such a study are discussed.

To some extent, if only due to the limitations of journal article length and the interest in findings rather than methodology, researchers in Information Science and in particular in HCI, software engineering and expert system design, have not explicitly stated the theoretical orientation that underpins their work. There are of course exceptions. In our own discipline Hert, (1997), Ellis, (1993), Dervin, (1992), and Nahl, (1997), for example have made explicit the philosophy that underpins their research. These authors are rare. In HCI design and software engineering the lack of clearly stated philosophical viewpoint is perhaps not surprising since the emphasis is on applied research and building solutions to immediate problems. The theoretical underpinning of software engineering stems largely from the theoretical domains associated with computer science and understandably has not concentrated on the theory associated with the social context within which this takes place. This situation has changed to some extent over the last few years. With the desire for user-oriented solutions and a realisation of the complexity of social situations (Heath and Luff, 1992, Simensen and Kensing, 1997) the need to take on approaches more commonly found in the social sciences and disciplines such as sociology and social anthropology has become more evident.

Wilson (1994) in his review of information needs and uses research over the last fifty years, argued that there has been a lack of explicit methodology and theoretical framework in our discipline. In fact, it is only recently that distinctions have been made between information behaviour research in general and information search behaviour (Wilson, 1999), and also between information seeking episodes with their associated cognitive processes and the completion of the larger work task (Hert, 1997, and Kuhlthau, 1991).

Due to the qualitative nature of this research and the concern with methodology I have therefore chosen to attempt to be explicit about the 'world-view' that underpins

the research. This is because the researcher is felt to be part of the research context and are in a continuous process of constructing meaning. How this takes place will depend to some extent on previous experience and hence the researcher should state their own orientation when approaching a research situation. This may help the reader to evaluate the work.

Firstly it is relevant to note that the author's first degree was in Social Anthropology and later at the Master's level he concentrated on user studies in Information Science at Sheffield University. Both experiences are reflected to some extent in the sociological and ethnographic approach taken in this research that is discussed in detail below.

The author's 'world-view' assumes that individuals construct and make sense of their experiences and create perceptions by applying their cognitive process, cognitive knowledge, cognitive ability and style. This may result in behaviour (actions and speech). It is also assumed that there are categories of phenomena of shared perceptions and experience that can be described as social reality. This is made up of language, norms, knowledge (subject content associated with public and private contexts), cultural, socio-economic and organisational norms, tasks and roles. The individual has impact on, and is influenced by their interaction with this 'reality'. Furthermore, the individual is constrained by the nature of the material world, in particular, by the information artifacts that stem from this reality. These artifacts are the tools for exchanging shared meanings and perceptions and are a legacy of individuals' interaction with the environment and other individuals.

These various levels of abstraction can be represented as follows:

a) the society and culture that the respondent is a part of with a particular economic and technological infrastructure. Certain values and behaviour are associated with this society and culture.
b) The immediate social context within which information behaviour and sense-making takes place. This may be an organisation or group of people who are connected due to a common purpose or interest. This group will have values, norms, roles, tasks, goals and subject content associated with it.

c) The individual with their associated psychology and behaviour operating within the group (people obviously may at different points in time be involved with many groups) and having to perform diverse roles and accomplish many different tasks. The individual has to make sense out of the surrounding environment to fulfil these roles and hence requires constant access to data, information and knowledge.

Some roles and tasks are more information intensive than others in the sense that they require access to repositories of data, information and knowledge. It is these roles and tasks that the information professional supports through the development of information services and systems.

An information service or system therefore should reflect both the individual's reality and the social reality. An information system or service that helps people resolve problematic situations that they tend to experience therefore requires the developer to create a 'reality' in terms of the (information) environment that the user will recognise and where the meaning of what is presented to the user is self-evident and relevant because it embodies the semantic nature of the domain and context. The information system would, therefore, include the use of relevant terminology and concepts associated with the domain such as linguistic strategies to describe the domain, for example, recognised thesaural terms or cognitively explicit icons that represent familiar functions. In addition, it would include recognisable mechanisms and tools for navigating, accessing and capturing the data, information and knowledge of the domain. For example, useful electronic alternatives of accepted features such as the contents page of journals, the ability to insert a bookmark etc. Furthermore to reflect the internal 'reality' of the user it needs to support their psychological states, (cognitive processes, affective states etc.), that they are likely to experience when interacting with the external 'reality'. For example, the need to conceptually redefine a search strategy. Ideally this would be done in such a way that there is sufficient flexibility in the system or service so that different styles of interaction and learning are supported. In other words an information service or system where individual sense-making situations are supported.

Overview of the methodology

As described in chapter 2, an inductive review of the literature was conducted to identify the various significant aspects of a person's information interaction. The key areas, on which data should be collected, that were identified in the literature were: the environmental, the psychological, and the behavioural and relationships between these were suggested. A pilot study and two case studies were then conducted to test the framework. The populations selected were not chosen on the basis of any specific criteria or combination of criteria, such as gender or age, since the purpose was not to determine the impact of specific variables. The communities were chosen because they represented the type of community that one could want to develop an information service or system for and therefore served the purpose of testing whether the framework could be applied for this purpose. The first group was made up of fifty-eight postgraduate Information Studies students who were split into eleven groups of four and three groups of five members. The second case study involved sixty informal carers. Both groups were chosen partly because they were accessible and also because they were involved in activities that necessitated interaction with a broad range of data, information and knowledge. The task of collecting data on their interaction with information and the data that was gathered therefore provided a suitable environment for testing and evaluating the conceptual framework. A detailed description of the two communities and the methods used to study them is given below.

The approach taken was as follows:

- A pilot study that served to try out various techniques of studying people and their interaction with information bearing in mind the intention of capturing data on specific domains;
- A first case study where chosen methods where used to capture data on the students while they interacted with information. It was expected that having done this it would be possible to determine how effective the framework was for both studying the respondents and organising and understanding the data. Effectiveness was judged in terms of whether a specific set of empirical data could be integrated into the structure or not. It was also judged in terms of whether the result of the analysis of the data provided insights into the respondents' information experience and enabled user requirements to be

specified. Furthermore the findings were compared with previous research about students' information behaviour. This provided an additional indication of the validity of the findings and the efficacy of the methods.

- A second case study was conducted where data was gathered without reference to the conceptual framework. The data concerned a completely different, and relatively unknown, community: informal carers. The objective here was to test the transferability and robustness of the framework in terms of whether the framework could be usefully applied in a 'hostile' environment.

As stated, due to the need to capture the external and the internal information 'reality' of the respondent, qualitative techniques were applied. Quantitative techniques tend to lend themselves to studies where variables are well understood but their significance and representative nature as well as the interrelationship between these variables is questioned. Qualitative techniques tend to be more appropriate for exploring a little known area where the purpose is to identify variables and where depth and detail of data, rather than breadth, are required which was the case in this study. In addition qualitative techniques are generally more successful for studying the thoughts, perceptions and feelings of individuals, which was an important aspect of the conceptual framework. Lastly as Bryman (1988) points out the target community was a social entity and holistic solutions were envisaged and hence the need to understood it in its entirety rather than focusing on a discrete set of variables. For example, to try to gather data about their environment, respondents were asked for their perception of how they would undertake information intensive tasks. It was expected that this questioning, which focused on goals and tasks, would help build up a general picture of the information world (the environment) of the respondent. The researcher did not intervene in the information seeking activities or try to influence the respondents' behaviour or perception of how things should be done. The underlying assumption of this approach was that, if a number of people were studied in context, themes and processes common to the group would be identified and that these would be grounded in their reality rather than one imposed on them by the researcher. The expectation that themes and processes, common to the group, would be found was based on the assumption that the environment of the respondents would impose its own limitations on behaviour and cognition and because common psychological processes are learnt by a community to deal with common experiences.

In the first case study an ethnographic approach was taken to help understand the culture and norms of the group and because it was felt important to study people in context when they were undertaking their normal tasks. Otherwise the study would have depended on data gathered after or before the information seeking event(s), using interviews or questionnaires, which can result in simplified and idealised accounts, (Silverman, 1988), of what actually takes place in practice and lack detail on the thinking processes experienced at the time. Students were therefore studied while they tried to find material that would help them answer questions.

In the second case study it was not possible to study the community in context. This was because the context was their homes and access to their homes over an extended period of time would have been difficult to arrange and also because of the limited time frame available for gathering data. The reasons for the latter are explained later in the section that provides background on the respondents. Semi-structured interviews were used to gather data in this case study. The informal carers were therefore not studied in context, which for the reasons stated above may have been a better approach. However, the data gathered on informal carers was chosen for analysis because it presented an effective way to test the conceptual framework. This was because the data gathered would, despite not having been gathered in context, still provide a data set that was rich enough to apply the conceptual framework and help to determine its efficacy. It was therefore important that this data had not been gathered with the conceptual framework in mind and, in a sense, to provide a 'hostile environment' where the effectiveness of the framework could be tested. It was therefore an intentional strategy to capture data on information interaction using radically different techniques and about a very different community. A well-tested method was chosen for gathering data on the respondents' interaction with information, Dervin's (1992) sense-making technique. This was because this technique has been shown to help derive a broad range of data on the information seeking experience and therefore would generate rich enough data to test the usefulness of the framework. Using the case study approach therefore helped to test a theoretical principal rather than to demonstrate that certain characteristics were representative of a community (Silverman, 2001).

The techniques that were applied are described below in general terms, following a brief description of the popultion sample. A detailed description of the implementation of these techniques is given in each of the case study chapters which follow.

Background on respondents

Before conducting the first case study a pilot study of computer engineering students at Nanyang Technological University in Singapore. This community were chosen because were accessible to the researcher and because they were involved in an information literacy project that required them to gather information to help answer questions. They therefore provided an opportunity to explore the use of various types of equipment including tape recorders and video as well as techniques such as task analysis. This stage was considered preparatory and served to familiarise the author with available techniques and tools. Data gathering tools were developed that could be used in the first case study, including task analysis flow charts and forms to capture environmental, behavioural and psychological data. Video tape and screen capture software were experimented with. Audio tape recording was also experimented with. During the observation and talk-through sessions respondents were asked to talk about what they were thinking while they were using artifacts.

The first case study involved two cohorts of one hundred and eighteen postgraduate Information Studies students who were taking part in a module on developing services for users. A range of techniques were used to study these respondents including task analysis and information needs analysis, focus groups, talk-through and observation. The students were divided into groups of four and five. Each group tackled one question. Over the space of ten weeks each week a tutorial session was devoted to this task. Each week students took on the role of respondent (the person seeking information) and researcher (the person who gathered data on the respondent's information interaction). The reason for this was that for pedagogical reasons, it was felt that students should experience both roles. All students at the end of the project

were involved in a participatory fashion with system and service specification based on the research results. This imposed limitations in that it was not possible to gather continuous data on any one individual's interaction with artifacts over the duration of the project. The nature of this community may have had some impact on the findings. For example one would expect them to have a greater familiarity with information artifacts than other students. The study of the second cohort of Information Studies students involved some minor modification of the techniques including the simplification of the data capture forms and providing more training for the researchers. Despite these minor modifications data derived from studying these two cohorts was treated as one case study. The data gathered was analysed inductively to identify situations and processes. In other words a conscious effort to impose the conceptual framework on the data was not attempted. However as will be seen from the student case study chapter the most effective way of synthesising and explaining what took place in practice was through the framework. Proposals were outlined for the development of information services to satisfy their needs partly to see whether the findings were relevant to the task of user requirements analysis and system design. The findings were also compared with those of previous research, into information retrieval, information seeking and use of information by students, to get an indication of whether the research contributed to our current knowledge of information interaction of students, plugged gaps or helped question the self evident. Critical reflection on the methodology was also included.

The second case study involved informal carers in Leicestershire. Sixty respondents were interviewed. Some selection was done by the researcher so that young carers, working age carers and carers of people with dementia were included. This was because the funding body for this reserch, the Deprtment of Socil Services, were prticularly interested in the informtion needs of this community. The sixty respondents volunteered and hence were self selected. This probably meant that they were more confident and able communcators than the population as a whole. These groups were of particular interest to the Department of Social Services who funded the study. The pupose of this study, as well as to understand the information needs and information behaviour of this community so that solutions could be proposed to meet their needs (to satisfy the funder's remit) was, as stated, to collect rich data on the information experience of a community using methods that were not closely

linked to the theoretical framework (and hence satisfy my own research objective). In this study interviews were transcribed and the data analysed using two qualitative data analysis software. Atlas/ti ws used to code statements that provided data on the dimensions specified in the framework and Decision Explorer ws used to help visualise the process of information seeking.

The validity of the conceptual framework was explored in relation to this new data set. Initially the interview transcripts were coded using categories from the conceptual framework. However, during this process, the framework was criticlly assessed in terms of its ability to adequtely orgnise, present and analyse the data. As a result modification of the conceptual framework took place. This was necessary to more adequately reflect the data. This modification, which included re-labelling and sub-dividing codes took place as, what Miles and Huberman (1994) describe, 'field experience' continued. The coded quotations, which still fell into the broad categoris of environmental, psychological and behavioural, were themselves coded. For example, types of behavoural data, were identified and coded. These were derived from the data inductively, rther than applying pre-defined categories, until all of the incidents were classified. Relationships and patterns in the data were identified. On the basis of this data user requirements were specified for information service provision to informal carers.

The accumulated experience of the second case study helped to redefine the conceptual framework. This conceptul framework which, in a sense, is the end product of the research was then compared with other theoretical models and conceptual frameworks. On the basis of this analysis and the accumulated findings and recommendtions which stemmed from the first and second case studies are the basis on which the final conceptual framework is evaluated.

The following provides an overview of the techniques reviewed and applied.

Data gathering techniques

The following describes the techniques used during the case studies:

- **Orientation.** Orientation concerns familiarisation of the researcher with the respondent's environment. This includes the review of documents. This form of orientation is often practised during systems analysis and design, (Tudor and Tudor, 1997). The first case study involving Information Studies students took place in a domain that was familiar to the researcher. Only one particular task was studied rather than all aspects of the student's information environment. The subject content concerned Information Studies and were therefore familiar to the researcher who works in this field as were the artifacts that the respondents interacted with the OPAC, CD ROMs, online databases, Web based resources, books and journals. The norms role and tasks associated with a student undertaking research were also familiar. Hence little time was spent orientating the researcher to this community. In retrospect I think that the study of students may have benefitted from a period of systematic orientation. This would have included understanding the roles, tasks and norms from both the students' and faculty's perspective. When studying a community that the researcher is new to, which may be the case when the information professional is developing a new system or service for a community, this type of orientation is, I would argue, a necessity so that the context within which information behaviour takes place as well as the wider goals are understood.

  In the case of informal carers orientation took place by reviewing the literature on informal carers and also through a questionnaire that provided a profile of the carers and their tasks and the situation of the cared for person.

- **Task analysis and information needs analysis interview.** Task analysis, as mentioned in the previous chapter, has been used extensively by designers of the human computer interface, software engineers and to some extent in knowledge elicitation, (Cooke, 1994). It is used elicit descriptions of what people do, (Preece et.al. 1994). It is used to help identify the goals and associated tasks that people perform in their work context and to help break these tasks down into their component parts. The objective being to understand these tasks in detail and to support them through the development of an appropriate system. Authors in our

own field have noted the usefulness of task analysis, including, Sebillotte, (1988), Evans, (1988) and Bystrom and Jarvelin, (1995).

In this research task analysis was used to explore the respondents' perception of how they would complete information intensive tasks and to break these down into sub-tasks. This was achieved through the use of a semi-structured interview. The interview questions focused on the tasks and sub-tasks necessary to achieve their over-riding work related tasks. However it was recognised that this perception may not exactly reflect what they do in practice. In fact having completed observation/talk-through, it was found that people's perception of what they would do was a highly rationalised and simplified view of what actually happened in practice. This approach was taken because it is relatively easy to implement and could be used by practitioners and more importantly because people find it easier to talk about what they do rather than their information needs. Once placed in the context of a task situation they find it easier to talk about associated needs. Task analysis combined with information needs analysis helped to identify the artifacts they would interact with or would like to use to gather information. In addition, it helped to identify the information they required to complete these tasks i.e. their information needs in terms of subject content. To a lesser extent cognitive processes such as defining the topic were identified via task analysis.

Task analysis was therefore used in the traditional sense to help determine the questions to ask i.e. what people had to do and their goals, (to identify major tasks), and how questions, (to identify sub tasks). However, the method was adapted to help identify the information needs and use associated with these tasks. Indirectly it also provided data on the cognitive knowledge required to complete the tasks.

- **Flow charting.** The final stage of task analysis required the respondents to draw flowcharts of the tasks they had described and to identify input and output of data and information. Visualising the tasks in a flow chart format (on large pieces of paper) helped to get a better grasp of the sequence of events. It was also found that it helped respondents' recall and added more detail.

- **Focus groups.** Task analysis/information needs analysis and flowcharting was conducted on an individual basis. Following this the focus group technique was used to stimulate discussion about the individual flow charts to help enrich the data derived from individuals (additional approaches and added detail were incorporated) and also to arrive at some consensus. The focus groups were, therefore, used for the traditional reason i.e. because the group interaction encourages people to think and talk about the issues, (Baker, 1991), and the procedure can be carried out quickly, (Widdows, Hensler, Wyncott, 1991). However the use of the flow charts to focus discussion and arrive at concensus over people's perception of information seeking tasks is a novel approach.

- **Talk-through.** This method falls into the category of 'verbal on-line reports', (Cooke,1994), and is also known as think-aloud and the data is referrred to as verbal protocols, (Schraagen, 1993), and has been associated with knowledge elicitation. Respondents were asked to think aloud while they were going through the process of gathering information. This was when they were involved in information intensive situations such as accessing the Internet, the OPAC, online databases, the library shelves, a book or writing a report. Talk-through helped to identify cognitive processes (for example when the respondent was trying to decide on appropriate terms or the location of a database). It also helped to highlight affective states (such as frustration or satisfaction), cognitive knowledge (for example about the subject domain) and problematic situations (such as those associated with a lack of knowledge about the domain or the artifacts they interacted with).

  Talk-through had the advantage of taking place in the respondents' context while they were undertaking a task. This enabled the gathering of data that was detailed and directly related to the information seeking context. Interviewing and task analysis, although useful techniques, depend on the memory of the resondent. As stated earlier, data that depends on memory tends to be selective and is not as detailed as the data derived during an incident. In addition, aspects of how people go about a specific task may to some extent be unconscious and therefore will not

be elicited during an interview or task analysis. Furthermore, when asked about how people do things they may give an idealised accounts, (Silverman 2001), which do not relate to practice. However, one problem of the observation/talk-through technique is that people feel self conscious and may behave as they think they should rather than how they generally behave. It was, therefore, necessary to get respondents to practise talk-through before doing it 'for real' to help reduce this problem.

- **Observation.** Observation was used in conjunction with the talk-through technique. Respondents were observed while involved in information intensive situations. This was useful for collecting data on the behaviour of respondents. This included the actions they took when interacting with, for example, a search engine or scanning a journal. It also helped to consolidate the researcher's knowledge about the artifacts that the respondents used in their local environment, such as directories or reports as well as how they interacted with these artifacts (scrolling, browsing, recording etc.). Observaton has been applied in a number of studies in Information Science, (Line, 1971, Eager and Oppenheim, 1996). In some cases it was applied primarily to orientate the researchers to the users' context rather to monitor their information seeking bahaviour, (Wilson, Streatfield and Mullings, 1979). However, it has not been applied as often as one would imagine. This may be partly because of the length of time taken to study any one respondent and the large amount of data generated and also because of the intrusive nature of observation. In some situations of extreme confidentiality or cultural sensitivity observation may be restricted. Despite these limitations I would argue that it is an important research tool because of the detailed knowledge it gives the researcher of the respondent's interaction with information. This includes detail about the nature of the tasks of the respondent and also detail about their interaction with artifacts, as well as, the use of artifacts that may not be mentioned during task analysis or interview due to the reasons mentioned above. In this research forms were developed to help capture and organise observed data.

- **Participative design.** During the case study involving the first cohort of IS students a participative design technique was used at the end of the project. This

was partly for pedagogical reasons but also because the researcher wanted to see whether their solutions corroborated the findings of the researcher. It was also thought it could be a useful way of involving the respondents in the user requirements analysis process and encouraging a user-oriented solution. Unfortunately it was not possible to apply this technique in the other case study.

- **Graphic design.** Results from the second cohort were given to graphic design students who then developed user interface designs. They produced some innovative designs that tackled the visualisation issues associated with the students experience. I think it would be good to involve peole with such skills in the early stages of requirements analysis and design. However it was not possible to replicate this process, nor to see the benefits of taking this approach. Hence generalisations about its usefulness can not be made.

- **Interviews.** As mentioned earlier the sense-making interview technique was used during the study of informal carers. These interviews were semi-structured and took between one and one a half hours. This technique concentrates on situations, gaps and the use of information experienced by respondents. The structure of the interview is given in a later section where specific tools are described. Using this technique did impose limitations. The major limitation was that it requires people to concentrate on a small number of significant situations (which is also its strength because of the depth of data). This meant that day to day tasks may have been underrepresented. In addition, because the data depended on people's memory it was simplified.

The following tools were tried out:

- **Video.** Video was found to be useful for recording respondent's behaviour. However it was very time consuming both in terms of taking the video and analysing the data. It was also difficult to capture the various concurrent interactions unless several cameras were used. Task analysis/information needs analysis combined with observation/talk through was found to be more effective at generating relevant data in a shorter time frame because it sensitised the researcher to capturing certain data and hence (intentionally) acts as a filtering

mechanism reducing redundant data. This is not to say that video is not useful, numerous studies have shown that it can be useful, (Omodei and McLennan, 1994). It was, for example, found to be particularly useful for providing information on the dynamics of group work. However this was not the concern of this study. Video could also be useful for documenting specific situations where respondents interact with a particular artifact if these moments could be identified in advance or set up in an experimental environment or if continuous video recording was feasable. In addition, it may have been useful to get respondents to comment on video footage of their behaviour, (Van House, Butler and Schiff, 1996).

- **Tape recording.** Tape was initialy used in the pilot study. Tape data has a richness that notes find it hard to capture. However, the taped conversations of the talk-through/observation sessions were found to be extremely time consuming to transcribe and analyse. Hence it was decided not to record data except in the informal carers study where interviews were the only source of data. As an alternative, forms were developed to sensitise the researcher to record specific types of data that were required by the theoretical framework i.e. on behaviour, cognition and the respondents' interaction with their environment hence speeding up both data capture and analysis. In the informal carers study interviews were taped and transcribed. The verbatum interview proved to be a rich source of data and were able to be coded using the qualitative data analysis software. This helped to organise the data.

- **Screen capture software**. Software that captured the respondent's computer session including all screens accessed, mouse selections and voice input was also experimented with during the pilot. This proved useful for capturing the detail of specific interactions. However again the time taken to analyse the data captured over a period of time and the usefulness of the data was felt to be incompatible with the user requirements process. The task analysis/information needs analysis forms proved adequate at capturing in real time the data specified by the conceptual framework. Nevertheless, screen capture software would be useful for analysing the use of a specific electronic source of information if one was

conducting, for example, usability testing or monitoring the use of specifc features or commands. Increasingly software is becoming available to help log and analyse such data. This provides the opportunity for extensive quantitative analysis of the behavioural data. This data can also be shown to the respondent to elicit their qualitative explanations for events.

The following tools and techniques were developed:

- **Task analysis/information needs analysis forms** to identify tasks, sub tasks and information needs. During the case studies these evolved. By applying the same methodology to the two groups of students it was possible to identify problems associated with specifc tools such as data capture forms and rectify these problems.

  For example, the initial task analysis/information needs analysis data capture form had a number of headings to prompt the researcher to collect relevant data. The form is shown below.

Figure 6 First focus group form

Format for recording results of the first focus group interview covering the repondents perception of the overall process involved in finding information on a specific topic

Tasks	Sub-tasks	Goals	Constraints	Actions	System	Content	Notes
Define the topic ...	*Identify relevant terms, concepts ...*	*To focus the topic and come up with relevant terms ...*	*Time ...*	*Think of terms, Find a thesaurus ...*	*Library Online Internet ...*	*Thesurus, list of possible terms ...*	*Respondents seemed aware of problems ...*

This was found to be too complex, time consuming and to some extent repetitive in terms of the data that was entered in the different columns. As a result this form was radically simplified during the second study. The form which includes instructions is shown overleaf.

Figure 7 Second focus group form

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TASK ANALYSIS

WHAT[TASK]/ GOAL/
HOW [SUB-TASKS] / GOAL/ ENVIRONMENT

TASKS AND SUB-TASKS	COMMENTS (resources/services used etc.)

The researcher had to identify WHAT task the respondent is trying to do and the GOAL of the exercise. They then identified HOW the respondents intended to do the task, the associated SUB-TASKS and how they intend to do the sub-tasks. The researcher also tried to get an indication of the resources, services [the ENVIRONMENT] that the respondent interacted with to achieve their goals and undertake the tasks.

This proved more practical in terms of time and enabled a less structured interview which was appropriate to the discussion of processes and tasks. This form enabled the capture of data that was then used in the focus group to develop flow charts which helped to visualise and also to expand on the task data.

- **Flowcharts** to capture environmental data including perception of tasks and interaction with information artifacts and subject content. This tool was an adaptation of the task hierarchy diagramming, (THD), technique associated with HCI.

Flowcharts derived during the second study of Information Studies students produced more detailed flowcharts partly because of the change in original task analysis forms and also due to additional training of the researchers. These charts then became the focus for discussion and the information 'inputs and outputs' for each stage defined.

Data gathered from the flowcharts included, for example, **Psychological - cognitive processes:** clarify area of focus, define key terms, develop search strategy, analyse, evaluate findings, identify strategies/programmes, identify book.
Environmental - artifacts: internet, library, subject indexes (Yahoo), book, periodicals, database (ERIC, DAO), librarian
Behaviour - actions: use OPAC, capture results, conduct observation, contact MOE

- **Observation/talk-through forms** to capture environmental, behavioural and psychological data during talk-through and observation of information interaction. The example shown below was derived after previous searches had been conducted and the respondent started to search the physical collection.

Figure 8 Observation talk/through form

Cognitive & Personal Factors	Behavioural	Environment
Need to learn to use the OPAC		Library1 OPAC
	"t=making a charge for library and information services" *(this is what the respondent typed in)*	record
		call number
Finds books	record call number	
	"t=fee based information services"	...fee based information services: a study of a growing industry...call number, z674.5.U519311
Decides to look for other books		0 hits
Modify search	"t=information as a commodity"	0 hits
Modify search		many hits
Look for appropriate books	"t=information +commodity"	
Find some relevant books	"t=information"	
	Browse	
Decide to look for books on shelves	use call numbers to look for	2 available

	books	
I'll go back to OPAC		
Look for more titles because two books insufficient.		
Include 'ethical and moral issues'.		headlines
Looks like a journal	Go through hits	
	Note call numbers	
Decides to search shelves		Shelves
	Refers to signs for directions	
	Search shelves for books	
Titles looked for not there, but find related titles	with call numbers recorded	
	Look for titles	
	Put book aside	
Look for articles by searching for key words e.g commodity, not bothered by currency	Go to Journals	Journals ...Journal of Information Ethics...
	Flips through articles	
	Goes back to shelves	
Appears relevant but not.		...Information Society...
Nothing relevant	Find another journal	
		shelves, books
Find book	Goes back to book z section	...marketing concepts for librarians and information
Think it relevant		services...and ...customer
Look for similar books		service excellence...
	Borrowed book	
Decide to use Reuters to search for recent articles, since the library items seem to be not suitable		Reuters online
	"information and commodity"	
Find relevant article	Print	Article
Print for discussion later.	Search 'archive'	32 hits
	"information and commodity"	headlines
1 relevant		...USA:Information the commodity of the future...

- **Qualitative data analysis software** Atlas/ti was used to code and help analyse the data generated from the interviews with informal carers and Decision Explorer to help document the informal carers individual experiences.

This chapter has provided a description of the development of the methodology and techniques that the author chose and felt appropriate, bearing in mind the proposed conceptual framework, for the derivation of user requirements for information systems and services.

The following chapters describe the implementation of the methodology on groups of respondents.

Chapter 4 : Student Case Study (findings and analysis)

Overview of student case studies

Following the definition of the conceptual framework a pilot study on five Computer Engineering students was conducted to try out techniques such as task analysis and the use of data capture tools such as video. This was followed by a study of two cohorts of fifty nine Information Studies students while they were undertaking a research project.

The study of the second cohort of IS students used the same methodology and was considered to be part of the first case study. However some modification of the data gathering tools took place and more time was spent preparing the researchers and respondents in the second study.

The chapter is structured in the following way:

- the context within which the study took place;
- the research process and the techniques and tools that were applied during the study;
- the findings and reflection on the usefulness of the theoretical framework and models of the user;
- the implications of the findings for the design of an electronic environment that supports the users' needs;
- a review of the methodology in the light of the research questions.

Pilot study of computer engineering students

Context

A group of five first year undergraduate Computer Engineering students were studied before, during and after they undertook information intensive tasks. These students were taking part in a series of information literacy and skills workshops. The

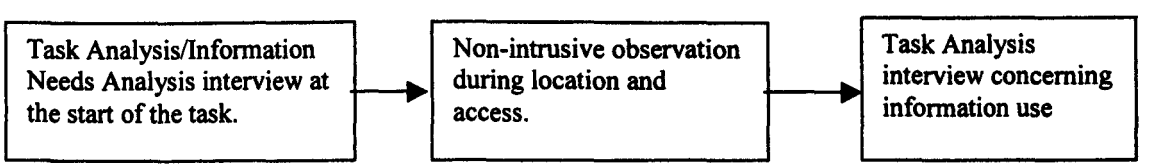
student's task was to create a presentation to the class on a topic concerning information technology and Singapore. It involved gathering information and preparing a presentation. This study focused on the sub-tasks of task definition, developing information seeking strategies and location and access.

Research Process

The study started with a semi-structured interview which focused on the respondents' perception of how they would undertake the task particularly the task definition and location and access. Emphasis on these three categories of information skill reflects the terminology used in information literacy and skills research, (Eisenberg and Brown, 1992, Kulthau, 1991). Questions concerned what they expected to do, how and why and also what (knowledge, artifacts) would help them to conduct these tasks. To some extent the emphasis on predefined 'features' of information literacy and skill created an artificial context. This study was, therefore, not naturalistic in the sense that students were not left to their own devices to undertake the project and studied in context. This was due to the pedagogical necessity of focusing on specific recognised skills. Nevertheless, it provided an adequate opportunity to test out questioning techniques associated with task analysis.

An observation session was then conducted during 'location and access'. A form was developed to capture data. There followed an interview with the students once they had found information. Questions were asked about the materials they had found, their selection process and what they expected to do with the material and how this would be undertaken.

Figure 9 Research process with Computer Engineering students



Techniques and tools: findings and comments

The first interview concentrated on the respondent's perception of the task and included the following questions:

1. What are you trying to find out about? Do you have particular ideas/a proposal/or a hypothesis you want to prove?

It was expected that this question would gather data about the respondents' cognitive knowledge about the subject content and the process they go through to define the problem. The students' research topics included 'Towards a cashless society with card systems', 'Issues involved in Internet Security', 'Use of the Internet in the medical field'.

The data derived provided evidence of the respondent's need to recognise appropriate terminology and concepts such 'patient's records system', 'extent of cash card use', 'importance of Internet security', [medical Internet] ideas/benefits/implementation'.

2. Can you explain what you are going to do and how you are going to do it?

Using the 'first' task analysis question (What) the intention was to obtain a rationalised representation of tasks and their goals and objective. Ideally data on behavioural and psychological processes would be derived.

Data derived included statements such as 'narrow down what we are going to find into smaller parts'; 'find newspaper articles via Newslink'; 'find articles the measure (sic) taken by the government to block secretive issue' later amended to read 'to find out related article and browsing those article on the shelf, also check out CD'.

Data was thus derived on the environment, expected behavioural and psychological processes.

3. Why do you do this/these task(s)?

This question provided an indication of the goal(s) of the task. These goals are associated with cognitive problems associated with the subject content such as 'to extract a batch of information for evaluation for its quality' or identifying specific artifacts for example 'finding facts to support our point' or 'to find events, opinions'.

4. What do you have that is going to help you conduct these tasks? What would help you to conduct these tasks? What information or knowledge do you already have that will help?

This question elicited information about artifacts that the respondent would use.

5. How do you do this/these task(s)?

This question went back to the key tasks that the respondent had identified and served to break these tasks into sub-tasks. Further behavioural data and information about artifacts that the respondent would use were identified, such as 'consult the librarian', 'use the OPAC', 'scan the shelves'. Question 4 was repeated.

This was followed by observation during location and access and instigation of previously defined tasks and sub-tasks. The objective was to identify new tasks previously unspecified and data on the use of content and attributes of content. A form was developed to capture data. A partially completed example is shown overleaf. In this example the student is unaware that the OPAC does not provide access to journal articles.

Figure 10 First observation form

Context	Use of system	Tasks/sub-tasks	Behaviour	Use of content/ attributes of content	Psychological processes (cognitive/ affective)
Searching the OPAC in the library resource centre	*OPAC*	*Asks whether can get full image*		*Has a print out of bibliographic references found using the ABI database.*	

Finally, an interview was conducted after the respondents had retrieved material. Only two subjects were interviewed hence the data derived was limited. The structure of the two interviews also differed slightly. They were questioned about how they had found the material and also what they expected to do with the material and its potential usefulness. Questions included,

1. What did you do to find the materials?

This received responses such as 'finding a matching book ... pick out key words ... browse – skim through article headings, sub-headings again picking out key words'.

2. i) Why are you going to use them?

This received responses such as 'provide definitions/guidelines/issues ... a professional point of view', 'compare with other works', 'check whether off track', 'limit the information to what I can digest', 'find one I am comfortable with not too technical'.

ii) In what way do you feel they are useful or relevant?

No data was derived for this question.

3. How will you use them?

In this case responses included 'newspaper article is useful for local examples ...what the NCB has done, plans', 'short descriptions of systems', 'glossary could be useful', 'books provide the wider context'.

4. How have you benefited from this exercise? What lessons have you learnt? What problems have you encountered?

This question was included for pedagogical purposes to get the students to reflect on the tasks and the information skills they had used and to help emphasise the problems associated with accessing information.

Tape recorder and video were used during this study. The tape recorder was useful for capturing interview data enabling the transcription of results. However, it was time consuming and when working with a larger sample it is likely, particularly in a non-academic setting, that it would be used to compliment notes rather than as a source for transcription. However this would depend on the time and people available. Video was found useful for capturing the dynamics of group situation and related discourse. Its usefulness was limited in terms of the amount of useful data derived about information behaviour and user requirements. It was also very time consuming both in terms of implementation and analysis. In a controlled experimental situation video would be of more use. It may be necessary to use more than one camera to capture concurrent events, particularly in a free flowing situation involving group activity. Effective methods would need to be found for storing and indexing and coding such data.

Conclusions drawn from the pilot study

The study was useful because it enabled the trial of various techniques and tools. In particular it helped the researcher to try out the task analysis questioning (what and how) which proved useful in gathering data about the environment (subject content,

artifacts, tasks) and to some extent psychological data although this was primarily elicited by the 'why' question. However the data was 'thin' i.e. the data set was not rich enough. This was partly due to the small number of respondents. Nevertheless this observation led to the decision to use flow-charting and focus group techniques in the second study of students with the objective of developing a richer picture of the respondent's perception of the task.

With regard to the observation technique the process was of some success however it was felt that the form was not structured correctly (categories overlapped) and needed simplification. It was felt, nevertheless, to be a useful for gathering data partly because it gave the researcher the opportunity to witness the complexity of the interaction. For example the range of problems the respondent had when trying to access information systems became very apparent.

Case Study of Information Studies students

Research Context

The objective of this study was to see whether:

- the proposed models of information interaction were supported by the data and represented the respondents' experience
- the theoretical framework that requires the researcher to focus on the environmental, the psychological and the behavioural aspects of a situation was a useful construct and helped to gather relevant data.
- there were patterns of interaction between these three domains. For example, did certain environmental factors, such as the response from IR systems, lead to a recognisable psychological reaction that in turn was followed by associated behaviour.
- data captured could be used to help identify user requirements for an information system or service.

- The researcher was also interested in the efficiency of the research techniques and tools.

In addition to these research objectives, it was necessary to involve the students in the process of information needs analysis and system design. This was because part of their curriculum involved the study of information needs and the design of user oriented information solutions. It was therefore useful for them to try out various techniques and experience the role of both respondent and researcher. As a result, it was decided to get the students to be both researchers and respondents reversing roles throughout the user study and data capture episodes. It was also felt that in a non-academic setting, for example, in an organisation that wanted to specify new information systems, such an approach could be implemented. This would encourage maximum participation in the project and could lead to the increased likelihood of a user-oriented product as well as ownership of the results and a mutual understanding between researcher and respondent. However, whether organisations could take on board such a radical approach and be willing to devote staff time to such an exercise is debatable. The negative aspect of this approach was that behaviour could not gathered on a specific individual throughout the process. This meant that individual differences could not be identified. Ideally, for the purpose of this research, each searcher would have been studied in isolation throughout the entire information exercise to help determine whether individual characteristics would have affected interaction with information. Furthermore, great dependence was placed on the students' ability and willingness to capture data, which in some cases proved a problem. Also limited time was available for training the students. Other methodologies would have required a very different approach and would have involved either using more researchers or the use of other data capture techniques such as logging and self-reporting. Such techniques can be very useful, providing rich data on what people do, but provide little data on the thoughts and feelings of the respondent and why they conduct tasks. One solution would be to gather these retrospectively by asking them what they felt and why they took various approaches. It was decided to try to capture this data in context due to the problems of reflection and self-reporting outlined in the chapter on methodology.

The students were given a choice of eleven questions on which to gather material. The questions were broad, vague, contemporary and covered relatively unfamiliar topics. The use of such questions meant that students were not experts in the domain.

This led to students spending considerable time throughout the project defining and redefining what was relevant to the topic. It also involved the use of a wide range of artifacts such as the World Wide Web, newspaper databases etc. It is likely that more specific questions, for example, seeking a specific fact would not have resulted in same findings. The results of this study therefore relate to the user requirements of students when finding material on unfamiliar and unspecific problems. Questions included *'How can we measure information literacy?' 'How can the Internet or an Intranet be used to support users of information services? Analogies may be drawn from the use of such systems in other sectors.' 'What is meant by the 'commodification of information' and what implications does this concept have for information professionals in Singapore?'* Referring back to the conceptual framework one could define the initial context as follows:

Environmental

From the researcher's perspective far more was known about the environmental domain in this case study than would be known if the researcher was studying a community that was unfamiliar. In addition, the task was relatively well defined and constrained by the academic assignment and the environment in which it took place.

The role of the student is of course multi-faceted including, for example, learner, socialite, job seeker etc. In this case study the objective was to derive user requirements of an information system or service that supported the learner role, in particular the task of gathering material on a topic with the objective of creating a presentation or report. In other words, to conduct a piece of desk-based research using published media. Expected 'norms' included the definition of information need, including identifying search concepts, the development of search strategies, identification of sources, access of services and retrieval, recording and analysis and synthesis of information. The norms are relatively well defined in terms of what is expected from a social science student conducting such a task. For example, it was expected that artifacts such as the OPAC, which would give access to books, CD ROMs, such as LISA, which would give access to articles, and the World Wide Web would be searched. The final output is also relatively well defined in terms of the structure of presentation, (form, depth, length, the inclusion of references etc.). The

overall time it was expected to take and the degree of collaboration are also predefined.

The subject domain was defined by the academic discipline of the students and the specific question. The study objective of this study was therefore not to investigate all tasks and subjects that would be relevant to the student but one task that related to gathering information on a specific subject domain. Consequently the study explored the student's interaction within a relatively narrow subject domain.

In this study the artifacts were limited to those that the students could get access to through the Information Studies laboratory. This included the OPAC, the Internet and networked CD ROMs as well as paper based indexes. In addition, the hard copy collection in the library was also available. These limitations are of course typical of a University environment. A working practitioner would probably depend far more on colleagues and the use of primary data.

Psychological

With regard to the psychological domain the following was known. Students had a broad knowledge of the discipline and the cognitive processes required, having previously taken core courses on the information society and information retrieval. They had conducted similar assignments in the past and hence had some grounding in the specific cognitive processes associated with the tasks and sub-tasks such as choosing information sources and constructing search strategies. At the undergraduate level those doing humanities and social science should have done desk-based research using published sources. However, the amount of independent research would probably have been small. Prior to university due to the style of teaching and learning in Singaporean schools again independent learning would have been minimal; [this has now changed to some extent]. However despite some training in these areas one would still classify their knowledge of IR and IR systems as basic. It is also evident that, for various reasons, students may not necessarily apply knowledge learnt in one semester to tasks in subsequent semesters or different situations.

One distinction between respondents, in terms of background, that seemed to have implications for the cognitive processes of the respondents, was that approximately half did not work in libraries and half did.

The respondent's knowledge of the answers to the particular questions that they were researching was low and they had not explored the subjects before. Phrases such as the 'commodification of information' were unfamiliar although similar topics may have been discussed in courses like 'the information society'.

Behavioural

From previous published research into information seeking behaviour it was expected that students would go through a series of steps similar to those defined by Kuhlthau, (1993), Eisenberg and Berkowitz, (1990), and Ellis, (1989), in a relatively linear fashion. Strategies such 'building blocks', 'pearl growing', 'simple search', use of concept maps where people identify synonymous terms and essential concepts and the ability to broaden and narrow search strategies were also expected due to the respondents having completed a course in IR. A systematic use of search commands and database functionality such as Boolean logic, truncation, phrase searching, field searching as well as the use of a comprehensive range of artifacts was again expected. Where systems and functionality was unfamiliar respondents were expected to use help systems where available.

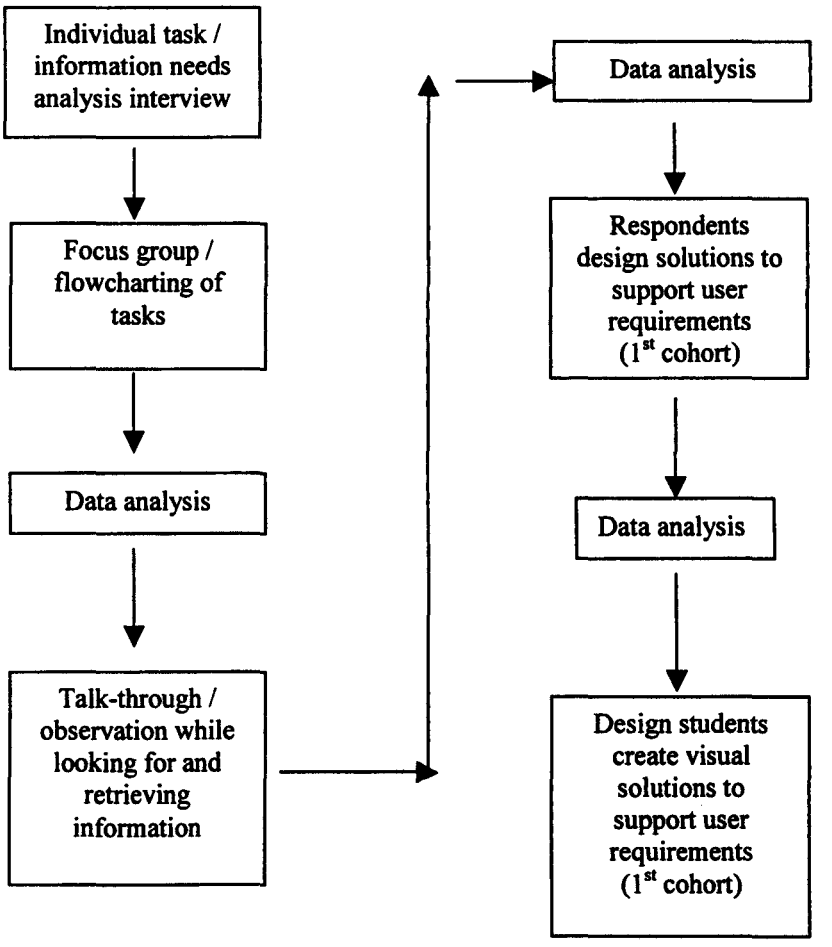
Research process

The research process took the following steps:

After an explanation of the project to the students and their choice of topics the students were divided into groups of four and five. Once a week at each tutorial group would conduct research on the topic. The study was therefore constrained or 'unnatural' due to the structured nature of the sessions. Within these sessions it was expected that the respondents would go about the task in a 'natural' manner. As stated previously, the students were asked to interchange between the role of respondent and researcher. This took place for five weeks. The changing of roles made the process less 'natural', however, students did seem to 'do their best' to conduct the task to the best of their ability. The extent to which this created an

artificial research context is debatable. It would seem to be bound to affect the findings to some extent. For example, due to the mixed roles and the academic objective of the study, rather than preparing an assessed report for credit, the students may have put less effort into the actual process of gathering and processing information. In fact the students did not reach the point of actually writing up their research. The major limitation the method imposed was the lack of opportunity to study any one individual throughout the entire process. This meant that individual differences and their effect on information behaviour could not be monitored.

Figure 11 First case study research process



Individual task/ information needs analysis

Researchers conducted interviews with respondents using a predefined form to capture data, shown in Figure 10.

The form was filled in while researchers asked task analysis type questions about what the respondent expected to do to complete the overall tasks and how they would do this, hence identifying sub-tasks. In addition the goals were identified as well as actions, (behavior), and the content, (the artifacts), that they would interact with. Data on tasks and sub-tasks included statements such as 'breaking down [the topic] to different components' or 'definition of [the word] children'. Goals included statements such as'[identify] conference papers', systems identified included the 'library', 'online', 'resource person'.

Focus Group/Flowcharting of tasks

These 'task analysis/information need' forms were then taken to the focus group where tasks were flowcharted by the group, consolidating and expanding on the individual's perceptions of the task. The process of developing flowcharts in a group, having gone through an individual process of defining tasks, stimulated discussion, prompted respondents to think of other things they would do and enriched the data gathered. Task analysis/information needs analysis was more successful using the combination of interview, flowcharting and focus group compared with the interview method applied in the pilot study of computer engineering students. However greater emphasis on the 'what' and 'how' type questioning and the lack of a 'why' question limited the amount of data on cognitive processes.

Observation/Talk-through

Observation/talk-through was then conducted whereby the respondent looked for information and tried to get informed on the topic. During this process the researcher asked the respondent to verbalise their thoughts and recorded these along with their behaviour and interaction with the environment using the predefined forms shown below. A 'dry run' was conducted to help respondents and researchers feel comfortable with this process.

Findings

Analysis of data derived from flowcharts

The flowcharts were synthesised and data was coded using the sub-categories of the three dimensions i.e. environmental, behavioural and psychological.

Data about the respondent's environment (roles, tasks, norms)

The tasks that all the respondents identified and flowcharted included:

- *Defining the topic* ('define the topic', 'define the terms', 'identify key terms', 'define the key concepts', 'brainstorm', 'clarify area of focus').
- *Access artifacts and information services* ('use the library', 'use the internet', 'librarian', 'subject indexes', 'OPAC', 'online databases', 'commercial companies', 'listserve', 'search Dialog', 'search CD ROMs', 'use search engines'. Specific types of media were also identified such as 'identify books, conference papers, dissertations', 'relevant articles', 'relevant journal articles', 'IT magazines', 'government Web sites', 'newspapers (Chinese, English)', 'published labour statistics', 'abstracts', 'advertisements'). Specific sources were named ('use Straits Times, Dow Jones')

- *Analyse, identify relevant data* ('conduct content analysis', 'determine relevant material', 'identify trends', 'evaluate sources', 'identify relevant data', 'use book index to identify relevant data', 'evaluation of gathered material', 'organise the information', 'check authority', 'take quotes').

- More than half the respondents suggested conducting *primary research* ('conduct user survey', 'conduct observation', 'conduct interviews', 'find primary data') as well as secondary research. This was not expected by the researcher and shows a contradiction between the respondents' perception of the task and the researcher's.

- Respondents also highlighted *intermediary stages* such as refining the search (refine criteria/narrow down and data capture ('print', 'photocopy', 'capture') and

- the *final stages* ('compile report', 'present report', 'evaluate the report – logical, not contradictory, supported by evidence').

Generally the role and tasks data provide a high level view of those associated with this community and this research role. The main tasks correspond to those identified by other researchers such as Kuhlthau, (1988), Eisenberg and Brown, (1992), Wilson, (1999), Ingwersen, (1996), Marchionini, (1995). One difference is the inclusion of the primary research tasks. This perhaps reflects the practitioner's mind set (the students were all part-timers) where more emphasis is given to gathering primary (market research) data which tends not to be the case for desk based academic research and is unlikely for small scale projects and essays. In addition, there was greater emphasis on the process of identifying relevant data than specified by other authors.

Data on the environment (artifacts and subject domain)

Data about the respondent's environment was the most common category of data derived from the flow charts. This is because the respondent's description of tasks and sub-tasks primarily concerned the environment and in particular the artifacts that they expected to interact with. The following table lists the artifacts. Determining those artifacts that a user community needs access to is of course necessary for the design of information products and services that relate to their needs. In this particular case the system design that provided access to these artifacts would relate to the needs of a student undertaking a research project. The following is, therefore, a summary of the students' perception of the physical environment that they would need to interact with to complete the task of answering the set question.

Tabel 1. Artifacts used by students

Media artifacts	Research tool artifacts	Student created artifacts
Libraries	Interview	Notes
Library shelves	Questionnaire	Summaries
OPAC	Textual and numeric data analysis	Student's text
Call numbers	software (NUD*IST, SPSS)	Cover
Books	Spell checker	Bibliography
Periodicals	Grammar checker	Quotations
Magazines	Search engine/interface	Appendices
Encyclopaedia		Report
Dictionary		
CD ROMs		
Online databases		
Database guide		
Internet		
World wide web		
Internet Relay Chat (IRC)		

Discussion Lists Indexes References Titles Summaries		

These lists give a clear indication of the need for holistic solutions to providing electronic working environments for students. The table above therefore represents the environment that the respondents expect to work within.

In terms of subject matter this stage of the research produced little data. This was not surprising since the objective at this point was to gather an overview of the respondents' perception of the process and the tasks they expected to undertake. With regard to data on behavioural and psychological aspects of their information behaviour again limited data was gathered from flow charting and task analysis. However some indication of the cognitive processes associated with the main tasks are given. These include cognitive processes such as

- 'clarify area of focus'
- 'determine relevant material'

Behavioural data was implied in statements such as

- 'use library',
- 'use book index'.

Findings from talk-through/observation

The following table provides an example of the data derived from talk-through/observation. These were produced for twenty-nine different research teams. Each team undertook two or three search sessions. Each session lasted approximately one hour. Generally respondents conducted five to eight separate searches before identifying material that they perceived as relevant.

Apparent success i.e. finding highly relevant material took a long time. The lengthy process and high degree of iteration witnessed maybe, in fact, an important part of the process of searching for a topic where the subject knowledge of the respondent is very limited. Generally the process documented via the talk-through/observation did not correspond to the student's perception of the process which was captured via the task analysis and group flowcharting. There was little evidence of students taking the

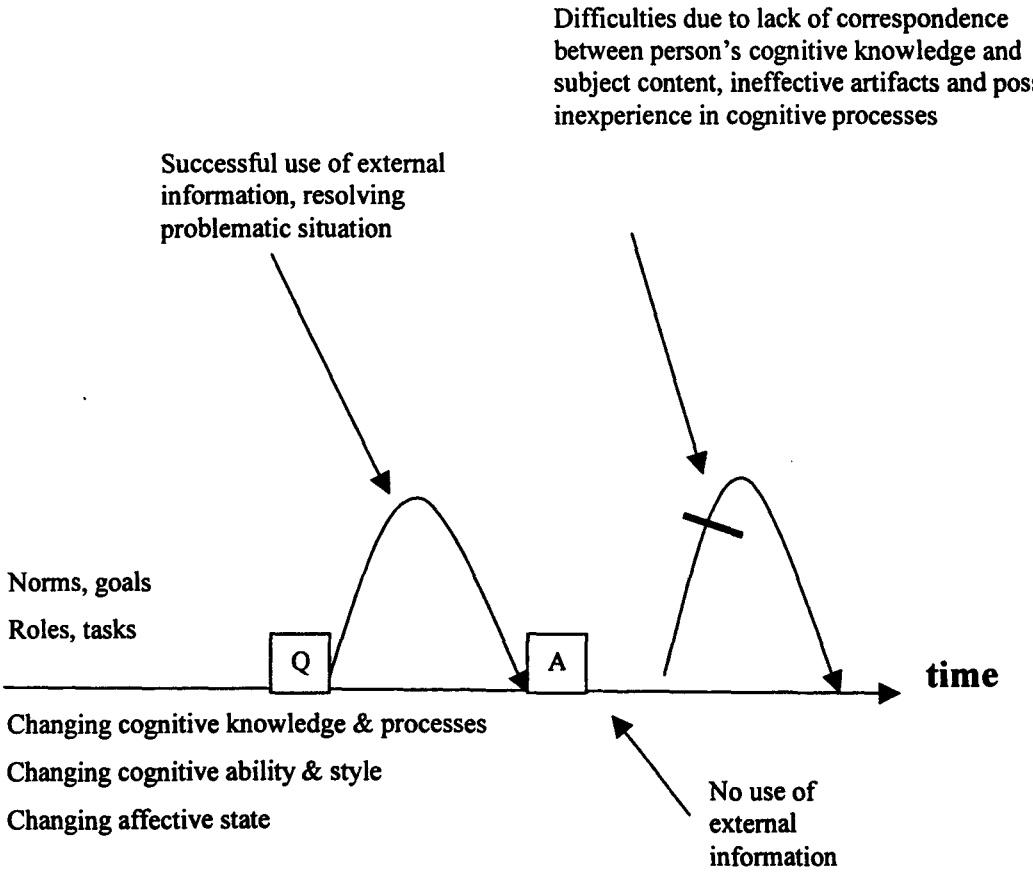
measured approach they had outlined. In fact their descriptions proved to be an extreme simplification of what took place in practice. Nor did it correspond to common perceptions of the 'research process' in that it was neither linear, nor linear but to some extent iterative, as described by previous researchers such as Kuhlthau, (1991). It was, in fact, extremely iterative and apparently confused. However, at a high level similar broad processes, that other authors have identified such as chaining, (Ellis, 1989, 1993) or defining the problem, (Kuhlthau, 1988, 1991), were identified. Little evidence was found of students applying IR methods they had been taught.

Analysis and reflection on the conceptual framework

The analysis of the data is presented using the conceptual framework and the models derived from the framework which were discussed in Chapter 2. This was done

- partly as a method for presenting the findings and
- to reflect on the framework and to see whether it helped to depict the experience of the respondents

In the first place the model of the search process shown overleaf, figure 5, is discussed in the light of the findings from the talk-though/observation data.



Although, in general, this model reflects the overall process the data derived implied that the respondents shared a different experience. The model above implies a relatively linear process that can be interupted by incidents due to a lack of the respondent's cognitive knowledge of the subject, the artifacts or the cognitive processes associated with IR or due to 'faulty' artifacts. Although this does seem to be the case at one level the extent of the problems experienced by the respondent and the degree of iteration was far greater than that implied above or by other models of IR information interaction which, although accepting iteration, do not highlight the extent of the iteration. In this study a great deal of the respondents efforts went into defining and understanding the subject domain and determining what may or may not be relevant to the question. This was likely because the respondents, despite having some knowledge of the topic domain, had relatively little knowledge of the specific subjects the research questions were about. Nevertheless, the extent of iteration and difficulty experienced by the students was surprising to the author and it is relevant to

note that the situation that the students were in would be typical for a student exploring a new area. This implies that either our previous conception of this process is simplistic or from the student's point of view the process is very complex. Perhaps, combining the two, we have radically simplified the process of knowledge generation and have underemphasised the process of recognising and constructing boundaries around a new area of knowledge. Furthermore, the current artifacts, that are supposed to be designed to help with this process, in fact offer little help. The experience of the students also has implications for the teaching of information literacy and information skills. The students that were studied had taken a course in information retrieval and the organisation of information and still had difficulty. Most students would not have had that experience. Perhaps the emphasis, when training, on the mechanics of finding relevant articles, although necessary, ignores the value of a gradual construction in the mind of the searcher about a topic. As a result of the study the diagram would have to change to reflect the data gathered via the talk-through/observation. It would need to show a far more iterative behaviour where the individual goes backwards and forwards. On average, five to eight such iterations were made by the respondents to find information that they perceived as relevant. Some sessions involved as many as ten iterations. In all cases, little obvious movement forward in terms of interacting with relevant information and finding answers to the question, was experienced and the respondent seems to return to the same point. Where 'progress' was made more extensive reading and recording would generally take place, but again the search is redirected. However, as stated above, perhaps this apparent negative experience is in fact an important part of the knowledge generation process.

It was noted that five to eight searches were conducted before respondents found information that they thought was relevant, (relevance being defined by comments such as 'this is relevant' or the respondent recorded data that would later be used to find hard copy in the library). This conforms to Spink, Bateman and Jansen's, (1998), findings. Only seven searches, from the twenty nine groups, fell into the category of 'exactly what they wanted'. What did occur as respondents retrieved artifacts, Web pages, OPAC records, database records, headlines etc., and information, is that the respondents became clearer about the subject domain and what could be relevant or not relevant. In a sense the highly iterative interaction shown above seemed to serve

the purpose of helping the respondent to draw boundaries around the subject domain and to identify possible paths that could be followed to identify relevant information as well as paths that should not. Respondents found this process frustrating and difficult.

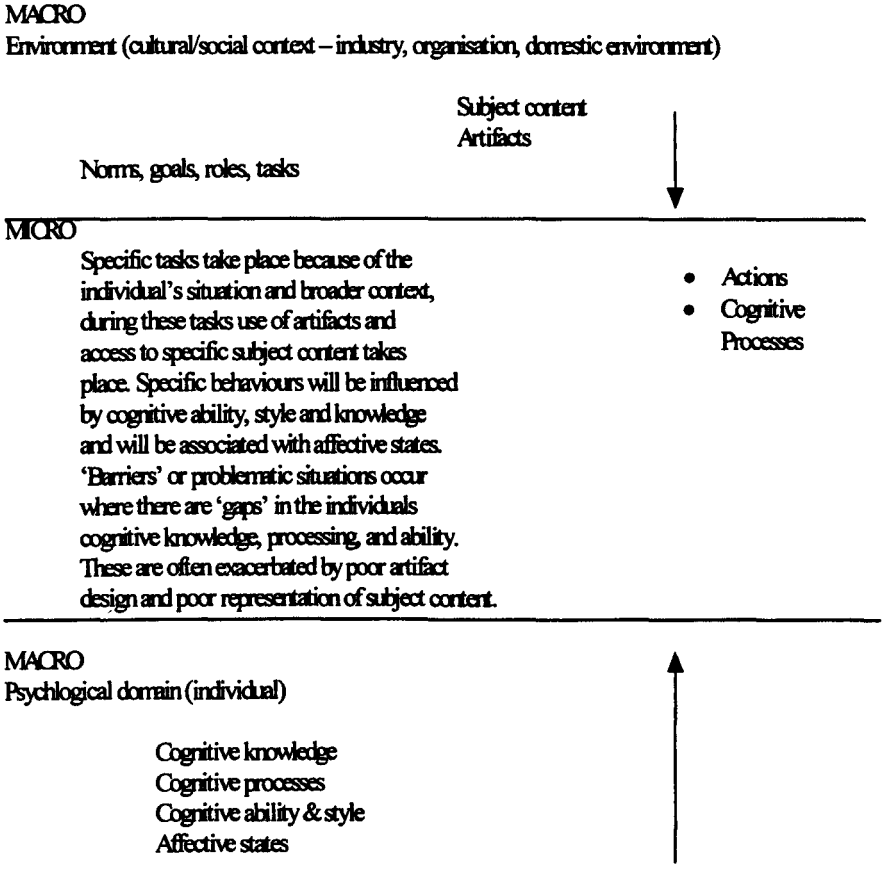
Another reason for this iterative approach to searching was the respondents' reaction to perceived barriers. Examples of these barriers included error messages from the IR system, large numbers of hits, nil hits, hits that were considered completely irrelevant. When situations such as these occurred respondents would tend to start a fresh search in the same IR system or choose another. Responses from the system were taken quite personally and met with a high degree of frustration. This may be partly because no explanation is offered by the IR systems as to what had gone wrong or how to correct the problem. In these situations there was little evidence of respondents analysing the problem and consciously refining the search strategy or using help systems to identify appropriate search techniques. Their frustration may also have been compounded by the fact that they had been taught, (the 'norm'), that to find relevant information and answer the question quickly was efficient.

This iterative behaviour is probably also the result of the low cognitive knowledge of the subject domain and associated terms and concepts and limited knowledge of the artifacts and their functionality. Although Information Studies' students should have a better knowledge of these areas than many other students. However, it is also tempting to speculate, as indicated above, whether this apparent inefficient approach is in fact an effective way for the user to develop a cognitive map of the subject domain. This seems to be supported by the large number of quotes from the respondents that indicate the need to define the topic, and the problems associated with it, which re-occurred throughout the search process.

The original model shown above therefore, at a high level, reflects the information behaviour of the respondents but does not adequately represent what happens in practice. In particular it does not adequately reflect the situation of respondents working in a domain where they have little knowledge. It also does not adequately show the difficulty respondents have in identifying relevant terms and the lengthy

process of familiarisation with the domain or the degree of affective reaction to perceived negative responses from the system.

Turning to the second model, figure 4. This model was designed to help explore the various levels of analysis or abstraction in particular between the general context and the moment of information interaction.



This model helped to bring to light the false expectations of the researcher in terms of MICRO information behaviour. The model highlights the relevance of MACRO – environment data which stipulate the role and tasks of the respondent as well as the artifacts they can interact with. In this case these were the artifacts that were readily

available from the desktop in the laboratory and the library. The role of the students, in this study context, was to conduct a small-scale research assignment which involved finding material to help complete the assignment. The researcher is therefore prompted by the model to document the subject content and artifacts that the respondents use or need to use as well as their tasks and roles. The accepted norms for conducting a piece of research are, at a high level, conformed with, such as, defining the need, formulating search strategies, accessing a range of artifacts, recording bibliographic information etc.. However, as stated above, the actual behaviour witnessed at the MICRO level departs from the expected norms in that it is far more exploratory due, to some extent, to the limited cognitive knowledge of the both the artifacts (systems) and the subject domain and the need to identify 'relevance boundaries'. In addition the model does help to distinguish between the social context, the context that the individual brings to learning and the moment of interaction i.e. when an individual interacts with artifacts to help find information and learn about a topic.

The difference between respondents who have a high level of (MACRO – psychological domain) skills in terms of knowledge of the artifacts and the cognitive processes were more adept, at the MICRO level, in the following ways:

- defined the topic (despite similar unfamiliarity with the topic)
- used thesauri/dictionary;
- explored possible (Library of Congress) subject headings;
- used a greater range of artifact functionality such as field searching or the use of truncation or Boolean logic etc.
- were more knowledgeable of possible relevant artifacts.

There was some evidence of respondents from a library background deliberating more about the choice of terms, making more use of Boolean logic, in particular, the Boolean AND, and also truncation and also making more use of help systems. In addition, the data derived from the task /information needs analysis and flowcharting, indicated that they were more likely to suggest using outside help such as a librarian. The use of professionals and help systems could have implications for training, in that when training people to be information literate emphasis should be given to how to

resolve common problems as well as the more usual procedural training into how to search.

This model did draw attention to the various levels of analysis and that it is useful to distinguish between:

- gathering environmental data on the context within which the individual operates;
- gathering psychological data about individuals that make up the group in terms of the cognitive knowledge and processes that are apparent and useful for finding information and solving problems and
- gathering data about the moment of interaction which concerns the interplay of environmental and psychological factors and the behaviour of the individual.

At this point in the research it was proposed that a study that hopes to understand the user requirements of a group of people for an information system or service needs to work on these three levels. If one only collects data on the macro environment, for example the artifacts, without understanding how people interact with them at the micro level then the analysis will be weak because it will too generalised. This thinking about levels of analysis is developed later in the thesis.

Evaluating the interaction between the three domains

The next section presents a synthesis and analysis of the observation/talk-through data using the three categories of data to cluster data gathered during the search sessions. This section is particularly important because the analysis draws directly on the conceptual framework and also because extensive empirical data is used to support the analysis. It will be seen that generally data was only gathered on certain elements of the conceptual framework i.e. primarily on artifacts, cognitive processes, and behaviour and to a lesser extent on cognitive knowledge and the affective domain.

First of all three examples of the data captured on three individuals' experience has been included here to give the reader an indication of the data that was analysed and synthesised using the triadic model.

The following examples show the experience of two respondents who work in the National Library and one other who does not. All are similar in the sense that they

undertook 'successive searches' (Spink, Wilson, Ellis, Ford, 1998) and are iterative. The respondents with the library background tended, but not exclusively, to demonstrate a slightly more reflective approach to the situation in terms of thinking about the sources available and to some extent a greater use of search functionality such as Boolean logic. However the difference in this sample is not sufficient to draw any categorical conclusions.

Example 1 (respondent who does not work in a library). It should be noted that this session is relatively brief. Some sessions had as many as ten iterations, the majority between five and eight. OPAC sessions tended to be less successful than the World Wide Web. OPAC sessions often retrieved zero results due to the input of the 'wrong' term by respondents and the minimal use of synonyms or alternative terms. This compares with searching the World Wide Web where, due to 'best-match' algorithms and large indexes, usually something is found.

identify keywords > choose search engine (Yahoo) > input keywords ('3-D research') > 10 hits > scroll/browse hits/select useful site/read for further information >change search engine (AltaVista)/change keywords ('visualising information') >3655 hits > searching for relevant information/wonder whether relevant > change search engine/more familiar (Infoseek)/('visualising information') > selecting relevant site > identify keyword from abstract > reading, digesting information bearing in mind the research question > scrolling down page > reading / summarising the information/ trying to get relevant information on the topic > think I have found relevant information > click on other hits / read / look out for keywords related to question > relevant data found > click on links > decide on relevant data > print > go back to Web sites/scrolling > deciding on Web site relevance/reading > add to favourites / print

Example 2 and 3 (respondents who work in a library)

Search sessions varied in terms of commands used, and effort spent on defining the topic and the terms, identifying and choosing sources. The first session, shown below, is uncharacteristically successful. This may be partly because the respondent is relatively familiar with the subject domain (user training).

Which search engine > AltaVista > formulate search statement > define term, break question into concept blocks > 'user training + library' > long time, stop > > try

'library user training' > wow 10,6000 > go through hits > some relevant >e.g. library instruction – user skills training session > hyperlink > University home page > hyperlink > training session, effective training programs > looking for journals > print > OPAC > 'library + computer + training + system 0 hits > library + computer + training = 3 hits > look relevant e.g. case study > choose subject hyperlink > identify record call no. > hoping for summary > reserve > browse titles > identify terms 'information literacy, library orientation' > write call numbers

Example 3

Define concepts, how information is commoditised, will search databases to find how other researchers define these concepts > access Tiara > 'which databases to use' > read database synopses discount some 'not relevant' > > 'which specific databases' > > don't like page design 'very sombre' 'very slow' 'frustrating' > consider other online sources > which options > try A-Z > list of journals and newspapers > do not know which journals > try search > simple or advanced search? > which category business & Market research, science, information technology > decide not to select category > type commodification > error message > must select a category try Asian business newspapers and magazines > try keywords commodification and information > wondering if commodification a widely used term, should have used thesaurus > 100 IBM, Dialog hits > feeling 'wow', looks promising, will try to narrow down > read abstracts > feel cheated only abstracts and are not useful, can not see keywords > go back > thinking of what other terms maybe selling information and business > should go to library and use CD ROMs > scroll articles > keywords found but not in right context > what other databases to use, possibly ProQuest

As noted earlier, data was collected under the three broad classes of variable:

- the **environmental** (primarily on artifacts; subject was largely ignored but was implicit in the data);
- **psychological** (cognitive knowledge of the subject domain and the artifacts), cognitive processes (associated with solving research questions and interacting with information). No data was collected on cognitive style. Limited data was collected on affective state.)
- **behavioural** (actions, speech).

Applying this framework enabled the identification of situations that were significant for the respondents. These situations help to provide an insight into respondents' user requirements for an information retrieval system that would support their needs. Each situation was defined by the interplay between the environment (artifacts), the psychological state of the individual (cognitive processes and in some cases the affective state) and their behaviour.

In each situation three boxes are shown. In each one examples of data are given that relate to the situation. In the 'psychological' box are examples of quotes from respondents when they verbalised their thoughts during observation/talk-through. In the 'behavioural' box are examples of actions observed and in the 'environmental' box are examples of responses from the system that the respondent was interacting with. The arrows between the boxes indicate an association i.e. certain responses from the environment tended to be associated with certain psychological reactions and tend to lead to or be associated with various behaviours.

The situations:

1. 'unsatisfactory results'
2. 'perceived errors'
3. 'relevant material found'
4. 'poor knowledge of artifacts'
5. 'lack of knowledge of the subject'
6. 'lack of knowledge of search techniques and system functionality'

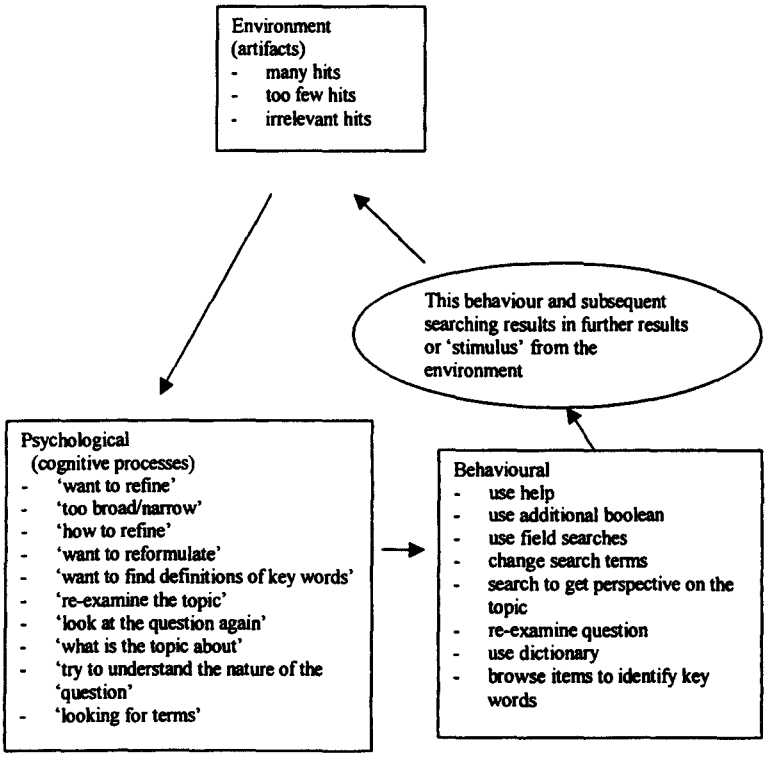
are not presented in any particular order and it would be hard to state that any one was definitely more significant than another. However situation five, 'lack of knowledge about the subject', did occur in more than half the search sessions. As stated earlier, the fact that the students were learning about a new topic may be the reason for other behaviour such as the high degree of iteration and the chopping and changing between search tools. Or, to turn this idea around, these may in fact be effective strategies for learning i.e. gradually building up a mental map of a domain. The labels for the situations were chosen to reflect, as closely as possible, the experience of the respondent that each situation encapsulates.

SITUATION 1: unsatisfactory result

A common situation was when respondents retrieval results that were perceived to be unsatisfactory. This was the case when **too many hits** (what actually counted as too many varied between respondents), **too few hits** or **irrelevant hits**. These are common situations as documented by Shneiderman and Byrd and Croft (1997). This led to typical psychological responses (cognitive processes) and behaviour as shown overleaf.

Psychological responses can be seen to fall into two categories: looking for search techniques to narrow/broaden/refine the search and secondly trying to understand the question including getting a better understanding of the subject domain and associated vocabulary. Behavioural responses include choosing specific techniques to change the relationship between search terms, or trying to find out how to do this, for example, using the help system. Alternatively, the respondent revisits the question to try and generate new ideas about the topic or selects artifacts that may help with this process, such as a dictionary. Similarly browsing the text of retrieved items also serves to try and clarify the topic (what is it about, what is relevant or irrelevant) and also to identify potentially useful search terms.

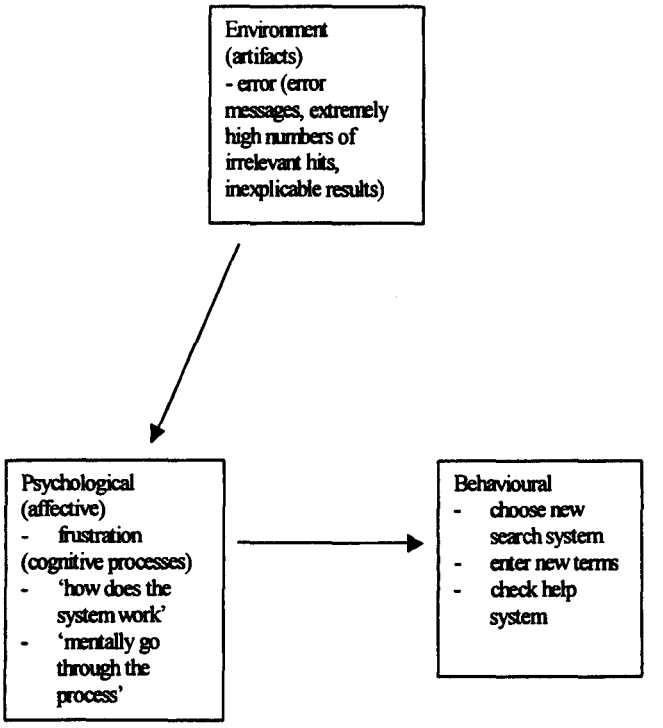
Figure 12 Student situation 1 – unsatisfactory result



SITUATION 2: perceived errors

Another common situation was repeated error or inexplicable responses (these could be similar to those above, such as very high numbers of hits, but were interpreted in a more negative fashion i.e. that an error had occurred). This was accompanied by feelings of frustration and inadequacy.

Figure 13 Student situation 2 – perceived errors



As commented earlier the process of searching was highly iterative, far more so than expected. On average respondents changed their search tool, (search engine, OPAC etc.), five times per search session. Choosing to search new systems seemed, from the researcher's point of view, illogical. Respondents in these situations were expected to spend more time reflecting on the process and developing search strategies that could be more effective. However, perhaps this apparent 'knee jerk' reaction could be perceived as a rational strategy to cut one's losses and start searching 'fresh pastures' and should be seen as part of the wider process of orientating the respondent to the general subject domain and potential resources, as discussed earlier.

The lack of planning and the limited use of vocabulary as well as the limited use of search functionality in general is demonstrated by the following four search sequences. These findings correspond with Spink, Bateman and Jansen (1998) data on Excite searching, where the mean number of search terms was 3.34 and also later studies of over one million Web queries (Spink, Wolfram, Jansen, Saracevic, 2001) and those described in Jansen and Pooch's (2001) review of Web searching studies.

More often than not search terms were limited to words or phrases found in the question. The vertical bar | indicates a fresh search. This data resulted from observing the actions of the respondents.

Information commodity | information + commodity | information services | information services + commodification | information commodity | commodification of information

Information + (trade or good or commodity) | information entrepreneur | information consultant | information resources management | hypertext to records via subject index terms information: economic aspects and to national information policies and strategies

User training + library resources | library user training | library instruction | library + computer + training + system | library + computer + training

Infosmart , information literacy | education + inforsmart , information literacy | information literacy + school children

Interface + design + OPAC | interface + design + internet | human + interface + design | interface + design + database | interface? + design? + information? + system | information systems | human computer interface design | interface design + information systems

It was evident that the respondents did not find this an easy process and thinking of relevant terms was difficult. This may have been exacerbated because the respondents were Singaporean many of whom, despite studying in English throughout

their education, generally prefer to use their mother tongue when talking to friends or family. However, from anecdotal evidence, derived from teaching British students information retrieval, similar problems occur with speakers of English as a first language. Other researchers have also identified the use of a limited range of vocabulary, for example in the U.S. and U.K., Spink & Xu (2000) found that on average a query contained 2.21 terms when searching Excite and one in three had only one term. It may also be the case that if the searchers had been experts on these search topics then they would have had a broader range of vocabulary to draw on and a clearer idea of what they wanted as well as what was relevant and irrelevant.

SITUATION 3: 'relevant material' found

Once materials were found that seemed to have relevance further exploration took place. Features within the artifacts were then used to try and identify relevant material. For example, hypertext links to material with the same index terms were selected or links within or from a Web site were selected. Respondents also started to record elements such as call numbers, titles and also to identify and note key words and useful search terms etc. Relevant items such headlines, texts, references, Web sites, were perceived as such when

- they helped to answer the question,
- they helped to explain what the topic is about,
- items contained terms in the question,
- items contained terms that could be useful,
- items contained links to other potentially useful items.

Respondents did find it difficult to determine relevance. Comments such as 'not sure if relevant', 'seems relevant' were common. Respondents complained that in many cases headlines or bibliographic references were inadequate for judging relevance and that a summary or abstract would have been useful.

These situations can be represented in the following way:

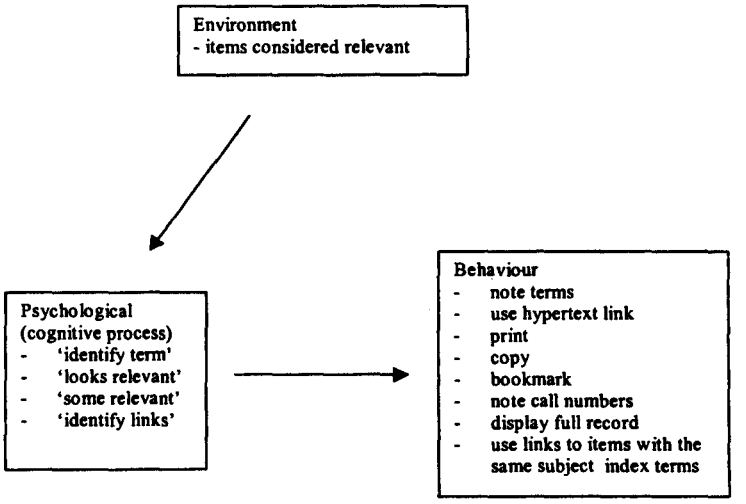


Figure 14 Student situation 3 – 'relevant material' found

SITUATION 4: poor knowledge of artifacts

A fourth situation was identified that reflected the respondents' lack of knowledge about the artifacts that would either help them locate documents or contained the full text of documents. It can be seen that the respondent's strategy in this situation tended to:

- try the artifact and see whether useful information was found
- choose the broadest collection of artifacts (sources) or where possible
- browse a list of sources.

Seldom was the latter strategy enabled by the system or services and when it was insufficient information was provided to enable the respondent to make a well-informed choice. Not knowing where to go for information is a familiar phenomena

and the poor performance of students in this area has been recognized, (Allen, 1990, Seiden, Szynboiski and Norelli, 2001).

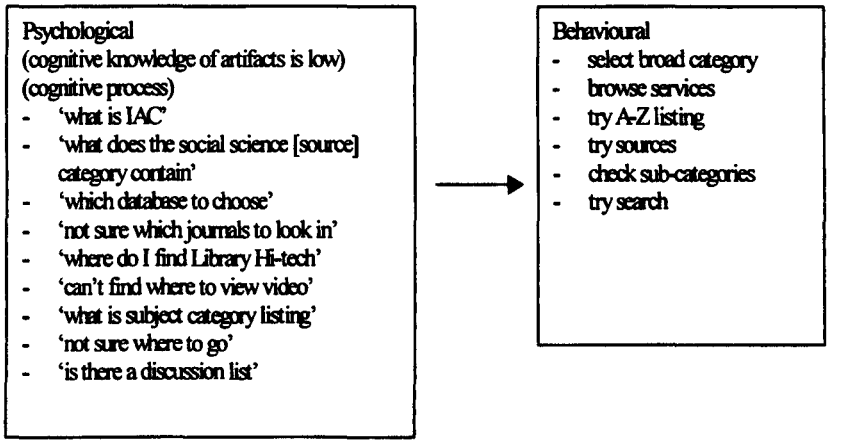


Figure 15 Student situation 4 – poor knowledge of artifacts

Bearing in mind that the respondents were Information Studies students it was salutary to witness the difficulty they experienced in identifying useful electronic indexes or full text sources. The respondents were generally unsuccessful in finding guidance that helped them to identify relevant sources. One of the attractions of the World Wide Web over other electronic information services is perhaps the fact that it appears to provide one window onto 'all' information; there is therefore no perceived necessity to choose particular artifacts that provide good coverage of specific topics.

SITUATION 5: lack of subject knowledge

As stated earlier, respondents generally had little knowledge of the specific subject domain about which they were searching. This was reflected in their numerous statements, such as, 'what is the topic about', 'need to understand the topic' etc. and resulted in respondents referring back to the question, trying to identify relevant terms in the retrieved items and in some cases the use of thesauri or dictionaries. Referring

back to the question occurred throughout the search sequence and in fifteen out of twenty nine search sessions. The following statements collected during observation/talk-through reflect the need for respondents to clarify the topic and the difficulty they experienced. Each statement would fall under the psychological heading and indicates the cognitive processes of the respondents. Due to the number of quotations the 'box' format has not been used. However as before the psychological data was associated with the behavioural data as shown below. Interaction with artifacts is indicated by reference to using OED or broadening the search which implied using the search tools.

Psychological
(cognitive processes)
'need to define concepts', 'no controlled vocabulary', 'must ask professor if on right track', 'what is the topic about', 'remind myself of search topic', 'look at question and try to identify synonyms' [resulted in one phrase], 'identify terms' [resulted in two phrases], 'what is expected?' [resulted in one term]. 'think about question', 'search not well defined', 'change words', 'must narrow', 'need to refine', 'try to define using OED' [unsuccessful], 'use all words from question', 'understand question', 'look for key words related to the question', 'identify keywords from abstract', 'what is the question aiming at', 'look at question again', 'title appears relevant but not', 'looking for terms on information services', 'take a broad start', 'not what I want', 'browse titles to see if additional terms to pick up', 'wants an overview of different types of books available', 'didn't find right subject', {use Yahoo} 'to get more perspective on what commodification means'.

Behavioural responses included

- referring back to the question;
- using artifacts that help define and identify terms and subjects (such as OED – this only occurred in four cases but nevertheless has implications for the kind of help required);
- using techniques to broaden or narrow the search as a means to help identify relevant subject matter;

- searching and browsing to identify terms and orientate themselves to the subject domain.

The cognitive processes can be seen to fall primarily into two categories: trying to identify relevant terminology and trying to understand what the search topic is about – both are obviously interrelated. These questions reflect a lack of cognitive knowledge about the subject domain. This process of the individual orientating themselves to the topic and starting to build a mental map of the subject domain in terms of relevant concepts and relevant and irrelevant subject matter was not supported by any of the systems that the respondents interacted with.

SITUATION 6: lack of knowledge of search techniques and system functionality

This situation identified inadequate cognitive processes in terms of the students ability to construct search strategies combined with a lack of cognitive knowledge of system functionality.

In general limited search functionality was used. In terms of Boolean logic the Boolean AND was the most common command (43 times out of 150 search strategies), proximity operators were only used once. The Boolean OR was used explicitly only twice. Parentheses were only used twice. Field searching was hardly used (keyword 10 times, title 3 times). Truncation was only used 8 times. For all respondents the most common strategy was to enter either a single term, several single terms or a phrase or phrases. Again these findings are supported by the work of Spink, Bateman and Jansen (1998) where little search syntax was evident and also in Spink, Wolfram, Jansen and Sracevic (2001) where, when searching Excite, only 5% of searches used any Boolean. However it should be noted that in both Spink's et al studies the population was mixed and not solely made up of IS students where expectations in terms of search ability are higher.

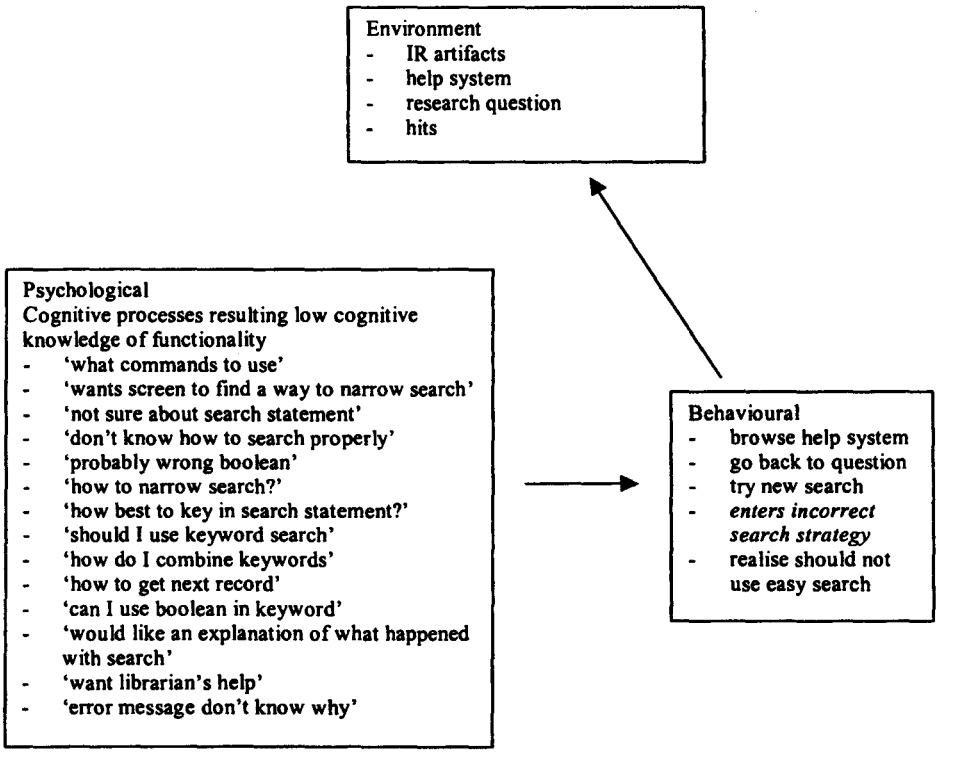


Figure 16 Student situation 6 – lack of knowledge of search techniques and system functionality

As stated earlier, help systems were generally found useful when specific command syntax was needed but did not help with the need for more general strategies to help broaden or narrow the search.

These findings, which show a lack of 'sophisticated' search commands and limited use of Boolean logic, echo the findings of other authors, such as, (Ray & Day, 2000, Spink & Xu, 2000, Rowley, 2000).

Recommendations

Based on these findings recommendations are made that would help the individual who experience the situations described above. In particular recommendations are made that relate to the situation where people are unfamiliar with their research topic.

It is likely that these recommendations would, however, also benefit the subject expert especially if they were relatively unfamiliar with electronic sources.

- **Student workbench:** This refers to the development of a holistic environment that caters to the range of needs identified in this study including more search aids and a broader range of resources than normally found in electronic information system, (EIS), environment that students encounter.
- **Process oriented help systems:** Assuming that the development of more holistic environments is futuristic and that it is fraught with both political and technical difficulties. It is suggested that, in the short term, it would be useful if help systems were designed to reflect the situations that are experienced by the searcher. Generally help systems provide documentation on the functionality of the system rather than help the searcher resolve common problems.
- **Effective training:** similarly to the previous recommendation it is also suggested that training courses aimed at developing effective searchers and independent learners should also take on board the common experiences associated with searching and learning rather than focus on the functionality of individual EIS.

Student workbench

The findings from this study illustrate the process the student goes through when finding information. In particular, the process associated with researching a question where the searcher has little knowledge is highlighted in 'situation five'. Five other common situations are identified. These processes could be better supported by EIS systems. As Spink, Wilson, Ellis and Ford, (1998), point out traditional EIS systems tend to assume that every search episode is an end in itself, which may be the case where the searcher wants a known item or small number of highly relevant items. The kind of interactivity and gradual exploration of a subject domain as documented in this study is generally not supported. Generally useful tools such as dictionaries, thesauri, encyclopedia, mind mapping facilities etc. that would help people orientate themselves to a topic are not integrated into the EIS environment.

Current digital library initiatives are 'still at the early stages of realizing the potential of digital libraries in educational contexts', (Borgman, Gillian Swetlan, Leazer, Mayer, Gwynn, Gazan, and Mautone, 2000, p2). A survey by Meyyapan, Chowdhury

and Foo, (2000), showed that generally current digital libraries are conservative in terms of the support they offer the user. One initiative, however, that does seem to be striving for a more task and user oriented approach is the Alexandria Digital Earth Prototype, (ADEPT), (Brogman et. al., 2000). Their objective is to provide improved means and support for enquiry based learning and will facilitate question asking, information gathering, information organisation, information analysis and question answering. Taken on board are the need for visual representations of information and the need for tools for aggregating and analysing data as well as the personalisation of the digital library

A 'student workbench' that would facilitate the process of learning about a new topic would need to:

- Enable the searcher to become familiar with the subject domain. On the basis of the words in the searchers query or as a separate function the searcher needs orientation to the subject domain. This could be achieved by, for example, browsing concept maps of subject domains, related or general, to help determine what may or may not be within the topic. Words or phrases could be generated by the system and these could be browsed, narrowed or broadened. Domain visualisation as described by Chen, Paul and O'Keefe, (2001), should help to achieve this. Specific algorithms designed to extract key terms and identify related index terms, that the user could then browse, could also be useful. The ability to browse a broad landscape of obviously related or probably unrelated material would help to map the domain for the user. It would also appear useful to be able to drill down to more specific subject matter or broaden out or leap to distantly related material.
- Once material has been retrieved, clustering and representation of their content, as explored at Xerox PARC, (Mackinlay, Rao and Card, 1995), could enable the user to understand the relationships between documents as well as their content, enabling relevance boundaries to be drawn. The popularity of such facilities was demonstrated in the recent investigation by Chern Liew et al., (2001).
- Situation four showed the need for help in identifying relevant sources. This situation is exacerbated where the individual is dealing with an unfamiliar domain. Students, for example, need to be helped to find appropriate sources of

information. Ideally, based on the subject of the question, appropriate sources and services could be presented to the user with the pros and cons of the various sources. This implies the development of electronic directories of sources that can be searched. Dialog supports this kind of function, to some extent, through the Dialindex database enabling users to identify appropriate files. This thinking needs to be applied on a wider scale and be tailored to the environment that the individual has access to. There is little point in alerting the user to sources that they can not access. Librarians already make this kind of information available via library Web pages and leaflets. However, this information needs to be integrated into the 'student workbench' and be searchable. Once sources were identified, information would be made available on how to use them, in particular, the use of fields, (Schneiderman et. al.,1997). Seamless links should be provided between different sources, media types and search systems to reduce the need to learn how different systems work, as in situation six. This concept has been developed to some extent by portals such as SOSIG, the Social Science Information Gateway. Priority could be given to readily accessible material. Databases such as ProQuest, for example, provide links to sources held locally.

- As indicated by the group flowcharting data, a broad range of sources should be integrated into the workbench. Convenient access to thesauri, dictionaries, encyclopaedia, 'pocket guides' to subject domains as well as relevant magazines and newspapers, should be made available in the same working environment. This would enable students to identify search terms and familiarise themselves with the subject domain, at a high level, and what may or may not be relevant.
- To encourage information literacy, and to support the student, an electronic environment that supports common tasks could also be developed. Situation four highlights the need to make use of relevant information once it has been found. Although it is possible to cut and paste from the EIS into Word etc. this kind of function could be taken a step further. For example, project portfolios could be part of the 'workbench' where information is organised either according to the search sequence or the structure of the final report. Extracts that have been copied from full text sources could automatically be accompanied by the full bibliographic reference that, in turn, can be reformulated into appropriate citation styles. Search strategies could automatically be captured by the system and stored

for reference and future use. The topic under investigation should be able to be seen by the user at all times to help users to refer back to the question which students in this study often needed to do. Ready access to templates for related tasks such as the expected cover page of a report or thesis and style guidelines and folders for bibliographies, quotes, appendices etc. as well as links to related course material could also be made available in the same 'workbench' environment. This would help to integrate the search process into the wider learning process.

- Respondents' statements showed that access to people is important and that this is not currently integrated into the EIS. Twidale, Nichols and Paice, (1997), reinforce this point and show that when students conduct research it is a highly collaborative experience, discussion and sharing takes place (as it would in the work environment), and that this can be supported by the system. This would include access to
  - the lecturer to enable discussion about what is expected and the topic;
  - to an information professional who can advise on strategies and sources and also
  - to their colleagues via discussion groups or chat rooms where they can discuss the topic and the assignment.
- As noted from the task analysis and group flowcharting data, respondents would expect to use either qualitative or quantitative methods to capture data when conducting a piece of research, for example for a final year project or thesis. It would, therefore, seem sensible to include in the workbench software that would be useful and could be used for this purpose. In addition, links could be provided to information and help on research techniques.

Process oriented help systems

Some of the recommendations listed above are beginning to be implemented, however, the current situation where the searcher accesses standalone EIS that are oriented towards the core IR task is likely to persist. It is, therefore, suggested that the help systems of current EIS could explicitly help the searcher deal with common problematic situations that have been identified. This would mean that:

- Help should be readily available that enables the student to think about search strategies and how to broaden and narrow a search. Help systems in general should be written in a way that reflects the learning process and the situations

commonly experienced by users i.e. situations 1-6, rather than focusing only on the mechanisms of the EIS system. This is happening to some extent. Alternatively the user could specify which of the six situations they are experiencing and then be provided with a range of possible solutions. In addition, the EIS could provide better feedback on what has happened, (Shneiderman, Boyd and Croft, 1997).

- Traditional help should, of course, also be available on the functionality of the system and how the search syntax can be used. Respondents commented on the apparent verbose and lengthy nature of current help documentation and that this was off-putting. It should, therefore, be provided in manageable chunks. Help could also be provided in a way that reflects the questions posed by the students (shown under the 'psychological' heading in situations 1-6) and the processes they are going through. ProQuest is one of the few commercial EIS that actually provides a tutorial that takes the user through the process of searching and OCLC is rare in that it provides feedback that suggests possible strategies to the user.

Effective training

Another strategy, that the findings suggest, is to provide training that relates to the experience of the searcher. It has been recognised that students are weak in the use of EIS and their knowledge does not improve dramatically throughout their university career, (Rowley, 2000). Partly as a result of this and the importance placed on these skills we have seen an increase in information literacy initiatives. In North America, in particular, such training is becoming a compulsory part of the University curriculum. However, as shown in this study, even students who had experienced IR training find it difficult to apply this knowledge to the information seeking process. Training therefore needs to be provided in a way that reflects the processes the user goes through and their likely experiences rather than focusing solely on the mechanistic tasks, such as using Boolean logic or field searching. Integrating such training into the learning environments, for example when students are undertaking an assignment, is probably more appropriate because the skills can be learnt in context as part of the process of discovery and orientation which should help the learner to internalise these skills. Teaching such skills separately from the tasks of 'finding out' is also difficult because people are generally not conscious of how they learn. This was noticeable in the respondents' simplistic and idealised descriptions of the process.

Furthermore, when librarians and academics describe the search process as a relatively linear process this leads to a false impression and unrealistic expectations amongst the users and perhaps explains, to some extent, the high levels of frustration associated with the search process amongst the students.

Situation four implies that searchers require more training about where to go to find different types of information. At present training tends to focus on one electronic source, and its functionality, at a time. A wider knowledge of sources in general and their strengths and weaknesses is also required. Again it would be easier if this training was integrated into the curriculum so that the identification of relevant and irrelevant sources was part of the process of becoming familiar with a subject. This would work particularly well if a problem based approach to learning was taken, where students are set a problem and they determine the questions to ask and how to answer them, which has been shown to lead to a greater use of a wider range of sources, (Rankin, 1992).

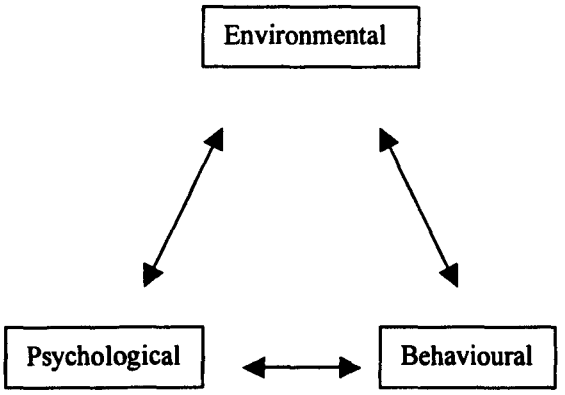
Comment on the conceptual framework and methodology

The conceptual framework was useful in that

- It helped to integrate the various dimensions described in earlier models outlined by Wilson, (1999). It also helped to highlight different levels of abstraction associated with information interaction. This implied that when gathering data to get an understanding of the requirements for an information system or service it is productive to focus on three domains: the environmental, psychological and behavioural. Furthermore, within these domains there are different levels of abstraction that relate to the variables associated with generalisations made with regard to the group, the individual and the moments of interaction with information. The notion of levels of abstraction or analysis builds on the initial concept of macro and micro aspects suggested in chapter 2. To enable a comprehensive understanding of the target audience data would therefore need to captured at all three levels of abstraction. Using the triadic model these can be shown as follows:

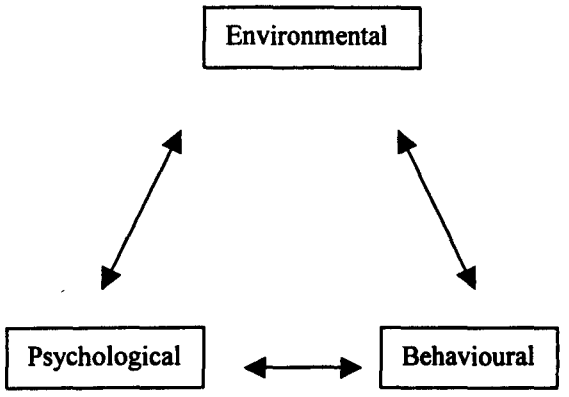
Figure 17 Three levels of analysis

Group



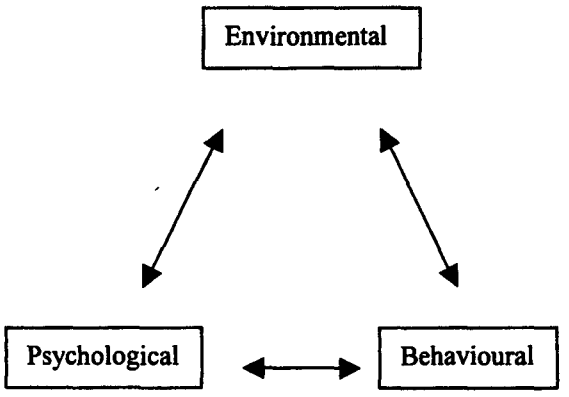
At the social or group level we can describe the information environment in terms of information intensive roles, norms, tasks as well as the subject domain and associated artifacts that are available. Psychologically certain cognitive knowledge and process and barriers maybe evident. In addition common behaviour in terms of information interaction such as the use of certain systems can be documented.

Individual



At the individual level again specific roles, norms and tasks will be relevant as well as the subject domain and artifacts associated with them. However individual cognitive knowledge, processes and style will vary, for example, due to tasks, character, background and expertise of the individual and will have implications for behaviour as will the artifacts that they interact with.

Moments of interaction



At the moment(s) of interaction data needs to be captured to help understand the experience of the individual – experiences that tend to be unconscious. At this level it is possible to document the process of interaction with the 'systems' as well as the interaction between the three domains enabling the design of aids or solutions.

The earlier model was shown to be too simplistic in that it did not demonstrate the highly iterative nature of the search process and the ever present need for the respondent to orientate themselves to and define the topic and its boundaries.

The conceptual framework:

- did help to identify methodology and techniques that would elicit useful data for specifying user requirements. By useful I mean data that helps to understand the information interaction of the respondent sufficiently so that design solutions to facilitate this process could be proposed. In addition, it has been possible to corroborate some of the findings with previous research which indicates that the results are reliable. However, by focusing on the environmental, psychological and behavioural domains and the use of qualitative methods it was possible to provide a rich picture of the interactive nature of the information seeking process and identify cognitive problems and behavioural responses in relation to their interaction with the information environment. It could be argued that the qualitative approach was able to build on, and suggest explanations for the findings of previous researchers who had used quantitative techniques. For example, providing a possible explanation for the iterative nature of searching documented by Spink et al., (1998) and Bates' 'browsing' and 'berrypicking', (1989), and also relates to the work of Belkin, (1980), and Ingwersen, (1996), who highlighted users' difficulty in expressing a problem due to poor domain knowledge discussed more recently by Robins, (2000). The notion of sense-making, (Dervin, 1992), also supports the idea of people gradually building a mental map of an unfamiliar environment. This was achieved due to the observation and talk-through methodology which captured data on the psychological aspects of the interaction.
- Lastly the theoretical framework helped to identify techniques and survey tools that could be used to study a large group of people and were effective for capturing data on the three domains.

Limitations

There were limitations to the approach taken. For example, ideally more information would have been gathered on why certain strategies were taken by the respondents. During the observation/talk-through sessions, other than keeping the respondent

talking and describing their thinking and noting their actions, little probing was done. In retrospect it would be useful to gather more data on why the respondent had chosen a specific path and what they were hoping to achieve. Therefore it would be necessary for the researcher to probe further when the respondent made choices and took actions. This would of course interfere with the process, to some extent, and may make the process less authentic. Capturing more data on key strokes using logging software or videoing the search sequences would not necessarily add much to an understanding of this process. Using the tabular paper approach to capturing data has the advantage of being relatively quick and easy to capture data and also meant that analysis was relatively straightforward. However, logging would enable a quantitative analysis of the data that could have been useful. Tape recording all statements and transcription would not necessarily have enriched the data, however, it may have provided more data on the cognitive processes of the respondent. Note taking verbal data, while trying to record actions and responses from the system, is bound to lead to simplification of the data captured due to a lack of time to record all statements. Transcription and the opportunity to use qualitative data analysis software could also aid analysis and findings. In addition, as mentioned, above to find out more about the impact of relationship between the individual's psychological state and their behaviour and their interaction with the environment data would have had to be captured on an individual throughout the information task. This was not possible due to the need to reverse roles.

Questions remain unanswered. These include:

- Did individual differences such as cognitive style influence the information seeking strategies? Was this related to some individuals seeming more comfortable with large numbers of hits and continuing to browse within these hits whereas others immediately abandoned the search when similar quantities of hits were retrieved? Due to the role reversal it was not possible to track individuals and their behaviour and cognitive style tests of respondents was not undertaken so no possible correlation could be investigated.
- Nahl, (1999) has argued information need is closely connected to the affective state of the user. Again to investigate this further additional data would need to be

gathered on the user. In this study relatively little data on the respondent's affective state was captured except where frustration was obvious.

- It was not clear from this study to what extent the knowledge of the individual either about the topic they are searching or about the systems they are searching influence the information seeking behaviour of the individual. There was an indication of a knowledge or experience difference between respondents who worked in the library and those who did not but it was not conclusive. To understand this additional interviews would need to be conducted with the respondents to get an indication of their knowledge. Groups, with distinct differences, would also need to be chosen for research to help to identify the implications of these differences.
- To what extent do the task objectives, roles or norms associated with the individual's environment affect the information interaction? For example, would non-Information Studies students have behaved differently? Did the fact that the tasks were set up and in a sense imposed on the individual affect their motivation and the strategies they took? Judging from studies of other students the findings do seem to have some transferability. However, the norms associated with the academic experience such as attitudes to the breadth and depth of material the student is expected to review are different from those in some work contexts where relevant answers rather that exhaustive research is the norm. How do these different norms affect the behaviour of the individual and would different behaviour be witnessed in different environments and to what extent are behaviour and cognitive processes similar?

One particular concern with the study was the possible self-referential nature of the research i.e. a conceptual framework was developed that suggested capturing data on specific domains. As a result methods were developed to capture data on these three domains which after analysis of the data indicated types of interaction between the domains. To what extent therefore did the data capture methods encourage this finding and if data had been captured in a very different way would the conceptual framework still prove useful for organising data? As a result it was decided, in the second case study, to apply the framework to data about people's information

experience that had been captured using techniques that were not connected to the framework.

The following chapters discuss the second case study. The data was derived from interviews with sixty informal carers i.e. people who care for someone else for more than fourteen hours per week and are not formally employed carers. Due to the significance of this last case study in terms of the thesis it has been broken down into three chapters. The first provides background on the study in terms of previous research and the methodology used. The second provides a detailed description of the findings. The extensive use of quotations is used to help demonstrate the 'grounded' nature of the data and to paint a rich picture of the carer's situation. At this point modifications, primarily re-labeling and sub-division of categories, to the conceptual framework are suggested. The third chapter provides an analysis of the data and discusses the implications of the findings for information system/service provision. The third chapter also reflects on the conceptual framework and proposes a reformulated framework based on the experience of the case study.

Chapter 5: Informal carers case study

Introduction

The next stage in the research was to apply the conceptual framework to a body of data that had not been specifically gathered with this purpose in mind. The reason for this was that in the previous case study methods were chosen because they were appropriate for gathering data on the three domains. For example, the task analysis interview was designed to primarily help gather data on the environment of the respondent including their tasks and roles as well as the artifacts and subject matter that they interacted with. The talk through and observation focused primarily on the psychological in particular the cognitive processes, knowledge and state as well as the behavioural domain. There was, therefore, a danger that determining the usefulness of the conceptual framework, using this data, could be self-referential although the empirical evidence did seem to support the conceptual framework and recommendations for satisfying identified were able to be made. In other words, the usefulness of the framework was being judged on data that had been derived by applying methods that were specifically designed to gather data on aspects of that framework. This possibility is present in most research and judgement is made on whether the data convincingly supports a specific 'argument' (or not) and whether the research was carried out in a professional manner. The wider conceptual framework that determines the methods and questions is seldom questioned. In this study because the emphasis was on the wider framework rather than analysing the relationship between variables in the framework it was thought necessary to see whether the framework could be usefully applied to data that had not been gathered with the three dimensions in mind. In addition, while undertaking the initial case study the framework developed. In particular it was suggested that that the framework could be applied at three levels of abstraction i.e. that information interaction could be analysed and generalisations made at the group, individual and moment of interaction level. At the group level the broadest generalisations would be made about the community as a whole. At the individual level individual's information seeking processes and experience would be described and analysed. Differences associated with specific roles and influenced by individual differences would be highlighted. Specific moments of interaction would provide data at a lower

level of granularity where, for example, cognitive problems associated with using specific systems would be identified.

To tackle these issues data was gathered on people and their interaction with their information environment using methods that stemmed from a different conceptual framework. This data came from interviews with informal carers. Informal carers, in this case, are defined as anyone looking after a disabled or ill (including mental illness), relative or friend for more than 14 hours a week without being paid to do so. The interviews were designed drawing on Dervin's, (1983), Sense-Making approach which focuses on critical incidents that are broken down under the headings, situations, 'gaps', and uses. The situations were associated with being a carer. The information needs associated with these situations, the gaps in understanding and the barriers to resolving these situations and the uses information was put were explored. Dervin's approach to gathering data on people's interaction with information is relatively well established and has been applied by numerous researchers including Solomon, (1997), and more recently by Savolainen, (2000). The interviews asked the informal carer to think of three situations, good or bad, which stood out in their mind. The 'situation' was first explored and questions asked about what happened, what questions cropped up, things that needed to be found out, confusions. The interview then moved on to discuss 'gaps' (how much they knew, how they got information, what helped, the importance, barriers and feelings). Finally the 'uses' were discussed (how the information helped, hindered and what would have helped). Each interview lasted approximately one and a half hours and was transcribed verbatim. None of the methods used in the first case study, task analysis/information needs interview, group flowcharting or talk through/observation, were applied. Data about moments of interaction depended on the respondent's recall of interaction with artifacts and how they resolved situations because no observation took place.

Research context

The opportunity to collect this data arose as a result of a project funded by Leicestershire Social Services to study the situation of informal carers in the county and involved the distribution of two thousand questionnaires and sixty interviews. This was, in turn, stimulated by central government's National Strategy for Carers,

(Department of Health, 2000). Over the last few years the government has made a commitment to provide better support for informal carers of whom there are an estimated 5.7 million in Britain, with one in six households containing a carer, (Richards and Parker, 1998). Included in this national strategy was the remit to regional Social Services to gather data on their informal carers. In the past Social Services had captured data on the cared for person rather than the carer. One of the areas highlighted in the National Strategy for Carers document was the need for carers to be provided with information and the need to collect information about carers and their requirements. Information was identified as one significant factor in helping carers to cope and to continue to care. In addition to identifying the need for information there was also recognition, within government, that carers should be herd to help determine what they want. Various initiatives have taken place around the country to provide information for carers. For example, Cambridgeshire Social Services circulated 10,000 copies of a handbook covering information on the role of statutory agencies, how carers can access support, with sections on money, benefits, respite care and day care services. However, provision of information is uncoordinated, patchy and for people who have not had previous contact with the 'support' infrastructure very hard to navigate. Leaflets can be found in some General Practice receptions, hospital noticeboards, Social Services headquarters, the benefits office, voluntary organisations for carers, carers groups, non-government organisations such as the Red Cross and so on. Some information can be found on the World Wide Web provided by the same or similar organisations to those listed above. An indication of the lack of systematic information provision is the recent perceived need for the national association for carers, Carers UK, to develop a web site for informal carers over the next three years, (conversation with Chief Executive, Diana Whitworth, 2001).

In our particular sample, (Hepworth, Harrison, Odhiambo, 2001), informal carers although spanning all ages, seventy one percent were between forty and sixty nine years old. Slightly over two thirds were women, (68%). The relationship between the carer and the cared for person was predominantly spouse/partner, (47%), followed by parents caring for children, (29%), and adults caring for elderly parents, (20%). The cared for person's condition varied widely and many had a number of medical conditions. The most common were stroke, (13%), confusion, (13%), diabetes, (7%),

heart disease, (7%), and Alzheimer's, (6%). The level of care was high with 62% stating that they spend over one hundred hours per week in their caring role. Caring involved personal care (such as, bathing, washing and dressing), physical help (such as, getting up and downstairs, getting in and out of bed), help with paperwork (filling forms, bills, finance etc.), practical help (preparing meals, laundry, talking to doctor, doing shopping etc.), keeping company (sitting with, talking to etc.). The carers and cared for were eligible for a number of benefits, depending on their situation, including attendance allowance, disability living allowance, invalidity benefit, mobility support and council tax discount. From the questionnaire data carers were seen to have contact with a wide range of 'professionals' including General Practitioners, (GPs), health visitors, psychiatric nurses, community nurses, chiropodists, social workers, meals on wheels, home carers, voluntary workers, religious organisations and carers' groups.

The information needs of informal carers

A relatively small body of literature has been published on informal carers. The majority addresses carers as part of the wider topic 'care in the community'. A few, including Twigg's, (1994), seminal work, concentrate only on informal carers as a group and their experience and the services they encounter and the wider policy issues. Other literature tends to focus on the experience of particular groups, such as, families caring for the mentally ill, (Perring, Twigg, Atkin, 1990). The role of the young carer has received particular attention in recent years, (Dearden and Becker, 2000). In these works the information experience of informal carers forms part of the discussion but has not, generally, been dealt with as a topic of research in its own right. For example, Bibby and Becker, (2000), note the '*urgent need to ensure that young carers have the access to the information they need*' (p22). Those areas that have been identified as significant include:

- Respite care
- Social services/health support
- Equipment
- Helplines and support groups
- Benefits
- Day care support

- Assessment
- the condition of the person they care for;

In our own survey carers highlighted the medication/condition of the cared for, (112 positive responses), aids and appliances, (111 positive responses), and statutory services/benefits, (101 positive responses), as the most important. It was also found that general practitioners, (GPs), were the most common source of information followed by newspapers, magazines, television, chemist/pharmacy, community nurse. Analysis of the interviews, during which significant situations were discussed, highlighted the importance of people in a similar situation, health and social care professionals and non-government organization, (NGO), staff for providing access to information. However, as will be seen, it was difficult to prioritise these sources because inadequate information provision and support as well as excellent support was experienced from different potential providers of information.

Providing information to carers is problematic. One fundamental problem is that many carers do not recognise that they are carers, which may mean that many do not actively look for information directed at carers. This makes it difficult to target the community with information provision. Many carers, judging from the experience of this study, also find it difficult to get to places where information is exchanged, such as carer's groups. The information they need, as can be seen from the list above, is diverse and tends to be provided in a fragmented fashion. The content is, to some extent, driven by the service provider, for example, social services provided information on their services, health on theirs and so on. This is recognised to some extent by these agencies. In Leicestershire partly in response to the informal carers study, a leaflet has recently been produced that provides 'signposting' information to a broad range of services. This will be made available in GP's practices. Despite this and other initiatives it is recognised that, on the whole, carers get their information by chance rather than through systematic provision, (Twigg, 1994), and this was found to be the case in this study.

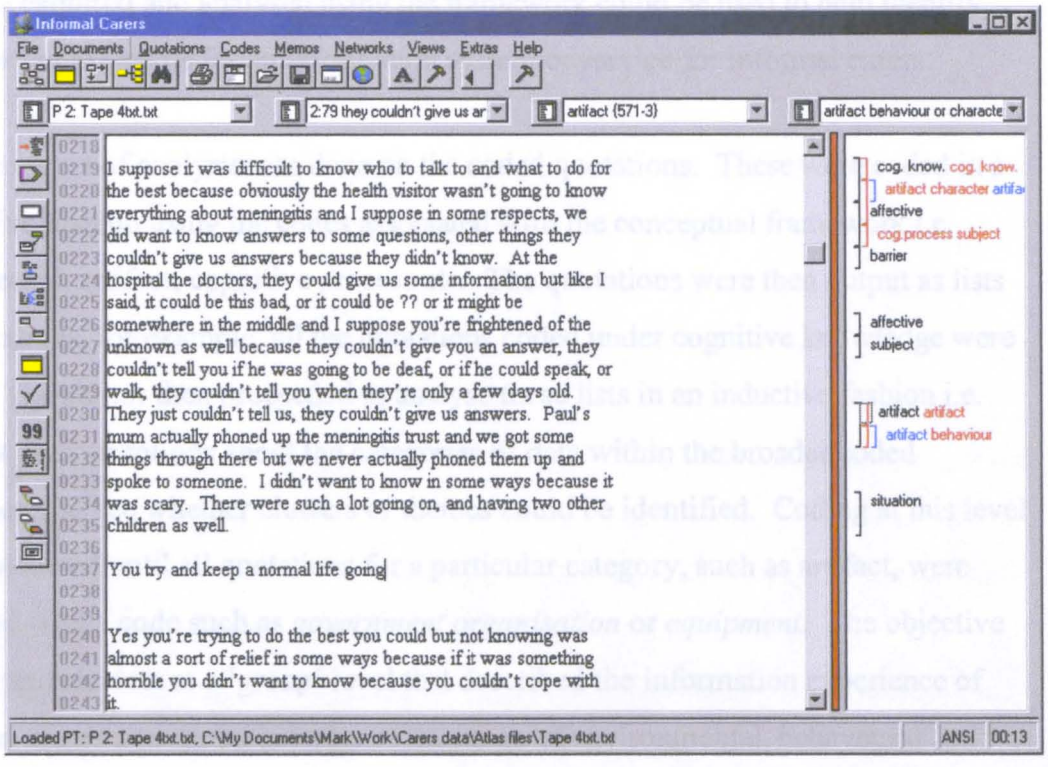
Research process

Initially 2000 questionnaires were distributed via Leicestershire and Rutland NHS Trust through community service and mental health teams as well as via voluntary organizations, CLASP, (Carers of Leicestershire Action and Support Programme) and CVS, (Council for Voluntary Services). This resulted in 174 returns. The low return was primarily due to the poor distribution of the questionnaire via the Health Trust. Ninety percent of the questionnaires returned came back as a result of distribution via the voluntary organisation CLASP. Out of these 64% agreed to be interviewed. Sixty informal carers were selected for interview. These carers were clustered into three groups, at the request of Leicestershire Social Services, and included: twenty carers who spent over one hundred hours per week in the caring role, twenty carers of people with dementia and twenty young carers. On the basis of the questionnaire findings and the interviews a report was submitted to Leicestershire Social Services, (Hepworth, Odhiambo, Harrison, 2001). The questionnaire was created in collaboration with the other researchers. The interview was designed by the author but based on the situation-gaps-uses format evolved through sense-making studies. The author prototyped the interview format and conducted the early interviews to help prepare the research assistant. Subsequent interviews were primarily conducted by the research assistant but reviewed by the author. The analysis of the transcribed interview was analysed for the report for Social Services collaboratively. The coding and analysis described below, however, using the same raw transcribed data, was done entirely by the author without any collaboration with third parties.

For the purposes of coding and analysis the transcripts were taken and loaded into the Atlas/ti qualitative data analysis software application. The author proceeded to code the data using the conceptual framework that was developed during the first case study. This included the sub categories of the environmental domain i.e. tasks, roles, artifact, subject, the psychological domain i.e. cognitive process, cognitive knowledge, cognitive style affective and the behavioural domain i.e. actions.

The following screenshot provides an example of initial coding of the transcript of an interview using Atlas/ti software. Interestingly this interview segment shows that the interviewee while needing information was also wary of information.

Figure 18 Carer data – Atlas/ti screen capture



As in the previous case study the aims were to determine whether:

- the conceptual framework that requires the researcher to focus on the environmental, the psychological and the behavioural aspects of the data was a useful construct and helped to explain the information experience of the informal carers.
- there were patterns of interaction between these three domains. In this case it was predicted that scenarios would be apparent that represented a recognisable form of interplay between the environment, the psychological and the behavioural. For example, interaction with certain artifacts would be associated with certain cognitive processes which in turn would be associated with behaviour and also whether the idea of three levels of abstraction proved useful and tenable
- there were significant portions of the data on informal carers that did not fit into or were not explained by conceptual framework. This was a new objective compared with the previous case study. This was included to help see whether the

conceptual framework was useful in helping to analyse data derived using techniques not specifically designed to collect data on the categories in the framework.

- data captured and analysed using the framework could be used to help identify user requirements for an information system or service for informal carers.

The first level of analysis was done on the coded quotations. These were coded in a deductive fashion using the codes associated with the conceptual framework i.e. behavioural, artifact, cognitive process etc. The quotations were then output as lists of quotations, for example, all the quotations coded under cognitive knowledge were listed. The author then proceeded to analyse these lists in an inductive fashion i.e. without preconceptions about the categories of data within the broader coded quotations, to see whether clusters or themes could be identified. Coding at this level was conducted until all quotations for a particular category, such as artifact, were assigned with a code such as *government organisation* or *equipment*. The objective was to provide data at a 'group' level that described the information experience of informal carers as a group in terms of the range of environmental, behavoural and psychological phenomena.

The second level of analysis was at the 'individual' level where, for each transcript, the information interaction described was mapped out. This data was then analysed to see whether generalisations could be made or themes or interactions identified that relate to the three domains and the experience of the informal carers. These related to situations or a chain of situations experienced by carers, such as getting a wheelchair or applying for financial help. The third level of analysis was the 'moments of interaction'. This concerned aspects of the carers' interaction with artifacts.

During the early stages of this process it was found that the concepts in the original framework needed to be refined to more accurately reflect the data and hence become more empirically robust. For example, 'artifact' was broken down into artifact type, artifact character and artifact behaviour. It was found that artifact had distinctive characteristics (as perceived by the carer) such a 'helpful' person or person 'who knew nothing about carers' and also behaviour, such as, 'helped fill in the form'. These characteristics had a dramatic impact on the carer and helped to distinguish

between positive and negative artifacts and hence had implications for the design of an information system that would relate to the needs of the informal carer. The category artifact was therefore broken down into these three areas.

The psychological concepts, cognitive process, cognitive knowledge, cognitive style and affective were renamed cognitive state, knowledge state, style state and affective state to reflect the transient nature of these conditions experienced at a particular moment in time when interacting with information. Although, as will be shown, respondents may have a tendency towards a certain style any type of state could be experienced depending on the situation.

In comparison with the student case study it was found that informal carers interacted with a far broader range of artifacts. Behavourial data tended to be a little thin in that respondents often describe their interaction as a phone call or visit and describe the interaction itself in general terms i.e. primarily whether it was successful or not and what happened. No data was captured on what happened during these interactions. This is a reflection of the different technique used to gather the research data i.e. dependence on the sense making interview.

Chapter 6: Informal carers – findings

Introduction

The findings are presented using the three levels of abstraction:

- group
- individual and
- moment of interaction

that were identified as potentially useful ways of thinking about data concerning people's interaction with information. The group dimension provides an aggregated view of the data for the group as a whole. This view identifies the range of environmental, psychological and behavioural phenomena associated with the group. This includes the artifacts that carers interact with and the psychological and the behavioural data associated with carers' interaction with data, information and knowledge. The second dimension concerns, the individual, and significant tasks and situations carers experience and their navigation through these situations. Lastly, moments of interaction are discussed. These moments of interaction concern particular experiences associated with interacting artifacts.

As stated in the previous chapter data was coded using the headings from the original conceptual framework. However it was found that the original headings did not adequately represent the data and broad concepts were subdivided, for example, the category artifacts was subdivided into artifacts, artifact behaviour and artifact character. This was because these aspects of artifact had significant implications for the user. In addition cognitive processes, cognitive knowledge, cognitive style and affective were relabeled cognitive state, knowledge state, style state and affective state. It was felt that these labels more adequately reflected the transient nature of these states and that one individual could experience various states in the course of their time as a carer. The category 'subject' was not treated separately because it became explicit when discussing the other categories of data.

As stated the group view reflected the range of phenomena associated with carers and their interaction with information. From an information system or service design

point of view this data indicates, for example, the universe of artifacts that the carers in general need to interact with. Artifacts are aggregated, clustered and categorised under broad headings. Similarly the psychological states cognitive, knowledge, affective and style are also aggregated, clustered and categorised indicating the range of states that need to be supported.

Having presented the data in aggregated fashion, at the 'group' level of analysis, it is then presented showing situations experienced by individual carers and the interaction between environmental, psychological and behavioural phenomena. This enabled patterns of interaction to be identified. Presenting data in this fashion was important because it conveyed the constructuctivist nature of how people try to solve problems. Presenting data in this fashion also led to the identification of the impact of style state on information interaction. Plus the effect of positive and negative interactions with artifacts became more apparent.

Lastly moments of interaction are discussed. These highlighted aspects of the carer's interaction with artifacts, such as the effect of 'good' artifacts.

Extensive lists of quotations are given under the various headings. The reason for this is to provide a sufficient body of data to substantiate the categories and also because, although quotations are similar, each provide a separate nuance that helps to give meaning to the categories. Repetition of similar quotations in some cases also has the value of giving the reader an indication of the frequency of certain types of data and the exhaustive nature of the analysis. It should be noted that some of the terminology used to describe artifacts, such as the titles of people or names of organisations, may be incorrect. This was because it was felt necessary to stay true to the transcripts which reflected the carers' knowledge or lack of knowledge.

It should be recalled that the methodology chosen to gather the data, the micro time line interview, was chosen because it was not driven by the conceptual framework, unlike the methodology deployed in the first case study. One consequence of this, however, was that certain types of data such as that on norms, roles and tasks were under-represented. In addition no observation took place which again meant that the data on 'moments of interaction' was limited.

Findings: Group level of abstraction

Environmental data

Norms

It was difficult to identify recognisable 'norms' of carers. Caring does not take place within an obvious set of normative guidelines. Whereas students, for example, are given normative guidelines when conducting an assignment as to what is expected in terms of effort they should put in and the content and format of output. This lack of clear norms is partly because caring is an informal activity and not one that has been officially recognised until relatively recently. Even carers themselves may not recognise the term carer. A recent leaflet, (Looking, 2001), aimed at carers, has the heading, '*Looking after someone*', partly for this reason. The 'norm' that carers do seem to share, however, is a feeling that they should do everything they can to help the cared for person and make their lives as good as possible (generally to the detriment of their own). The following quotations exemplify this attitude:

'I will look after him as long as I can' (adult carer) and
'I spent most of my time thinking what I should be doing for my dad, I didn't go out a lot' ... 'I would rather look after my Dad than go out anywhere' (young carer)

This level of commitment can cause difficulty particularly when the carer has similar feelings and responsibility for others. The following quotation exemplifies this:

'I also have my daughter ill and at the time ... my mother had just had a heart attack at the time and my daughter sort of collapsed because she has got ME, and I just didn't know, do I go to this one or that one? Quite honestly it was absolutely horrific'.

Even when this is not the case the stress of coping with living up to the 'norm' is apparent as shown by the following quotation:

'she rarely wants me out of her sight, she relies on me for practically everything, I am supposed to be Doctor, God, dentist you know, that's what I am supposed to be'.

This situation may be compounded by the type of relationship, for example, a couple may feel added presure. The following quotation indicates this when the carer is talking about not taking a break,

'I do need a break but ... she has got enough upsets, and enough... I can't think of the word I want now but, indignities inflicted on her, I am quite happy to go along with her she would have done the same for me'

It was also evident that carers have to deal with incredibly stressful interpersonal relationships and with an individual, the cared for person, who could be very difficult even offensive or violent. Dealing with these situations was very difficult and emotionally draining, partly I would argue, because of the normative expectation to care, whatever the consequence for the carer. When carers admitted to feelings of resentment or negative thoughts about the cared for person this tended to be accompanied by self recrimination and guilt.

Roles and tasks

Roles and tasks were not explicitly investigated. This was primarily because the sense-making methodology concentrates on specific situations and does not ask people to think in abstract terms about all the things they do. This is part of the strength of sense making in that, although 'narrow', it provides depth of data. Conscious methods such as task analysis and information needs analysis or focus group flowcharting, which were applied in the previous case study, were not deployed in this case study. However, the analysis of the situations that the carers experienced and the behavioural data did provide some data on roles and tasks.

The fundamental role is of course caring for another person. The specific nature of the tasks varied to some extent depending on the condition of the cared for person in terms of the type of medical condition and the severity of their condition. However the tasks, common to all the carers in this sample, that were associated with the carer role were:

- organising health care related services;

- organising social care such as home help;
- organising financial support to enable caring to take place.

Tasks that were common but not always evident were:

- managing the diet of and in many cases feeding the cared for person;
- administering medication;
- facilitating the mobility of the cared for person. This often involved manual labour but also included organising a wheel chair, stair lift or taxi;
- adapting the accommodation to cater for the cared for person.

Less frequent were:

- identifying suitable accommodation.

One young carer mentioned *'get her happy because she is always miserable'*. This may be a common yet unconscious task. Other tasks such as washing were mentioned and the questionnaire survey revealed a number of other tasks such as doing paper work etc. The nature of the sense-making interview, by asking the respondent to concentrate on situations that stand out in their mind, does however tend to focus on the most significant events rather than these day-to-day tasks.

Artifacts

Five hundred and seventy quotes, in the transcribed interviews, concerned the category artifact and it was the most common type of data. This is perhaps not surprising bearing in mind that respondents were asked to talk about past situations which by default tend to be memories of interactions with the environment that they experienced rather than, for example, detailed memories of the cognitive processes associated with these interactions. Artifacts include any aspect of the environment that the carer interacts with and could be an object, (equipment or information object), person, organisation, or service such as financial help. The latter could be a specific allowance that the carer is eligible for. It could be argued that artifact means something manufactured and hence excludes people. However, in terms of gathering

information in this thesis, interaction with people is seen as interaction with an artifact. In fact, in many cases, the function the person serves could be replaced by a system or product which perhaps legitimises this assertion. As stated earlier the concept 'artifact' was broken down into three sub categories:

- type of artifact,
- artifact character and
- artifact behaviour.

This was partly because of the range of artifacts and also because there was a significant quantity of data that concerned these elements that could not be adequately represented by the broad label artifact. Furthermore, these aspects of artifact or sub-categories had a significant impact on the carer and have implications for information service provision.

Artifact type

Some artifacts are relevant to all carers. Others are specific to carers who care for someone with a specific medical condition.

Artifacts were categorised in the following way:

- Organisations

Organisations included:

Government organisations: hospitals, general practitioners, benefit agencies, special schools, the County Council and Social Services offices, the Town Hall, Post Office and Police Service, Family Support Centre, the Disability Centre, Respite Care establishments, Day Care centres, the library

Non-government organisations (which in some cases are supported by government funds): Alzheimer's Association, British Epilepsy Association, Age Concern, Leonard Cheshire, John Storer House (a building hosting a number of social welfare organisations), Citizens Advice Bureau, Muscular Dystrophy Society, Cleft Palate Association, Care and Repair, Red Cross, CLASP, Leicestershire Guild of the Disabled, Meningitis Trust, Toy Library, Carers' Groups, Mencap, Welfare rights, Multiple Sclerosis Society, Young Carers Group, Access.

[The organisations that are concerned with a particular condition relate to the condition of the person the respondents were caring for. This list would obviously grow if a comprehensive list of useful organisations was created for all carers.]

Private organisations: pharmacist, taxi service, wheelchair vendor

- People

People included:

Health professionals: behavioural psychologist, geneticist, orthopaedic, speech therapist, consultants specialising in a number of areas including ear nose and throat, dialysis, diabetes, heart [again this list reflects the condition of the cared for people]; dietician, homeopath, health visitor, psychiatrist, community nurse, psychiatric nurse, physiotherapist, district nurse, doctor, GP, occupational therapist, ambulance crew, pharmacist

Educational professionals: educational psychologist, headmaster, teacher. [These people were mentioned by carers who cared for young people and also by young carers.]

Social professionals: social worker, occupational therapist, health visitor, home help, special needs health visitor

Public: people who have been or are in a similar situation, neighbours, relatives

- Information objects

Information objects included:

Medical books (in particular books about the medical condition of the cared for person, medication and its effects), leaflets (generally on benefits and services), Age Concern directory, telephone directory, NHS directory, national and regional newspaper articles, television and radio programmes that relate to the carer or cared for person, Web pages, articles in local free papers, First Aid book, Council Services book

Included in this category are 'forms' which although not conveying information are important for capturing information and communicating it to agencies and hence are an important part of the information environment.

In addition, prescriptions and instructions for administering medication are included since these provide information.

- Equipment

Equipment included:

Stair lifts, wheelchairs, eating aids, commode and medical devices such as a caliper

- Services

Services included:

Services that carers and cared for people needed and were generally supplied by government organisations such as respite, home help, meals on wheels, occupational therapists, needs assessment, blood tests and transport

- Financial help

The most common financial help was attendance allowance that could be used by the cared for person to pay for care. Other allowances depended on the situation. Financial help was also obtained from non-government organisations such as charities, religious organisations and previous employers. Finding out about these sources of financial help is of course extremely important for informal carers, particularly in this sample of carers who were unlikely to work due to the level of care demanded.

Artifact character and artifact behaviour

Data on artifact character, (202 quotations), and artifact behaviour, (230 quotations), is closely linked. Artifact character referred to the carers' perception of the quality of an artifact and artifact behaviour refers to the carers' description of what the artifact did. Numerous quotations are given, which in some cases may seem repetitive, to provide a richer understanding of the categories. Each quotation, although similar,

helps one to appreciate the nuances associated with each artifact and how the carers see their environment.

As stated earlier, the carers' perception of professionals they had contact with varied in terms of whether they thought the interaction was beneficial. It was not the case that any particular group of artifact was especially bad or good. Professionals such as doctors, community nurses, social workers etc. were described in both positive and negative terms depending on the interaction. What was apparent therefore, was the inconsistent nature of the quality of response. It also became evident, from the carers' point of view, what characteristics were seen as 'good' and which were perceived as 'bad' – which has implications for the provision of a user oriented information service that satisfies the needs of carers.

The significance and impact of these positive and negative characteristics should be considered in terms of the wider context. In other words, the negative impact is probably compounded by, for example, the stressful and depressing situation carers are in and the extreme difficulty they have in leaving the home and the cared for person, or taking the cared for person out of the home. Under these conditions to receive inadequate or incorrect information or advice is likely to be particularly frustrating and may mean that 'finding out' is delayed for a long time.

Artifact character

Positive characteristics were as follows:

Accessible

'she came round'

'because they came to the school'

'you can ring up if you have problems'

'I phoned them up, you didn't need to be referred by somebody, you could ring up yourself. So I phoned them up and asked them if they would do that, and they came over and assessed me and said 'yes'

Flexible

'we just wanted it for a couple of weeks, I think we have had it four times now ... a brilliant service'

'six different chair lifts ... you could sit on them and try them out'

Knowledgeable / experienced

'they do have experience of special needs children'

'she is a mind [sic] of information'

'they know all the volunteers etc. in the city and the county and they know all the places'

'she had been through it twelve months before'

'through her other people have been contacted'

(describing help from another carer) 'the pattern isn't quite the same progress, the symptoms and the way of treating it is virtually the same'

'she recommended all the supplements ... to feed her'

'who has experience ... has got to be the best bet'

'you met other people in the same situation'

'she knew what to do, that's how I know'

'we get somebody who knows about that and to talk to everybody on this'

'this medication will upset his stomach even more'

'she has been through the mental health system ... and those sort of places, and so she knows'

'you have really got to talk to someone who has been through it'

Listens

'somebody to listen'

'they would come and just sit and talk'

'you could talk to them about anything, and they like listen'

'she is on the end of the phone and its someone to talk to'

Manner

'seemed sort of personally interested'

'he was positive over things'

'she is so helpful'

'been coming for 12 years and she is quite a friend'

'he has been very good actually he has looked on us as a couple'

'she was patient enough to go through them and made sure I get them right'

'was very supportive'

Proactive

'when they saw I needed help they put me in touch ... '

'keen to volunteer their help'

'she forced it on me sometimes that I needed help when I didn't realise'

'it was them that started things rolling'

'if she doesn't know she will go and find it like straight away'

'if you want to talk to a nurse they would get a nurse to come'

'if you want to talk to somebody they can arrange to meet somebody'

'they can find out what you need to know'

'wanted to see what pills he was on ... she said did you realise your Dad's got Parkinson's disease' (the carer had not been told)

Information provider (examples of where information was provided are found in the next section 'artifact behaviour')

'the lady was lovely ... and she gave us lots of information'

'he will give us everything you need to know, and tell you where to go, recommendations ... he will discuss with you what medications are available, what's new, what do you think will work'

'she has expert knowledge of the illness because her mother, she is nursing her

mother at home with Alzheimer's '

'she actually got a diagnosis'

'told me what I needed to know'

'gave us information ... about what help was available from where, numbers to ring'

'they told me a lot of things and they really helped'

'tend to offer more information without having to ask'

'it describes the type of seizure, there are different types of seizure so you can identify which type of seizures your child is getting'

Responsive

'they will answer your questions'

'how quickly he will respond to requests'

'she will get back to me'

Negative characteristics are in most cases the opposite of the above. For example:

Providing the wrong information or inappropriate advice

'when we got there was ... sort of big, electric wheelchairs which wasn't what we wanted ... they weren't eligible under their voucher scheme'

'I should divorce him' [advice from Doctor]

'thinks I should sit and talk to him, but I hear the same thing day in out'

'it (medication) *accelerated it and put her in a coma for three days'*

Lack of knowledge

'I mean I knew more ... she couldn't even open one' (wheelchair) ... *if someone had been there to totally tell you about things from start to finish'*

'barely out of nappies ... (they) *haven't got a bloody clue about hands on handling the situation'*

'they seemed to know actually less how to treat a mental disorder or whatever than I did'

'hadn't got that information in the first place and it wasn't until I went down talking to him that he found the information and I think he has used it since'

'the schools I went to didn't know what a young carers' like'

'they don't realise I have got to look after my mother'

Poor manner

'you're sort of dismissed'

'don't need to be told you are an over anxious Mum go away and come back when there is anything wrong'

'rushed for time, and I don't think they give enough time to ask questions'

'I don't think I would have gone to the doctor because he dismissed too many things'

'had got no time or patience for mental patients'

'some are very dedicated but other I think it was a job'

'nurses know more and will tell you more than the psychiatrists'

'why should he talk to riff raff' [consultant]

Lack of access

'they are sometimes too far away or not at appropriate times'

'its very difficult to get a place and there are very few and a long distance away'

'there are long waiting lists to get an appointment'

Unresponsive

'you could never get to speak to him, he was unavailable'

'have to wait six months for a consultant'

'they don't push it'

'after weeks and weeks of chasing she came to the house'

Don't listen

'then people started to listen' [eight months after birth of child with severe learning difficulty]

'nobody listened'

Lack of continuity

'they leave too often so you can't really get any continuity'

'the right hand doesn't know what the left is doing'

'papers were lost ... then it would all start again'

'little link between the diabetic side and the dialysis side'

Poor information provision

'I don't think they can tell you, that there are side effects'

'they don't volunteer it'

'didn't tell me that' [about side effects]

'don't want to share their information around'

'she never mentioned respite care'

'they come specifically to what you have requested' [i.e. don't think about what else may be relevant]

'they don't tell you anything really ... just tells you what the illness is about not about what to do' [books]

'got to ask them and you have got to know directly what you want'

'nobody had actually said to us there is an Association'

'very difficult to find anybody with any practical information'

'without the name its no good to you because you rang up several times didn't you and because we had not been allocated an OT [occupational therapist]

they just fob you off'

'no one tells you what to do about behaviour'

Additional categories that were not opposites of the previous positive statements included:

Complexity of information

'you have really got to find someone brighter than you are or know what they are talking about' [forms]

'overlap in benefits and all these different rules and regulations ... is so complicated'

'sometimes you can understand what they say' [implying often cannot – in this case a young carer referring to contact with doctors]

Information overload

'piles of them there' (referring to leaflets)

'the amount of paper work you get back, absolutely ludicrous questions'

Artifact behaviour

This refers to the actions of artifacts (three hundred and twenty three quotations). Comments on how artifacts behave give a further indication of the needs of the respondents. Again these were categorised and divided into positive and negative behaviour (as perceived by the carer).

Positive characteristics

Facilitating contact with another artifact

'took me up to school to talk'

'got us in touch with the specialist'

'she just rang them up while I was there'

'I can refer you to psychologist'

'came with us' [to the school]

'referred to the Red Cross'

'told you to ring Social Services'

'he rang it up there and then'

'put us on to the General'

'she put me in touch with so many people'

'reinstated him for physio'

'put us in touch with the organisation'

'I will take you to see consultant'

'he gave me a phone number and since then I have been in touch with a group of people who have got children similar to James'

'she set the wheels in motion'

'she in turn put me in touch with somebody who provides a grant'

'(they) have access on different phone lines directly into the benefits'

'she made a phone call told me it would be at the surgery in a couple of weeks ... three weeks later she rang me up because she hadn't heard anything'

'they did put us in the right direction'

'she had been in touch with Stannah' [stair lifts]

'they came round ... and they helped to find a group' [local carers group]

'she personally got in touch with the man at the City hospital who had the power to say yes or no'

'she gave me the name of someone who had been a care assistant'

'to give me a break, and the whole thing ...was all fixed up by his team'

Contact in the home (implying responsive, proactive, accessible characteristics)

'came round and talk'

'brought it round'

'came along and discussed various supplements, and provided them'

'one of them came down very quickly, less than six months after she had been diagnosed'

'came straight to us'

'she actually came round the next day and ... to me up to school'

'a lady come out to see us'

'they would bring it ... for us to look at and try out'

'the next day she brought them to my home'

'who comes to help me have a bath and keep her eye on things'

'he rang me up and said I have got your search through'

'they were brilliant, they bring it out, they pick it up'

'called me up and got me the forms'

'phoned me up and said I understand you have got problems I will come and see you'

'said she would phone me at 2.00 to tell me yes or no. So she phoned just before 2.00'

'she phoned me ... said well his vitamin B12 is due'

'she suggested mobility [allowance]'

'came out to us and in case they could supply us with pads'

Information provision

'they sent me the whole thing about how much calcium she does need'

'she was able to tell me quite a bit about how they expected the illness to progress'

'they told me what was available'

'they sent me the carers booklet'

'put on seminars'

'talked about having a week's holiday next year with X in a centre'

'she gave me a this book here to help and in there was all the information I've ever wished for and I got their name from there'

'discuss the grants available'

'gave us loads of information we had never had before'

'saying this school is good'

'sent me information issued by the Alzheimer's Society'

'I got the information at the right time and did something about it at the right time'

'she said you can have respite you know'

'doctor said I need to do exercises to my back'

'she gave me a sort of information sheet you see, all these sort of things, carers groups ...'

'she has had an answer, if she hasn't had an answer she has gone away and thought about it and come back with an answer, or introduced me to people that have made suggestions'

'got the information from there' [social services]

'dad found out from somewhere'

'showed you them [stair lifts] *going up and down'*

'she told me what to do and how to apply'

'said you were entitled to income support'

'this is what we suspect'

'she said his heart has an extra beat'

'she gave some sort of hint as to what you could do'

'a push in the right direction'

Form filling

This is similar to contacting organisations, however, it occurred to such an extent and carers perceived it as very important, hence it deserved a separate category.

'did a lot of paperwork, in fact she sent most of the forms in for me'

'initial filling in'

'fill a form in'

'she brought the forms helped me fill out'

'helped me fill out a form so he could get invalidity benefit'

'filled the form in for attendance allowance'

'helped us fill it in, because I filled it in roughly and she just finalised one or two things I was finding difficult'

'I will get you a wheelchair ... so she filled in the forms'

'she helped us apply for the orange badge'

'got the forms sent to us and he helped us fill them in'

'spent about two hours filling in paperwork'

Financial help

'he helped find the money'

'RAF bought him the powered wheelchair'

General service

General services tend to relate to common tasks and situations that need to be resolved.

'they (OT) *look around the house to see what other things that is going that they could help you with'*

'came to see dada what he could do and what he couldn't' [assessment]

'one of them said that a commode upstairs would be a great help ... and now the next thing is they are talking about a commode downstairs as well to save dragging her upstairs'

'she said "oh we can put a thing on the telly"' (to aid hearing)

'they put up a bar'

'they were arranging for her to have one of the standard NHS wheelchairs'

'everything is marked up on the cooker so that she can see things'

'puts me in the chair straight into the taxi ...it saves all my difficulties of changing chairs'

'give me a day each week in the garden'

'since then they have been doing physiotherapy, they came back twice that week, once the next'

'she deals with any sort of medication'

'does a bit of cooking'

'took us out to Launde Abbey for the day'

'you can come here and get away from it, cause you are with people that are like sort of in the same situation'

'to wash and dress him and at night they come to undress him and put him to bed'

'he will take me shopping'

'takes my Dad to the fish shop'

'they fitted my sink with some plastic handle things so I could use the taps'

Negative characterisitcs

Poor knowledge or inappropriate advice

'too quick to give her some really potent antibiotics and it made her ill for a month whereas our own Doctor probably wouldn't have done that'

'saying you should walk on the foot you should exercise, then you will get somebody else within a week saying no you must keep the weight off the foot'

'he said if you have seen as much Alzheimer's as I have you would know' [the cared for person did have Alzheimer's]

'they haven't told us how to manage this'

'a lot of medication ... walking around like zombies'

'they offered quite a lot, home help, meals on wheels, that sort of thing, none of which I needed'

'he told mum not to keep getting lifted' [but no alternative given]

'years after we had been through all this they suggested a colostomy' [apparently could have been done much sooner]

'women's problems he described it as, two tablets and off he went' [cared for person had a broken a bone]

'were advised [by the practice manager] *to do this* [suing the GP]*'* [Consequently difficulties registering for a GP]

Lack of continuity

'everybody writes things down but the next person writes more things down but nothing ever happens'

'its just written down but they still come and ask the same questions'

'can we have you in we can't find the papers on you'

Not responsive

'neither the GP nor the consultant phoned for follow up blood tests'

'no one wants to know around my area' [young carer describing bullying situation]

'if you put in another claim ... why didn't you do it before'

'the onus was always thrown back on us to prove the point whereas they should have had files on everything that had happened to us'

Not informative

'never said I could get Carers Allowance'

'they just said post mortem full stop'

'he said he wasn't at liberty to tell me because my Dad was an adult and they shouldn't disclose'

'that man never told me I could get Carer's Allowance'

'you need to directly ask them, they don't very often offer information back to you' [social services]

Behavioural data

Behavioural data refers to the information seeking behaviour of the carers (two hundred and thirty quotations). Again an inductive approach was taken to code the data. No broad sub-concepts of behavioural data were identified but types of behavioural data were clustered under representative headings. It should be noted that, due to the lack of observation, the iterative nature of the interaction (as evident in the previous case study) and the number of failed attempts is probably under-represented by this data due to the simplified nature of people's accounts of past events.

Some categories are only supported by one quote however they were included because they did seem to reflect one important aspect of carers' behaviour. Nevertheless where categories of behavioural data are supported by a large number of quotations I would argue that carers are more conscious of these areas and hence they may be more significant. However this may not necessarily be the case.

The bahavioural data was categorised in the following way:

Telephoning a professional

Medical (health service staff):

'rang up school Doctor'

'I did actual ring' [NHS Direct]

'I phoned' [consultant for results]

'I phoned up Doctor' [to ask to check on mother in hospital]

'I phoned' [to get an ambulance]

'phoned hospital'

'I had to ask for help, to see a psychologist' [about child's behaviour]

'I always make sure I can still ring them up if there's any more problems because I don't want them to cut her off and I have to get referred back again' [maintaining continuity]

'rang the hospital up saying that I need to check my back'

'chased up can we have physiotherapy'

Medical (association)

'phoned the Hydrocephalus Association'

'we rang them up'

Social services/benefit:

'ring up and get an explanation' [benefits office]

'I got in touch with the Social and they sent a lady down and yes, I started getting Carer's Allowance'

'contact someone in welfare rights'

'we got in touch with the social services'

'so we phoned up and asked them to send forms' [benefits]

'I rang up and said you have not forgot to sort me out a knife' [social services]

'now we phone the OT'

'I phoned them up' [Glebe House to arrange a sitter]

'I rang up to inform them and they sent a leaflet' [social services regarding attendance allowance when cared for person went into hospital]

'I rang up to inform them' [husband in respite and therefore only eligible for a reduced allowance]

'getting hold of the right person' [who dealt with wheelchair voucher scheme]

'I had to go to the social worker'

'... if she doesn't help and can't put me in touch [the Doctor] *then I will phone the Social Services'*

'I have asked them to send the claim forms'

'so we phoned up and asked them to send forms' [benefits]

'inform the attendance allowance people'

'I have got to let them know as and when he comes home'

'I phoned [to get physio]

'so we phoned up and asked them to send the forms'

'to get occupational therapists to come'

Educational services

'phoning the peripatetic teacher'

'worth phoning [special needs school] *and having a word with them'*

'phoned up school'

'phoned midwife'

Police

'we rang the police so many times' [harassment of young carer at home]

Equipment

'I rang up' [to hire a wheelchair]

Read printed material

'look the information up in books' [about the medical condition]

'we just happened to look at a paper'

'check each one' [packaging of food to ascertain the contents in case of allergic reaction]

'looking it up' [benefits office]

'until you read up about them or ask about them ... you don't know which ones apply' [benefits]

'read information and filling forms'

'you read all of them ... doesn't quite apply' [benefits material]

'I read' [medical books]

'I read up' [on the condition]

'I got books, and also found somebody that worked in the NHS who was willing to bend the rules, look in the book of medications'

'I read books, loads of books'

'I tried reading up in books but I didn't get any proper answers'

Visiting places

'going to have a look' [special needs school]

'gone to the educational psychologist first'

'go to the toy library'

'go to the local office' [benefits]

'I went along to a meeting' [carers group]

'we went' [to mobility exhibition]

'joined all the long queues and sat and waited and didn't seem to get much information' [benefits office]

'I ask at the GP.' [about medical condition]

'I asked the Doctor about that' [getting a wheel chair]

'you then go and try things and you see things that you want and they are not in stock'

'to get into the disabled toilet' [going to three offices to find a key for the public toilet]

'went down to carers' open day'

'you have to see so many different ones' [Doctors in a practice – this relates to continuity discussed under artifact character]

'I went to both schools'

'used to mix with other parents'

'we go once a month' [carers group]

'ask other people their opinion'

'I go to the library'

'I went out to the ward and spoke to him and said ... I think there is something wrong' [alerting the consultant]

'I went to the carers' group'

'I go to the pharmacist'

'I can go and look these places over'

'I went directly to the psychiatric nurse'

'I used to go occasionally ... a bit like the WI ... and leave him for a couple of hours'

'I went up on Monday and said to the matron is she alright now'

'I went to the doctor's'

'I asked at the hospital' [about condition]

'go to the hospital three times a week'

Consultation with professional

'I went to the orthopaedic doctor'

'went to the GP'

'I made an appointment to see her' [welfare organisation]

'to see an occupational therapist'

'seen two different behaviour psychologists'

'I am going to go to the Doctor' [to get information in general]

'to check it further we had a appointment at the General'

Speak to people in a similar situation (sharing information)

'I'd spoken to people'

'I did get some information from other visitors'

'you would ask around really, you are not sort of offered these things'

'you just sit and talk, thrash out problems sort of thing, what we have to do and what we don't'

Getting equipment

'find all the equipment I have wanted'

'we just went and bought this bath seat'

'tracking something down' [wheelchair]

'we went to look at a range of wheelchairs'

'now it means I can take her out' [wheelchair]

'I did have the Red Cross out'

'I had a toilet frame, I can't remember what else, oh the banister on the stairs'

Educate/explain

'you sort of try and educate ... if you know what I mean ... your mother and the rest of the family'

'I said she has these funny blackouts and things'

'I was saying no there is something else the matter' [influence consultant]

'thinking of trying to help people in understanding what carers do'

Housing

'looking for a bungalow' [for mother]

'I will have a word with the council tomorrow and see if I could get them moved up here

'you have still got to maintain the house, I am still paying someone to help in the garden, the cleaning and so forth, and mending things, mending the washing machine'

Fill form

'fill the form in for attendance allowance ... I did it off my own back ... I filled it all in with great difficulty'

'I will get him to sign another one and send it'

'I filled in most of it'

'filled in form after form and then each time you go back'

Medical supervision

'I used to get all the medication'

'I just try and sort him out'

'I look after him to give Mum a break'

'I was getting out of bed to check that he hadn't rolled off on to the floor'

'I will give her an injection'

Feeding

'by giving him different foods' [trailing different foods]

Spending time with the cared for person:

'spent the morning doing something with him'

'Fight'

'so I wrote to them and said just think about it I have a husband with Huntington's Disease ... and yet I have to fight you' [arguing for mobility allowance]

Time off work

'had to get time off work'

Saving

'we started saving again for the next car'

Wait

'we had to wait for several weeks for them to come'

'I was struggling in the meantime' [waiting for appliance]

New Location

'you having to sort of settle her in with a new set of people, doctors and nurses'

Time management

'you try and be as efficient as you can not wasting time'

Membership

Few carers mentioned actually joining societies. However many did mention how they received help from these societies and therefore are 'members'.

'I am a member' [joined British Epileptic Society]

Political

'I helped to arrange support groups for epileptic children'

'I have sat on a lot of committees and things when Terry's been a lot better' ...

'you prick your ears up and you listen'

Chores

'bringing washing down, washing pots'

'I pay my daughter to come down and do the cleaning, she helps with my dad, and if I nip down to the shops she is here watching him'

Psychological data

Quotations were initially coded using the categories cognitive process, cognitive knowledge and affective which had been used in the previous case study. However, as stated earlier, during the organisation of the data on carers these categories were reconsidered and refined to better reflect the data gathered and the condition of the respondent. As before, within the broad categories, data was sorted into topics that were evident.

- Cognitive processes was renamed cognitive state because, although cognitive processes were evident the use of the word 'state' seemed to more accurately describe the situation of the carer i.e. thinking processes experienced by the individual. Within the category cognitive state four types of data seemed evident: 'uncertainty' (where the respondents were unsure what to do and in some cases extremely stressed), 'questioning' (when specific questions had been formed and needed answers), and 'strategic', (when the respondent described mental strategies to help resolve their problematic situation(s)).

- Cognitive knowledge was relabeled 'knowledge state' for similar reasons and was made up of incidents where respondents expressed a knowledge or lack of knowledge of a particular area – that indicated knowledge that was useful to carers. These knowledge states could be described as explanatory cognitive frameworks or mental maps that the respondent had 'built' to enable them to navigate the domain. Knowledge state included knowledge about artifacts as well as knowledge about a subject.

- Cognitive style, renamed 'style state', here refers to the attitude of the respondent. It was evident from the data that some respondents were far more proactive than others and consciously sought information and solutions whereas others appeared less proactive and seemed more at the mercy of events. This had implications for their information gathering. The former people tended to have wider networks of

information sources, (artifacts). However it should be noted that these groupings are stereotypes and all experienced both positive and negative style states and affective states. This will be discussed in more detail later at the individual level of abstraction rather than at the group level.

- Data on the 'affective state' concerned the feelings and emotions described by the respondents. This category is closely linked to 'style state'. However, affective state refers to an emotional state, in response to an event, rather than a pervasive attitude.

Cognitive state

Uncertainty

(then all of a sudden he's allergic to all these foods) 'what do I do now'

'the unknown' (first school)

'scared of the unknown but then you don't really want to know if it's the worst'

'you didn't know what to do'

'what if they couldn't find anything that was alright' (diet)

'when you have a long medical history you can't think of everything, you think, did I say that, or did I tell them that'

'confusions were listening to people, people telling you "oh you won't get this, you won't have enough to live on"'

'nobody sort of catalogues these things'

'sometimes you don't know what the hell you want'

'I wondered what was going on' [difficulty in getting medication]

'most children do recover from illness anyway. But it did worry me that there was something more serious or something would be .. it would never get right again'

'I might be taking her out of the fire into the frying pan'

'up to him being eighteen months old I was banging my head against the wall, asking if something's wrong'

'I think mental health is very difficult to put into words and describe in a form ...it isn't back and white ... it's hard to explain'

'I don't think I could cope with incontinence at night'

'what the hell do you do if you are stuck on your own'

'I didn't know like what was going to happen when she came home'

'make sure he is talking, cause it could be anything, it could be heart attack or anything so you don't know'

'things confused because of all the different medical problems, never able to get down to the basics to say this is the problem'

Questioning

'want to know the answer to some questions'

'why there are so many different allowances that do the same job?'

'I asked him about the fact that her tongue was sticking out'

'why has this been rejected?'

'finding out how to get a wheelchair ...not one from the Red Cross that you can rent'

'find out who gives money and who they will give it to'

'what happens to the carers when the caring stops'

'very difficult to find anybody with any practical information'

'she needed a new bungalow'

'we had to take into account how hilly it was'

'you were wondering what it was going to be like over there' [new location]

'I've always been worried about the calcium levels'

'to have a look round both schools, and I asked them all questions'

'I would really like to know about my daughter's condition'

'what is the life expectancy of these children ...what are the prospects for them ...when she is 14 where are we going?'

'was there any side effects?'

'what forms do I get?'

'I want to find out about respite care ... how do you go about getting it?'

'how are we going to get her upstairs?'

'how I get you, the psychiatrist, the police, social worker, the ambulance everybody all together at the same time?'

'what causes this brain disorder?'

'I needed the help of a dietician'

'what was happening, and why he was being sick, he just kept being sick and kept being sleepy'

'I needed to know if there was anywhere he could go to get his anger out and get help'

'what's wrong with my Dad, and how its affecting all the family ... is it going to be like that for my brothers?'

'I would have liked more help in knowing more what to do'

'why are they doing it' [bullying]

'not knowing, because we didn't have a home, not knowing whether we would have a home, where we would have a home and what our financial position would be'

Strategic

'find that out for yourself'

'by word of mouth I did find out more about it

'answer by trial and error'

'finding out all the information'

'part of working through the process of ending up with the final answer of what we were looking for'

'takes time to sift through it all'

'wanted to look at as many as you could, see which was the best stair lift'

'we wanted to get ideas' (mobility)

'I could concentrate on the caring because all the other things were slotting into place'

'you still have got to be able to go and sort these things out yourself, there is a lot

more help out there'

'by this time, found out a lot more about what went on'

'a case of finding out for ourselves really'

'word of mouth that I found out that you can actually get these from the Doctor'

'A lot is knowing how the system works'

'you come against your problems and find a way of sorting them out'

'I think it is easier if you have some sort of plan and know what you are up against'

'it is very difficult sort of juggling people, deciding whether yes my mother does actually need me and I need to go or whether we go and do what we had planned to do that day'

'finding out what help you can get'

'you have to find it all out yourselves'

'the best way to find out is by parents'

'if I am referred to another hospital that the consultants work together'

'it helps to read about the medication'

'see if she [doctor] *knows anything about it'*

'I have found out things'

'I got the information at the right time and did something about it at the right time'

'ringing about every taxi firm in L and asking if they had got special provision for disabled'

'I did hope at one time to join the carers group at ...'

'I made sure that I learned quite quickly'

'it took a great deal of trouble to find out exactly what medication was supposed to be doing'

'but then you had to check to find out it was true, but this was only from another patient, another visitor'

'I'm sure there is some in the library'

'in the first place it was quite difficult to track down help'

'I will have to look into the platform ... the actual run will have to be extended which is going to cost'

'we have to deal with instructions, the instructions are quite difficult'

'you just learn basically over the years'

'I just ask mam because she goes hospital with him, they tell her and she passes it all on to me ... when Mum tells me I understand'

'it's best to find out through your Doctor'

'I have always learnt find out first, before you see it'

'I thought most would be in books'

'I thought if we are all in one unit, I can make sure they are in bed safe, my dad don't have to walk upstairs, because he fell down a few times, and I could make sure that they were fed'

'try and make as informed choice as you can'

Knowledge state

Medical

'thought I would give her this and then she would be ... it wouldn't be a problem [incorrect knowledge]

'it does actually help you it describes the type of seizure, there are different types of seizure so you can identify which type of seizures'

'I personally think her that epilepsy and her behaviour go hand in hand'

'I think she needs to behave socially, she needs to be socially acceptable'

'I think there should be some guidelines out there to tell you this is likely to happen'

'I think ... she needs to go to an epilepsy school'

'I found out the side effects what was likely to happen over a period of time'

'a hysterectomy at one time ... I thought it may have contributed' [could be incorrect]

'didn't know if it was his heart'

'still didn't know how he was going to be'

'I thought most would be in books but they don't tell you anything really, not a lot, just tells you what the illness is about not about what to do' [required knowledge]

'even now they can't give me answers to what he's going to be in five years down the line'

'I knew that he could eat them and he wasn't going to be ill'

'whatever disease you are looking after you will know a lot more about that disease'

'I knew she needed more support at 11'

'she has too many medical problems and she has lost too much at school and it's not practical for her to go there ... she just needs the stability of ... quietness it's at a much slower pace that at a normal school and that makes ... you bombard Y with information and speak and she is lost and baffled and don't get that at that school'

'it's quite important to know other parents whose children have.. but even if they don't have epilepsy, its quite important to know other parents that children have problems'

'we know there is no cure for epilepsy, just a control, and it can have side effects with the medication'

'I didn't know anything. I thought we came home with a bottle of medicine and that was it. I mean I was told that we try this medicine and if it doesn't work, we have got other medicines that we can try, which we did do, but as I say nothing has actually'

'things tend to work for a little while and then they go off and you tend over the years to expect that'

'it was the brain deteriorating, the action of the brain and that J wasn't recognising the need to go'

'we are made aware actually of the effects of the medication'

'in K's case when you give vitamins in half an hour you get a different child, and when its wears off it's worse, you get this naughty child back again'

'he does have fits it's just controlling them and they wasn't controlled, you know. We have medication, too much of it gives you more damage'

'found out he was deaf, and so I knew at five months old he was deaf'

'lady I speak to in Dumfries regularly on the phone, her daughter is going to college at the moment, she had speech problems and hearing problems and she goes on the school bus now'

'if you feed that him it will take a while but he will come around slowly when the sugar starts getting in there, cause his liver is like damaged and its like leaking out'

'as far as I knew her arteries had furred up and she wasn't getting enough blood or oxygen to her brain'

'she can catch the school bus and is fetched back as well. She is really doing well, she has got the same break of chromosome that J has got'

'I didn't know a lot for a start off as I say, I made sure that I learned quite quickly' [mental illness]

'when I found out the side effects what was likely to happen over a period of time, I suppose it did help a lot because I knew what was likely to happen'

'it must have been 10-15 years...before I realised how bad the side effects were ... would have helped if you could have gone somewhere or were given a sheet which explained the medication'

'medication, now that Propolazine call it that, briefly PRN, so unless you know what PRN is she don't know what you are talking about'

'so you think well if you had told me that for a start off I would have told them she didn't want that medication, you know I wasn't going to accept it...but too late irreversible, a bit late to find out now'

'the supplements again have built her up again she is back up to six stone regularly'

'we could like learn how to push it properly, and how not to injure ourselves, just to look after ourselves'

'it just told you what blood pressure does, but it doesn't say, which way it should go'

'when this reading gets to a certain point they say yes that's it you have now got to start dialysis'

System

'I think that's why we haven't got a social worker because we wouldn't accept the respite care' [probably incorrect knowledge]

'it's just that I didn't know' [about respite care]

'the best time is half past three in the afternoon, you are more likely to get through, try the morning and you have had it'

'they don't tell you is that if they refer you to the Red Cross you have gone off their waiting list and then if the Red Cross refer you back you go back on the waiting list,'

'I knew that you could get them if you was in the right criteria to get one, sort of thing, but I didn't realise it would take that long sort of thing'

'You could also rent or whatever from the Red Cross, but I mean I have got this on loan and I am not paying for it sort of thing, but a lot of people don't know

that'

'does help to go to these groups to explain to people that do have a social worker that you don't give your child up and they are not there to'

'not until recently that I realised that they have access to everything'

'I didn't know about mobility either, and it's somebody at school that said "well you could have a car to help"'

'I didn't know how it was done, I certainly didn't think the attendance allowance would be stopped, I more definitely didn't know that the pension would be reduced' [while cared for person in respite]

'I don't know a thing' [respite]

'the estimated costs probably were a minimum £300 per week, to keep somebody in hospital, probably more, taking all the overheads, that somebody mentioned perhaps £10,000 per year per person'

'the Govt. changes the goalposts quite often, you get there and they say sorry we have just got a new directive'

'there are that many disabilities allowance that only applies for certain ages, it used to be attendance allowance its not now, or severe disablement allowance, so she is a bit disabled but you don't apply for severe disablement allowance, you apply for disability living allowance. Apparently, that's what I am getting at, and also mobility allowance which is something else its also called disability living allowance, mobility, now there is three limits, three levels'

'unless you can talk in the right terms you might just as well talk at the brick wall. Because there are certain terms you have to use or that they use all the time, which to an outsider probably you know'

Organisations

'so obvious now is the CLASP organisation, but it wasn't when you don't know about it'

'when I was 14 I found out about this group'

'difficult to know who to talk to'

'I have since learnt from various magazines that we have had, that people like Leonard Cheshire do a service'

'I didn't know that there was any help available or groups'

'lady at Welfare Rights had done one for someone else with Huntingtons and sometime before and the Hinckley and Rugby has accepted it'

'I knew there was a charity organisation in Leics that if you contacted them they would help you find the money for these things'

'in possession of a lot more useful numbers'

'if you have got a name and a number you can get help'

'we didn't know anybody that really lived that way, ... You presume there is going to be Social Services and whatever but... what they are like from area to area you just don't know, it's just pot luck'

'I am finding my way around now I've done it since 1994 which means I am reasonably experienced'

'got the picture that wherever you go for respite care you are never going to be 100% satisfied with it'

'if we claim for it then it's easier than trying to claim for it after 65'

Finance

'I didn't know we could have Carers' Allowance'

'I thought "no we are entitled to this, this is not our fault we are in this situation"'

'I didn't think anyone would give me one because of going onto benefits'

[incorrect knowledge regarding mortgage]

'I should have thought would have qualified for a higher rate of disability'

'we know we aren't going to get a grant because I am working'

'Didn't know that at the time' [source of finance]

'I filled in most of it, there were one or two bits I wasn't too sure about so the chap Bob sorted the rest of it'

'knew what he was entitled to'

'once your benefits are in place a Building Society will see that the money will be there'

'they backdate it to when you apply, when you phone up and ask for the forms, to be sent, that's when it starts and I think they give you a month to return them'

'when they reach 65 certain benefits become unobtainable they just cut off. I am not quite sure, if you didn't get them before a certain date, when you get to 65 they stop, I am not quite sure how they work'

Education

'I realised that it got to the point when mainstream school was not going to work'

Equipment

'wasn't what I had expected. Because never having to sort of ever had anything to do with wheelchairs'

'I have been told aren't any good anyway because they have got no back support on them'

'I am quite a wheelchair expert now'

People

'you sort of learn it, and it's learning how to manage people'

'Helped me to understand what I was doing, that I was different to everyone else, and why things were happening to me and not other people' [young carer]

When respondents were asked about the situation when the cared for person was first ill, on the whole, carers knew little as shown by the following quotations:

'I knew nothing, I thought an epileptic fit was a grand mal fit I used to go to school where a child had a fit, and like everybody knows they lay down and the kicking and, that was what I thought epilepsy was, and my daughter didn't have fits like that'

'Not a lot, it wasn't explained to us or anything like ... it could affect your kidneys' [medication]

'Very little'

'Very little, I had read about it I knew the title but ... nobody can understand what it is like until they have been involved in it' [Alzheimer's]

'I didn't know anything about battery bath lifts'

'Nothing' [arranging wheelchair]

'we had very little dealing with disabled people' [before]

'the first time it just caught us totally off guard and we didn't know where to go or what to do'

'what to do for the best'

'hadn't got answers to a lot of questions'

'know what a shunt is or hydrocephalus'

'telling us about shunts that we never realised'

'nothing' [about special needs]

'five before we even knew about it'

'which ones apply which don't ... you just didn't know' [benefits]

'the way you require forms to be filled in and the wording and the exact detail'

'Well nothing really we just had to deal with it ourselves'

'very little, everything with the diabetes with all of it, it's what we've had to resolve for ourselves'

'part of the diabetic problem and where the circulation speeds up so much in the extremities it, I think it actually pushes the bones apart'

Style state

Style state refers to both cognitive style and learning style is associated with terms such as holist, serialist, field-dependent, (Ford, 1995), 'monitor', 'blunter', (Baker, 1995). These terms imply a tendency for people to have preferred ways of capturing, processing and ordering information. These characteristics may be considered to be 'hard wired' into the individual or be developed through the individual's interaction with the environment depending on whether one takes a cognitivist or constructivist view of learning and the mind. The individual could exhibit a combination of styles or apply different styles in different situations. It was not possible in either case study to test respondents to see what 'style' they conformed to. However, what did seem to be apparent, in the second case study, was that respondents did react to their situation in different ways and there did seem to be a distinction between people. Some people seemed to see the situation as a problem or challenge that they would, or had to, resolve. These people tended to be more proactive in their interaction with artifacts and use of information and had a wider network of sources of information. Others tended to seem to be more at the mercy of the situation. The affective data in these cases tended to fall into the category of 'despair'. They tend to have smaller networks of people and organisations that can provide help and information. In some cases they seemed to take longer to find out useful information. Several accounts describe

coming across an individual such as a community nurse who was particularly responsive and then helped to navigate the environment for the carer. Both groups however experience situations where they feel emotions of 'despair' and both groups were facilitated by third parties. Style state quotations are clustered under positive and negative to help demonstrate these style states.

'Positive' cognitive style state

'I have always been able to go and find out and ask and not been afraid to do that'

'I am strong enough I think to fight for what I want ... and find out things'

'you still have got to be able to go and sort these things out yourself, there is a lot

more help out there'

'I will manage somehow with him ... I thought "damn it we will manage"'

'I will resolve it and in the end we did'

'if you want anything you have to try for it, it doesn't come naturally, I have to ask'

'what I found out I found out myself, from the Internet, what I needed to know about him I got on the Internet, because the condition was never explained to me'

'R and I are articulate'

'find out ourselves'

'information is there if prepared to look for it'

'I am that independent minded'

'now come on ...do it yourself, there must be away'

'I am an organiser'

'I am more extrovert'

'I made sure I learnt quickly'

'chase it up ...push, push'

'I go out and sort it out'

'I will go at it until I sort it out'

'badger people'

'I was determined I would resolve it'

'cant find information that easy you have got to go and dig it out from

somewhere. I am not really used to read information and filling forms and that
sort of thing, it's all so complicated'

Three of the more positive respondents said that they were *'admin oriented'*, had *'worked in an office'*, and *'was a librarian'*. This could imply that people's experience in the past encouraged a more problem solving attitude and enabled greater familiarity with bureaucracy and administration, which perhaps gave them more confidence.

People who were interviewed who seemed less confident about their ability to find information, solve problems and get results, made fewer positive type of statements. However, having said that, all respondents experienced difficulty, as the following quotations, from the more 'positive' group, imply:

'I used to come out there and cry'
'what's happening, why am I in this situation ...it was horrible'
'it was absolutely horrific' [relationships]
'big disappointment' [medication not working]

Nevertheless, the following quotations come from respondents who generally exhibited a style state that was less positive. These quotations illustrate an experience associated with feelings of loss of control, disbelief, despair and isolation. Several of the quotations describe an affective state. However in these instances it is suggested that the same terms reflect a style state.

'Negative' cognitive style state

'hope that the problem will go away' [early stages]
'it seemed to be one relapse after another'
'rather abandoned at the time'
'thought we had been forgot about ...abandoned by the system'
'I feel that because he is handicapped maybe he is not as important'
'it can't be happening really'

'scared of the unknown but then you don't really want to know'

'just too much'

'why me again'

'stress, stress all around'

'it's just horrible'

'scared'

'I didn't want to like tell a lot of people because then it would have ... I didn't want to be treated differently' [young carer]

'it never entered my head to apply for anything like that'

'I needed a push in the right direction'

'I just live in a state of shock'

Affective state

As mentioned above there was overlap and association between the cognitive style state and the affective state. As one carer put it *'I have not been afraid ...I am an extrovert ...I have been able to access the services'* [where the phrase 'not been afraid' could be interpreted as an expression of a style state or an affective state]. Setting this aside, affective data can be identified and tends to be associated with the carer's interaction with information and dealing with specific situations. Again positive and negative are highlighted because these distinctions have implications for information service. Thus, a good service or positive information interaction should encourage a positive affective state. It is interesting to note that many of these negative affective state quotations are associated with a lack of information or knowledge.

Negative affective state

'everything just got worse because they didn't know what it was'

'scared of the unknown but then you don't really want to know if it's the worst' [nobody had a proper diagnosis]

'you're frightened' [lots of unknowns ... is he going to be deaf ...]

'sort of scary' [not understanding medical situation]

'complicated the way things are done ...confusing' [benefits, tax]

'not really used to it' [reading, filling in forms]

'I used to come out there and cry' [overwhelmed by the situation] *'you just didn't seem to get any answers, it was fill this in, do that,.. well by the time... you know I don't know what I am supposed.. some people ...I suppose in the benefits system for a long time and knew what they were doing, I didn't and I was in tears, I used to come out there and cry, and I thought what's going to happen with us, you know, because I had never had to do this before'*]

'most carers' biggest worry' [what happens when, having cared for 20 years, the caring stops and most financial support is lost]

'rather abandoned at the time' [wanted information before the event, subsequently didn't know where to go for information, now obvious since finding CLASP]

'it was absalutely horrific' [managing family relationships]

'in hospitals, it's just written down but they still come and ask you the same questions. I don't know, five, six, every time you speak to someone different they would ask you the same questions as the previous ...you just think why did they bother'

'it did worry me that there was something more serious or something would be .. it would never get right again' [wanted to know]

'I think if you know you can deal with it, it's the not knowing, you imagine all sorts of things if you don't know what it is'

'it was just going on and on, we just didn't get any information or help' [following a sequence of trying different medication without any understanding of what was going on]

Positive affective state

Positive affective states tend to be associated with positive interactions with people and in several cases becoming informed.

'that was brilliant' [people you could talk to ... they were there when you needed them]

'quite nice' [talk to mothers]

'was helpful' [she (occupational therapist) talked to me about things]

'they were very helpful they seem to have certain people who specialised in various aspects of disability' [carers' organisation]

'I got the information and I read it and I felt happy that I knew about it'
'I feel the more information was given the better you are to deal with things'
'we were concerned' [about weight loss ... resolved by the dietician ... *'she came along and discussed various supplements, and provided them'*]
'that helped a lot' [read about the condition]
'that took away the worry' [house alterations]

Other feelings fell into various categories, including:
Isolation and victimisation

'why me again'
'rather abandoned at the time'
'thought we had been forgot'
'you just feel like one in a million'
'is it just us, do these things just happen to us?'

alternatively,

'you realise you are not on your own ...there are people out there who probably that were in a lot worse situation than me where their children can't do anything, losing their speech and their hearing. But on the other hand, I now have a child who has severe behaviour problems, which is very unsociable, so it is very important to know other people and that there are other people. No one actually volunteers any information to you, and no one tells you that Social Services supply needs or there are these help groups out there, volunteer groups, you have to find it all out yourselves. So the best means, no one tells you about the social - the DSS payments either that you can apply for. Now the best way to find out about these is by parents, through parents help groups'

which shows how important it is for the carer to have contact with other people in a similar situation partly to limit the feelings of isolation described earlier.

Overwhelmed

'just crying'

'Hopeless really, it was upsetting because I didn't know whether it was worth going to anyone about, confused, cause you know you feel like you are doing wrong' [young carer]

Impact of inadequate help

'he didn't believe me' [doctor] *'why me again'*

Reaction to information that was not wanted

'just horrible' [possible negative effects of earlier treatment]

'in some respects, we did not want to know answers to some questions' [proceeded by statements *'what to do for the best ...health visitor wasn't going to know everything'* [about meningitis] *'scared of the unknown but then you don't really want to know if it's the worst.*

The way information is provided and received

'being told he can't do this' [no talk of what he could do]

'it's not as straightforward ...answering all the different questions, you have to know how to go about it'

'I thought it was absolutely dreadful' [told, bluntly, she had Alzeimer's]

Anger

'Not treated as an individual'

'penalised for having money'

Desire for easy access to information and knowledge

'to think that there is somebody on the other end of the line that can instantly help you ... it doesn't turn out like that'

'I would have valued some sort of help from them to sort of tell me that' [regarding prognosis]

'I ought to get somebody on the phone to speak to at this particular time'

Findings: Individual level of analysis

The same model can be applied at this level of analysis. In this case instead of generalising across the group, the analysis focuses on specific roles, tasks and situations and maps the individual experiences of the respondents. For example, the individual may experience a chain of events from the point of discovering that the cared for person has a particular medical condition to situations such as finding out about and obtaining a wheelchair or learning about a medical condition, dealing with a dietary issue, moving house etc.. This is a different level of analysis from the moment of interaction, which will be discussed later, which focuses on specific interactions with artifacts. This level of analysis serves to highlight individual experiences within the group and specific situations that may be common across the group.

Each interview was mapped using a software package called Decision Explorer. This enabled the flowcharting of individual carers' experiences as they encountered situations identified during the interviews. Having organised the data in this fashion it was possible to identify patterns or themes. These included the impact of:

- a positive style state and a negative style state
- a 'better' knowledge state i.e. the carer seems to have a better knowledge of their environment, the range of artifacts and how they work and a 'poor' knowledge state
- 'good' artifacts i.e. where the behaviour and characteristics of an artifact had a positive impact on the carer.
- Tasks and situations and people's experience of dealing with these.

Representative examples have been chosen to present these phenomena. It should be born in mind that these were identified only as a result of mapping all the interviews.

Positive style state/negative style state

Having mapped each interview where the carers described how they dealt with situations, it was apparent that the maps tended to fall into two main categories: those that reflected, primarily, a positive style state of the carer and those that reflected a

negative style state. These two poles should be seen as stereotypes. In reality individuals experienced negative and positive style states.

Positive style states were associated with statements such as '*determined would resolve it*', '*go out and sort it out*', '*badger people*', '*am strong enough to fight, to find things out*'. These in turn tended to be associated with:

- understanding what questions to ask (a positive cognitive state)
- knowledge of the environment, in particular, the range of artifacts available for help and information, (a positive knowledge state)
- more proactive behaviour in terms of information seeking (positive behaviour – contacting a wider range of organisations)
- less negative affective states i.e. fewer occurrences of descriptions of despair and being overwhelmed by the situation.

However, although this tended to be the case, it was not possible to say that any one of characteristics was a determining factor. For example, it was not possible to say that positive style state necessarily led to a positive knowledge state or whether the reverse was the case. It is likely that each could encourage each other. It is possible that other factors play a role. For example, respondents who were categorised as reflecting a negative style state maybe less communicative that this led to less detailed data and therefore less interaction. Alternatively they may be less well educated which could lead to less confidence when dealing with bureaucracy. Or differences could be due to previous experience rather than any inherent style state. For example, one respondent had worked as a librarian, another as a formal carer, both fell into the category of positive style state and both were more proactive in their information seeking and had a better knowledge of their environment. The causal relationships between these factors could form a separate topic for research. What was important is that distinctions were apparent in terms of how people confronted their situation and that this had an effect on the respondents' experience as a carer.

Three positive style state maps have been chosen. These provide examples of

- positive style state

- proactive behaviour i.e. actively seeking out help from a number of artifacts (people, organisations, books etc.)

which is associated with better knowledge of the environment and also being put in touch with other artifacts. Contact with artifacts with positive character and behaviour leads to:

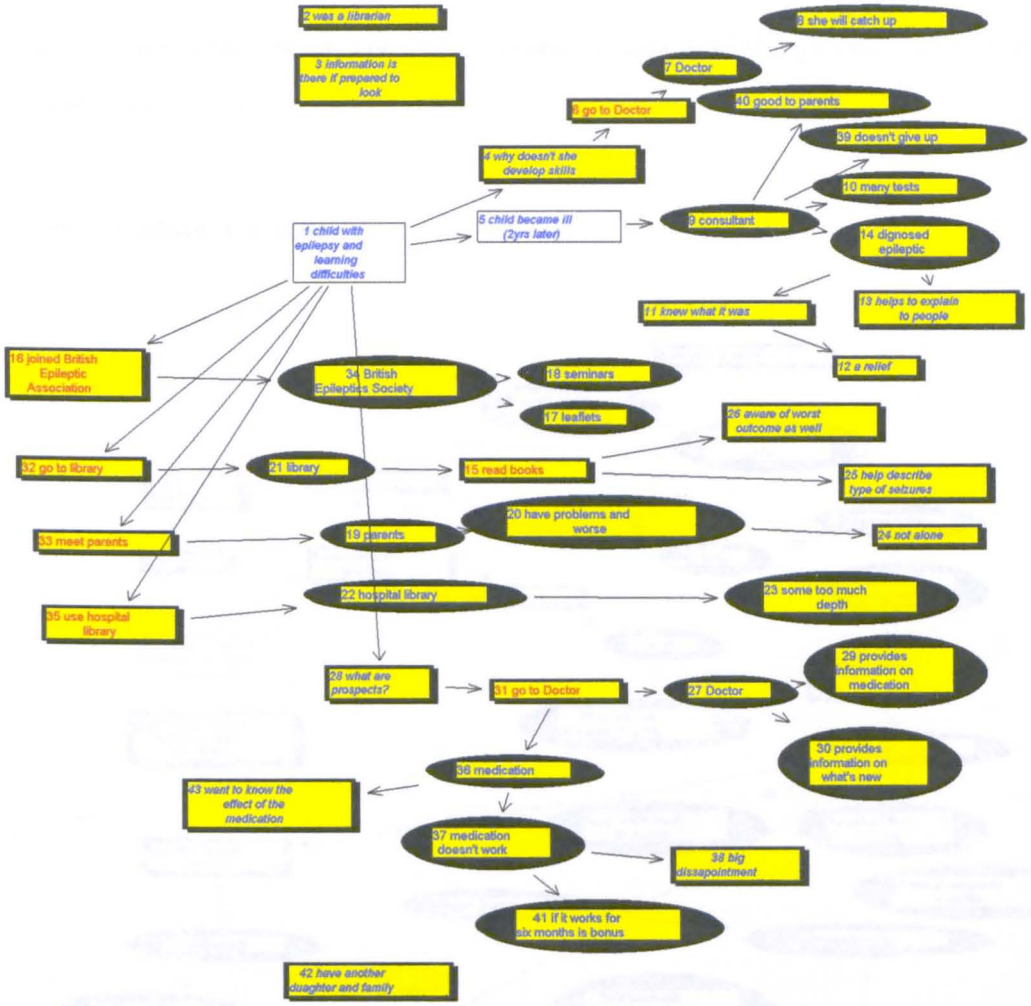
- contact with other artifacts i.e. one tends to see a 'snowball effect' either through information provision or through direct action where one artifact contacts a further artifact
- access to financial help; artifacts may provide financial support or facilitate access to financial support through, for example, form filling
- access to information which may
  - ➢ enable action
  - ➢ serve to bring about a more positive affective state. For example, in the first map the carer describes the '*relief*' of knowing what was wrong.
  - ➢ help to explain what is wrong to other people.

Map 1 provides a good example of the range of artifacts that the carer proactively gets in touch with and some of the benefits of these interactions. In addition the map shows what aspects of artifact character are valued by the carer, (the numbers refer to the map set number):

29 provides information on medication
30 provides information on what's new
39 doesn't give up
40 good to parents
41 if it works for six months is bonus

In addition '23 some too much depth' identifies a negative characteristic of an artifact which has implications for information provision i.e. it needs to be of an appropriate depth for the carer.

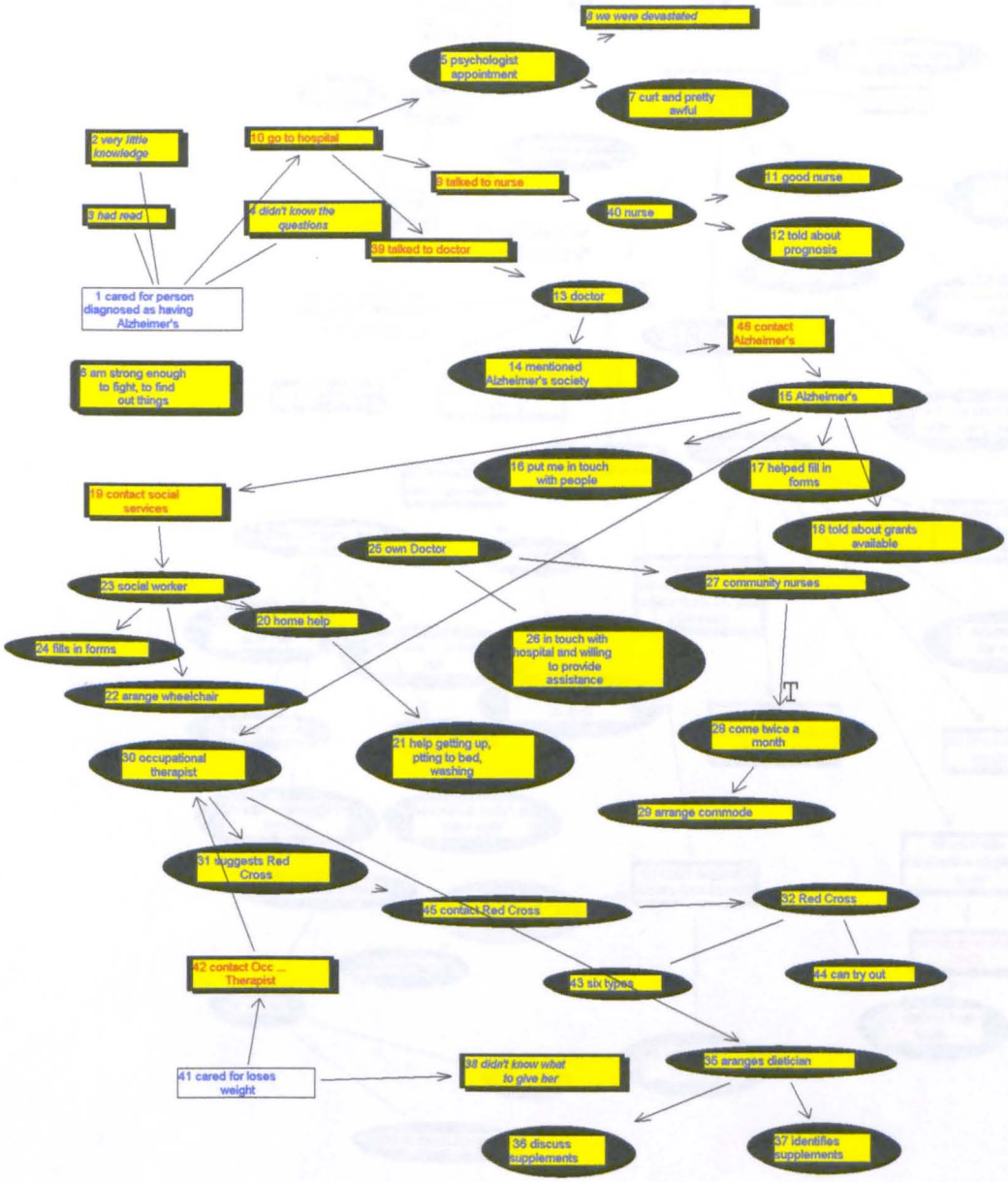
Map 1 Positive style state



In every map blue text/no background boxes describe the situation, red text/yellow background boxes contain behavioural data, blue text/yellow background/square boxes contain psychological data and blue text/yellow background/black oval boxes contain data on artefacts.

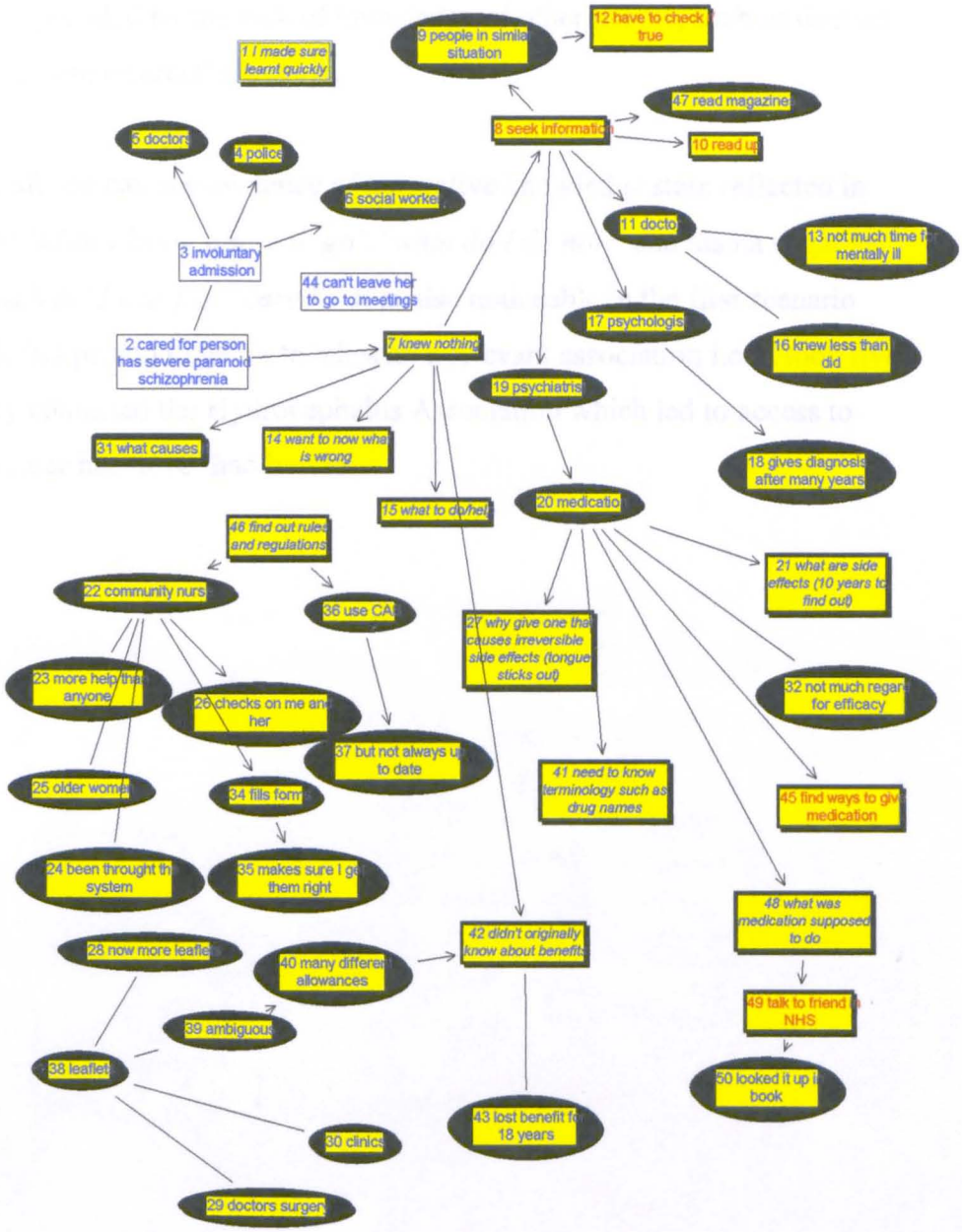
Map 2 provides a good example of an artifact with positive character and behaviour i.e. the Alzheimer's Society. The society played a significant role helping to navigate the environment for the carer, facilitate access to other artifacts (social services, occupational therapist), knowledge (about grants available) as well as help conducting tasks (fill in forms).

Map 2 Positive style state



In map 3 again proactive behaviour is evident and access to a range of artifacts. In addition, one can see the range of questions that are asked (positive cognitive state). Such questioning is less evident in the negative style state interviews.

Map 3 Positive style state

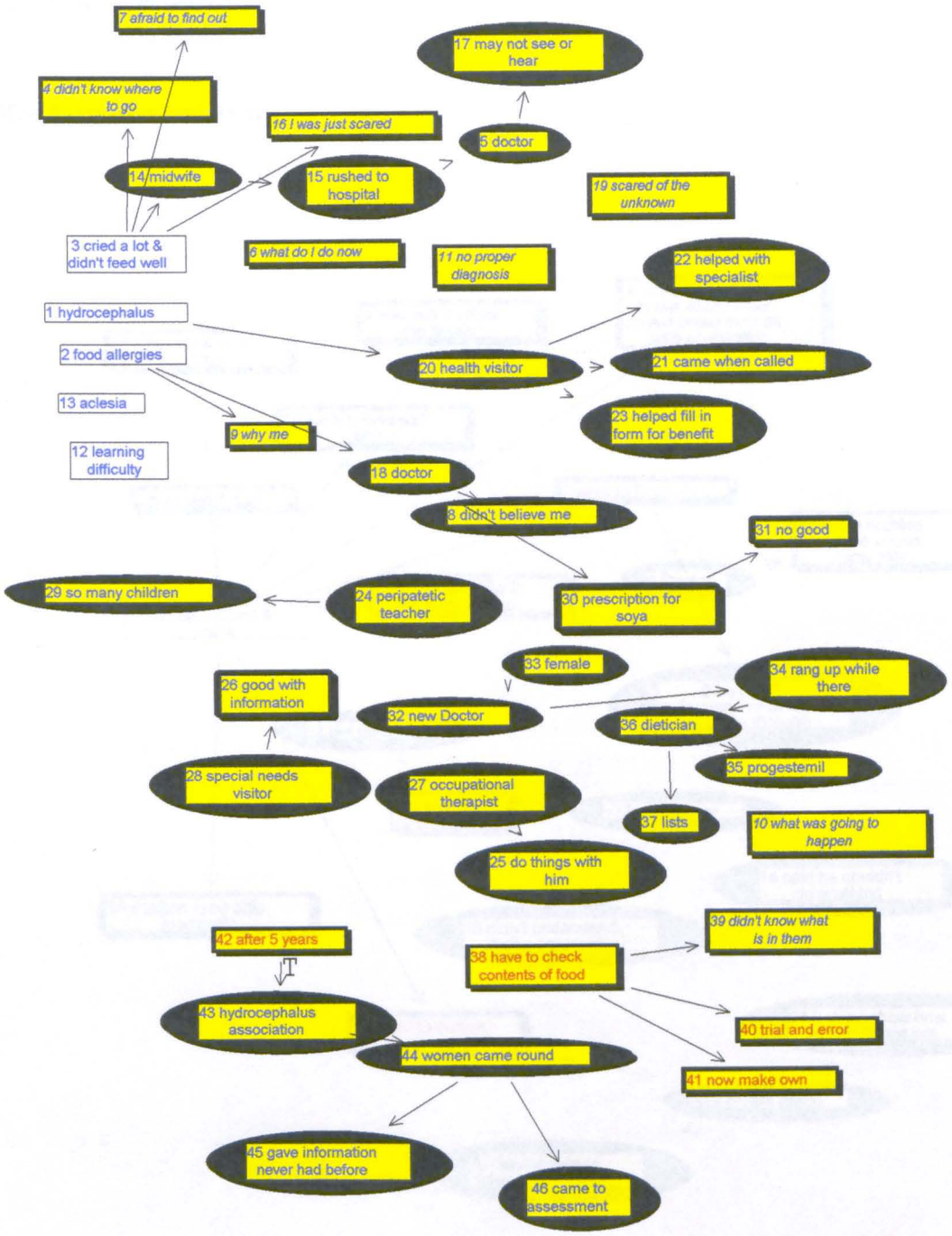


Negative style state

The following three maps show the results of interviews with carers where statements reflect a predominantly negative style state. The three maps show less evidence of proactive behaviour. In fact in map 5 the respondent, a young carer, states that they did not contact people. The young carers, unsurprisingly, showed the least knowledge, few questions and little proactive information seeking. This in turn meant lack of support from outside the family which exacerbated their isolation. This situation was compounded by the lack of knowledge of other people, such as doctors or teachers, of the young carers' situation.

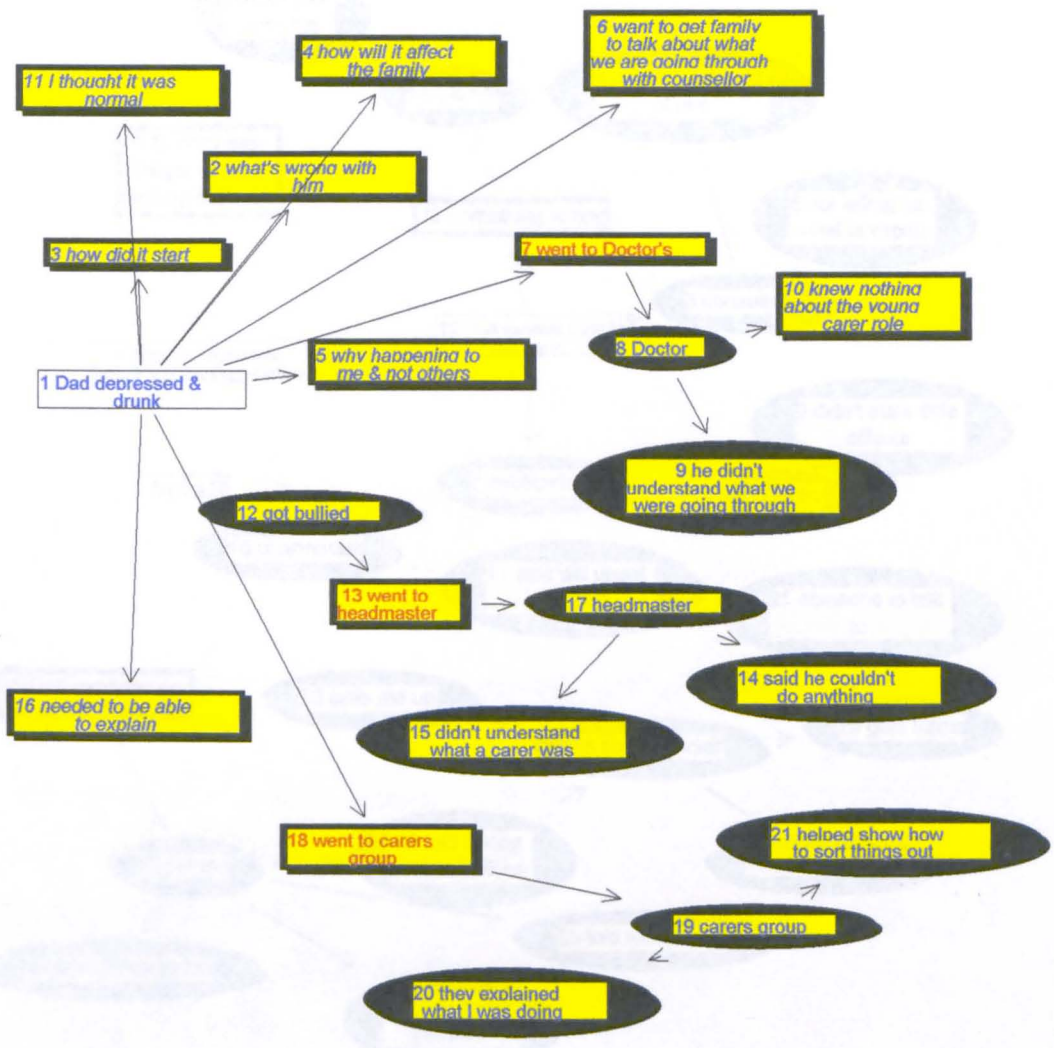
In map 4, overleaf, one can see evidence of a negative knowledge state reflected in questions such as '*didn't know where to go*', '*what do I do now*' and also a negative affective state such as '*I was just scared*'. It is also noticeable in the first scenario how long it took this person to get in touch with a relevant association i.e. it took five years before they contacted the Hydrocephalus Association which led to access to information the carer had never had before.

Map 4 Negative style state



Map 5 shows data gathered from a young carer which, at the 'negative' end to the spectrum, highlights the problem of lack of recognition or understanding of the young carer role and the consequent lack of support. It is only when the young eventually identifies the young carers group (quite how is unclear) that useful support and information is provided.

Map 5 Negative style state



Other young carer scenarios also highlight the need for information to be provided in an appropriate way. For example, one young carer talked about hospital appointments

with the cared for person and stated '*I never understood it the way they talk*', and with the doctor, '*sometimes can understand what they say*'. The isolation, due to lack of knowledge seems to be exacerbated '*didn't know others in the same situation*'. One carer stated '*I thought it was normal*' (see map 5). She had been caring from a very young age.

Map 6 Negative style state

Map 6 'negative style state' exemplifies poor interaction with the artifacts that are available. For whatever reason the respondent did not get a good response from health professionals. The consultant was unresponsive. The doctor did not believe

the carer and '*told just worrying*' when the carer first realised there was something wrong with her child. Eventually the most successful route was informal i.e. advice from the pharmacist that made the carer aware of the side effects of the prescribed drugs and the person who had a child in a similar condition. The latter was able to help the carer navigate the system.

Findings: Moments of interaction

As stated earlier, the use of interviews and the sense-making technique to gather data in the second case study did not lend itself to capturing data on moments of interaction unlike in the first case study where observation was conducted. To gather this kind of data, that in the first case study highlighted the iterative nature of information interaction and the process of gradually building a mental map of a domain, necessitates some form of observation or detailed logging of interaction so that it can be discussed with the respondent. However, despite the limitations of the method applied some data was gathered which highlighted positive and negative moments of interaction which in turn tended to indicate positive and negative artifact character and behaviour. Understanding these incidents would help to determine the characteristics of 'good' information artifacts and systems or services that would help to satisfy the needs of the carers.

As mentioned earlier extreme cases of poor interaction was where artifacts were unhelpful such as:

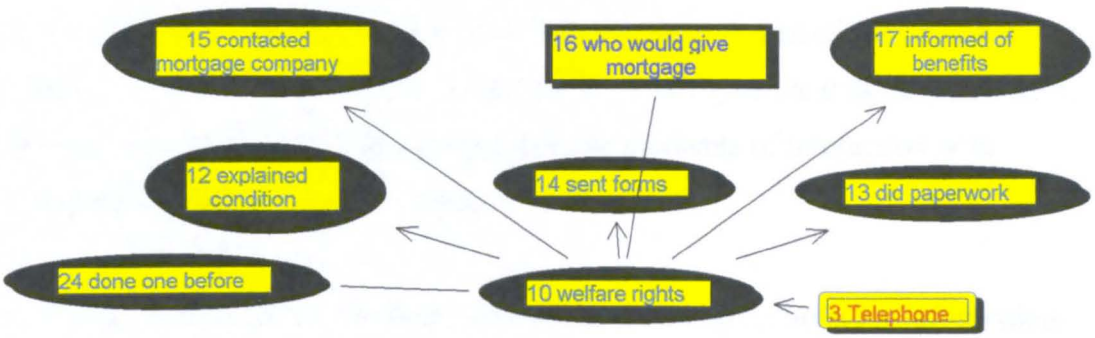
- the doctor who disbelieved the carer;
- the doctor who did not state the side effects;
- the provision of information that was too complex for the recipient;
- the difficulty of understanding the benefits system;
- the consultant who would not tell the carer what was wrong

Alternatively it was possible to identify very positive interactions such as:

- interactions with organisations that were particularly helpful partly because of the 'caring' character but also because they were able to satisfy a range of needs and facilitate access to a range of other artifacts including information, people and services. The interaction with the Alzheimer's Association is a good example (shown in Map 1), where interaction leads to further interaction with other

artifacts, cutting across service provider boundaries. Similarly in another interview the carer made contact with a Welfare Rights organisations as shown below

Map 7 Interaction with Welfare Rights organisation



In this case one can see how the artifact (organisation) provided access to information, were proactive in contacting other organisations, helped complete forms/paperwork and also how this was enabled by previous experience (knowledge) of the person working in the organisation. This led to a mortgage that the carer had previously assumed was impossible.

At the moment of interaction the impact of access to information became evident. Access to information about the medical condition of the cared for person was generally seen as positive, for example, the carer '*want to know what is wrong*', and '*what causes it*' and '*if you know you can deal with it*'. Interactions with information was generally perceived to be beneficial. For example, contact with a consultant in Map 1 led to a diagnosis which was good in that the carer '*knew what it was*' which was '*a relief*' enabling the carer to '*explain to people*' what was wrong. Reading books about the medical condition also '*help describe type of seizure*' i.e. to third parties which facilitated support. In addition it prepared the carer for '*worst outcome*'. However some interactions were less positive. With regard to books for example although providing information about an illness they '*don't tell you what to*

do'. Some books were also described as having '*too much depth*'. In one situation the carer was ambivalent about finding out too much and at a later date found information that implied earlier decisions may have been mistaken. This situation is not an argument for not providing information but rather the correct information should have been supplied at the right time and that information needs to be provided in an appropriate way.

As stated earlier although some data was gathered on the moment of interaction it was not detailed. However, this was to be expected from retrospective data on past events. Ideally more data would have been gathered on the moments of interaction with artifacts and situations and the experience of the respondent.

The next chapter analyses the findings, determines their implications for information service provision and reflects on the conceptual framework. This proceeds the final chapter that discusses the conceptual framework in relation to other models of information interaction and reflects on methodologies for understanding user requirements for information services.

Chapter 7: Informal carers - analysis

Introduction

This chapter initially reflects on, and further refines, the conceptual framework. This is followed by an analysis of the data using the three levels of analysis. In addition the implications of the findings for information service provision are given.

The objective of the case study was to determine whether:

- the conceptual framework that requires the researcher to focus on the environmental, the psychological and the behavioural aspects of the data was a useful construct and helped to explain the information experience of the informal carers;
- there were patterns of interaction between these three domains. In this case it was predicted that scenarios would be apparent that represented a recognisable form of interplay between the environment, the psychological and the behavioural. For example, interaction with certain artifacts would be associated with certain cognitive states which in turn would be associated with behaviour and also whether the idea of three levels of analysis proved useful and tenable;
- there were significant portions of the data on informal carers that did not fit into or were not explained by the conceptual framework.
- data captured and analysed using the framework could be used to help identify user requirements for an information system or service for informal carers.

The initial conceptual framework has, I would argue, at a broad level provided a useful starting point in terms of sensitizing the researcher to distinct categories of data that help to understand the individual's interaction with information. However, during the course of the research it can be seen that the initial framework has changed and developed. Concepts have been refined and redefined and different levels of analysis identified as discussed in previous chapters. Two further change took place.

This was to replace the broad category in the conceptual framework, applied in the first case study, 'environmental' with the category 'sociological'. This was because

the category artifact has been categorized as a separate class of data, source data, from what is now termed the sociological. The sociological 'class' of data now includes: roles, norms and tasks. This seems to be a more effective label since these phenomena are defined by the social context. The other change is that the term 'psychological' has been replaced with the term 'psyche'. This is because the data under this heading concerns the mind of the respondent i.e. the psyche, which describes what is being described whereas the word psychological does not. I am not entirely comfortable with this label however it does seem to encompass the four states: knowledge, cognitive, affective and style state. In the same way the other broad headings describe the type of phenomena that are being described i.e. artifacts, norms etc. However if one did categorise the various types of data they would fall under the headings behavioural, psychological, sociological and information source phenomena.

With regard to the second objective listed above, it will be shown that there does seem to be some correlation or relationship between the various concepts such as between the various dimensions like style state and behaviour, knowledge state and affective state. However, it has not been possible to categorically state 'rules'. There is an obvious opportunity for either large scale quantitative studies to see whether there is a predictable correlation between personal characteristics, such as blunter and monitor, and information interaction and also more detailed qualitative investigation to explore the characteristics of style states and their effect. This would be an interesting channel for further research but is beyond the scope of this thesis. However, it is evident from the data that, although it would be useful to explore in more detail these dimensions, one should be cautious about stating categorically that certain outcomes occur. This is because people can experience a range of states, positive and negative, at different points in time and in different situations. They can also experience the same situation in very different ways. Furthermore, if one accepts the personal constructivist nature of learning then it is hard to define exactly what any one individual will experience – nevertheless, generalisations can be made and an indication of the range of possibilities suggested. Perhaps it is more productive to think of these as recognised transitive states. This strategy encourages the developer of an information service to present a range of possibilities to the user rather than trying to determine a specific path that the user should follow.

The third objective concerned the efficacy of the conceptual framework to explain and encompass the data that was gathered. Generally it is argued that it has provided an effective tool to enable the collection, organisation and analysis of data. There were not large 'chunks' of data that fell outside the conceptual categories. All quotations did fall under the headings in the framework. However, as stated, categories were refined and in some cases subdivided. For example, the broad concept artifact was unable to encompass important features of artifact i.e. their characteristics and behaviour. In addition, having started with a two-dimensional view of information interaction, (macro/micro), three levels of analysis developed: the group, the individual and the moment of interaction.

The fourth objective has I think been satisfied and will be demonstrated in this chapter in the sense that the framework has enabled sufficient data to be gathered to make recommendations for information system and service provision and that this is an indication of the usefulness of the conceptual framework.

The conceptual framework

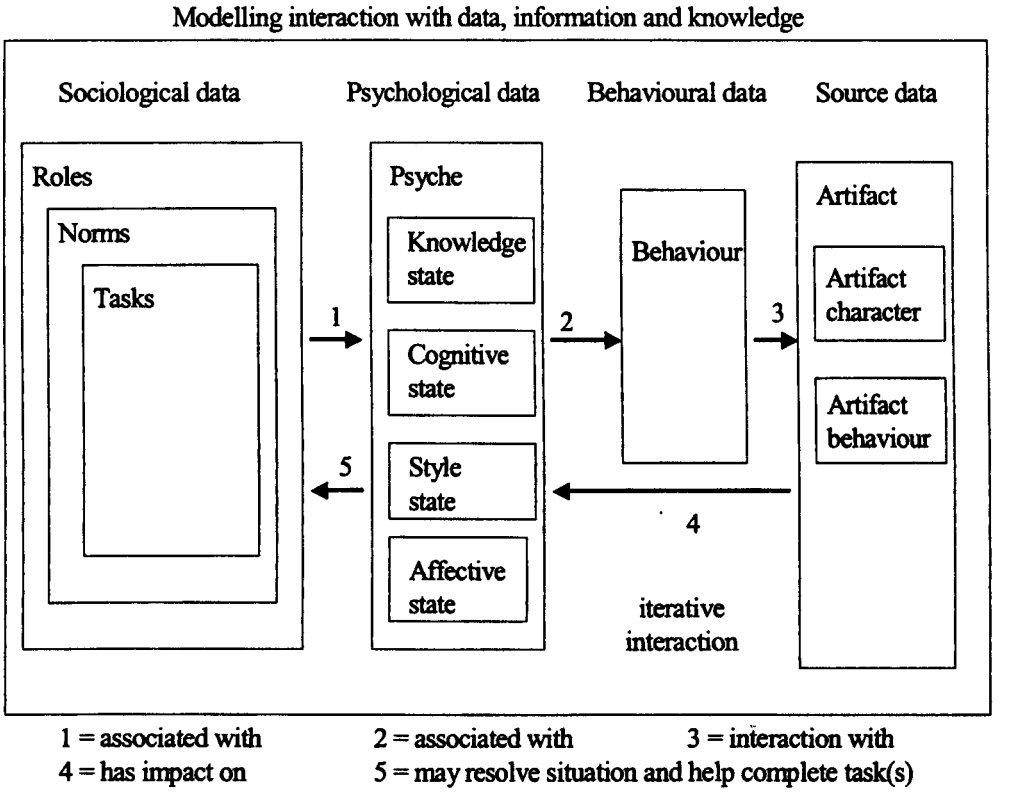
The intention now is to provide evidence for the usefulness of the conceptual framework through its ability to synthesise, distil and present an analysis of the findings – as well as to describe phenomena which was the purpose of the previous findings chapter. This in turn will lead to an identification of the requirements of the target community for an information service and recommendations for solutions. As with all qualitative research, judgement of the value of the research is made, to a great extent, on the apparent authenticity of the findings which implies reliability and validity. Kirk and Miller, (1986), introduce the term 'currency' meaning what the research will 'buy' which in this case refers to ability to specify user requirements for an information service. They also question whether phenomena are properly labelled, this refers to 'construct validity', which draws attention to the categorisation of phenomena which in this case have, I would argue, been grounded in the data as shown through the extensive use of supporting quotations. Other criteria for validity include 'pragmatic validity'. This will be discussed primarily in the next chapter, summary and conclusions, in terms of whether the findings and analysis are supported by, or build on, previous research. The reliability of this research will be judged not

only on the way the research has been conducted but also in terms of whether consistent results were achieved across the two case studies and also in relation to previous research. This will be discussed in the final chapter.

The conceptual framework can be visualised and modelled as shown in the following diagram. Members of the target community are a part of the wider society. An individual member can, of course, fulfill a number of roles with associated norms and tasks. Specific tasks may, for example, deal with problematic situations or incidents associated with obtaining a particular allowance or organising a wheelchair. In the original model, these all formed part of the general category environment as did the concept artifact. These could still be considered part of the external environment to the individual. However, it seems useful to visualise the concepts as shown below because it emphasises the importance and nature of artifacts and also the effect they may have. It also reflects the 'driving' force of role. For example, the data on psyche and artifact tends to be connected with the role and tasks that the researcher is trying to understand and hopefully support through the recommendation and development of future information services. However, the psyche and behaviour of the individual are not determined only by the immediate situation, task or role or associated norms. The experience of the individual in other domains would also have an influence. An indication of this was the possible impact of the previous work experience of the carer on style and information seeking behaviour. For example, a carer who had been involved in administrative work seemed better able to deal with bureaucracy and other administrative structures.

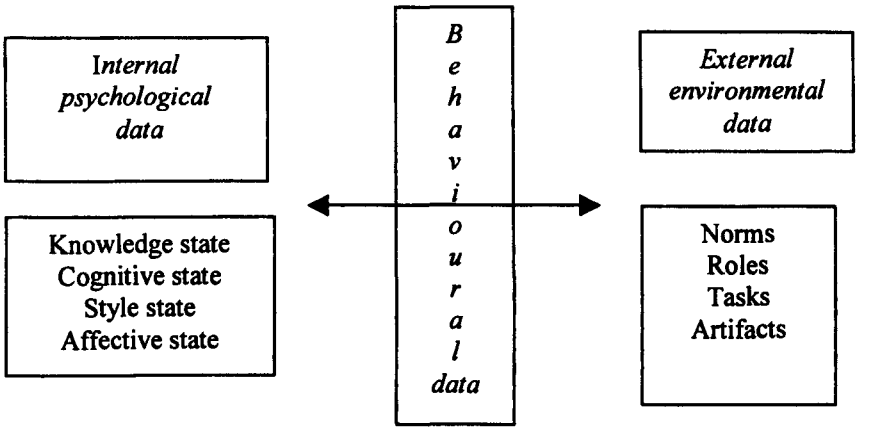
The framework shown below can be applied using the three levels of analysis: group, individual and moments of interaction. The group level of analysis is concerned with aggregating and listing data gathered about the group. This would include the range of artifacts used or needed, the tasks, behaviour etc. At the individual level this data is put in context in terms of paths people go down and sequences of events over time. This will include data on tasks, use of artifacts, associated states. Moments of interaction describe a point in time, when an individual interacts with an artifact. This will be associated with a particular role, norm, task, role, state.

Figure 19 The final conceptual framework



Therefore data, on the informal carer community, or any other community, can be synthesised and presented using this framework. Furthermore, it is argued that, presenting the data in this fashion provides a rich picture of the requirements of this community for an information service as well as highlighting areas that could be explored in detail. In terms of types of data it would nevertheless be possible to describe norms, roles, tasks and artifacts as part of the environment in that they are external to the individual. This could be shown as follows:

Figure 20 Internal/external data



Behavioural data results from an interaction between the internal and the external 'worlds'. This would conform to the original framework that was applied in the first case study. However I think that figure 6, provides a richer picture of the interaction between the categories of phenomena in the framework and helps to clearly distinguish between the distinct classes of data.

Group level of analysis

Sociological data

Roles

The role, (that the researcher was interested in), of this community is to informally care. This has been defined as a person who cares for another person for fourteen hours or more per week and is not formally employed for this purpose. Within the role of informal carer there was a distinction between carers in terms of the condition of the person they cared for. All carers, however, shared common needs, including the need to understand the health service, social services and the non-government sector. Certain information needs, however, may be specific due to the medical condition of the cared for person, for example, the need for dietary information or information about a specific condition such as Alzheimers. There were also specific situations that could apply to all carers but depended on their individual experience, such as moving home or getting a wheelchair. We therefore have:

- generic needs associated with the role of carer;
- generic needs that may be associated with the role of carer (depending on specific events);
- specific needs that relate to categories of carer whose experience has unique qualities such as those that care for a particular condition or young carers.

An information service could present information in accordance with these three types of need.

Norms

The norms associated with the role of informal carer are epitomised by the quotation,

'I will look after him as long as I can' (adult carer).

Norms are not an area that tends to be discussed in terms of information provision. I would argue that norms of this kind should be made explicit and discussed. This is because they have implications for the carer. Information, for example, could be provided that did discuss these issues and helped the carer to set 'normative' boundaries around the role of carer. This kind of discussion would lead onto related topics such as respite for the carer and forms of help that may provide some relief for the carer which otherwise may not have been explored due to the acceptance of the overriding norm of selfless unstinting care. In addition, information could be provided that helped with the related interpersonal issues that these norms raise. For example, it has been noted that several carers talked about the difficulty of juggling their commitment to the cared for person with responsibility for their family. Related to this is the complex relationship beween the carer and the cared for person. The latter may not be in a condition or frame of mind to appreciate the care that is being given and in some cases may not be co-operative. These situations are difficult to deal with and carers had to cope with the internal conflict between the norm and the reality of caring for, in some cases, a 'difficult' person. Skills are required to cope with these situations. Information and advice and probably training are therefore required to help the carer to come to terms with and possibly resolve situations that may result from norms associated with their role.

One aspect of an information service would be to recognise these needs and provide information on these areas. Video would probably be a particularly effective medium for training people in these interpersonal skills as well as text. In addition, the opportunity to share experiences of how other carers cope with these situations would be useful – particularly because this area is generally not talked about, partly because admitting difficulty in this area, that is the relationship with the cared for person, in a sense contradicts the norm and is taboo.

Providing information on this area would also be beneficial to other people who have contact with carers. Professional fieldworkers need to be aware of these norms and their impact on the carer.

Norms and attitudes, however, were not explicitly addressed through the survey methodology and it is an area that would deserve further investigation particularly in terms of how norms may impact on information behaviour and information needs. Perhaps, for example, the carer norm epitomised by the quote could encourage a tendency to struggle on without seeking external support.

Tasks

Again due to the methodology applied in this case study little explicit effort was made to investigate the tasks of the carer in comparison to the first case study where task analysis took place. However a number of tasks became apparent and were stated in Chapter 6 but are worth repeating here, including:

- organising health care related services
- organising social care such as home help
- organising financial support to enable caring to take place

Tasks that were common but not always evident were:

- managing the diet of and in many cases feeding the cared for person
- administering medication
- facilitating the mobility of the cared for person. This often involved manual labour but also included organising a wheel chair, stair lift or taxi

- adapting the accommodation to cater for the cared for person

Less frequent were:

- identifying suitable accommodation

One young carer mentioned *'get her happy because she is always miserable'*. This may be a common yet unconscious task. Other tasks such as washing were mentioned and the questionnaire survey revealed a number of other tasks such as doing paper work etc. The nature of the sense-making interview, by asking the respondent to concentrate on situations that stand out in their mind, does however tend to focus on the most significant events rather than these day-to-day tasks.

In terms of information provision these tasks do provide one structure for presenting information to carers. Many routes would be used to present information to carers, for example an A to Z listing of relevant job functions in the NHS, however one way to organise data, information and knowledge provision could be around the tasks carers undertake. This would be, for example, a 'how to' or 'frequently asked questions' approach associated with tasks such as organising a stair lift, administering medication or organising health care.

Source data

Artifact

Artifacts that the carers, as a group, interacted with can be summarised as follows:

Organisations

- Government
- Non-government
- Commercial

People

- Health service professionals
- Social service professionals
- Commercial service providers (transport, pharmacist etc.)
- Non-governmental organisation staff

- Carers

Information objects

- Books
- Leaflets
- Directories
- Newspapers
- Television
- Radio
- Forms
- Prescriptions

Equipment

- Mobility aids
- Medical aids
- Other specific aids e.g. for eating

Services (in the home)

- Home help
- Meals on wheels
- Occupational therapy
- Medical service e.g. nursing

Services (hospital)

Financial

- Allowances (attendance, mobility, council tax etc.)

It can be seen that carers as a group come into contact with and need to know about a wide range of artifacts. Many of the carers did not know about the range of artifacts, particularly when they started caring, and were unsure about the function of these artifacts. Some are specific to carers caring for someone with a particular condition. Others are relevant to all carers. Some are relevant to carers at specific points in time. Building up a mental map of this information landscape was not easy for the carer and developed over time, generally with the assistance of other people who were familiar with the environment. With regard to organisations and people and services in some cases carers were unclear about where 'helpers' had come from and how they had got in touch and did not know about the organisational structures within which these helpers operated, as the following quotation shows:

A - 'Well someone from Leics came to see me about benefits, I can't think what her name was.

Q - She came because you asked her or ...

A - I can't remember, a social worker, and I think it was through her, I am not sure, I am pretty sure it was but ...I don't know quite where she is involved but she says that she has a survey and she says there is a grant'

An information service for informal carers would need to enable people to map and navigate this information landscape showing the relevant organisations, their role, the function of their staff and the services they provide and how they can be contacted. Ideally a service that provided information and access to these artifacts would need to be able to relate to the situation of the carer in terms of:

- the condition of the cared for person,
- whether the carer was a new carer or experienced and
- the specific situation that the carer was trying to resolve.

As well as directional information telling people about agencies and how to contact them carers would need to understand the organisational structure, their functions, how they could help and the services they provide, eligibility for these services and how their help could be instigated.

Informative content would also need to be provided on specific artifacts such as equipment. For example, objective information on equipment supplemented with reviews of, for example, the various wheelchairs. Guides to relevant allowances would also be useful, particularly if was presented in a way that related to specific situations experienced by the carer. Carers found this area one of the most difficult to navigate as will be seen form the psychological data about knowledge states and cognitive states. Factual information could also be supplemented with articles and reports from the media. These were used by carers and may present information in a form that it is suitable for many carers, in other words, condensed and easy to understand.

The range of information objects also has implications. Carers' information can and should be gathered from a range of sources. For example, certain channels and mediums may be more effective for disseminating data, information and knowledge. The range of information objects used implies this. However, it is unclear from the data whether this range is a result of chance and reflects what happens to be available to the carer. Or whether certain channels such as television and mediums like video are more effective for disseminating information or are more appropriate for different consumers.

Artifact character

Artifact behaviour and character were found to be significant. Identifying these characteristics and positive and negative features has implications for the necessary attributes of an information service.

Analysis of data on artifacts and the respondents' interaction with them provides an indication of the information needs of the carers. It was also noticeable how some artifacts play a key role, (in this case primarily people), in navigating the environment, for example the Alzheimer's society or the Welfare rights organisation. The role of these artifacts is reminiscent of the positive role of gatekeepers identified in organisations by Allen, (1979). This environment is made up of other artifacts which, in the case of carers, is primarily agencies and people working in these agencies who can provide information and knowledge and access to services, support, and places to go where information can be gathered. Various types of support can be identified such as medical support and help with caring tasks. One of the key functions is seen to be filling in forms that are crucial for getting access to financial support or equipment, or to instigate access to services.

Another feature that is apparent is the importance placed on information and the recognised need for information. Furthermore, the way information is provided is also fundamental. The ideal can be seen to be the proactive provision of information and provision that takes into account the total situation of the carer and cared for person rather than reactive and incomplete provision. The issue of the quality of artifacts is also highlighted and the need to ensure that the correct and appropriate information is given. The manner of the artifact is an aspect of its quality. Positive

descriptions of the sensitive and caring nature of 'good' artifacts have implications for the provision of information services and the 'attitude' that is presented which would be different from, for example, a service catering to a business audience.

Encapsulating many of these positive qualities is 'the person in a similar situation', *'you have really got to talk to someone who has been through it'*, who has knowledge that can be applied directly to the situation of the carer needing information. However, as one carer pointed out, when one gets information from informal channels one cannot be sure about the quality of the information. The community nurse was also often described in this light due to their ability, in most cases, to combine sensitivity with an in-depth knowledge of the carers' situation and the environment.

The attributes that should be associated with a 'good' information service for carers, (whether this is a face to face, paper based or electronic service), include:

Artifact character

- Accessible
- Flexible (able to cater to individual situations)
- Knowledgeable
- Listen
- Good manner
- Proactive
- Information provider
- Responsive
- Appropriate information

It may seem strange to apply these criteria to paper or electronic information service. However, the implications are clear. Even a paper based service can be 'accessible' in terms of the ease of finding the information which has implications for its distribution i.e. either proactively sent to the home or in media that are commonly accessed, such as free papers or locations like carers' support groups. 'Flexible' implies that services should be responsive and adapt to the situation and needs of the carer. Therefore the usefulness of information that is only accessible outside the home is limited. Exceptions however would be when information is provided in

places carers tend to go such as the General Practice, the chemist or Post Office where they would need to be presented in a way that caught the attention of the carer. 'Knowledgeable' may seem obvious but it was apparent that service providers were, in some cases, not knowledgeable about their own services or about other services. Because it is difficult for carers to access services it is important that any contact they have is knowledgeable and informative. This has implications for the training of and information provision to the range of professionals that carers come into contact with. A health professional cannot be expected to know in detail about social services. However they should have some knowledge and have access to information so that they can distribute it where necessary.

'Listens' may be an inappropriate category for print, however, in this case printed material should provide directional information to services where people will 'listen'. Electronic services could facilitate access to experts or professionals who can 'listen'. In addition, technology could facilitate access to other carers in the same way, for example, electronic discussion lists have been set up for people with multiple sclerosis to share information and experiences.

'Knowledgeable' *'she is a mine of information'* has implications for the depth of information provided. For example, for this community, it is probably not enough to provide directional information to other sources of information. NHS Direct and similar services tend to lead the reader to a reference rather than actual information. This also has implications for quality control and the vetting of information that is provided. 'Poor information provider' which is a cited negative characteristic also tends to be associated with incomplete information provision. The irritation of dealing with people who lacked knowledge is made clear by the following quotes: *'I mean I knew more ... she couldn't even open one' (wheelchair) ... if someone had been there to totally tell you about things from start to finish'* and *'barely out of nappies ... (they) haven't got a bloody clue about hands on handling the situation'*. The impact of the characteristic 'proactive' is less clear but has implications for the availability and the possibility of providing carers with information when appropriate or when new information becomes available. Although this kind of thinking has been applied in the commercial and scientific domains it is far removed from the current information environment associated with carers.

'Manner' was an important criteria, in relation to how people interacted with the carer. The abrupt, remote manner of several consultants and the patronising character of other health professionals, to the extent that, incorrectly, they did not believe the carer, epitomises inappropriate character. Therefore, information provision needs to done in a way that is sensitive to the carer and should be aware that, in some cases, there is a depth of experience.

'Responsiveness' again has implications for information service provision. For example, if a facility offered a question and answer service it would need to respond, and respond in a time frame that was thought appropriate. This may seem ambitious but, as NHS Direct has shown, services of this kind are possible. Such services can be responsive without depending on an immediate response from a person. This kind of support in the home is important for this community because of the difficulty they have in leaving the home and the need to relieve the sense of isolation that has already been identified.

Negative characteristics such as 'poor information provision', 'complexity of information' and 'information overload' draw attention to the format of the information provided. In some cases medical information was provided in a way that was too complex to understand. Different levels of complexity and detail are probably appropriate at different points in time. For example, initially a new carer probably needs orientating to the services available and background information on the medical condition of the cared for person. Greater depth could be provided later. Information also needs to be supplied that relates to specific situations as needed.

Artifact behaviour

Good artifact behaviour can be summarised as follows:

Artifact behaviour

- Enabling contact with other 'artifacts'
- Contact in the home
- Information provision
- Form filler
- Financial help

General services (such as helping with day to day tasks)

'Enabling contact with other artifacts' was found to be a crucial role of services. In particular those agencies that were able to facilitate contact with organisations and services across the board. At present there seems to be a great deal of dependence on other people to 'set the wheels in motion'. Part of the barrier to information access has been the partisan nature of information provision. For example, certain organisations tend to only provide information on their services or that part of the service they deal with. This is a recognised problem and is beginning to improve. Again the need for 'joined up' services is extremely important when addressing the needs of a community where it is difficult to leave the home.

From an information provision perspective these aspects of artifact behaviour have implications. Information needs to be made available in the home either face to face, by paper or electronically. In the future it is likely that the World Wide Web will play a significant role in satisfying these needs, partly because it can be made available in the home. However, the cost of access and, the skills necessary to use such services as well as the service design issues would need to be resolved.

'Provider of information' was a common description given to a good service provider and referred to features such as 'discussing', 'giving print' (leaflets etc.), 'drawing attention to services', 'finding out', 'showing how to apply'. This demonstrates that there is a genuine demand and need for information provision.

'Form filler', which is a similar function to 'making contact' was a common 'good' attribute given to a service provider by carers. This was seen to be a fundamental service. Otherwise carers would not have accessed services. An information service for carers would, therefore, need to provide advice and help on the filling in of forms and enable access to appropriate forms. Links to 'experts' whether real or virtual would also facilitate this activity which after all is part of the information and communication chain between the carer and their environment.

Direct 'financial help' from non-state bodies was rare and limited to charities, the church and in one case a previous employer. However, as will be seen, when

knowledge state is considered, knowing how to get access to sources of finance was one of the main issues for carers following medical knowledge.

With regard to 'general services', that tended to concern day to day tasks, it covered a wide range of services including gardening, laundry, shopping, a trip out. An information service would need to enable access to services such as home repairs or laundry. In addition, practical advice could be given on how to conduct tasks like paperwork or giving medication. The full range of tasks, undertaken by carers and the knowledge states and cognitive states associated with them, require further investigation.

In conclusion, from this section on artifacts it can be seen that capturing the positive and negative attributes of artifacts could also play a role in benchmarking and evaluating information service provision to carers.

Behavioural data

Behaviour

Behavioural data provided an insight into what the target community used and hence suggested what artifacts they need to use to access relevant data, information and knowledge. It also provided an indication of how they want to interact with the artifacts around them. Behavioural data, therefore, complemented other data in terms of helping to understand what people would like to have or need. Behavioural data is probably one of the easiest to capture plus it has the attraction of being able to be gathered by independent observation which implies some form of objectivity and empirical validity. Whereas psychological data tends to depend on subjective descriptions and interpretations as data on norms does. In this case study behavioural data depended on what respondents said they did – which, as noted, tends to lead to simplification of the data.

Data on behaviour was synthesised as follows:

Telephone contact with

Social (social services, non-government organisations)

Health (health service, non-government organisations, independent practitioners)

Educational services

Police

Equipment suppliers

Reading (generally medical literature)

Visiting

Consultation

Sharing

Educating

Conducting tasks (feeding, giving medication, filling forms, getting equipment etc.)

Using the telephone to contact services was the most common behaviour. This means of remote communication is likely to be important partly because of the difficulty the carers have in leaving the home. The immediacy of telephone contact was seen as important. An effective method to resource services for carers from the home, is therefore, seen to be important and could be supported by electronic means. Electronic means could, in fact, be more effective than using the telephone because messages could easily be left providing a written rather than verbal record. This would, assuming it was dealt with, reduce the frustration of not being able to get through, being held in a queue, getting through but then being redirected to another person and possibly experiencing similar problems. Written records are also less likely to be ignored and are easier to manage from a service provider's point of view because they are easier to store, organise, analyse and distribute, for example, to re-route. Such a service would also aid the logging of calls. This could facilitate the development of services like providing responses to frequently asked questions. These could be accessed not only by the end user but also by the service providers to help ensure consistent responses and as a means of knowledge management. In addition, if access was secure and callers could be identified using a unique identifier then previous records of interaction could be called up which would help to ensure continuity of help and reducing the need for carers '*to say all the same things over and over again*'.

In addition to e-mail based services, which facilitate communication but are not interactive in real-time, the use of chat and electronic whiteboard facilities as well as image and video could also be used to enhance interpersonal communication. However the necessary infrastructure would need to be put in place to support such a service and, in addition, technological and administrative changes would have to take place to enable this to happen. Issues such as data protection and privacy would also need to be addressed.

The majority of carers read books, leaflets etc. that they could find, and as will be shown later, the most common cognitive state was trying to find out about the medical condition (closely followed by trying to find out about financial support). One carer went to great lengths to find material using a contact in the hospital to source medical books. However, as indicated earlier, when discussing artifact character the content was often inappropriate in terms of the language used and the level of detail. Therefore, there is a need for medical information to be accessible that is appropriate for people with little medical knowledge. If sufficient thought was given to this problem it may be possible to provide material that is appropriate depending on the state of the reader and their situation and to gradually enable the carer to learn about the medical condition helping effective management of the condition as well a less stressful state of mind for the carer.

'Visiting places' was associated with a range of situations including going to various agencies. In several cases there was a need to see a place where the cared for person was going for a short or extended period such as a respite centres or a special needs school. In these situations it was extremely important, due to the relationship of the carer with the cared for person, to make sure that these places were going to be appropriate and that the cared for person would not be unhappy and that they would be well cared for. Again the problems of leaving the home and the cared for person created a barrier in terms of the carer getting to see these places, in addition to the problem of finding out about these places in the first place.

The opportunity for virtual tours could help the carer to at least get a first impression of the location and the services provided, particularly if it was supplemented with the views of other people who had had experience of these services. Questions could be

raised at this stage that would enable the carer to be better informed perhaps helping the carer to narrow their choice and be better prepared for their visit. Effective e-mail communication could also reduce the need for some visits.

'Consultations' outside the home tended to be with experts in the various areas identified, but particularly in the medical area where they may be combined with check ups, treatment or diagnosis. Similar kinds of meeting were held with social services staff, educational staff where the cared for person was a child or young adult and with non-government organisations such as Welfare rights or condition related associations. The latter, however, tended to come to the home of the carer rather than expecting the carer to come to them which was most welcome. The opportunity to have dialogue with an expert from the home would therefore be welcome.

'Sharing' refers to the sharing of data, information and knowledge informally between carers and other people they may meet (neighbours, relatives etc.). As noted earlier this was seen as an excellent way of becoming informed, particularly where others were having or had had similar experiences. There is therefore an obvious opportunity for an information service to facilitate this sharing whether via discussion groups or other means such as case studies circulated by newsletter. However, as one carer pointed out, the information exchanged in this way needs to be vetted and to undergo a process of quality control. This could be achieved by using a moderator. An alternative strategy would be to give information such as this a low ranking (one star) until it had been vetted by the community and or experts external to the community.

'Getting equipment' was relatively common. However, finding out about equipment or trying out equipment was not easy and should be facilitated bearing in mind the difficulty of getting out to visit places where equipment could be viewed.

'Educating' was cited by one adult carer and three young carers. It is interesting to note that Bruce, (1995), when discussing various levels of information literacy, associated this kind of activity with an advanced stage of information literacy because, as in this case study, it tended to be associated with people who had been carers for many years. They had now reached a point where they were educating

others about carers. For example, one adult carer was attending the local government policy meetings and presenting the carer situation. The young carers had been involved in presenting to doctors and informing them of the role of young carers.

Other 'behaviours' were evident but less common. As mentioned earlier some tasks, which one would assume were relatively common, such as 'medical supervision' or 'feeding' may have been downplayed because they did not stand out as significant events in the mind of the carer. If observation had been conducted or particular attention had been paid to day-to-day tasks the importance of other tasks may have been more apparent.

In general the behavioural data shows that the key services that carers interact with are state medical and social services. The importance of the non-governmental medical association are probably under-represented in the behavioural data judging from the positive descriptions of the help provided by such organisations as shown in the 'artifact/artifact character/artifact behaviour' data and also later in the data on individual situations.

One aspect which has been emphasised but is worth emphasising again because it was very evident and has impact on the behavioural data was the problem of leaving the home and getting to places either with or without the cared for person as the following quotation makes clear:

'I've never been able to go to meetings [carers group], *but I get the newsletters'*

Each of the behavioural activities of the carer, including the tasks highlighted through the questionnaire, require further investigation. Due to the lack of observation, because of the time constraints imposed on this project, limited data was captured on the moment of interaction. Further study of how these interactions took place, exactly what with and their effect would help to gather a richer understanding of what takes place, its value and how it could be improved.

Psychological data

Psyche

As shown in the redefined model data that concerns the mind i.e. the psyche, falls under the broader heading of psychological data. The following categories provide a synthesis of the data:

Knowledge state

Medical

- condition or illness of the cared for person
- medical terminology
- medication
- side effects of medication
- diet

Organisations

- organisations that they need to interact with and may be useful

Finance

- sources of finance
- eligibility

System

- 'rules of the game' – how the government's health and social system works including knowledge of changes that take place, for example, new allowances or legislation, but also practical knowledge such as the best time to phone.

Equipment

- equipment for the cared for person to enable them to function
- strengths and weaknesses
- for the home
- to enable mobility.

People

- learning to manage people

The categories of knowledge state have obvious implications and correlate with the types of artifact used. There is a particular need for knowledge about medical and

health related areas. In addition, knowledge about sources of finance, the relevant organisations that they may need to deal with and how interaction with these organisations and the 'system' works is fundamental. In addition knowledge about equipment was also highlighted as important. Further research would, however, be necessary about exactly what the carer needs to know and how this knowledge would be best conveyed. For example with regard to a medical condition exactly what does the carer need to know, how much do they need to know, when do they need to know what and how should this data, information and knowledge be communicated? The latter would help to define the appropriate media, format, depth etc.. One area of knowledge that was highlighted by young carers was the need to understand their own role and to be clear about what they are doing. One young carer, for example, only realised that they were a 'carer' after many years of caring.

One area that tends to get overlooked is the 'people' category of knowledge. It was evident from the interviews that carers had great difficulty juggling with the demands of their relationship with the cared for person and in some cases their own family. Furthermore the relationship with the cared for person was very stressful. This data implies the need for training or advice on how to help deal with the relationships.

Different levels of knowledge have implications for information provision. As can be seen from the findings new carers generally '*knew nothing*'. Young carers had very little understanding of the system, organisations or the medical condition that led to uncertainty. A better understanding of the levels of knowledge state and how they affect the learning experience and their impact on information needs therefore also deserves further investigation.

Cognitive state

Uncertainty (a conscious state of unknowing about a situation or topic)
Questioning (specific questions asked)
Strategic (mental strategies such as '*finding out for oneself*', '*taking time to sift information*' etc.)
Reading about the condition
Using directories

Cognitive states provide an indication of the questions in the mind of the user, what they would like to know, mental strategies they have developed as well as cognitive skills. The category 'uncertainty' reflects the expressed need to want to find out about what is happening now, what will happen in the future. A lack of understanding in these areas tended to be represented by 'what if ...' questions which were often associated with severe anxiety. Getting some kind of answer to such questions would be of great benefit. Capturing specific questions, such as, how a certain benefits work provides a clear indication of information need. Strategies provide an insight into cognitive strategies that could be encouraged or helped or communicated to other carers, for example, *'juggling people'* or *'dealing with instructions'* or *'reading about the condition'*.

Greater depth would also be required about cognitive state and, for example, the specific questions the carers ask. Although data has been gathered on this area and one can see the areas that questions fall into, such as about the medical condition, further research could be conducted that specifically probed respondents about questions they needed answers to and also what questions related to specific situations. This in turn could lead to the development of information services that addressed specific questions.

Style state

A 'positive' style state was represented by statements such as:

'Strong'
'find out'
'manage'
'do it yourself'
'chase'
'be proactive'
'badger'

These style state characteristics do not obviously have significance for the design of an information service. However, one could argue that the system should enable and encourage these positive style states and information could be provided, quite specifically, to encourage and enable these states. In addition, it could be helpful to

make the carer aware of these different style states both negative and positive and the likely implications. Perhaps this would help them to reflect on and adapt their behaviour. It is also important for health and social professionals to be aware of these different style states so that, for example, they can recognise someone in a negative style state and realise they are probably going to need greater support.

Style states are particularly evident when the data on individual interactions with information are mapped. This is shown in the next section. The consequence of a more positive style state does seem to lead to a wider network of artifacts and quicker access.

Ethnographic studies where observation and collection of verbal data via talk-through methods while carers were involved in caring and while they confronted specific situations would be likely to elicit more detail about cognitive states and knowledge states and the relationship between these and other factors.

Affective state

The affective state associated with the carers' experience also has implications for information services design. In the first place it is important to recognise that carers do experience certain positive and negative affective states and an information service can help make people aware that others experience these states and that they are not alone (which in itself was a common feeling). In addition the service can take as one of its objectives to help counteract the negative affective states and encourage where possible through information provision the resolution or reduction of negative affective states. For example to:

- consciously address the issue of isolation by informing people of others in similar situations and facilitating contact;
- to present information in such a way that it can be taken on board and that enables the carer to be become aware of strategies and solutions that may help them and the cared for person thus decreasing the feeling of being overwhelmed.

Effective information solutions which have a positive effect on the affective state can be identified and provide pointers for the developer of an information service in terms of good solutions and also things to be avoided. An example of the latter was when a

carer was continuously presented with information about the things her son could not do rather than any information about what he could do despite his condition. This information provision followed regular assessment sessions of the condition of her son. The result of this constant barrage of negative information was despair.

The feelings of isolation and victimisation could be addressed, to some extent, through carers being able to contact and exchange information with others. Feelings such as being 'overwhelmed' tended to be associated with inadequate information provision or information being provided in an inconsistent way – again providing justification for effective information provision.

At the group level of analysis the conceptual framework can be seen to have two purposes from the researcher's point of view:

1. It enables the researcher to highlight the range of data that needs to be captured on a community to enable an understanding of their needs for data, information and knowledge and how that service should be provided;
2. It highlights aspects of the target community's experience that need to be studied and which will be important for effective service provision. For example
    - what are the tasks of the community
    - what situations occur
    - what knowledge is associated with situation and how do different knowledge states relate to different needs in terms artifact character and behaviour
    - what cognitive states are evident and how can these be supported
    - what affective states are commonly experienced and can data/information/knowledge provision help create positive affective states
    - do certain style states require certain types of information support

Resolving these questions and gathering data on these areas will, in turn, have implications for information service design.

Individual level of analysis

However, if one only studies the community at the group level of analysis then there is a danger that simplification takes place. Solutions based on this level of analysis alone are likely to be too generic and do not sufficiently relate to the experiences of individuals. This would tend to lead to, for example, only presenting carers with directional information on the range of services available to them albeit in this case cutting across the traditional system boundaries of government health, social and non-government. Individual yet common situations would not be highlighted or explored, for example, getting a chair lift. It should be possible to model situations and provide a guide for the individual – a kind of route map. Understanding the nature of experience at the individual level provides an insight in to the range of information that would be useful to provide in specific situations. For example, in the situation where a wheelchair is required the following information or map could be provided:

- the range of wheelchairs
- the opportunity to see the full range
- their strengths and weaknesses
- the range of organisations that may have expertise in this area
- the sources of finance that could be available from government as well as non-government organisations
- the access issues and implications for transport and the home.

In other words, understanding these situations and the individual's experience in terms of how these situations can be navigated should enable information solutions to be packaged in way that is

- holistic;
- that the carer can relate to and
- will facilitate the resolution of these situations.

The individual level of interaction relates to how people learn. An area, I would argue, that does not receive sufficient attention in the area of information retrieval and information service or systems design.

At the individual level of analysis and the mapping of carers' experiences it is evident how people gradually build up a map of their environment and knowledge about the subject domain. Again this provides a useful insight for the information provider identifying the process of learning. This in turn may have implications for information provision. For example, it provides an indication of what the carer may need to know first. Early on in the mapped scenarios one can see evidence of a pressing need for an explanation of what exactly is wrong with the cared for person. Later this leads on to the need to understand the prognosis and what is likely to happen so that the carer can prepare psychologically and practically. Care, however, has to be taken so that the carer at this early stage is not overwhelmed by the negative aspects of the condition of the cared for person. This is accompanied by the need to have an awareness of the organisations they may need to come in to contact with, their function, the roles and the services they provide which may be of use. Later specific detailed information needs to be provided on how to access these services. Particular services that are appropriate to the carer that have an in-depth understanding of the carers' situation and are particularly good at facilitating contact between services should then be highlighted. Ideally, therefore, there is a need to provide information in a way that mirrors the learning experience and fosters a positive learning experience. This may be difficult and require significant thought but should relate to the needs of the community better than traditional information solutions that are not based on this level of understanding.

The individual level of analysis also highlighted the difference between positive and negative style states. These findings conform to those of Miller and Mangan, (1989), and Baker, (1995), and their description of 'monitors' and 'blunters'. These distinctions are important for the information provider, firstly, by recognising these distinctions exist, the provider may identify people who may be likely to not seek out information and are hence more dependent of the provider. Secondly it may be possible to present information in a way that is more appropriate for the two groups. However, to determine whether this is the case and what solutions should be provided would require further investigation.

Mapping at the individual level has also made clear the positive and negative aspects of artifacts and those that act as gatekeepers providing connections with other

artifacts. It also may help to identify those most in need of information, for example, the young carers and how services should be promoted. With regard to style state at the individual level it could be seen that a more positive state tends to be associated with more extensive networks of artifacts.

Moment of interaction

Understanding is, I have argued, enhanced by identifying and gathering data on moments of interaction. In this case study, in comparison to the first, insufficient data was gathered. However some data on specific moments of interaction was gathered, for example, on the carers' interaction with doctors and consultants. It was possible to identify negative and positive interactions with artifacts that could lead to a better understanding of what should be provided. The benefits of interaction are also understood at this level, for example, the relief associated with knowing what was wrong with the cared for person. Understanding at this level would help to improve interaction and enable one to tailor interactions to the needs of different people.

The data gathered on students and their experience provides more persuasive data about the value of looking at the moment of interaction. In the student case study, where a large body of data was gathered on the 'moment of interaction' the nature of the students' experience when learning about new topics was highlighted. The specific knowledge state or cognitive knowledge as termed at that time in the research of the individual could be seen to have impact on the moment of interaction. For example, the need to be introduced to the subject domain and provided with pointers in terms of the language used to describe the subject domain and help people to identify the areas they were interested in. Furthermore, the gradual and the highly interactive nature of learning was highlighted. Moreover, gathering data at the moment of interaction helped to identify cognitive states (cognitive process). These cognitive states needed support. For example, how to deal with irrelevant information. I suggest that if carers were studied while they interacted with artifacts and tried to resolve situations additional data would be gathered on problematic cognitive states or knowledge states which in turn would have implications for information service or system design. However, without undertaking this kind of research this claim, although supported to some extent by evidence, is speculative.

In conclusion, it can be seen how the conceptual framework can be applied at the three levels of analysis. It seems useful in that it helps to draw attention to levels of detail that the designer or provider of an information service needs to consider. Referring back to the objectives set out at the start of the chapter although data can be labelled as environmental, behavioural or psychological it is clearer to:

a) distinguish between the levels of analysis i.e. the group, the individual, the moment of interaction;
b) that the data itself is most effectively described as sociological, psychological, behavioural and source (of data, information and knowledge).
c) Within these broad categories are sub-categories which are
    - sociological: roles, norms, tasks and situations
    - psychological: knowledge state, cognitive state, style state, affective state
    - behavioural
    - source: artifacts, artifact character, artifact behaviour.

Within each of these sub-categories of phenomena can be identified so that for carers various types of knowledge, artifacts etc. can be defined. None of these are necessarily specific only to the carer community nor are the sub-categories necessarily found in other communities. However, it is proposed that finding out about the full range of data, shown in the conceptual framework, has been important for developing a good understanding of a community. It has also enabled the specification of requirements for information service or system provision and has built upon previous understanding of the information needs of informal carers. Nevertheless, it was noted, that further research into these various phenomena would help to get an even better understanding of the carers needs and requirements.

The final stage of this thesis is to step back and evaluate what has been learnt and its value and reliability and also to reflect on the implications of the research for methodology and techniques for studying user needs and lastly possible future research.

Chapter 8: Summary and Conclusions

Summary

The primary aim of this research was to develop a conceptual framework that would be useful for understanding the requirements of a target community for an information service or system. This aim was stimulated by an awareness of the inadequacy of current information systems and an assumption that this inadequacy was due to a lack of understanding of the complexity of people's interaction with data, information and knowledge. It was also assumed that this lack of understanding was partly due to the absence of a structured methodology that was based on a conceptual framework for understanding people's requirements. It was proposed that an analysis of previous research in Information Science and, to a lesser extent, software engineering and human computer interaction could lead to the development of a comprehensive conceptual framework that could be applied to user requirements analysis. To develop and test this framework the following strategy was taken:

- An inductive analysis of the Information Science literature concerning user needs analysis, information behaviour and information seeking behaviour as well as literature from software engineering and human computer interaction that discussed methodology.
- The derivation of an initial conceptual framework that could be used to highlight those aspects of information interaction about which that the user requirements analyst should capture data. Analysis of the literature led to three iterations as shown below. The third was used to develop survey methodology and to analyse the findings:

Figure 21 First representation of the conceptual framework

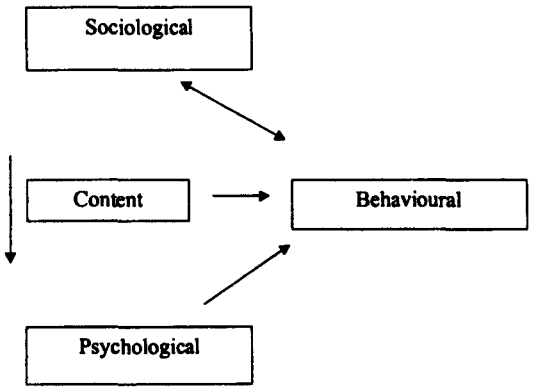


Figure 22 Intermediate conceptual framework

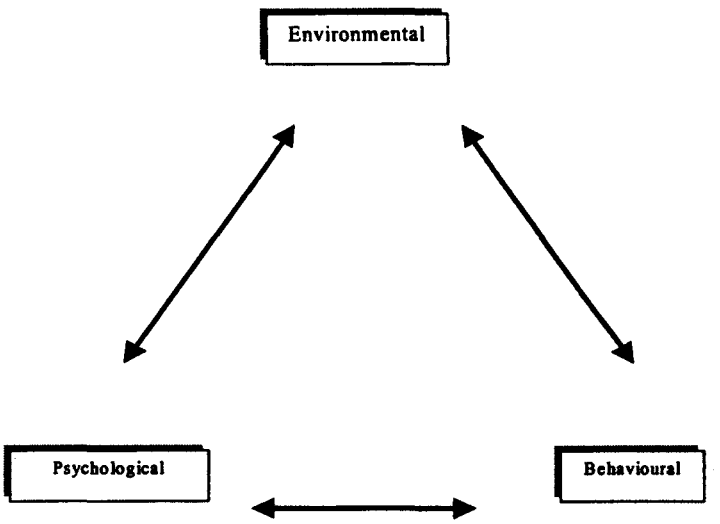
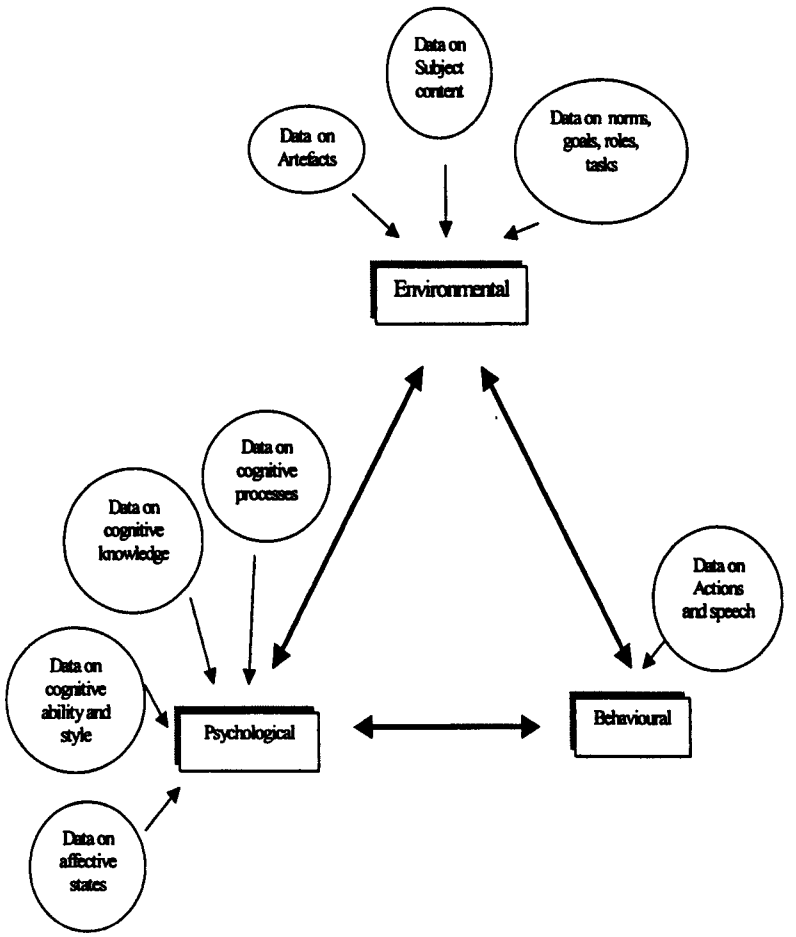


Figure 23 Conceptual framework applied in the first case study



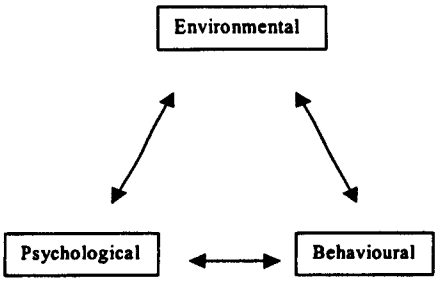
The development of a possible conceptual framework was followed by:

- The development of a methodology and techniques to capture this data.
- Piloting, modification and implementation of the methodology to study the information interaction of two cohorts of students while they tried to find material that would help them to answer questions on areas that were unfamiliar to them.
- Determining the usefulness of the framework in terms of its being used to help develop an understanding of the students' interaction with information. The framework was found to be useful in that it helped to:

- facilitated choice of data capture techniques;
- organise and analyse the research data;
- identify similar processes and phenomena found by previous researchers
- provide additional insights into the target community's information experience
- identify possible system or service solutions that would be helpful to the community.

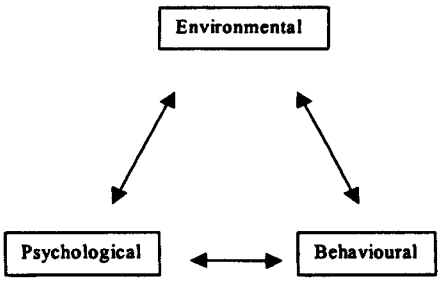
- This was followed by further evaluation, and modification, of the initial conceptual framework. In particular three levels of analysis were identified, as shown overleaf (for ease of reading these are presented on one page).

Group



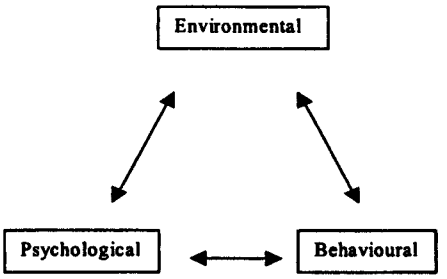
At the social or group level we can describe the information environment in terms of information intensive roles, norms, tasks as well as the subject domain and associated artifacts that are available. Psychologically certain cognitive knowledge and process and barriers maybe evident. In addition common behaviour in terms of information interaction such as the use of certain systems can be documented.

Individual



At the individual level again specific roles, norms and tasks will be relevant as well as the subject domain and artifacts associated with them. However individual cognitive knowledge, processes and style will vary, for example, due to tasks, character, background and expertise of the individual and will have implications for behaviour as will the artifacts that they interact with.

Moments of interaction

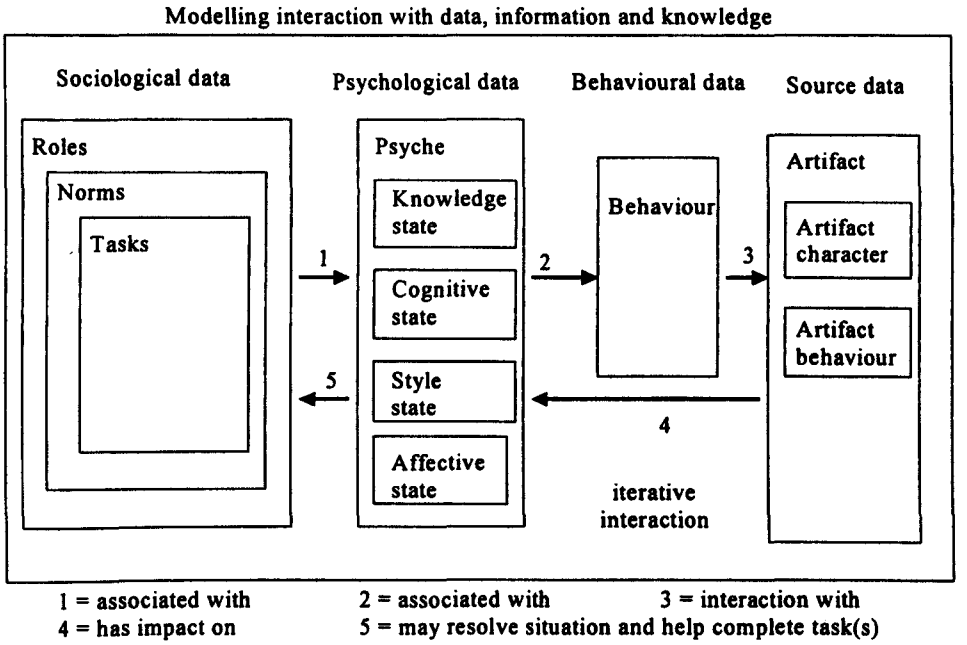


At the moment(s) of interaction data needs to be captured to help understand the experience of the individual – experiences that tend to be unconscious. At this level it is possible to document the process of interaction with the 'systems' as well as the interaction between the three domains enabling the design of aids or solutions.

Figure 24 Three levels of analysis

- To test the usefulness and robustness of this framework a further study was conducted. The objective here was to apply the framework to a very different community. This was partly because students have been studied extensively and this may have influenced past models of information seeking behaviour. It was also felt that the first case study used a methodology that was designed specifically with the intention of gathering data on the various areas proposed by the framework and hence could be self-referential. The conceptual framework was therefore applied to a body of data, which concerned the information experience of informal carers, that had been gathered using a very different technique, the sense-making technique or micro-time line interview.
- Again this led to modification of the conceptual framework eventually arriving at a formulation that the author felt was robust and is shown below.

Figure 25 The final conceptual framework



This model shows a similarity to the initial model shown in figure 1. In that the four types of data are shown to be important i.e. the psychological which includes data

about the individual's mental state (psyche); the sociological which includes roles, norms and tasks and the behavioural (the actions of the individual). The difference is that the types of data are broken down further, the interaction between the categories of data is more clearly stated and also 'content' is superseded by the concept artifact. Content, meaning subject matter, is not explicitly stated but is implicit in the concept knowledge state and would be specific to different roles and tasks. Different sub-tasks and subject domains would also be associated with different artifacts. For example, annual reports are considered a necessary artifact for conducting competitor analysis in the business environment. In addition, the use of the word 'state' implies that people are perceived as experiencing transient conditions which fall into the broad category of psyche and the sub-categories of knowledge, cognitive, affective or style state. Also that any individual may experience one or more states but not necessarily in any particular order. This is in contrast with previous researchers who tend to strive to show there are specific cognitive processes (cognitive states) that can be generalised across groups and follow a specific order.

A further significant difference between the original conceptual framework and the final framework is that three levels of analysis were defined: the group, the individual and moments of interaction. At the group level generalisations are made that apply across the target community. This is the aggregate of data about the community. It would be unlikely that any one individual would experience the range of roles, tasks, psychological states, behaviour or artifacts. However, to satisfy the needs of the community as a whole an information service or system would need to encompass all the requirements of the group, unless of course it chose to service only a sub-set. For example in the first case study:

- the full range of artifacts that students interact with would ideally be encompassed by the system ;
- the range of cognitive states, such as wanting to narrow or broaden the search or find out about terminology, or useful sources, or system functionality would need to be supported;
- the range of knowledge states, such as being unfamiliar with the subject domain or the range of artifacts, would be recognised by the system and relevant alternatives suggested.

Similarly in the second case study the full range of artifacts and their positive behaviour and character should be incorporated into the information service. In addition, what the carer needs to know, (which was defined via the data on knowledge state), and the type of questions they ask, (cognitive state), as well as their preferences for interaction, (behaviour), should be supported by the service.

The individual level of analysis concerns the identification of stereotypical scenarios that individuals experience and places information behaviour and needs in context. For example in the first case study these would stem from a combination of data that came from the tasks analysis/flowcharting and also from observation of what took place in practice over time. This would include, for example, the range of activities commonly experienced by the student when searching for information on an unfamiliar topic such as beginning to understand the question, identifying some key words, accessing the OPAC, databases, the Web, gradually orienting themselves to the topic etc. A different scenario would be when the student was looking for a known item. So the service would need to be designed in a way that recognised these individual experiences and provided explicit support for them.

Similarly with regard to the informal carers situation specific sub-tasks can be defined such as seeking financial support or researching and acquiring a wheel chair. The individual level would also encompass the range of situations that the carers experience. An example of a common carer situation is when a person becomes a carer, and needs to understand the condition and medication of the cared for person, needs to understand and navigate health, social and non-government sector and deal with specific situations such as finance and mobility. As shown in the informal carer findings looking at the data from this perspective helped to highlight the impact of 'gatekeepers' such as non-government organisations that were able to cut across and facilitate interaction with a range of organisations and negative and positive interactions. Viewing the data at this level of analysis also helped to highlight the different style state of respondents i.e. the 'blunters' and 'monitors' and the implications these differences may have for information provision.

Identifying the moment of interaction and distinguishing it from the above two levels of analysis concentrated the mind on specific problems and needs associated with the

interface between the individual and artifacts and the immediate context within which that takes place. In the first case study this level of analysis led to the identification of situations that the students experienced when interacting with the information systems and exploring a subject domain. This drew attention to the feedback from the artifact and the impact this had on the student. For example, it was possible to identify a situation or 'moment' when the system was perceived to be in error and the strategies students used to resolve this situation which, in turn, could be used to help develop a proactive help system to help the student resolve these situations. Capturing data about the moment of interaction also helped draw attention to the highly iterative nature of the students' experience and led to the suggestion that this was in fact an important part of learning about a new subject. This in turn led to the proposal that this iterative browsing should be supported by the service. In the second case study limited data was captured about the moment of interaction. However some data was identified that concerned this level of analysis. For example, positive interactions helped to highlight both the positive and negative characteristics of artifacts and their effect on the affective state of the individual and impact on the knowledge state and cognitive state of the individual.

Lastly, it should be noted that one fundamental difference between the initial conceptual framework and the final conceptual framework was that it was derived through analysis of primary empirical data rather than secondary published material.

The next section takes the proposed conceptual framework and compares it with those of other researchers to see how they differ and whether it builds on previous research and whether the research has facilitated new views. The phrase 'new views' is interpreted to men:

- a new way of conceptualising the individual's information experience and identifying areas on which data should captured if one wants to have a holistic understanding of a community's interaction with information, data and knowledge and hence requirements for information service provision;
- new insights into the information experience and information needs of a community

- new insights into the methodology for understanding a community and their requirements for an information service.

Comparison of the conceptual framework with previous research

It would be naïve to claim that the conceptual framework derived as a result of this research was completely new. In fact it shows many similarities to previous conceptual frameworks and models of information behaviour and information retrieval. However it does contribute through redefining, reordering, decomposing, integrating, confirming and also, to some extent, by extending previous models and frameworks. One reason for the difference between the proposed conceptual framework and previous ones is that previous researchers tend to tackle information interaction from the information retrieval perspective and are primarily interested in the 'classes of variables involved in all interactions' (Saracevic, 1996, p. 3) during information retrieval. As a result they concentrate on the moment of interaction and do not distinguish this from the group and individual levels of analysis described above. This is true of Saracevic, (1996), Spink, (1997), Ingwersen, (1996), and Marchionini, (1997). Nevertheless, as noted, many concepts are shared.

The most similar models are probably Wilson's 1981 and 1996 models and also Ingwersen's (1996). Many of the elements that make up the models are shared. However in this conceptual framework the social, psychological, behavioural and source data are clearly separated. In addition the need to focus on the three levels of analysis is distinctive, although, here again there is some similarity with Wilson (1999) and also Hert (1997). Wilson, (1999), distinguished between information behaviour, information seeking behaviour and information search behaviour. Wilson sees information behaviour as connected to the wider 'communication model' and also related to 'self-image, personality structure, working team, social environment', (Wilson, 1999, p264) i.e. combining factors that are separate and distinct in the conceptual model put forward in this thesis. Wilson's distinction between information seeking behaviour and information search behaviour, however, does correspond with the 'individual' and the 'moment of interaction'. Hert, (1997, p62), also identifies and distinguishes between 'the time of interaction', which is similar to

the 'moment of interaction', and understanding the larger 'information seeking process' which is similar to the 'individual' level of analysis.

Many authors, as in this study, place great emphasis on the interactive nature of information retrieval, including: Belkin, Cool, Stein & Thiel, (1995), Saracevic, (1996), Spink, (1997), Ingwersen, (1996), Marchionini, (1997), Hert, (1997), and Wilson, (1999). This signifies a move away from the matching metaphor that was predominant. In the carer study and in the student case study, the interactive nature of finding out and building a mental map of a new subject domain was seen to be fundamental and not just a result of successful or unsuccessful information interactions.

Looking at specific components of the final framework, roles, norms, tasks, and situations are shown as key drivers and therefore are important to find out about when studying a community. In previous research, it has been appreciated that interaction takes place within a wider context, but it is given slightly less weight than in this study. Perhaps this was because many cases studies concerned the same, relatively well understood audience, that is, students or academics and the information retrieval aspect of the research process. However, Ingwersen mentions the significance of 'work', 'task', 'goals' (1996); Saracevic, (1996), mentions 'situations' and 'task', Marchionini, (1997), 'tasks', 'components (time, costs)', Hert, (1997), notes 'orgnisational setting', 'roles', 'project', 'tasks', Wilson, (1999), notes the significance of 'person in context', 'role related', 'environment' factors. The new conceptual framework helps to pull together and make clear the significance of this class of variables.

Few authors highlight norms as significant. Solomon, (1997), does recognise the significance of norms. Nicholas, (2000), also recognises and corroborates the importance of norms, although he does not use the term norms, in that he notes that different occupations will place different values on artifact characteristics such as quality or currency. Belkin, (1994), also noted how the characteristics of texts (artifact character) may be relevant in different situations which again implies that the normative values and expectations affect information interaction. However, the value of certain characteristics are likely to be more obviously determined by the knowledge

state, cognitive state, style state and affective state of the individual. The extent these are tied into normative states is unclear. The impact of norms and how people perceive data, information and knowledge, in terms of what is considered appropriate or valuable, is an area that deserves further research.

Knowledge state has again been recognised as significant by other authors Allen, (1991), who tend to interpret it in terms of the knowledge the individual has of the subject and also the knowledge people have of the information systems they use. Thus distinctions are made between novice and expert user. Similarly, in this thesis, knowledge state refers to data collected that highlights what people needed to know and their lack of knowledge. For example, students needed to know about and lacked knowledge of the subject domain, as well as, information sources and system functionality. It was argued that this lack of knowledge led to the highly iterative search behaviour and the need to explore and learn about the subject domain. With regard to informal carers, for example, the lack of knowledge of the state system and the need to know about the medical prognosis of the cared for person were highlighted.

With regard to cognitive states Ingwersen's, (1996), conception of cognitive state most closely relates to that defined in the conceptual framework. He recognises the transient nature of these states. Authors such as Hert, (1997), (who list many 'cognitive processes' such as choosing, doubting, revising etc.); Kuhlthau, (1996), (increased interest), and Ellis, (1987), (differentiating etc.), tend to imply that the states they define will always be evident among all people when they conduct an information intensive task. Marchionini (1997) uses the term cognitive skills to highlight skills such as using an alphabetical list or a contents page. In this study these skills would fall under the heading of cognitive state, where the state associated with using these artifacts is described. However, these tasks would also involve a knowledge state and this would describe the people's knowledge of the artifacts they are using. It is possible that such cognitive states are common amongst people conducting similar tasks. I would suggest that, today, it is probably possible to develop a comprehensive list of cognitive states of people involved in the academic task, due to the number of studies that have been conducted. Furthermore, similar states may be apparent in other communities conducting similar tasks. However, I

would argue that when studying a community it is productive to initially have an open mind about the possible cognitive states associated with the group and that these should be explored. These may be common or they may be unique to the group and may be specific to the roles, tasks and situations they experience as well as their style state and affective state. For example, task initiation is unlikely to be associated with uncertainty, as postulated by Kuhlthau, (1996), if the task is well defined and the individual is seeking a known document. Furthermore, how people experience uncertainty is likely to be affected by their style state, such as, the degree they feel either challenged or overwhelmed. Dervin, (1983), argues that there are fundamental cognitive states that any people in any situation may or may not experience. From this research it is not possible to confirm whether or not this is the case. To determine the full range of cognitive states associated with information interaction, assuming this is possible, and whether or not there are common cognitive states would require further research focusing on this particular aspect of information interaction. Then it would be possible to focus on the possible artifact characteristics and behaviour that would help support these states, which could be rewarding. I think it is also important to be clear whether one is describing cognitive states at the group or the individual or moment of interaction level of analysis. Although some authors have tried to identify cognitive states at the group level, (Dervin, 1992), the majority of research is concerned with defining cognitive states at the moment of interaction with an information retrieval system and when specific events such as retrieving a large number of 'hits' are experienced. This is important and may identify problems with the interface of specific artifacts. Therefore it is important to make distinctions between the levels of analysis. For instance, at the group level of analysis, in the carers project, specific cognitive states were found to be common i.e. uncertainty, questioning and strategies and these concerned specific topics such as diagnosis. At the individual level of analysis these were put into context in terms of what led up to the situation, what people did and the results of their interaction with artifacts. Whereas focusing on the moment of interaction stimulates the researcher to explore in detail the respondent's experience when interacting with specific artifacts. In the student case study, for example, this led to an appreciation of the interactive nature of the learning experience and the cognitive, knowledge and affective states associated with this interaction. In the carer case study it helped clarify what the carer perceived as a 'good' artifact.

Fewer authors highlight the importance of style state. Nicholas, (2000), uses the term 'personality' to refer to this area, Hert, (1997), 'mood'. In this research it was not possible, due to the methodology deployed, to elicit extensive data on style state. What was evident was the difference between people who regarded their situation as a challenge and were very persistent and proactive in looking for answers and those who did not. This corresponds with the findings of Miller and Mangan, (1983), and Baker, (1995), and their description of 'monitors' and 'blunters'. Ingwersen, (1996), and Wilson, (1999), do also note styles of search such as, respectively, 'weak curiosity' or 'passive attention'. However, it is unclear whether these are prevalent styles associated with an individual or whether they describe the type of information behaviour witnessed at specific point in time. Other researchers such as Ford, Wood and Walsh, (1994), look into the impact of 'cognitive style' on information behaviour and draw attention to, ideally, the need to develop information services that relate to the different characteristics of the individual. However, currently, it is not clear how important these characteristics are for service development and exactly what implications they have for information provision. Nevertheless, an awareness of these differences does seem to be useful if only to make the information provider aware that some individuals tend to be more proactive than others and that some people may prefer information in a certain way and that particular effort should be made with 'blunters'. It is also apparent that Marchionini's, (1997), conception that information retrieval is a process that people purposefully engage in stems from studies of the academic environment community. Whereas, in other settings, although people may need information, they may shy away from information and would not describe themselves as actively seeking information. Again further research is required into why some people proactively seek information and others do not.

The affective state of people when involved in information intensive situations has not been of great concern to researchers except Kuhlthau, (1991) and Nahl (1998). In this research this type of data, although not the focus of the study, was shown to be important. This was particularly the case where the negative and positive affective states associated with artifact behaviour and character were identified. This gave an indication of those aspects of an information service that are important for helping to generate positive affective states.

Behavioural data is clearly a type of data that the conceptual framework identifies as important. This is not surprising and, as stated in the literature review, there has been a long tradition of capturing data on this area. Behavioural data is important because it indicates demand that implies wants and needs and preferences for use. It provides us with the opportunity to capture empirical data that can be correlated with other variables such as knowledge state or cognitive state. Again I think it is important to distinguish between behaviours that are associated with specific groups and specific activities. Chaining, (Ellis, 1987), for example, has been presented as a general phenomena and yet it is likely to be primarily associated with the academic environment. Unless one interprets chaining in its broadest sense, as when the characteristic of an artifact enables the user to 'jump' to another artifact. If this were the case, the usefulness of organisations such as the Altzheimer's Association to connect to others would fall into this category. However this seems too broad a definition of chaining and it would be better encompassed by the 'gatekeeper' concept (Allen, 1979). The concept chaining would then be used to describe the use of features embedded in the text of a document that helped identify and link to other published resources.

Artifacts are recognised as significant by most authors and have traditionally been the focus of library science. However, the frameworks and models of information retrieval that have been proposed in the past tend to assume that artifacts are either electronic information sources such as databases or published material. The concept of artifact here is broadened to include the possible range of artifacts that people could access to get information including organisations and people – hence making the framework more applicable to understanding the full range of user requirements. Furthermore, the concepts of artifact behaviour and artifact character were introduced which proved important for understanding what was deemed a good artifact. Belkin, (1994), Nicholas, (2000), and others have highlighted the importance of different characteristics of artifacts – although they are primarily concerned with texts. I think it is useful to broaden the concept of artifact but to still draw attention, when defining information needs, to the importance of the character of artifacts and how certain characteristics may be relevant in different settings and situations. Further research is required to see how certain artifact characteristics relate to different users and contexts and how these needs can be determined and responded to. In this study, for

example, young carers had particular needs in terms of how the information about the medical condition was presented. Furthermore, the style of response from the artifact was seen to have significant impact on both the student and carer. It is also likely that information could be presented to people in different ways depending on their experience. For example, the content, style, quantity and depth of information that is appropriate for a new carer is likely to be different to that provided to a long term carer.

The conceptual framework can therefore be seen to integrate and build upon the work of previous researchers providing a holistic structure that can be applied at various levels of abstraction. This serves to clarify what it is that we are studying. It is formulated in a way that enables the researcher to clearly identify the range of data that should be gathered to generate a detailed understanding of a groups' interaction with information and enabling requirements specification for an information service. Alternatively it suggests areas, such as behaviour or knowledge, that the researcher may choose to concentrate on. Similarly the interaction between phenomena suggests areas that could be studied in more detail. For example, whether certain style states are better served by artifacts of a specific character or whether knowledge states and cognitive states are associated with specific roles and tasks etc. The framework also has implications for the methodology of user studies. This will be discussed later.

Another way of trying to evaluate the robustness of the framework, in addition to comparing it with others, was in terms of its usefulness in generating insights about the population and to be able to recommend solutions. It has been demonstrated in both the student case study and the informal carers study that insights were gleaned, building on previous research into these communities, and information solutions were able to be proposed. Some external validation of the usefulness of these findings has been through publication. This has included two refereed conference article, (Hepworth, 2001, Hepworth, 2002). In addition a further article concerning the informal carers study has been accepted for the Journal of Information Science. The data on the carers is also being used to help formulate information provision standards and guidelines for the Health Service and Social Services in Leicestershire and Rutland.

Implications for methodology

The secondary concern of this research was to think about the methodology for understanding the requirements of people for information services. If one accepts the conceptual framework as useful and intend to apply it to the study of other communities methodological questions are raised.

- First of all one would need to determine which of the classes of data in the framework do we want to gather data on: all, some or specific interactions between phenomena?
- Secondly, what are the most effective techniques for capturing the data on areas, such as, tasks, situations, cognitive states etc. or interaction between them?

In this thesis, data was derived on the two communities using very different methods. The implication of this is that there is no one method that is 'best'. Various methods can be used and will depend on time, resources, access to the population, the objectives of the study in terms of how rigorous the study should be and the primary interest. For example, if the primary objective is to populate a database with material it would make sense to capture data on the artifacts that people use and also the cognitive states and knowledge states of the population. The latter two would help to identify what people want to know i.e. the subject matter. The former would indicate what people would like to have access to. Studying the moment of interaction with artifacts is likely to lead to an understanding of interface problems and to identifying possible improvements plus proposals for ways of accessing the information i.e. functionality.

In this research what was apparent was the limitations that resulted from applying specific techniques. For example, the use of the micro-time line interview tended to focus attention on major events in the lives of carers and did not provide data on the day to day tasks. I think it would have been useful to get a better understanding of the wider range of tasks and situations experienced by the carers. However, perhaps the aggregate of the interviews did identify the most significant situations. In general, I was impressed how the micro-time line interview or sense making technique did manage to identify important situations and the experience of people while they navigated through them. The lack of observation of carers meant that less data was gathered on the moment of interaction with artifacts than in the student case

study. This may have resulted in a simplification of the information seeking process and less data than could have been gathered on positive and negative artifact characteristics. In the student case study although observation and talk-through was deployed it was felt that more data should have been gathered on the cognitive state and knowledge state of the respondents. This would have provided a better understanding of why the students did what they did and what they would have liked to happen. In general I now think it would be useful to incorporate into any user requirements activity the opportunity to test the findings on the community by getting their comments on the findings and recommendations. Ideally when researching and recommending information solutions early prototyping of the solutions would take place. During the first case study one cohort of students was asked to take the findings and in groups propose solutions and, in a sense, get involved in participative design. Their designs helped to identify possible solutions and common requirements. This process could be used to help gain consensus on solutions and to help ensure that solutions were related to the needs of the community. However, whether or not one could apply these methods in practice would depend on the willingness of the target community to participate and the time and resources available.

In general from the experience of this research it is recommended that where possible a range of techniques should be deployed to capture data on the various domains. It is recommended however, due to the richness of data generated via observation and talk-through and the likelihood of the simplification of data that depends on the recall of the respondent during an interview, at some point in a user study, people should be studied in context. Whether this is done by logging interaction with artifacts, video, tape diaries or on the spot observation by the researcher will depend on resources and access. All techniques for gathering data have their strengths and weaknesses and each environment and community studied will impose its own restrictions as to what techniques can be applied.

Limitations of the study

Developing a universally acceptable conceptual framework is, to some extent, complicated by the fact that in our discipline there is no consensus over terminology and hence the variables or conceptual categories could be given different names. It is

therefore unlikely that there will be unanimous agreement and debate will continue about the meaning of the names given to variables as well as their content. I have already noted that authors use the same label to talk about both cognitive and behavioural data. This is partly because we do not have the language to describe certain phenomena. For example, how do we verbally distinguish between the mental process of browsing from the behavioural process of browsing? Different names will have slightly different meanings to different people and this is partly why I have gone to great length to both define the categories and provide extensive examples from the empirical data as to what is meant by the categories. Creating diagrams to help visualise how these categories are related to each other can be done in a variety of ways. Different people would probably prefer the framework to be presented in different ways such as a list of categories and sub-categories. Therefore it is not possible to state categorically that this is the conceptual framework. However I think it is possible to state that the framework is useful and highlights key variables and their possible interaction. One area, however, that is not explicit in the conceptual framework that Wilson, (1996), noted, and that is demographic data, such as age, gender, eduction, geographic location and economic status. It was evident that young carers did have specific information problems and this became apparent through descriptions of their knowledge state, cognitive state, use of artifacts and so on. Other differences associated with age or gender may have been found in the carer community. In future it may be necessary to pay more attention to these kinds of variable. They are likely to influence the design of information solutions. However it is possible that the needs of the community and differences within, will be identified without explicit reference to these variables. For example levels of knowledge will be evident without focusing on age. Many needs, such as the need for prognosis information were generic across all demographic groups.

With regard to the individual case studies the major limitations were in terms of the range of phenomena that were studied and the depth of data that was captured on the various domains. In the first case study the questions that students chose from were broad in scope and covered topics that they were unfamiliar with. The fact that they had to choose questions from a list may have had a negative impact on their motivation. In addition, because the observation took place at the university the artifacts were restricted to those available in the laboratory and the library. This

imposed restrictions on the choice of artifact and probably limited the amount of use the students made of other people. Moreover the students' lack of knowledge about the topic led to data that highlighted the iterative, exploratory nature of the learning process and the way people gradually assembled a mental map of the subject domain. This in itself was interesting and provided an explanation for the findings of other researchers who have observed the iterative nature of searching. However, data was not gathered on situations where the students were familiar with the domain or were looking for items that they were already aware of. Hence the data, findings and recommendations only related to situations where the respondent's domain knowledge state was weak. Nevertheless, this research did highlight the characteristics of this type of situation that is common to many people who are learning about a new topic. This research also indicates that greater emphasis should be given to understanding how people learn about a topic as well as to the traditional emphasis on information retrieval. Furthermore, as stated earlier, due to the choice of relatively non-intrusive questioning not as much data was gathered on the psyche of the respondents as I would have liked, which would have provided a better insight into the learning process.

With regard to the second case study a number of limitations affected the findings. These include:

- the respondents were chosen from a group of people who had filled in the questionnaires and agreed to be interviewed. Therefore it is likely that this group were not representative of the entire carer population. For example, respondents who were not literate were excluded. In fact this proved such a problem with young carers that they were identified through people who worked with young carers since they found it too difficult to complete the questionnaires. It is also possible that people who had had particularly bad experiences with the state system would not take part in the survey. Similarly those that were very stressed or were completely overwhelmed by their ordeal may not have taken part.
- The people who did take part in the study had been informal carers for some time and hence now knew quite a lot about the system and the condition of the cared for person. Although people were able to recall their early experiences as a carer it would have been good to study some new carers because it is likely that the

problems identified in this study, for example lack of knowledge, could have been explored in more depth.

- The interviews were conducted with three groups of carers: those that spent more than one hundred hours per week in the caring role; carers of people with dementia and young carers. It is possible that their information experience and hence their needs were significantly different from other groups of information carers. However, at the level of generalisation in this study it is likely that the same broad areas of information need apply. For example, understanding the medical condition and its prognosis is likely to be important for all carers. From a recent reading of the Baker's, (1997), article on the information needs of people with multiple sclerosis this seems to be the case for both the carer and the cared for person.

In both case studies limited data was captured on the style state of the respondents. This could have been achieved through the implementation of learning style assessment questionnaires. In the first case study the interchange between 'respondent'/'researcher' this would not have been appropriate because the individual was not studied throughout the research process. In the second case study it seemed too much of an imposition on the carer to ask them to submit to yet another survey technique. Consequently, data on style state is limited and it is not clear from this research to what extent it has significance for the developer of an information service. Nevertheless the 'blunter'/'monitor' categories found in the second case study and previous research does indicate that it may be an important consideration.

Lastly a quantitative approach could have helped to appreciate the level of demand for certain types of information and perhaps could also have helped determine correlation between, for example, behaviour and style state or between knowledge state and cognitive state. However, to achieve this would require the large scale monitoring of behaviour over an extended period of time which was beyond the scope of this study.

Further research

The study of people's experience of interacting with data, information and knowledge is a rich area of research and it is evident from this research that numerous variables

can have an impact on this experience. In this chapter many areas for further research have already been identified. Further research is I think warranted on a number of areas including:

- methodology, which includes understanding in more detail the usefulness of various techniques to elicit data on the different elements of people's information experience and also on the methods used to document the findings in a way that is useful for service developers;
- understanding, in more detail, the individual variables. For example, it would be possible to focus entirely on one variable such as knowledge state. This would be useful because one would get a more detailed understanding of the sub-categories of this variable across a group of people in a similar situation. It would be also be possible to see how these varied across a group of people and to investigate why these differences occurred and their impact;
- studying the interaction between the different variables that are made explicit in the conceptual framework provides other opportunities for research. The interface between the four main domains: sociological, psychological, behavioural and sources of information are all possible areas for further research. For instance, what norms, tasks, roles and situations are associated with different communities and how are these related to knowledge, cognitive, affective and style states? Furthermore what behaviour is related to these states and what characteristics of artifacts are important to people when they experience different states?
- With regard to these two case studies it would also be interesting to go and develop information solutions based on the recommendations and evaluate the usefulness of solutions that stem from this research. For example, identifying situations experienced by informal carers at the individual level of analysis suggests that providing information to carers in a way that corresponds to these situations may be an effective way of delivering information. To a great extent, current information solutions tap into the group level of analysis, in particular the lists of artifacts. As a result directional information is provided to carers pointing them to organisations that may help. This is useful but it may be easier for people to relate to this information if it is also structured around dealing with particular situations. Moments of interaction also provide an indication of another way to provide information. Information could be packaged in terms of navigating these

moments successfully. For example, dealing with too many hits or managing a meeting with a neurologist or ensuring that they get the most out of their meeting with the social worker etc. These and other solutions suggested in the analysis and recommendations of both case studies therefore provide numerous opportunities for further research.

Conclusion

In conclusion returning to the original research objectives and assumptions which were as follows:

- that the accumulated past research in user studies and information seeking behaviour now provides a good basis for the development of a conceptual framework for understanding people's interaction with data, information and knowledge.
- that this framework will help to determine the phenomena that we need to study to understand the respondents and their interaction with information.
- the conceptual framework
    - ➢ will indicate those factors that will influence the individual's interaction with information.
    - ➢ will indicate and help explain those factors that influence each other and the individual's experience when interacting with information and information systems.
    - ➢ help derive data that will enable the researcher to identify user requirements for an information system that relates to their needs.

It was felt that the literature did enable the construction of a holistic framework that encompassed earlier models and frameworks. Without the work of previous researchers it is unlikely that this framework could have been formulated. However, the conceptual framework was not derived in one single step from the literature but has evolved through a process of continuous revision as a result of applying the framework to data concerning people's interaction with information.

A secondary assumption was that the 'conceptual framework would help identify appropriate research methodologies and appropriate techniques for studying people

and determining their requirements for information systems and services'. As stated earlier in this chapter it was apparent that although this research and the framework did help to identify the data one can collect, there are many techniques that we can apply. Furthermore the techniques that one chooses to use will depend on exactly what aspect of an information service one is interested in (the content, interface etc.), and the resources one has available plus the willingness of the target audience to participate. The conceptual framework therefore does not determine the methodology and techniques but it does indicate the areas on which the researcher of user requirements for information services should focus.

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