CONCEPTS OF RELEVANCE IN A SEMIOTIC FRAMEWORK APPLIED TO ISAD (Information Systems Analysis and Design)

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ABSTRACT

Relevance is the critical criterion for valuing information. The usual requirements of valuable information resources are their accuracy, brevity, timeliness and rarity. This thesis points out that relevance has to be explicitly recognised as an important quality of information. Therefore, the theory of signs is adopted to enable a systematic study of the problem of relevance according to the branches of semiotics in order to clarify the concept of information.

Relevance has several meanings according to the various disciplinary approaches including phenomenology, law, logic, information science, communication and cognition. These different concepts are discussed and criticised in two chapters. A new approach is proposed in which a universal concept of relevance is considered as an affordance. Therefore, all the approaches to relevance can be applied within the broader approach of the analysis of affordances. This approach not only encompasses all the underlying characteristics of relevance, it is also compatible with the assumptions of the logic of norms and affordances (NORMA). NORMA semantic analysis is used as a basis on which concepts of relevance are applied semiotically. Two case-studies are selected for testing these concepts which results in a guideline for practical application in a semiotic framework.

The results from these case-studies confirm the practical importance of these concepts of relevance which can be systematically used in the analysis and design of information systems. It also reaffirms the underlying characteristics of relevance which exist in the context of social reality.

My dear parents

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CHAPTER 1
INTRODUCTION

The importance of information as a resource has become widely recognised in the post-industrial age. This change was first indicated by the shift in the work force to the information sector industries in the U.S. economy (Machlup 1962). Machlup estimated that the 'knowledge industry' grew at a rate of 10.6% per annum between 1947 and 1958. Porat gave another indicator of the information-oriented economy in the U.S. by estimating that the primary information sector accounted for 25% of GNP in 1967 (Porat 1977). The similar pattern of change in occupational structure has also been found in other developed and developing countries such as in the U.K., Japan and Singapore (Lamberton 1989).

The expansion of the service economy, the growth of theoretical knowledge and technological progress were the underlying force of this evolution. Daniel Bell (1973) contends that in the post-industrial society innovation depends on research and development (R&D) while a greater proportion of GNP and employment shifts to the knowledge field especially in information handling. This change in occupational structure and the emergence of new information technologies made economists aware of the role of information and the allocation of resources to the information sector of the U.S. economy (Jonscher 1983). Jonscher concludes that information is the major source of economic growth.

Information becomes the key factor in planning and policy-making and organisations are perceived as information communicating and processing

systems (Cronin and Gudim 1986). The acquisition and use of information have a direct impact on organisational effectiveness. Therefore, the management of information resources becomes widely accepted as essential in transforming a society and its economy (Gassmann 1982).

For ordinary people as well as businessmen, the importance of information is reflected in everyday life, for example, in planning a holiday or buying shares. Businessmen and decision-makers require different kinds of information in order to reduce the uncertainty or risk. For example, changes in the economic, political, social, international and technological circumstances can affect the outcome of a plan. A list of important information required by a businessman is suggested by Tricker (1982). These include information about cash flow, monopoly and anti-trust situations, price movements, company law requirements and currency movements.

However, the advent of the information society unfortunately creates the problem of information explosion in which the abundance of information become untenable. Confronting this situation, Horton (1979, 3) concludes that 'there is indeed a lack of relevant information...as well as a glut of irrelevant or marginally useful information.' Black and Marchand (1982) also stress the need for relevant and accurate information including the emphasis on quality rather than quantity of information. The quality of relevance is also considered equally essential as the accuracy and timeliness for information to become valuable resources (Simon 1968).

Hence the quality of relevance has to be explicitly acknowledged in addition to the conventional requirements of valuable information: accuracy, timeliness, conciseness and rarity. Among these qualities, it seems that

relevance has a priority of importance as information which is accurate, timely, concise and rare can be useless if it is not also relevant to a user's need. On the other hand, the credibility and usefulness of relevant information can be enhanced by ensuring that it is also accurate, timely, concise and rare. Consequently, it would be beneficial to discover some ways of judging or identifying the quality of relevance for selecting and acquiring information resources.

The Problems of Explicating Relevance

The explication of the concept of relevance consists of a few major problems. Firstly, the meaning of relevance is not only abstract and elusive but also subject to different intrepretations. The diversity of different approaches to relevance is reflected by various definitions, e.g. the phenomenological concept of relevance, logical and legal concepts of relevance, and the information scientists' concepts. Secondly, the problem is compounded by the imprecise or unclear meaning of what we call information which has to be judged or selected for its relevance. Thus, the meaning of information has to be clarified and made explicit in order to create a sound basis for applying the criteria of relevance.

The second problem stems from the distinction between data and information which contributes to the impreciseness of the term 'information'. Data is considered to be the basic building blocks i.e. raw data, which have to go through some kind of processing in order to produce information. The widely held view is that data is something raw which has to be organised, interpreted, analysed, or processed in order to derive useful information (Clifton 1978,

Tricker 1982, Keen and Scott Morton 1978). This view is also reflected in the field of experts systems in which Cooley states: 'I get so much data I sometimes think I should weigh it rather than read it! If we structure data appropriately it might become information' (Cooley 1988, 14).

A different view is proposed by Kent (1978) in which he distinguishes between raw and deduced information, raw information being interchangeable with data. But he does not make clear the meaning of raw information. This adds to the confusion of the distinction between data and information. The examples of data given are usually simple and concise such as the weight, height, and age of a person; the date and payee of a cheque; the product groups and quantity, lists of statistics or numbers. The examples of information are often more complicated or substantial such as financial forecasts, production records, and accounting details of a company.

The distinction between data and information seems to be based on the view that data is something which does not require any human processing or interpretation and therefore being in its 'raw' stage, contain very little meaning. It is questionable whether this assumption is valid or correct. For example, data such as the quantities and prices of books in a bookshop have to be processed and interpreted by someone in that shop so that their data can be correctly recorded and compiled. The consideration of data as being something raw is therefore misleading.

In addition, the consideration of conciseness cannot be used to justify the meaning of data. For example, the letters of a flight number of BA302 can be considered to be a piece of information to someone waiting for the arrival of a British Airways airplane while it can be considered as data for the

computation of the total number of flights in a report. On the other hand, a financial report or economic forecast simply contains more complicated and comprehensive information. The difference between data and information seems to reflect the difference of the degree of complexity perceived by a person. Therefore, the perception of something as data or information depends on personal understanding and background knowledge.

Furthermore, data and information have been used interchangeably as reflected in their definitions in English dictionaries. According to the Collins English Dictionary (1982), data means 'a series of observations, measurements, or facts; information.' Different definitions can be found in the Oxford English Dictionary (1978), data is considered as 'quantities or characters operated on by computers' whereas information means 'telling, what is told, items of knowledge, news, etc.' These definitions do not help to clarify the distinction between data and information but seem to have raised more questions. Although most available definitions do not further a clearer understanding, the difference between data and information is seen as necessary (Liebenau and Backhouse 1990). It seems that the distinction between data and information depends on the need to recognise the unsophisticated item as being different from a more complicated and higher level of information.

Solutions to these Elusive Problems

New approaches to both the problems concerning the abstract nature of relevance and the vagueness of the meaning of information are needed. Firstly, the latter problem can be tackled by perceiving information and its properties according to the theory of signs or semiotics. The theory of signs is introduced

and discussed in chapter 4. By studying the different aspects of signs and their relationships such as the behavioural aspect and the issues of meaning, a systematic application of concepts of relevance can be established in a semiotic framework.

The problem of the elusiveness of relevance can be dealt with by introducing the theory of affordances as a basis for unifying all the different characteristics of various concepts of relevance. According to Gibson (1977), an affordance is the ability of some feature of the world which makes possible the accomplishment of certain behaviour patterns by an agent. For example, a train affords people the behaviour of travelling, a plastic bag affords a person the action of carriage.

By perceiving relevance as an affordance, all the different characteristics of relevance can be encompassed in a single underlying framework of semiotics. This is due to the linkage between the theory of affordances to semantic analysis which is adopted in this framework. The assumptions and methods of this approach to semantics are discussed in chapter 4.

In explicating a semiotic framework for applying concepts of relevance, two case-studies are chosen for this purpose. The first case-study is an academic research group in which the problem is managing an information system for supporting the group; the issues include the selection of relevant materials for the specialised library and ways of monitoring the changing requirements. The second case-study is used to evaluate the results from the first case-study and apply them to similar situations and to assess the intutitve application of concepts of relevance. This case-study involves the assessment of the existing ways in which a university attempts to disseminate research works

to the wider community.

The Research Methods and Outline of Thesis

This thesis consists of two distinct parts; the first part being the theoretical analysis of the literature on concepts of relevance and the establishing of a new approach in order to deal with the problem of applying abstract concepts to elusive entities. The theoretical assumptions of semantic analysis applied in the investigation of the case-studies are also discussed in detail.

The second part consists of the application of different concepts of relevance to the first case-study in detail. Then we evaluate the second case-study by applying these previous findings. The results from the two case-studies become the basis of the explication of a semiotic framework in which concepts of relevance can explicitly contribute to the process of analysis and design of an information system. Some observations about the weaknesses and strengths of the adopted semantic analysis methods are also discussed in the final chapter.

In chapter 2, concepts of relevance from three disciplinary approaches are discussed and criticised. We concentrate on the phenomenological, legal and logical concepts. The importance of the phenomenological concept of relevance is recognised as comprising all the characteristics of relevance so that it can encompass other more specific concepts. The legal approach to relevance is seen as contributing to the creation of systematic criteria of relevance. The examination of logical relevance reveals the validity of different meanings of logical operators under particular conditions.

In chapter 3, various concepts of relevance from the field of information

science are investigated together with the concept of relevance from the field of communication and cognition. The limitations and applicability of these concepts are expounded while the characteristics of relevance emerging from this examination confirm those mentioned in the phenomenological concept. Therefore, a conclusion on the characteristics of relevance is established from these discussions and investigations.

In chapter 4, the theory of semiotics is adopted as a means for studying different aspects of signs and their properties in order to overcome the problem concerning the impreciseness of information. The theory of affordances is introduced as it is the underlying idea in the logic of norms and affordances (NORMA) applied in semantic analysis. The assumptions and methods of NORMA semantic analysis are explained and illustrated. This is the semantic approach for the analysis of the case-studies.

In chapter 5, the elusiveness of relevance is brought out and solutions are suggested in terms of adopting different approaches to the problem. The first is to use semiotics as a framework for applying concepts of relevance so that different signs can be identified or used to indicate relevance. Secondly, the characteristics of relevance are perceived as being compatible with those of an affordance so that relevance can be considered as an affordance. This makes it possible to link all the different concepts of relevance on a common basis. The various concepts of relevance are also classified according to the semiotic approach and analysed from an ontological basis.

The second part of the thesis which concerns the practical work on the case-studies and their conclusions commences with chapter 6. The first case-study is subject to NORMA semantic analysis in which the importance of the

issue of meaning or semantics is reflected by the complexity of the analysis of certain affordances. The relationships between affordances which depict the behaviour patterns of the situation are shown graphically in ontology charts.

In chapter 7, concepts of relevance are applied to the first case-study in order to establish criteria for relevance judgments on a semiotic basis. Mechanisms for maintaining the relevance of information resources and their management are also established. Following that, we consider the applicability of the results from the first case-study by applying these results to a second case-study.

In chapter 8, guidelines for applying concepts of relevance in a semiotic framework are put forward in order to contribute to the management of information resources. These guidelines concern the establishment and use of rules for making relevance judgments and the use of signs in design as a means of maintaining and indicating the relevance of an information system.

In chapter 9, some observations about the strengths and weaknesses of the NORMA semantic analysis methods are discussed. Some reflections on the process of writing the thesis in connection with concepts of relevance are included. The final section proposes suggestions for further research into the application of concepts of relevance in other areas.

The Contributions of this Thesis

The initial contribution of this thesis is in the recognition of the importance of relevance as an essential quality of valuable information resources. This leads to the establishment of the major characteristics of relevance which exist in a social context, that is there must be an agent or a

judge to whom something is considered relevant. Therefore, relevance judgments are subjective according to the judges' contexts and their accumulated knowledge which makes relevance judgments a matter of degree. The dynamic aspect of relevance judgments is due to the changes in judges' requirements and situations.

The investigation of the different concepts of relevance also makes it possible to distinguish their practical contributions despite their elusive and problematic nature. The investigation of the concept of relevance in logic throws light on the validity of both the classical and 'relevantistic' arguments in different contexts. The practical work in two case-studies also confirms the established characteristics of relevance and the importance of the concept of relevance in phenomenology as an underlying concept in which other specific concepts can be encompassed.

The consideration of relevance as an affordance also makes it possible to link the different concepts of relevance in a semiotic framework. The semiotic approach to these concepts brings out the two aspects of the problem concerning relevance. The first aspect is the need to identify criteria for making relevance judgments. The second is the need to use appropriate signs to enable users to accomplish relevant actions.

The most important contribution is the establishment of systematic guidelines for applying concepts of relevance semiotically in the analysis and design of information systems. Furthermore, the results from the first case-study, especially the ontology charts, can be applied to similar situations while some of the criteria for making relevance judgments can be modified according to users' requirements. This thesis illustrates the practical contributions of

abstract and elusive concepts and their importance in the management of information resources.

CHAPTER 2

THE CONCEPTS OF RELEVANCE IN PHENOMENOLOGY, LAW AND LOGIC

In this chapter three different approaches to the concept of relevance are presented and examined in detail. These are the phenomenological, legal and logical concepts of relevance. The phenomenological concept of relevance plays an essential role in the study of the sociology of knowledge and deals with the understanding of routine and commonsense knowledge. The legal concept of relevance plays an important role in the admissibility of evidence in a case. The legal concept of relevance is made concrete by the practical rules for identifying the relevance of evidence. The logical concept of relevance deals with the manipulation of logical rules and the application of probability in establishing the criteria of relevance. The application of logical deduction is also explicitly employed in the legal process and implicitly in the process of reasoning in everday life.

The Phenomenological Concept of Relevance

Here we take the study of phenomenology to be a branch of the sociology of knowledge which is concerned with the analysis of the commonsense reality. Phenomenologists argue that the conventional sociology of knowledge is too theoretical and intellectualised while neglecting the everyday knowledge for living (Abercrombie 1980). The phenomenological approach to sociology was originated during the interwar years in Europe in which Alfred Vierkandt was a leading figure while Alfred Schutz was

responsible for the development of the commonsense view (Tiryakian 1973).

The concept of relevance is an important tool in Schutz' study of phenomenology in which he uses it to explicate the connection between individual consciousness and the social reality of actions. The phenomenology of mind has recently become an important aspect in the field of cognitive psychology especially in the theory of cognition and artificial intelligence (Harlan 1984).

Schutz (1970) conceives of relevance as the principle means by which we establish a relation between the prevailing stock of knowledge and actual experience in everyday life. His concept of relevance depends on two major postulates. Firstly, our commonsense knowledge of the world of everyday life which is called lifeworld; it is a system of constructs of typicality. Secondly, this lifeworld is the social context which consists of interlocking activities of people who inhabit the social scene.

According to Schutz, the world in which we live and work is taken for granted as our reality. Each person must come to terms with it through learning and experiencing in order to find one's direction or bearing. The combined knowledge and understanding from one's experience form what Schutz calls the stock of knowledge at hand. Schutz contends that by progressive sedimentation of our experiences of objects, events and so on, we are able to differentiate our experiences of things as certain kinds, in other words, as types such as strangers, friends, politicians and so on.

The world of everyday life is a social framework and the object of one's actions. In order to carry out a plan or project we have to act on the social world and perhaps try to change it or experience the resistence to our effort

within it. Therefore, the 'lifeworld' is not only an object of thought or primarily of knowledge but also a field of actions. Schutz contends that the social world is articulated into multiple realities which are related to each other through the principle of relevance.

As we are not equally interested in all the different layers of reality of the world at once, our attention to a particular reality depends on our plan of action or project at hand. The guiding principle of our everyday action, according to Schutz, is based on a whole system of relevances. Schutz's relevance structures consist of three interdependent relevances: thematic or topical, interpretational and motivational relevances.

Topical or thematic relevance

Thematic or topical relevance involves perception of something being problematic in that particular situation. This includes the enforced change of theme or attention as a result of a break in expectations or as a surprise. This arises when the unfamiliar draws attention to itself in a normal course of events within the familiar environment. This change of perception can also occur voluntarily such as the changing of interest or attention, as when one loses interest in a subject and turns one's attention to a more exciting one.

Schutz elaborates the concept of thematic or topical relevance by using an example of a man who, on entering a dark room, becomes uncertain whether an object is a pile of rope or a snake. This man's interest is to find out whether the object is dangerous and requires certain measures to be taken. He does not pay attention to other objects in the room except the object which he will attempt to interpret either as a pile of rope or a serpent. It stands out as being

relevant to him in his context. This arises as he does not find that the room is the same as he had expected, i.e. something has become unfamiliar to him. He might have entered the room concerned with other things, such as a forthcoming trip. But the collapse of his expectation and the unexpected change impose upon him a change of his thematic field. Something has become problematic and thus has been made into a theme which supersedes his previous concern, that is, it becomes thematically or topically relevant to him.

There are other kinds of imposed topical relevances such as the experience of a shock, which is characteristic of any shift of the attention from the previous concern to another. Any interruption or modification which necessitates the discontinuing of the current interest generally creates imposed topical relevances. In addition, topical relevances can be imposed by means of social interaction determined by the acts of other individuals or social groups; for example, a meeting of managers can bring about a new topic of relevance to their attention.

Topical relevance can also be brought about by voluntarily replacing one theme of thought with another. This can be done by gradually superimposing one on the other such as by enlarging or deepening the prevailing theme. On the other hand, a voluntary shifting of attention from one topic to another can occur when a person has lost his interest in the prevailing theme.

Interpretational relevance

Interpretational relevance involves the application of the stock of knowledge to grasp the theme or present perception of a problem. It involves the effort to bring coincidence between the theme and the stock of knowledge

in order to solve the problem. On the one hand, certain aspects of a perceived object or problem can become the thematic elements which can be brought into relief and are then relevant for interpretation. On the other hand, there are certain elements of the stock of knowledge which are within the grasp of the given theme and are also relevant for interpretation. In other words, a person will try to bring about a coincidence between the theme and his own knowledge.

In the case where there is no easy coincidence between the two elements, the process of explication must be pursued until a conclusion can be found or the process is abandoned as a result of diminishing interest. Interpretational relevance is therefore considered as situationally conditioned.

In the example given by Schutz, the man in the darkened room finds that the object in the room attracts his attention and is thematically relevant to him for interpretation. He must interpret it in the light of his knowledge of typicality and the various experiences from his stock of knowledge at hand. Within the context of his previous experiences, the object might be compared or interpreted by sameness, likeness and so on. In the process of interpreting the object as a pile of rope, his previous experience and knowledge of the characteristics of a pile of rope such as the shape and colour become relevant to the conclusion that it is a pile of rope.

The uncertainty will increase if he has never seen a rope formed in a pile or a rope of grey colour. If a person could not arrive at a decision, he may decide to make the experiment with a stick, hoping to determine how the object is to be interpreted by gaining new interpretatively relevant material. Therefore, the interpretation remains tentative, subject to verification or falsification by gathering interpretatively relevant material.

Motivational relevance

Motivational relevance follows as a consequence of the existence of interpretational relevance. It refers to the course of actions undertaken in the explication of the perceived problem in which the solution of that problem demands a certain course of actions. These actions are governed by the particular goal of each actor in the social world. The motivated actions in turn obtain additional material and feedback which may affect the perception of the problem as a result of the interaction among the three systems of relevances.

The correct or at least the satisfactory interpretative choice of the object in the room will determine the man's future conduct. He will act differently according to the context of his topical and intrepretative relevances which are also motivated by his goal. In this example, the man experiments with the object by hitting it with a stick in order to gather more relevant material for his decision. His motive of avoiding the danger of sleeping in a room with a snake determines his actions of trying to remove the object. These actions are said to be motivationally relevant for bringing about the desired result.

The interdependence of the three different relevances

Schutz states that it is perfectly possible to experience the three main types of relevance in quite a different chronology. Sometimes the boundary between the three relevances becomes unrecognisable reflecting the dynamic and complicated characters of these concepts of relevances.

Generally, the emergence of something which seems to be otherwise than expected gives the experiencer the feeling of uncertainty or unfamiliarity

which needs to be resolved. This gives rise to topical relevance. In this situation, there is a twofold relationship between topical and motivational relevances. On the one hand, it is the prevailing motivational relevance or one's interest which leads to the start of a new theme or topical relevance as a result of the need to investigate the atypical. On the other hand, the topical relevance may further influence other motivational relevances. In other words, something which appears to be irrelevant can attract a person's interest, thus motivates him to familiarise with it through the interpretative process.

In addition, a shift in the interpretational relevances can occur such as in the introduction of a new concept. This gives rise to a new set of motivational or topical relevances which are not present in the stock of knowledge. Any of these three relevances may become the starting point for bringing about changes in the other two.

Schutz himself recognises that there are several shortcomimgs in his explication of different systems of relevances as a framework for everyday life. An interesting point which has not been identified by his critics is the misleading use of the phrase 'stock of knowledge'. This can lead to the assumption that knowledge can be treated in a way similar to other physical objects which can be stored away in some repository such as spare parts in a factory. The misleading implication is that we then expect that knowledge remains static while being neatly stored away for a period of time.

Knowledge is socially created by members of the society and is subjected to changes by social forces. For example, the publication of works in journals make it possible for the sharing of knowledge and exchanging of ideas. Issues

which are controversial are usually subjected to the process of negotiation and debate among leading proponents; this process is evident in the sociology of knowledge (Remmling 1973). In the development of scientific knowledge, the rise and fall of scientific theories are socially sanctioned by the community (Lakatos 1983).

Furthermore, the existence of knowledge depends on the existence of those people who continue to make use of their particular skills and pass it to other generations. For example, the knowledge of the archaic language of Sanskrit is not completely lost even though it has ceased to be a living language, as it is still used and studied by some people. Hence our knowledge cannot be treated as some static stock of physical bundles in a warehouse.

The major criticism of Schutz' work is on his view of the individual consciousness as a basis for meaning in the social world in the sense that lifeworld is perceived to be the product of a stream of mental acts. This leads to the implication that meaning is a mental happening. On the one hand, Schutz is criticised for being inconsistent with his own assumption that an analysis of social life must be based on the social world (Abercrombie 1980).

On the other hand, he is seen to be trapped by his own adherence to the basic postulate of Husserlian phenomenology that meaning is linked to the individual ego (Hekman 1986). This error has been criticised by Wittgenstein who argues that social actors, by using the social medium of language, participate in the shaping of meanings supplied by language (Wittgenstein 1953, Bloor 1983). However, Schutz's work attracts attention to the neglected aspect of the sociology of knowledge and contributes to the understanding of the nature of social reality (Hekman 1986).

Despite the weakness and flaws in Schutz's work, his phenomenological concept of relevance clarifies some important aspects and implications of the concept of relevance. Firstly, the concept of relevance is grounded in social context as our knowledge is derived from learning and experiences in everyday life. Secondly, relevance is changeable as one can lose interest in the current project or something else becomes more interesting. Thirdly, relevance is subjective, as topical or thematic relevance involves the perception of a person with respect to his accumulated knowledge. Fourthly, relevance is situationally conditioned depending on one's particular circumstance and expectation. Fifthly, relevance operates in a field of action as a person is motivated to pursue relevance to bring about a result or conclusion.

Schutz has also pointed out that we make use of the notion of relevance intuitively in everyday life which makes the concept itself so transparent that we are not consciously thinking about it most of the time. For example, a housewife having to prepare an authentic Burmese dinner will have to interpret the quality of ingredients available in a shop as to whether they are suitable for the particular dish. The topical and intrepretational relevances underline the process of selecting the proper ingredients while the motivational relevance underlines the decision to cook certain dishes. Similarly, in a business context, a manager's motivation to improve the sales figures may call for a market forecast report in conjunction with a report of current performance so that he can take appropriate actions.

Therefore, the phenomenological concept of relevance provides an explicit reflection of the intuitive way in which the three systems of relevance contributes to a person's endeavour in the social world and in the finding of

solutions to accomplish one's goals. Schutz's thesis offers the philosophical basis for the concept of relevance which underlies the more practical approaches to the problem of relevance.

The Concept of Relevance in Law

The concept of relevance is central to the law of evidence in which it is used as a criterion for admitting evidence in the court of law. In contrast to the phenomenological approach, the legal approach to the concept of relevance is made concrete by establishing explicit rules for identifying relevant evidence. The often quoted classic definition is that of Stephen in his Digest of the Law of Evidence in which he says of 'relevant':

> 'Any two facts to which it is applied are so related to each other that according to the common course of events one either taken by itself or in connection with other facts proves or renders probable the past, present, or future existence or non-existence of the other' (Cross 1979, 18).

Another simpler definition is that 'evidence is relevant if it is logically probative or disprobative of some matter which requires proof... evidence which makes the matter which requires proof more or less probable' (Keane 1985, 17). In the law of evidence, relevance is considered to be a question of degree which is largely determined by common sense and experience.

However, the relevance of evidence does not give an automatic admission in court. The law of evidence draws a distinction between the relevancy and admissibility of evidence. Relevance is seen as a product of

induction from experience whose applicability can be tested by logical deduction. The admissibility of evidence depends on the condition of relevance of a sufficiently high degree that the evidence tendered does not infringe any of the exclusionary rules.

The judge is responsible for deciding on the questions of the admissibility of evidence. In cases where there is a jury the judge gives his observations on the cogency of the evidence and arguments in the summing-up of the case. Moreover, he can withdraw an issue from the jury if a counsellor cannot produce sufficient evidence in support of a particular claim. But the judge must not direct a jury that they must accept his view.

On the other hand, the role of the jury is in deciding on the questions of the weight of tendered evidence and the existence or non-existence of the facts in issue. In civil cases the judge decides all questions of both law and fact. The law of evidence provides guidelines for admitting relevant evidence by stating the kinds of things which can be considered as judicial evidence and various rules for judging the relevance of evidence together with the rules of exceptions. As the main concern of the law is to ensure that justice is done, a certain standard of proof of evidence is considered essential.

The role of the judge and jury in appraising evidence is similar to the businessman who has to make decision on the basis of the ample supply of information such as from reports, forecasts, arguments and recommendations. The decision maker is also faced with the same problem of identifying relevant evidence in order to arrive at a correct or profitable decision. Therefore, the practical way in which the law of evidence deals with the issue of relevance can be beneficial to the problem of the ordinary businessman.

Admissible judicial evidence

In the legal context, there is a distinction between the 'fact in issue' and evidence. The fact in issue is the basis of the dispute between the parties in a case. The evidence tendered in court in order to prove or disprove a fact in issue is known as judicial evidence. A fact in issue in any given case is a fact which either party must prove in order to win his case. For example, in a dispute concerning insider dealing, the accused has to prove that he is innocent while the prosecutor has to prove that the accused has committed such a crime. According to the law of evidence, the principal items of judicial evidence consist of five categories.

The first category is called testimony which is the oral statement given on oath by a witness in court. The reliability of the witness's testimony are ensured by the provision of various rules such as those concerned with the oath, the competency of witnesses and their cross-examination. In the everday context of business, the application of critical examination of given items of information and their sources is an important aspect of decision making. The implicit mechanism of social sanctions such as loyalty to the group, the risk of gaining a bad reputation or the loss of status help in ensuring that the source of information is reliable.

The second categery of judicial evidence is admissible hearsay. Hearsay is defined as evidence which 'consists of any statement made by a person other than while giving evidence in the instant proceedings and which is tendered for the purpose of proving any fact contained in the statement' (Murphy 1980, 123). Usually hearsay cannot be admitted in court but there are few exceptions. For

example, documents are a major source of hearsay statements which are subject to rules against hearsay. However, the legislature provided a statutory basis for admitting trade and business documents under certain circumstances with the Police and Criminal Evidence Act 1984.

In contrast, the use of hearsay information is prevalent in business affairs such as in dealing with the stock market and in gathering gossip and rumours about competitors. As hearsay can be intentionally fabricated, the use of hearsay has to be tempered with precautions and critical examination of their sources and validity. In law, the concern is with the matter of justice or life and death which justifies its strictness with the admisssion of hearsay evidence.

The third category of judicial evidence is document which includes a wide variety of physical representation. Documentary evidence includes maps, plans, drawings, photographs, disc, tapes, video-tapes, films and negatives. A document can be produced to show its content, existence or physical appearance which must be subject to cross-examination. Therefore, a document produced in court must be accompanied by some testimony and identified by a witness.

Documents form an important basis upon which business affairs depend. The examination and rules for ensuring the reliability and admissibility of evidence can be applied to the business context especially in decision making involving a high stake.

The fourth category of judicial evidence is known as real evidence. Real evidence generally takes the form of some material object produced for inspection in court or out of court so that the judge and jury can draw an inference from observing that object. For example, a gun can be produced in a

murder case so that the jury can be satisfied by its existence or condition in connection to that case. As a means of proof, the weight of real evidence depends on the given testimony.

The idea of having a testimony accompanying evidence can be modified to suit the business context in order to increase the reliability of given information. The responsible agent who supplies or produces an item of information such as a financial report must be explicitly acknowledged or established so that additional testimony or elucidation can be acquired.

The fifth category of judicial evidence is circumstantial evidence which is sometimes called evidentiary fact or fact relevant to the issue. Circumstantial evidence is any fact which the judge and jury can use for proving the existence or non-existence of a fact in issue. Circumstantial evidence can be provided by means of other judicial evidence mentioned above.

Statements which come under the res gestae are also known as circumstantial evidence. Res gestae means a transaction. A fact or statement or an opinion which is associated with some element of the fact in issue such as by circumstances can be considered as a part of the same transaction. The justification of such evidence is its contribution to the understanding of an act or event which would otherwise appear to be inexplicable. Examples of circumstantial evidence are motives, plans, capacity, opportunity, identity, failure to give and provide evidence.

Lawyers exploit the force of circumstancial evidence on the basis of applying several items for pointing to the same conclusion. For example, the blood on the accused's knife may be defendable, but the additional facts, such as the accused's animosity towards the dead person and the effort to hide the

knife may turn it into a strong case for murder.

The role of circumstantial evidence or information in business affairs cannnot be over estimated as the bulk of the available information is not real evidence but the product of appraisal and observation. The criteria of relevance seem to be the underlying reason for giving consideration to this type of input so as to make the context or problem more meaningful and intelligible. The reliability of such information should also be subjected to scrutiny similar to the provision in admitting evidence in court.

The exclusionary rules

These are rules which state the exceptions to the admissibility of relevant evidence. Evidence which is sufficiently relevant is only admissible in so far as it is not excluded by any rule of the law of evidence. Consequently, however relevant it may be, an evidence is excluded from admission in court. The four frequently stressed exceptions are hearsay, opinion, character and conduct on other occasions.

Firstly, hearsay which could be highly relevant with regards to its contents is excluded because of the high probability of it being accepted without critical examination. The reason is that the witness who narrates the hearsay statement to the court has no personal knowledge of the incident. In addition, the person against whom the hearsay is directed often has no opportunity of cross-examining the hearsay evidence.

This cautious approach to hearsay can benefit the business community by raising the awareness of falsehood in hearsay occasion either by fabrication or misintrepretation by the hearer. Therefore, the weight attached to hearsay

depends on the examination of its source and content in conjunction with other evidence.

Secondly, the opinion of a non-expert is generally regarded as being insufficiently relevant for admission on the basis that the jury might be tempted simply to accept the opinion rather than drawing its own conclusion from the arguments and evidence of the case. This is commonsense in the business context in which opinions are sought from the learned expert or specialist. The complication of the business situation make it unlikely that an uninformed person can give qualified opinions on the matter.

Thirdly, evidence of the accused's bad character or his disposition towards wrongdoing is also excluded even though it may be relevant, as it throws more weight in confirming the case. The reason is that there is a risk that the jury would attach to it a greater probative value than it actually has, so that the case is ruled by prejudice.

The application of this rule is in providing precaution against judging information on the basis of prejudice whether for or against its relevance. The likelihood of an item of information being truthful must be based on some accountable procedures which can be logically examined, such as a mathematical model or logical deduction.

Fourthly, the previous behaviour by someone on one occasion cannot be used to prove that he behaved that same way again in the case in question. This is to prevent a person being summarily judged on the basis of the past rather than on the basis of actual evidence of the case. This rule is in contrast to the normal business practice in which previous knowledge influences the perception and expectation of our pattern of behaviour. For example, the previous

knowledge of the behaviour of consumers influences the marketing decision of a new product. However, changes in consumers' tastes and fashion means that this exclusionary rule is applicable in certain circumstances.

In addition, highly relevant evidence may be withheld as a matter of public policy as its disclosure would jeopardise national security or be harmful to some other national interest. Therefore, exclusionary rules provide a guideline for excluding relevant evidence which may result in the miscarriage of justice. For business application, the exclusionary rules can be established more specifically for the particular need of a situation so that relevant information can be admitted according to the explicit criteria. The importance of the reliability of evidence is also reflected in the exclusion of insufficiently relevant evidence.

Insufficiently relevant evidence

Relevant evidence which may have high probative value may be considered to be too remotely relevant and inadmissible on the grounds of being insufficiently relevant if it is not adequately reliable or easily examined. For example, evidence which might be highly relevant in a protracted academic investigation is treated as too remote from the issue in a forensic inquiry because the process of coming to the conclusion is governed by a time factor. Furthermore, there is a danger of distracting the jury with matters which are not being litigated.

There are two factors which may affect the relevance of evidence and its admission in court. The first is the danger that it will give rise to a multiplicity of issues. The second reason for considering that the evidence is insufficiently

relevant is the danger that it might have been manufactured. Therefore, the court adopted the view that the degree to which an item of evidence is relevant to an issue decreases in proportion to the likelihood of its having been manufactured. This factor has played a large part in the development of the rule excluding hearsay.

Both of these factors can enhance the quality of decision making in business situations so that superfluous and insufficiently relevant information can be prevented from distracting the decision makers. The degree of relevance has to be weighed against the probability of its unreliable source. Further application of legal rules can be gathered from other criteria for admitting evidence, namely the rules of estoppel.

Estoppel

The principle of estoppel is that a person should not be allowed to contradict his words or conduct which he has alleged earlier. This justifies the treatment of estoppel as an exclusionary rule which is enforced when it is pleaded. Estoppels could be regarded as something which renders proof of certain facts unnecessary. The three kinds of estoppels are estoppels by records, by deed and by conduct.

The two principles underlying estoppel by record are that there should be an end to litigation and that no one should be sued twice on the same ground. Consequently, the order of a court of competent jurisdiction is conclusive. Therefore, once an issue has been raised and legally determined between the two parties then neither side is allowed to fight that issue again. An estoppel by deed prevents a person who executes a deed from saying in a

court that the facts stated in the deed are not truly stated. For example, if a deed contained a receipt for the purchase of a house, the seller is estopped from alleging that the buyer has not paid the money, provided that the estoppel was pleaded.

The estoppel by conduct can be categorised into estoppels by agreement, representation and negligence. Where a person through his words or conduct intentionally makes another person believe in a certain state of things, and induces him to act on that belief or to alter his own previous position, the former is estopped from contradicting against the latter's belief. The estoppel by representation also works in the same way with estoppel by conduct but on the basis of representation.

The estoppel by negligence operates in favour of those who are the victims of fraud by some third person facilitated by the careless breach of duty of the other party. For example, a person signs an extraneous documents handed to him by his secretary; he would be estopped from denying his liability on the fraudulent document to anyone who reasonably took it to be his and acted upon it.

The notion of estoppel is implicit in the context of information system in that there exists a general expectation of a certain state of affairs in which people's intentions are communicated by words, records and conduct. However, the flexibility for changes occuring in these expectations and perceptions is necessary in the dynamic world of business. The application of estoppels in ensuring the relevance of information lies in the recognition of the existence of current estoppels such as in the users' indications for certain kinds of information.

Besides these legal rules for admitting relevant evidence, the important factor in deciding a case is the standard of proof of the tendered evidence. This requirement helps in ensuring that judgment of the court is competent and just.

Standard of proof

In order to establish his case or defence, either party in a legal proceeding has to bear the burden of proving fact to the required degree of proof. The success of a case depends on the ability of a party to convince the jury or judge of the truth or probability of some fact that is in issue in his case. In criminal proceedings, the standard of proof is proof beyond reasonal doubt whereas in civil proceedings it is on the balance of probabilities.

On the distinction between the two standards of proof, Lord Denning states that there is no absolute standard in either case (Cross 1979). The gravity of the issue becomes an element which the court has to take into consideration in deciding whether or not the burden of proof has been discharged. The more serious the case, the more cogent the evidence must be so as to overcome the unlikelihood of what is alleged and to prove it. For civil cases, the balance of probabilities means that the jury must be able to say, on the basis of tendered evidence, that the case for the successful party has been shown to be more probable than not.

The standard of proof in business decision is largely based on the balance of probability rather than proof beyond reasonable doubt. This is because it can be extremely costly to seek proof to the absolute standard. Likewise, the judgment on the relevance of certain information is a matter of degree depending on the factors or evidence which are used to decide its

relevance. The more criteria used for judging information, the higher the degree of its relevance.

Besides explicit rules, other legal criteria which judges can use to decide on the admissibility of relevant evidence are embedded in the various statutes and previous judgements or precedents. Statutes provide the criteria for deciding the fact in issue of the case, for example, whether it is the case of theft or negligence.

The other source of criteria for making judgment on the case is judicial intrepretation. Judicial interpretation of the clauses of a statute remains crucial, particularly when a new Act of Parliament is passed or an existing one amended. The first case which is considered as a test case brought under such an Act will be watched closely by the legal and political professions. The resulting interpretation will in itself establish a precedent.

In addition, precedents established by the decisions of judges in earlier cases can become binding for other subsequent cases. The case of Hollington v. Hewthorn & Co. Ltd. is often cited as authority for the provision that 'all judicial findings are inadmissible as evidence of the facts found in subsequent proceedings which are not between the same parties' (Cross 1979, 460). For example, in an action for damages for negligence in an earlier action brought by a passenger injured in a bus accident, a finding of negligence in an earlier action brought by another passenger in respect of the same accident would not be admissible.

The application of precedents in business affairs is implicitly reflected in the tradition of conducting daily business and various procedures, including the dependence on previous experiences. On the other hand, the explicit company

rules and mission being similar to the statutes or Act of Parliament in that they provide criteria for judging information or acting within the defined context.

Thus, the law of evidence not only gives a practical definition of relevance but also explicit criteria and rules for dealing with the admissibility of relevant evidence. The primary need to ensure that evidence is as truthful and reliable as possible is reflected in the distinction made between relevance and admissibility. The use of statutes and precedents gives the judge the basis on which he can interpret and decide on the facts in issue and their admissibility.

The law of evidence recognises that relevance is a matter of degree and also give reasons for not admitting insufficiently relevant evidence. The required degree of proof helps to ensure the standard of the conclusion or judgment of a case. The law of evidence points out clearly that relevant information is important in decision making so that explicit criteria are necessary to judge its relevance, which affects its admissibility to the decision process. Many of these rules and their legal framework can be modified according to the context of judging the relevance of information in a business information system.

The Concept of Relevance in Logic

The concept of relevance has been a subject of debate and controversy among logicians as some logicians become dissatisfied with the limitation in classical logic. The uncontroversial explication of relevance is given by Carnap who bases it on logical probability. The importance of logical relevance is reflected in its explicit application in the legal reasoning and in information

retrieval. Logical relevance is also implicit in the process of evaluating argument in everday life.

In classical logic, the term 'relevance' is also used in the context of the fallacy of certain types of deduction, for example, in questioning why certain conclusions are incorrect. The fallacy of relevance occurs in the situation in which the premisses are logically irrelevant to the truth of the conclusion. The exception to this case is the fallacy of 'petitio principii' or begging the question. The term 'fallacy' is used to refer to arguments that may seem to be psychologically persuasive but incorrect (Copi 1986).

Different types of fallacy have been given Latin names and a list of these can be seen in Copi (1986) and Hamblin (1970). Some of these are: 'argumentum ad baculum' which is the fallacy in which a person appeals to the threat of force to cause others to accept a conclusion; 'argumentum ad ignorantiam' (argument from ignorance); 'argumentum ad misericordiam' (appeal to mercy) and so on. Copi explains that the reason psychological relevance is confused with logical relevance can be explained in some cases by reference to the fact that language can be used to evoke fear, hostility, pity or enthusiasm (Copi 1986, 91).

According to Copi, the importance of the concept of relevance in logic can be clearly seen in the appraising of analogical arguments. Although the condition of logical necessity is that a conclusion follows from its premisses, some arguments are more cogent than others. For example, in order to support the conclusion that Peter's new tractor will give good performance, the known performance of the neighbour's tractor which is the same model and make with the same engine design and specification can be used to give the conclusion

more weight. In contrast, the weight of the argument is much less if Peter draws his conclusion from comparison of the tractor being of the same colour or the same numbers of gears.

The use of analogical reasoning plays a very significant role in the legal reasoning of the British legal system which depends largely on judgments of previously similar cases or precedents. Therefore, an argument based on one relevant analogy related to a situation is considered to be more cogent than another which includes several insufficiently relevant points. Copi contends that an analogy is relevant to establishing the conclusion of a given case provided that it is drawn with respect to the causal circumstances affecting it. In evaluating analogical arguments, we require some knowledge of causal connections which is gained through observation and experiment.

The other important use of the concept of relevance is in the evaluation of explanation, whether scientific or not. An explanation consists of a group of statements from which the issue to be explained can logically be inferred and the acceptance of the explanation destroys or mitigates its problematic character. For example, if a secretary in London had offered the explanation for late arrival that there is a war in Afghanistan or a famine in India, it would have been a very poor explanation.

Therefore, the relevance of a proposed explanation is enhanced by the cogency of the argument by which the explanation is derived. Any acceptable explanation must be relevant, but not all stories that are relevant in this sense are acceptable explanations. The other criterion for deciding the acceptability of the proposed explanation is that the explanation be true.

Hence, the process of cross-examination of a witness in a trial is vital in

that it helps in establishing the truth of the relevant evidence submitted in a legal proceeding. In addition, the possible fallacies of reasoning are diminished by the rules concerning the admissibility of evidence and the judge's sanction in court such as against 'leading questions'. The criteria of relevance is the crux of the successful result in a trial in which the case is won by the strength and cogency of the arguments and evidence given in that case.

The theoretical explications of logical relevance are concerned with the confirmation of hypothesis developed by Carnap and the logical implication or entailment, including the controversy between the classical logicians and the relevantists.

Carnap's concept of logical relevance

Carnap's theory is concerned with the following situation: an observer X is interested in a hypothesis (h); he possesses some prior evidence or information (e) and obtains additional evidence (i). Carnap is interested in investigating the change in the confirmation of the hypothesis (h) due to the additional evidence (i); whether the confirmation of (h) is increased or decreased (Carnap 1950). Therefore, the probability of increasing the confirmation of the hypothesis on the basis of personal observation depends on the additional evidence.

The confirmation of the hypothesis based on (i) is called the posterior confirmation while the prior confirmation is that of the hypothesis on the basis of (e), or the observer's evidence. According to Carnap, if the posterior probability of confirmation is higher than the prior probability of confirmation, we shall say that the additional evidence (i) is positively relevant, or simply

positive to the hypothesis on the evidence (e). If it is lower, we shall say that (i) is negatively relevant or negative to (h) on (e). On the other hand, if the confirmation of the hypothsis remains unchanged and also in another case where it cannot be applied, we shall say that (i) is irrelevant to (h) on (e).

For example, a farmer observes that the weather has been very dry for the whole month (e). He thinks that it will continue to be dry for a day at the most, then there should be some rain (h). On the radio, the weather forecast describes the possibility of a depression moving into that area hence bringing some rain in a few days' time (i). The farmer's decision to bring his flock of sheep back to the fells depends upon the confirmation of his hypothsis (h) and the probability of the forecast (i). If he thinks that the forecast is quite accurate with a high probability, it confirms his hypothesis so that he will wait for the rain. Hence, the additional information (i) is said to be positively relevant to the farmer's hypothesis.

The posterior confirmation of the hypothesis (h) depends on the probability of prior confirmation and the likelihood of additional evidence. If (h) is not merely statistical law but a deterministic law, we have the special case of the likelihood being equal to 1. The less a person expects (i) to be likely, the more significance of its relevance to the confirmation of his hypothesis. For example, a patient of Dr. Jones called Smith suffers from an illness which might be related to AIDS (h) on the basis of Dr. Jones' medical knowledge (e). As Smith thinks that it is highly unlikely, Dr. Jones decides to have a blood test. The result of this test (i) turns out to be unexpected as a positive result which confirms the diagnosis (h).

On the other hand, the result could be negative which is considered to be

negatively relevant to the confirmation of the hypothesis and the fact that Smith has a bad case of Chinese-Flu instead of AIDS. If the result gives the reading of the cholesterol level in Smith's blood instead of the presence or absence of a particular virus, it is considered to be irrelevant to the hypothesis. This irrelevant result which may be due to the technician's misunderstanding of Dr. Jones' instuction may be relevant if the hypothesis is that Smith is likely to get a heart attack.

Therefore, Carnap's logical relevance plays a role in confirming, either positively or negatively, a person's hypothesis basing on his knowledge or observation. If the additional information confirms his hypothesis, it is said to be relevant or positive. However, the degree of confirmation of (h) depends on the probability of (h) itself, and the accuracy of the additional information or evidence (i).

We can see the application of Carnap's idea in other fields such as in legal reasoning in which a fact is used to prove or disprove the fact in issue or in confirming an accusation by using other evidence.

The logic of implication and entailment

The other logical concept of relevance which has also been applied in the field of information retrieval is that of implication or more precisely entailment. As the logical structure of implication and entailment are the same, except for the different rules, we may find that some writers may use the two terms interchangeably. The difference between implication and entailment lies in the paradoxes of material implication.

Implication is the most general name for those relations between two

propositions or statements expressed in the structure of if...then in which the first component statement is called the antecedent, and the one following is the consequent. Hence, it is sometimes called logical consequence. A minimum condition for such a relation to hold is that 'if one proposition, p, implies another, q, it is not the case that p is true and q is false' (Lacey 1976, 102). Then we say that p materially implies q. The truth table of implication is as follow:

p	q	p-->q
t	t	t
t	f	f
f	t	t
f	f	t

The truth functional implication shows us that it is false if its antecedent is true and consequence false (Allwood et al. 1981). Therefore, a false proposition materially implies any proposition, for example, if Mrs. Thatcher is the leader of the Friends of the Earth (then) all elephants can fly.

The paradoxes of material implication are due to the fact that in propositional logic the implication is treated only truth-functionally according to its stipulation. Hence logical implication is different from the implication of everyday usage in which the antecedent and consequent are tied together by some causality or logical consequence (Allwood et al. 1981, 38).

The solution to the paradoxes of implication has been attempted via the concept of entailment. Entailment is a special relation introduced by Moore

(1942) in which it holds from p to q when and only when q can be logically deduced from p. Entailment in this case can be called logical entailment. It is different from strict implication in that it requires that the two propositions have some relevance to each other, or connection of meaning, so that the paradoxes of strict implication do not apply to it. This concept has become known as relevance logic and those logicians engaged in it are called the relevantists. But the formalisation of relevance logic has remained the subject of debate and controversy as it challenges the classical view.

The theoretical debate on relevance

Anderson and Belnap (1975) attempt to formalise the logic of entailment on the basis of relevance or meaning connection between the propositions so as to avoid the paradoxes of material implication. To this end, they contend that logicians have taught for more than two millennia that a necessary condition for the validity of an inference from A to B is that A is relevant to B. Thus, they argue that 'the fancy that relevant is irrelevant to validity strikes us as ludicrous, and we therefore make an attempt to explicate the notion of relevance of A to B' (Anderson and Belnap 1975, 18).

They return to the notion of proof from hypotheses, in which they want to infer A implies B from the hypotheses A. They interpret this as 'A entails B' or 'B is deducible from A' so we can say that A implies B whenever there exists a deduction of B from A. Consequently, the necessity of the deduction is seen as essential for the deduction to be valid so that an entailment, if true at all, is necessarily true.

The example given by Anderson and Belnap is difficult to be appreciated

except by mathematicians, so a simpler but similar example is used to illustrate their point that relevance is essential to a valid argument. An accountant submits a report to a director on the forecast of the company finance and concludes with a conjecture in the footnote. She says that if the conjecture is true, then the forecast on the company profit is complete; whereas if it is false, then it implies that the production manager's report of total output is correct.

The director objects to the footnote because the accountant has given no evidence that her conjecture about the total output is relevant either to the completeness of the forecast or to the production manager's report. On the other hand, the accountant argues that she simply uses logical implication according to the classical tradition. But the director's reason is that it is not the same as the everday usage of if...then. Thus, Anderson and Belnap asserts that we have to take seriously the word 'from' in 'proof from hypothesis'. They want a system for which there is a deduction to the effect that there exists a proof of B from the hypotheses A if and only if A implies B is provable.

The criticism on Anderson and Belnap's work

The attack on classical logic by Anderson and Belnap has given rise to lively debates and controversies in which their opponents have claimed that the notion of relevance is 'too vague, uncertain,...ambiguous and mysterious to be the subject of careful logical scrutiny' (Anderson 1972, 348) The 'relevantistic' movement has also been dismissed as a simple case of confusing the logical notion of implication and the methodical notion of inference (Burgess 1981, 103). The systematic and comprehensive criticism of their work can be found in the responses by Iseminger and Burgess.

Iseminger (1980) perceives that Anderson and Belnap's theory consists of a dilemma. The first horn of the dilemma is Anderson and Belnap's claim that classical logicians have taught that relevance is necessary for validity. Isminger points out that it is not clear that logicians have taught that meaning-connection relevance is necessary for validity. Although text books on logic give classifications of fallacies including the fallacies of relevance, there is no explicit requirement of meaning-connection for validity.

The second horn is that logicians have also taught that the argument from A and not-A to B is valid. This means that relevance is not a necessary condition for validity as we can infer a conclusion, B, from assumptions which do not have any meaningful connection to B. The second horn is called the systemic argument and is tackled by making the distinction between the meaning-inclusion account of validity and the meaning-connection sense of relevance.

According to Iseminger, meaning-inclusion is necessary and sufficient for validity, that is the conclusion of an argument includes the meaning of the premisses. From this, it follows that there must be some meaning-connection between the assumptions. Thus, meaning-inclusion entails meaning-connection and the latter is necessary but not necessarily sufficient for validity. For example, let A be Thai cooking is very spicy; B says that Helen is learning to cook. There is a meaning connection of cooking between A and B, but it is not necessarily sufficient for deriving a valid conclusion that Helen is learning to cook Thai food.

Furthermore, Iseminger argues that some meaning-inclusion accounts can have as a part of their meanings any contradictory propositions. Hence,

the meaning-inclusion account of validity will no longer entail the meaning-connection or relevance as a necessary condition for validity. This is because there would be no meaning connection between the contradicting propositions. Thus he concludes that the classical account of validity seems to be unshaken and the systematic argument for the view that meaning-connection relevance is a necessary condition of validity as unsuccessful.

Concerning the example given by Anderson and Belnap, Isminger argues that there are several objections to be made without invoking the claim that meaning-connection relevance is a necessary condition of validity. He would point out that the accountant does not claim that she has proved the validity of the production manager's report or how she might prove it. That is why she has claimed that 'if' her conjecture should turn out to be false, then the production manager's report follow from it. The director's objection to the footnote is seen simply as the demand for a demonstration of relevance in the derivational utility sense. He thinks that it cannot be used to derive such conclusion and not that he wants to see the meaning-connection.

The criticism on Isminger's arguments

Isminger's arguments seem to be weakened by the fact that he does not define more precisely the difference between meaning-inclusion and meaning-connection. The perception of these two categories is rather subjective which could create further debate rather than clarity. For example, one can ask these questions: How does one delinate meaning-connection from meaning-inclusion? Where do we draw the line? Is meaning-inclusion an absolute notion, if so, how can we be certain that it is complete? The other important

point is that meaning changes with the passage of time and that its nature is dynamic.

In reality, it is possible to find something which consists of contradiction in its meaning according to the different context in which it should be interpreted. For example, the meanings of the terms 'male' and 'female' can vary and be contradictory depending on whether their meanings are interpreted in the physiological or psychological context. Either meaning consists of contradictory propositions in the sense that each person could be said to be both 'male' and 'female'.

Therefore, it is extremely difficult to draw a line between the concepts of meaning-inclusion and meaning-exclusion in the real world. The limitation of classical logic in disregarding the relationship of the premisses and what they actually represent has led to the debate on the relevance concept. Anderson and Belnap's entailment and logical relevance become the manifestation of the recognition of the desirable link of classical logic to a greater degree of meaningful application in everyday life.

Burgess' criticism of Anderson and Belnap's work

The other critique of Anderson and Belnap's entailment is by Burgess (1981). He disagrees with their claim that the relevantists' position is more compatible with commensense than classical logic. His arguments are centred on challenging the representation of the disjunction and conjunction according to the notion of relevantists' logic which claims to closely represent the ordinary language of 'or' and 'and'.

The arguments are about the better ways to represent two situations.

The first situation is given as p or q and not-p, it follows that q. The second is that given the propositions of 'not both p and q, and the value of p; it follows that not-q'. For the relevantists, their conjunction is expressed as (p o q), and disjunction as (p + q). The corresponding expressions in classical logic are (p & q) and (p v q) respectively.

He argues against the relevantists' conjunction by using the example of a Mystery Card game. If the player questioned has either or both of the cards named by the other player, he must answer 'No'; otherwise he must answer 'Maybe'. In this game, Wyberg asks Zeemann, 'Is it the deuce of hearts and the queen of clubs?' Zeemann says 'No'. Let p be the mystery red card of the deuce of hearts, and q be the mystery black card of the queen of clubs. Therefore, Wyberg is hinting that not both p and q.

Further, Wyberg argues: 'It isn't both the deuce of hearts and the queen of clubs; but it is the deuce of hearts (p) ; so it isn't the queen of clubs (not-q)'. So, he goes on to use this deduction to win the game. Burgess argues that this is because Zeeman's answer has been that not (p & q) in the conventional form.

Therefore, Zeemann sees the queen in her hand and makes the statement according to truth-functional rules. The main reason here is that the two mystery cards have been chosen independently of each other, hence there is no basis on any relevance between p and q. According to the relevantists, this conjunction will be interpreted that there is a connection between the existence of the two cards, the one would not be drawn without the other. Hence Burgess concludes that a relevantist would fare badly in this game and other game-like situations in social life.

This example seems to have undermined the relevantists' position. But

it is important to realise that the connection of meaning between the two propositions have to be interpreted according to their context. In this game, it is apparent that there is no meaning-connection between the two different cards so that the application of the meaning-connection is not appropriate here. The point is that since classical logic disregards the meaning of the premisses, being concerned only with the relationship between their given values, the example given by classical logicians seems to be chosen to reflect this position. Hence the context in which meaningful interpretation of the premisses can be derived becomes prominent in deciding (by someone) whether there is any connection of meaning between the two propositions. Classical logic, despite its limitation, can work very effectively in those contexts where the meaning-connection is not applicable or it does not require attention.

The other example which is used to counter the disjunction according to the relevantists' position concerns the knowledge of a mathematical proof. In this case, Dr. Zeemann's result is a proof that every natural number n either has a certain property A(n) or else has a certain other property B(n). Zeemann has taken her proof that A(0) to dispose of the case $n=0$ of the general theorem that for all n, either A(n) or B(n). She has argued from the premiss A(0) to the conclusion that A(0) or B(0), which is objected by the relevantists. The reason is that the inference from A(0) to B(0) is only valid if 'or' is taken as the conventional sense such that there is no connection between the two propositions.

According to the expression of (p + q), Dr. Zeemann has to know the value of both A(0) and B(0) in order to be able to derive a valid inference. That is, there is a need to know whether there is any meaning-connection

between these propositions. In classical logic, the value of the antecedent is sufficient for deriving a valid inference. Therefore, it is not necessary to prove B(0) as well, in order to express Zeemann's theorem formally as (n)(A(n) v B(n)).

However, this example is indicative of the fact that logic is separated from reality. For in reality, the knowledge of B(0) can have an impact on one's view of the world even though it may be considered unimportant. In certain contexts, it is highly desirable to know both the values or consequences of a situation, that is both A(0) and B(0). For example, a cook may want to know the different ways in which an ingredient can be used in creating contrasting effects even though he already knows certain aspects of cooking this ingredient.

Indeed, the fact that the logicians of both schools of thought have managed to find examples to invalidate each other's belief reflects that meaningful connection or relevance has to be interpreted according to each person's particular context. Both cases seem to be valid according to their own context. These two approaches are similar to two different games each of which has different rules. Therefore, controversy naturally arises when the players of different games try to convince the other that they are playing the game wrongly. They are simply playing two different games. It seems much more beneficial to recognise which is the appropriate game to play in a particular context in order to make the most from that situation.

The important weakness of logic is that logical validity and logical truth are completely independent of the factual validity (Allwood et al. 1981, 16). Logicians are only interested in those properties that make an inference

necessarily valid. Logical validity and truth are also independent of the nature of the subject area the arguments refer to. For example, the premiss: the owl and the fox are both birds. The conclusion: the owl is a bird is a valid inference, even though its premiss is actually false. Logical inference is truth-preserving; it only tells us what has to be the case if the premisses are true. Therefore, logical inferences (truths) can be considered to be valid (true) independently of the reality of the situation.

The anomaly in logic has been traced by Wittgenstein to the foundation of logic itself (Bloor 1983). Wittgenstein (1953) argues that not only are the laws of logic the expression of thinking habit but also of the habit of thinking. He points out that conventionalism in logic treats the theory of analytical validity fails because logic treats conventions as verbalised rules. The use of rules is itself conventional so that in the last analysis, convention cannot be governed by verbally formulated rules. Instead, the consensus of action rather than the consensus of opinion or belief should be taken as the basis of knowledge.

The important point in his work is that logical inference has steps that are not brought into question and so long as we think it cannot be otherwise, we draw logical conclusions according to the established tradition. He suggests, for example, that we should not explain the lack of 'p and not p' by appealing to the meaning of negation. The meaning of negation does not determine the use, instead the use determines its meaning. Wittgenstein holds that concepts referred to as logical relations and logical constraints are really the constraints imposed upon the community by other people.

Anderson and Belnap's theory is an attempt to relate logic to a more

meaningful application to the real world by recognising that in certain practical contexts, the meaning-connection or relevance is an important factor in validating the statements. However, their concept fails to consider the existence of an agent or observer as being essential in the process of interpreting the meaning of propositions. That is why Carnap's concept of relevance on the basis of probability can be used to complement the relevantists' theory. Carnap acknowledges that we need an observer to make a hypothesis and an estimation of the degree of relevance. The relevance of evidence also depends on its reliability and the knowledge of the observer.

The practical application of the notion of relevance in legal affairs seems to be parallel to the concept of phenomenological relevance in which topical relevance is involved in the admissibility of relevant evidence. The interpretational relevance is involved in the process of cross-examination of other evidence according to certain legal rules and the motivational relevance plays its role in guiding the judge and jury to reach a just decision.

In the process of reasoning and interpreting evidence, barristers employ logical reasoning to establish a meaningful connection among their arguments in order to convince the judge and jury in their cases. The cogency of these arguments and evidence also depends upon the estimation of probability by the jury and judges such as the weights of the evidence. The cross-examination of witnesses and evidence is crucial for establishing their validity, meaning and truth. The legal rules on the admissibility of evidence helps in the identification of the elements involved in the fact in issue.

Therefore, in the context of information management, the concept of phenomenological relevance and the legal concept of relevance can be seen to

underlie the process of seeking relevant information in which logical relevance is central to the judgment of relevance. For example, the motivational relevance of a tour operator is trying to organise a package tour to Venice; the interpretational relevance involves the choosing of hotels and transport (topical relevance) based on the logical deduction of the detail about the cost of hotel rooms and the number of travellers. There may be certain rules governing the choice of hotel such as its location or the precedent of previously successful cooperation. The tour operator will make his judgment according to these factors and his personal knowledge or experience in order to achieve his goal in the best possible way.

CHAPTER 3

THE CONCEPTS OF RELEVANCE IN INFORMATION SCIENCE AND COMMUNICATION AND COGNITION

Concepts of relevance in information retrieval systems are discussed in the first section. The concept of relevance had been the subject of debate in information science since the 1960s. In the second section, the communication and cognition approach to relevance which is restricted to the context of verbal communication is examined. The underlying characteristics of relevance are concluded from the various approaches to the concept of relevance.

The Historical Background

The notion of relevance was the subject of much debate and attention among the information scientists during the 1960s. This interest grew as a result of the need to disseminate effectively scientific information among scientists and researchers. In the field of information science, relevance has been discussed in relation to communication and emerged as a central notion of the subject. The main objective of an information retrieval system was conceived to be the provision of relevant information to users.

Relevance was then considered as 'a measure of the effectiveness of the contact between a source and a destination in a communication process' (Saracevic 1970). The majority of the work on relevance in information science has concentrated on establishing, firstly, the factors which enter into the notion of relevance and, secondly, the relations which the notion of relevance specify (Rees and Saracevic 1966).

Recognising that not all the retrieved items would be relevant information, the information scientists explained that this was caused by the 'false drops' or 'noise' which is due to internal malpractices, the ineffectiveness of document representation. Therefore, in the early 1950s the system's view of relevance became a result of the thinking that relevance was mostly affected by the internal aspects and manipulation of information retrieval systems. Consequently, relevance was conceived in terms of indexing, coding, classification, linguistic manipulations, file organisation, question analysis and search strategies.

The challenge to the simplicity of the system's view began with the 1958 International Conference for Scientific Information (ICSI) in which a limited consensus emerged on relevance (Rees and Saracevic 1966). The consensus of the debate was that relevance was considered to be more than the operation of relating performance internally within systems and that it was not exclusively a property of document content. In addition, it was not a dichotomous decision and that it needed to be judged by users.

Saracevic (1975) suggests a theoretical framework for studying the notion of relevance. Firstly, it should be considered independently from any particular method of representation in information retrieval systems. Secondly, there exists a relevance to a subject. Thirdly, relevance is multifaceted and a matter of degree so that it cannot simply be a yes or no decision. Fourthly, the relevance of a given document changes with respect to another document and the person's knowledge.

The testing of information retrieval systems in the 1950s concentrated on the measuring methodology which shifted the problem of relevance from the

source to the destination's view of relevance or to users' judgments. There appeared to be two main schools of thought, one of which suggested that relevance is such an elusive and subjective property that it cannot serve as a criterion for performance testing (Doyle 1963). The other school led by Cuadra (1964) has proposed that experimentation with relevance judgments should be undertaken before any conclusion. Although it is recognised that relevance is subjective, the process of relevance judgment is considered to be objective under well-defined restrictions.

Definitions of Relevance in Information Retrieval

Most of the definitions were a form of hypothesis distinguishing the attributes of relevance. These definitions played an important part in setting the boundaries of the experiments. The general pattern of definitions appears as:

'Relevance is the A of a B existing between a C and a D determined by an E' (Saracevic 1975). Saracevic represents the various definitions as follows:

A	B	C
measure	correspondence	document
degree	utility	article
dimension	connection	textual form
estimate	satisfaction	reference
appraisal	fit	information provided
relation	bearing/matching	fact

D	E
query	person
request	judge
information used	user
point of view	requester
information requirement	information specialist
statement	

The first criticism of this kind of definition is that the primitive terms used have not been clearly defined before proceeding to more complex definitions. The second criticism is that some of the terms have similar meaning while some other terms are not appropriate for defining the concept of relevance. The terms listed in section E all refer to an individual who performs the role of judging the relevance of a document in relation to the information need. Therefore, the different terms (person, judge, requester, information specialist) in section E can perhaps be better replaced by one single term which includes all the different roles of a person in judging relevance.

Some of the terms in section A such as 'estimate' and 'appraisal' are very similar while the term 'dimension' is more suitable for measuring physical objects than for measuring an abstract notion of relevance. On the other hand, the term 'degree' is not appropriate in this context as it is a characteristic of relevance.

In addition, some of the sets of these terms are vague and too imprecise to be the definition of relevance, for example, the 'estimate of the satisfaction

existing between a reference and a point of view as determined by a requester'. The other inappropriate definition is the 'dimension of the connection existing between textual form and information used as determined by a user'. In this definition, the concept of relevance is restricted to a dimension which has not yet been defined. Furthermore, it is limited to textual form and its connection to the information used.

Therefore, this guideline for defining the concept of relevance has the weakness of not clearly defining the terms involved so the possible definitions offered are not completely reliable or operational. These terms also reflect the influence of the field of information retrieval in terms such as fit, matching, request and so on. However, it is apparent that the existence of relevance judgments depend on a judge and the objects of judgment.

Other more specific definitions of relevance are also associated with users and their needs or requirements. On the other hand, the more restricted notion of relevance which is the relation between a text and a request is used as a central concept in the study of bibliographic control. On this basis, Maron and Khuns (1960) define the relevance of a document to an index term as the probability that a user using this term will be satisfied with the document. However, this definition has been criticised as compounding the confusion by introducing the index term and an undefined variable of 'satisfaction' (Robertson 1977).

In contrast, a general notion of relevance is reflected by Bookstein (1979) who perceives that a relevant document must satisfy a person's need at least in part. The topic-oriented view of relevance is perceived as necessary in the context of the selection of documents for requesters (Swanson 1977). The

view that relevance is relative, changeable and depends on the user's knowledge is expressed by Saracevic (1975). The assessment of relevance is considered to be subjective as it depends on the person's understanding, purpose and the context of assessment (Vickery and Vickery 1987). The theoretical study of the notion of relevance can be found in relevance judgments, the application of logic such as in situational relevance and conceptual relatedness.

Relevance Judgments

Cuadra and Katter (1967a) point out that the term 'relevant' has been used in two primary ways. Firstly, it is used to indicate the relationship of a term or a document to a field of interest, hence the 'co-ordinate indexing' can be construed as relevant to the field of documentation. The second use of this term with which they are concerned, is to indicate a relationship between some system output, such as a document, and some kind of information requirement, either specified or assumed. Therefore, their definition reflects this concern.

> 'Relevance is the correspondence in context between an information requirement statement and an article, i.e. the extent to which the article covers the material that is appropriate to the requirement statement'.

They believe that relevance judgments can be useful tools in system evaluation if we can take account of the effects of the influencing variables. They suggest general classes of variables affecting relevance judgements which are documents and their representation, queries, judging situations, modes of

expressions and judges. Their study has confirmed the effect of these variables, for example, they found that implicit orientation of judges on the intended use of documents affected their relevance judgments (Cuadra and Katter 1967b). It is possible to obtain higher or lower relevance scores simply by informing some of the judges of the intended use of the documents. These findings support their belief that relevance scores should not be considered as absolute numbers but rather as products of particular conditions.

A summary of the ten years of experiments in relevance judgments has been undertaken by Saracevic (1970). These experiments were concerned with the effects of a variety of variables on relevance judgments. An analysis and correlation of experimental results suggest several conclusions. With respect to the documents and their representation, the most important factor affecting relevance appears to be the subject content of documents as compared with the subject content of the query. Titles have to be used with great scepticism while the specific subject content in a document appears to stimulate more relevance agreements.

With respect to the query or information requirement statements, the more that judges know about a query, the higher the agreement among judges on relevance judgments and the more stringent the judgments become. The less the judge knows about a query, its content and eventual use or the problem in relation to which the query is posed, the greater the temptation to judge documents relevant. On the other hand, the results of experiments concerning the judgmental situations and conditions are inconclusive and should be interpreted cautiously. However, it is accepted that changes in experimental conditions may introduce changes in judgment.

The important conclusion concerning the effect of human characteristics is that the judge's knowledge seems to be the most important factor affecting the relevance judgment. The level of judges' subject knowledge varies inversely with the number of documents judged relevant; an inexperienced judge will tend to judge documents more leniently. In addition, the intended use of documents may produce differences in relevance judgments which suggests that it should be a part of the query.

According to Saracevic, one of the major conclusions is that relevance judgments are not associated with random distribution. Although relevance judgment may appear to be a very subjective human process, it does have associated with it some remarkable regularity patterns.

In Rees-Schultz's study (1967), differences among users' cognition styles, personalities, education and work orientations have also been found to be important variables. Users' information needs can be changeable as the cognitive model is dynamic. Therefore, they found that as research progressed, users tended to become increasingly selective in their acquisition of information.

Harmon (1970) has suggested that the Rees-Schultz's study and Cuadra-Katter's findings are very similar regarding the individual user differences. According to Harmon, the other important variable associated with users' reactions is that which evokes their surprise reactions. If the user encounters material which has surprise value, his cognitive set would possibly be broken and consequently affect his relevance judgment.

The complexity of the judgment process has led several authors to state that 'stable relevance judgments cannot be obtained from individual informants'

(Fairthorne 1963). Other objections are the different conditions of judgment; different sets of judgments prevail when distinctions are made between motivated and unmotivated judges and between judgments based on the examination of full and partial document excerpts. The subjectivity and many variables involved in the process of obtaining relevance judgments seem to be the inevitable cause for disagreement on the reliability of such measure for evaluating the information retrieval systems.

Relevance as an Abstract Notion

In presenting various abstract models as the theoretical foundation of information retrieval, some writers started from the basis of treating relevance as an abstract notion. To summarise this approach, Hillman (1964) states that 'it is to describe a concept of relevance independent of, and logically prior to, any notion of relevance as determined by, and thus restricted to, a particular system of storage and retrieval'. In addition, this concept must not be confined with respect to index terms or such like.

The concept of logical relevance in information retrieval

Cooper (1971) proposed a definition of relevance based on information need and explicated it in terms of logical implication. He distinguishes four different kinds of entities: the information need, the query, the request and the information need representation. Information need is seen as a psychological state as 'it is not directly observable but has a definite existence in the mind of the user at least, and so it is useful to have a term by which one may refer to'.

The query is the user's own formulation of his information need, for

example, 'which are the halogen elements?' The request is the input to the retrieval system in order to perform the particular search. For example, the above query could be reformulated as the request consisting simply of descriptor 'halogen elements'. As the query or request is not necessarily a complete or accurate representation of the information need, finding adequate linguistic representations for information need is essential to Cooper's definition of relevance.

His definition is based on the relationship of logical consequence or entailment. He argues that when the retrieval problem is posed in terms of declarative sentences, logical consequence and relevance are very intimately connected. Cooper imposes three assumptions in defining logical relevance for information retrieval. Firstly, the search query is perceived as a yes/no type question or a true-or-false question. Secondly, the data stored in the system is expressed by well-formed sentences. Thirdly, the retrieval system is capable of inference so that it can deduce a direct answer to an input question.

According to Cooper, a stored sentence is logically relevant to an information need if and only if it is a member of some minimal set of stored sentences representing some statements of that need. The relevance of a sentence to a need is dependent upon its membership in a minimal stored set of statements from which an answer to the need can be adduced. There are two implicit assumptions, the first is that the query or component statement of the need is an adequate linguistic representation. The second is that a subset of all stored sentences becomes a premiss of a component statement if and only if the component statement is a logical consequence of the subset.

Under these assumptions, the basic mode of operation according to

Cooper is that each yes-or-no query is operated upon by the system in the form of a pair of formal statements of the form p and not-p. The query 'Is hydrogen a halogen element?' would have a pair of statements of 'hydrogen is a halogen element' and 'hydrogen is not a halogen element'. The task of the retrieval system is to discover whether either of the input pair of sentences can be logically deduced from some set of stored sentences. If the unnegated input sentence is a logical consequence of certain premisses or sentences in storage, the system should print out 'yes'. If the negated sentence is deducible in this way, the system should answer 'no'. If neither is the case, the 'don't know' answer is indicated. Therefore, Cooper's explication is that of a question-answering system based on the search for logical consequence.

Cooper attempts to generalise this definition of relevance beyond the imposed conditions. By repudiating each condition, he has to accept the limited viability of his definition in view of the limited capacity of logical tools and its inadequacy in dealing with natural language.

The criticism of the first restriction is that the restricted definition of relevance is workable only for yes-or-no type question as such a question is representable as a pair of component statements. This means that for other types of questions which are not straightforward as a yes-or-no type, it may be very difficult to simplify such a query into a representative pair of statements. The assumption that the user's need is for a list of one-word answers (yes-or-no) means that there is no capability to cope with questions which require complex answers such as the list of articles which are partially relevant to a request. The other problem raised is the inability of this model to handle the request which results in more than two component statements of unnegated and

negated statements.

The second assumption assumes that the retrieval language is formalised so as to obtain a mathematically precise definition of relevance. But the limitation of logical tools means that relevance cannot yet be defined on the mathematical level in the context of natural language retrieval system. The third assumption is that the retrieval system is fully inferential. But most existing retrieval systems are reference retrieval systems in which the user contributes his own reasoning power to the deductive process. So, this concept of relevance is limited in its practical use as it is based on very restricted assumptions. However, the approach of using the logic of entailment to explicate the concept of relevance has indicated the situation in which this approach could be of practical use.

Seeing the weakness of this approach, Cooper (1973) proposed a formulation of the utility-theoretic model which states that information systems should not merely produce relevant documents, but rather the system should produce 'useful' documents, for example, documents for which the user would pay. According to Cooper (1976), utility-theoretic measures are based on the modern concept of utility as developed in utility and decision theory, a concept better described by the terms such as 'usefulness'. The first criticism of this approach is that it suffers from the problem encountered by economists, namely the abstract nature of utility in which there is no standard measurement.

Furthermore, the operational difference between the relevance-theoretic and the utility-theoretic model of evaluation has been proved to be insignificant in the study by Regazzi (1988) and Saracevic et al (1988). In evaluating information retrieval systems, the judgment on the usefulness of retrieved

articles is considered a criterion of relevance judgment (Smithson 1989).

In the practical context of a user, a document relevant to his research topic or interest will subsequently be used in his work. Hence the relevance judgment of a document indicates a certain degree of the utility of that document. After all, a user will seek and judge something to be relevant according to the information requirement motivated by his purpose, for example, to write a paper or report. Therefore, it is preferable to avoid adding unnecessary vagueness and complication to the already abstract concept of relevance. The advantage is that the notion of relevance has been a subject of investigation and experimentation.

Pertinence and relevance

The concept of 'information need' prompted Foskett (1972) to elaborate on the distinction between the concept of relevance and the term 'pertinence'. He contends that pertinence should be taken to mean: 'adding new information to the store already in the mind of the user, which is useful to him in the work that prompted the request'. Relevance is taken to mean: 'belonging to the field/subject/universe of discourse delimited by the terms of the request, as established by the consensus of workers in that field'. The two are perceived to be often equivalent but not as a rule. Pertinence is decided by the user and the retrieval system is not at fault when it produces a non-pertinent document. For example, a search may produce documents which the user has read before. However, the retrieval system is not judged to fail in terms of 'relevance'.

Therefore, relevance is seen to be the relationship between the request for the information and the retrieved documents. Foskett suggests that

relevance can be based on the explication in the work of Kuhn (1962) with the concept of paradigm and Ziman (1968) with the definition of science as public knowledge. Therefore, relevance is judged in terms of being a part of the paradigm or public knowledge or consensus in a field; while pertinence is judged in terms of the relation to the specific pattern of thought in a specific reader's mind.

Kemp (1974) agrees with Foskett on the distinction between pertinence and relevance. He contends that relevance and pertinence are two different qualities. Relevance is capable of being objectively assessed while pertinence is subjectively assessed. Both relevant and pertinent documents have the quality of containing the information related to the need of a user. The distinction is that pertinent documents are those which the user finds useful because they have a bearing on his particular situation. As the emphasis is on the subjective judgment by a user, Kemp considers pertinence to be private knowledge.

On the other hand, the relevance of a particular document to a particular request is something which can be agreed by several people who are experts in that particular field of interest. Such assessment is mostly used in experimental situations so that it should be objectively arrived at. Consequently, he sees the correspondence between the pairs of terms: relevance/pertinence and public/private knowledge. Relevance being objectively derived on the basis of consensus of people in a field seems to correspond to the ideas of public knowledge. Pertinence being subjectively derived on the personal basis of information need corresponds to the ideas of private knowledge.

Using this distinction as a basis to emphasise the difference between

pertinence and relevance, he draws on other terms from other fields concerned with the study of knowledge and communication. The other pairs of terms are denotation/connotation, semantics/pragmatics and formal/informal communication.

According to Kemp, the denotation of words may be described as their publicly accepted meanings while connotation refers to the particular association unique to each person. Therefore, he regards connotation as being a part of the individual's private knowledge so that connotation is related to pertinence. As denotation is thought to be a part of public knowledge, it is perceived to be connected to relevance.

For semantics/pragmatics, Kemp sees that semantics is the study of the meaning of signs which belongs to public knowledge so semantics must relate to denotation and relevance. On the other hand, pragmatics is thought to be concerned with the relationship between signs and the receivers which is related to an individual's connotation. Therefore, pragmatics is perceived to be associated with private knowledge and pertinence.

For formal/informal communication, Kemp perceives formal communication as simply involving published documents such as books, articles, and so on. Informal communication is perceived as those other than formal communication such as a conversation. Formal communication is seen as closely associated with the idea of public knowledge as the creation of public knowledge depends on formal communication.

Kemp argues that the availability of informal communication is limited and does not usually result in the creation of some permanent record which may be a source of consultation. Kemps hopes that the generalisation of these

pairs of terms may lead to a greater understanding of relevance and pertinence. He also suggests that a retrieval system should include users' personality profiles in order to increase the number of pertinent documents in a search.

The first criticism of Foskett's arguments is that it is futile to make the distinction on the basis of the utility of a document; it has been pointed out earlier that relevance implies a certain degree of utility. Secondly, the basis of pertinence which depends on 'satisfying information need' is also challenged (O'Connor 1968). O'Connor states that this phrase has not really been clearly defined although several different things have been attached to it. The first meaning is reflected in the justification for using the techniques of request negotiation in the process of searching for documents. In the question analysis process, recourse to the user has to take place in order to bring the formalised representation of the question into closer coincidence with the information need.

The second meaning is to give the user 'information that will help his work', for example, the need to use documents in finishing a task. The third usage is simply to give the user some retrieved documents which he is glad to obtain. O'Connor criticises the first usage of the phrase 'satisfying information need' as an excuse for promoting the techniques of request negotiation; the second usage ambiguous in that it leaves the question of who should decide whether some documents will help someone's work. The third usage is criticised for the fact that the user will not always perceieve the pertinence of a retrieved document. Therefore, O'Connor does not agree that by distinguishing between the concepts of relevance and pertinence, the problem of measuring the effectiveness of information retrieval systems has been solved.

In addition, Maurice Line (1969) has pointed out that the literature on 'user needs' has been confused by imprecise use of the terms and he clarifies the meanings of the three terms of 'need', 'use' and 'requirement'. He concludes that 'requirement' is a bridging term that includes other meanings of what is needed, what is wanted or what is demanded.

Besides these criticisms on Foskett's basis of pertinence, we can see that his concept of relevance suffers from the weakness of being too general and unclear. He does not offer an operational or concrete way of defining the term 'relevance' and it is difficult to decide on the relevance of a document in relation to the general paradigm.

Thus the distinction between relevance and pertinence is trivial and can lead to unnecessary controversy. This distinction has arisen as a response to the fact that information retrieval systems suffer from the technological limitations of not being able to represent natural language; hence the need for request negotiation and question analysis. Therefore, we can see that Kemp's ideas on the difference between relevance and pertinence as belonging to public and private knowledge have added more confusion and raised more objections. The concept of relevance judgements proposed by Cuadra and Katter has taken into account both the subjective and objective aspects of judging relevance by a user. It is questionable whether it is always possible to separate the subjective and objective elements in judging pertinence and relevance because, in practice, a person does not consciously decide to be objective or subjective in judging a document. Also, a document can be both pertinent and relevant to a user. If this is the case, the question arises whether the subjective and objective elements are identical. Therefore, Kemp's arguments on the basis of

public/private knowledge does not justify the difference in defining the terms relevance and pertinence.

Furthermore, Kemp's grouping of formal communication, semantics and denotations with relevance appears to be based on his misunderstanding of the subjects involved. Semantics, which is the study of the meaning of signs, is not confined itself to the study of formal signs alone. In addition, pragmatics does not specifically include the study of only private relationships between users and private signs. By comparison, it seems that the study of relevance judgments has given a better understanding of 'relevance' than the emphasis between pertinence and relevance. The former concept only adds unnecessary complications to the understanding of the characeristics of relevance.

Situational relevance

Wilson (1968) has explored a few distinct approaches to the notion of relevance which include objective and subjective aspects. He contends that the crux of this concept can be approached by reflecting on the things which we usually thought to be relevant such as objectives, arguments, considerations and information. Anything which tends to sustain or overthrow a conclusion or hypothesis, or can be used as evidence with respect to a claim, has relevance to that conclusion or hypothesis. The more relevant some evidence, the more heavily it weighs for or against.

Wilson (1973) reiterates that relevance is a very general and vague notion that can be made specific and precise in several ways. He elucidates a notion of situational relevance based on the concept of logical relevance suggested by Cooper (1971). Wilson also makes a distinction between

psychological relevance and logical relevance in which the former is concerned with the actual effects of information. Psychological relevance is used to describe the subjective aspect of judgment, for example, how a person fails to see the relevance of a piece of information. Cuadra and Katter (1967a) have shown through psychological tests that perceptions of different people on relevance judgments are not the same.

Situational relevance is considered a static notion as it is restricted by a person's view of the world and preferences. However, it can become dynamic if a person's view of his situation is modified by the acquired information. In other words, relevant information must add to a person's knowledge. In contrast to Kemp, Wilson sees that the notion of information need plays no essential role in the formal definition although he retains the elements of Cooper's definition of logical relevance. According to Wilson, information need can be ignored without losing the relationship between the abstract needs and requirement statements.

Three factors which enter into the notion of situational relevance are an individual's concerns, preferences over ranges of alternatives and his stock of knowledge. Situational relevance is defined as a relation between these three notions and an item of information, which is established either deductively (Cooper's logical relevance) or inductively. It is a subjective notion as its judgment depends on a particular individual's situation as he sees it.

Based on Cooper's application of logical consequence, situational relevance is conceived of as a relation between items in a person's stock of knowledge and questions of concern to him. However, these answers can change over a period of time as order of preferences may change and the

content of one's concerns may fluctuate. Therefore, Wilson contends that for a potentially relevant item to become situationally relevant, a person not only must learn of it but also accept it even tentatively. For example, even if he is given information thought by others to be correct, he may not believe that is the case until it has been accepted for it to be situationally relevant to him. Wilson concludes that relevance is therefore a matter of degree.

Finally, Wilson accepts that his notion suffers from several weaknesses which Cooper has recognised in his logical relevance. His conclusion is that situational relevance is an indeterminate notion based on the changing and unsettled nature of our concerns. Furthermore, a person's view of his situation can be partial, undecided, and vague.

The important point in Wilson's explanation is that he asserts that situational relevance includes what he calls practical relevance. Practical relevance is the quality of information which offers ways of achieving goals or is relevant to plans of action. Wilson's exposition of situational relevance points out the characteristics of relevance as being subjective and changeable including the quality of being of practical use.

Conceptual relatedness

Donald J. Hillman (1964) attempts to construct a formal theory of relevance on the basis of conceptual relatedness which is independent of and logically prior to a particular system. His working hypothesis is that the most desirable retrieval output should consist of citations to all those items that are conceptually related to the topic in the request.

By basing his explication on Carnap's extensional intrepretation of

concept, Hillman formulates a theory of relevance according to classes of concepts. He regards concepts as classes so that he can associate a concept with a class of documents possessing the property expressed by the specified concept. Instead of considering relations between classes, he attempts to form those classes whose members belong to the field of partial similiarity-relation. Therefore, classes will have as members all documents that are conceptually related as defined by some partial similarity-relation. For example, documents which contain statements about the British political system are conceptually related by virtue of this common concept.

The two conditions which a concept-class must satisfy are, firstly, each pair of the concept-class must be part-identical, for example, air pollution is part-identical to acid rain, and secondly, the concept-class must be the greatest possible class satisfying the first condition. Hillman contends that the concepts are formed on the basis of observed similarities between objects, and that such similarities consist of part-identities or property-sharings. For example, the concepts of international trade and exchange rates are part identical as both belong to the concept of economics while the concepts of farming and conservation are related to effective environmental management.

In practice, we can appreciate the first problem of abstraction that is the identification of a property in the document. Different people will assign concept classes differently depending on their knowledge of the subjects involved and their understanding. In addition, some concepts are more complicated and may involve several related concepts. These add to the difficulty of assigning concept classes to documents consistently.

On the other hand, Hillman recognises that the whole process of concept

formation suffers from a fatal weakness since Nelson Goodman (1951) has shown that Carnap's method works only when certain circumstances do not take place. This is the problem of companionship difficulty in which concepts are independent of each other. In this context we have no a priori information concerning the independence of concepts expressed by the documents of a collection, therefore there is no guarantee that this method will always work. For example, let us suppose that a concept 'Tibetan Buddhism' can be truly ascribed to a document only if the concept 'tantric mantras' is predicated by that document. Then a separate concept-class for 'Tibetan Buddhism' cannot be constructed, since it would have to be included in 'tantric mantras' which is ruled out by the second condition.

Another difficulty is imperfect community where situations are such that every pair of a set of documents has a concept in common, yet no concept in common to all elements of the set. For example, three documents in which the first one includes the concepts of nutrition and famine; the second includes famine and agriculture; the third includes agriculture and fertilisation. These documents have an overlapping of concept without having a concept in common to all three.

Hillman perceives that the failure of this approach is due to the shortcomings in the general method for constructing similarity-classes. Therefore, the method of conceptual relatedness is not appropriate for the purpose of mechanising an information retrieval process. The additional problem is the difficulty to accommodate similarity-judgments in a formal theory. However, the notion of conceptual relatedness as a basis of the notion of relevance encompasses an intuitive understanding of a document being

relevant to a topic in question. In practice, this notion of conceptual relatedness can be applied to document selection which is not mechanistic; for example, the decision is taken by a person in judging the relatedness of keywords or concepts in documents. Hence, the problems and difficulties associated with this concept can be investigated and checked in actual operation according to that context.

In the field of information retrieval, the concepts of relevance are mostly concerned with the evaluation of information systems. Therefore, these different definitions have the same limited application in terms of the relationship between some system output, such as a document and some kind of information requirement. The notion of a relevant set of documents has been heavily relied upon by nearly all studies which attempt to evaluate the effectiveness of information retrieval systems. The concept of logical implication and Carnap's theory of relevance have been used by information scientists so that relevance judgments can be mechanically assessed according to some given rules such as in conceptual relatedness.

The important conclusions from these studies are that relevance is subjective and a matter of degree dependent upon various variables outlined by Cuadra and Katter. The consequence is that one cannot talk about relevance in isolation; relevance is related to a user and his context, that is, an item of information is relevant if it satisfies his need or helps him to solve his problem. The dynamic quality of relevance lies in the fact that it can change after a period of time and according to the user's knowledge and situation. Therefore, relevance has a duration according to the agent's or user's purpose or

requirement. In comparison with the phenomenological concept of relevance, we can see that Schutz's concept encompasses all the different concepts of relevance while logic provides the operational mechanism for deriving relevance assessment.

The Concept of Relevance in Communication and Cognition

Sperber and Wilson (1986) try to develop a theoretical concept of relevance for use in the study of communication and cognition. They concede that relevance is a fuzzy term which has different meaning for different people. However they believe that there is an important psychological property of mental process which approximates to the ordinary notion of relevance. They assume that people have intuitions of relevance in the sense that they can consistently distinguish relevant from irrelevant information.

They adopt the inferential model of commmunication instead of the coded model by Shannon and Weaver (1949) as the former is more appropriate to the study of verbal communication. Inferential communication is thought to be achieved by providing evidence of one's intention. The act of attracting the audience's attention is called ostention or ostensive inferential communication. Inferential communication and ostension are the same process which can be seen from two different angles. The communicator is involved in ostention while the audience is involved in inference.

Their book is essentially an exploration of the idea that there is the property called relevance which makes people feel that the given information is worth processing. As they are interested in relevance as a psychological property they see no reason to aim for a quantitative definition of relevance.

Consequently they only considered how relevance is sought and achieved in mental processes, particularly in the process of verbal communication. Their main thesis is that an act of ostension carries a guarantee of relevance.

Basic assumptions of the concept

The main assumptions are that people can be compared to efficient information processing devices and that efficiency can be defined with respect to a goal. They also claim that people automatically aim at the most efficient information processing. A person's particular cognitive goal is underlined by a more general goal of maximising the relevance of the available information for processing.

Information which is already present in the individual's representation of the world is considered not to be worth processing because it is easier to access from the environment than the memory. Other information which is not only new but entirely unrelated to the individual's representation of the world is regarded as consuming too much processing effort for too little benefit. When the processing of new information gives rise to further new information, it is considered relevant. In addition, they assume that information processing will only be undertaken in the expectation of that information being worth the attention.

Relevance in verbal communication

They propose the basic definition: 'an assumption is relevant in a context if and only if it has some contextual effect in that context'. No matter how limited the contextual effect of an assumption is, it is considered to be relevant

to some degree. A context is a psychological construct which is a subset of the hearer's assumptions about the world. Contextual effects are brought about by mental processes which require processing effort, such as in translating a foreign message into a native language. Therefore, the processing of information is considered as a negative factor. Other things being equal, the greater the processing effort the lower the relevance; and the greater the contextual effect an assumption has, the greater the degree of relevance. Consequently, the weaker the contextual effect of an assumption, the less likely that it is considered relevant.

Sperber and Wilson admit that there are problems involved in measuring contextual effects and processing efforts, as they are abstract dimensions of mental processes. They suggest that both can be represented in the form of comparative judgements which are intuitive. As a result, relevance is also a non-representational property which need not be represented in order to be achieved.

Relevance is treated as given in verbal communication, that is people hope that the assumptions or messages being processed are relevant. The extent of relevance communicated is determined by two factors: the effort needed to process a message optimally and the cognitive effects achieved during processing.

According to their thesis, their concept of relevance does not apply to all forms of communication. It only applies to an ostensive communication model and not to the coded communication model. The reliability of the presumption of relevance depends on the communicators as they might fail to achieve relevance or the presumption of relevance may be rejected as being false.

The time factor also influences the extent to which something is relevant enough to be worth the addresse's attention. The reason is that something can remain relevant and accessible for either a long time or a short duration. Therefore, it is beneficial to pay attention to a less relevant stimulus whereby its cognitive effects might be quickly lost. Other influences on the degree of relevance include the way in which information is accessible to the addressee and the quality of intellectual alertness.

The limitation of this theory of relevance is the result of their attempt to ground models of human communication in cognitive psychology, but many questions remain unanswered. Another challenge lies in their assumption that people process information in the same manner as a computer. It is arguable that most of the time we do not always process information consciously on the basis of cost and benefit calculation in terms of effort and effect. Some people put a lot of time and energy into something totally irrelevant such as watching a comic play which does not specifically add more to their contextual effects.

Furthermore, it is conceivable that we sometimes have to put a lot of effort in pursuit of relevant information, for example, a research student may have to learn a foreign language in order to be able to read foreign reports or archives, or study a complicated and technical subject for writing up a thesis. On the other hand, it is not always necessary that ostensive communication always guarantee relevance. Instead, it can be used to induce a certain perception of relevance, such as in using commercial advertisements to attract consumers' attention and persuade them that the advertised products are most relevant to their needs.

However, we can also find examples that comply with Sperber and

Wilson's theory. For example, in a business meeting, people would be trying to say things which are relevant to the context of that business as time and energy are very valuable there. Information which is not easily comprehensible and which requires a lot of processing time may also be excluded under the pressure for an immediate decision. Therefore, their theory of relevance is restricted by its own assumptions.

Although their theory of relevance is restricted to the process of verbal communication, the basic characteristics mentioned appear in accordance with those emphasised by other writers. The implicit characteristics for relevance in communication and cognition consist of the condition that relevance involves a person's perception and it is related to a certain context. Furthermore, relevance is dependent on time factors as the representation of information can change. It is also a matter of degree depending on the perception of the processing effort involved. For information to be perceived as relevant, it must modify and improve a person's overall knowledge or representation of the world by producing some contextual effect.

In the field of cognition, relevance is not viewed in isolation but as a property of a person's mental capability, although the comparison of human beings with processing devices could be misleading. The condition of the effort involved in processing information emhasises the importance of having relevant information which is easily comprehensible and retrievable in order to increase efficiency under available resources. For example, the verbal communication involved in organising an evacuation of people from some danger requires a concentrated effort for a sustained duration. The ability to ensure that the context of the situation is firmly established and recognised helps the flow of

communication and the relevance of messages or instructions also make the task easier.

The various disciplinary approaches to relevance in chapter two and this chapter have shown that 'relevance' has several meanings. The phenomenological concept of relevance seems to encompass all the other concepts; Schutz's concept being a universal definition of relevance while others being specific definitions. These macro characteristics of relevance include the agent's perception of a problem or topical requirement which motivates the process of acquiring further information or evidence in order to come to a conclusion or satisfactory result.

The other characteristics of relevance which can be seen from the investigation are its subjective dependence on a person's knowledge and perception (relevance judgments), and its dynamic nature which exists in the person's context (situational relevance). The identification of a relevant item of information can be achieved with the combination of logical concepts of relevance (logical relevance and conceptual relatedness). Various rules or conditions for judging relevance can improve the degree of evidence or statements as reflected in the legal concept of relevance. In practice, relevance does not exist in isolation, instead it exists in an agent's context with his underlying motive to take action or achieve a goal by gaining relevant information. These characteristics will be reflected in the practical application of concepts of relevance to case-studies.

CHAPTER 4

THE SEMIOTIC PERSPECTIVE TO THE CONCEPTS OF RELEVANCE

In this chapter the theory of signs or semiotics is adopted for the systematic investigation of the different properties and relationships of signs instead of the vague and elusive term of 'information'. The four branches of semiotics give us a comprehensive basis on which the quality of relevance can be investigated according to a particular perspective. This becomes the framework for the analysis of the case-studies in which concepts of relevance are applied (see chapter 6 and 7). The theory of affordances is explained together with the assumptions of the logic of norms and affordances which underlie the semantic analysis. The methods of semantic analysis are described in the final section.

The Need for a Semiotic Approach

The vagueness and abstract meanings of the term 'information' reflects the need for a better term which is capable of going beyond the problem of elusiveness. The inadequacy of the generally accepted view of information has been pointed out by Stamper as being 'based upon mentalistic notions which are left to the readers' interpretation' (Stamper 1985c). He contends that the influence on treating 'information' as a kind of mystical fluid is due to it being used according to the restricted concept in the engineering and mathematical aspects of computing.

Consequently, the mentalistic approach in defining 'information' can be easily found such as in the description of data being condensed or distilled or

processed into information. For example, this type of definition can be found in McCosh and Scott Morton (1978), Clifton (1978) and Dorn (1981). On the other hand, a narrow and technical meaning of 'information' can be found in the field of engineering communication in which information is coded into binary digits (Cherry 1978). This narrow meaning is appropriate only to the specific purpose of engineering in which the volume of signals being transmitted must be quantified in terms of bits.

An ostensive primitive for the entangling of the various aspects of the term 'information' can be found in the well established theory of signs. The semiotic approach also offers us a means for understanding the organisational activities and problems concerning with the whole process of information (Liebenau and Backhouse 1990). This allows us to study all that is involved in the term 'information' and investigate the different types of signs and their properties which allow us to achieve the quality of relevance.

Much of the work in the theory of signs has been strongly influenced by C.S. Peirce's work (Lyons 1977). Peirce refers to the theory of signs as semiotic. According to Peirce, a 'sign' has an object and an interpretant, the latter being 'the disposition of the interpreter to respond, feel or exert to a sign which represents the object' (Peirce 1931, Ogden and Richards 1985). In other words, a sign must be capable of evoking responses from the interpreter or a person; these responses can also become signs which enable further responses. Therefore, semiotics makes us recognise the importance of an agent as being responsible for the existence of a sign and its meaning (Liebenau and Backhouse 1990).

Peirce gives three classifications of signs: symbols, icons and indices. A symbol is a sign whose property or character would be lost if there were no interpretant. Symbols are created by members of a society; familiar examples of symbols are national flags, military symbols of ranks, logos of expensive cars and multinational companies, mathematical symbols, red roses, and the Statue of Liberty. The convention of these symbols is rooted in people's knowledge so that their existence and meanings depend on the sharing of this knowledge and the influence of social forces.

An icon is a sign which has the property which makes it significant whether its object still exists or not, for example, the statue of an Egyptian god and models of ancient cities, graphical icons used in computing softwares, photographs of great film stars. An index refers to the causal relationship between a sign and an object which can be observed by a person. For example, the position of foreign troops along a border indicates the imminence of an invasion, the Financial Times Index indicates the performance of listed companies, a knock at the door and a scream indicates trouble and so on.

The other important distinction of signs is that of sign types and sign tokens. Tokens are unique physical entities observed at a particular location such as this or that word on a single line of a page in a book. For example, in the sentence 'I have added essays which I have written occasionally on episodes of my life', there are two sets of different word-tokens: 'have' and 'I'. The words themselves are called 'word-types' as each makes up an English word. A similar example is that there are nine letter-tokens and five letter-types in the word 'reference'. Therefore, sign tokens are identified by 'their similarity with other unique physical entities and by their conformity to the type to which they

belong' (Lyons 1977). Other examples are the London School of Economics, University College and King's College which are sign-tokens of the sign-type of 'college'; Arthur Waley's Chinese poems is a sign token of the poem-type of sign.

Charles Morris (1946) has taken Peirce's definition further by stating that the development of a science of signs is based on a biological basis, in which meanings of signs are associated with goal seeking behaviour (Morris 1964). He also confirms Peirce's insight that a sign gives rise to an interpretant which is a modification of a person's tendencies towards action.

Therefore, we can see that the term 'sign' offers a concrete building block on which the quality of relevance can be judged. 'Sign' is used to embrace almost everything which can tell a person about other things such as words, gestures, statements, musical scores, physical objects and traffic signals. The subject of semiotics has the primitive notion of a sign which does not depend on a verbal definition as it can be defined ostensively and by its interpretant.

Semiotics

The shape of a science of signs was distinguished by Charles Morris (1971) into three branches of enquiry, namely, pragmatics, semantics and syntactics. Pragmatics is the study of the relations between signs and interpreters or users; semantics is the study of the relations of signs to the objects to which the signs designate; syntactics is the study of the formal relationship between signs. The fourth branch of semiotics, which is called empirics, has been added by Stamper (1973). Empirics is concerned with the property of signs according to the statistical theory of signal transmission. Thus

semiotics provides us a comprehensive means for investigating all the different properties of signs.

The study of a general theory of semiotics has been the major concern of linguists and analytical philosophers (Levison 1983). This approach to semiotics is narrowly concerned with the formal analysis of language and structure of discourse (Levison 1983, Lyons 1977, Matthews 1981). The interest in semiotics has spread into other fields such as law, information systems, literature and architecture which gives rise to different interpretation of semiotics according to the need of the enquiry. For example, the application of the theory of signs can be found in the analysis of various aspects of culture such as poetry, painting, literature and photography (Blonsky 1985, Culler 1981).

However, these applications tend to be restricted to the formal methods of linguistic analysis of structure and functions of language. In the field of anthropology, Levi-Strauss applies the method of structural linguistics and treats cultural phenomena as signs. The anthropological application of semiotics is limited to ethnological subjects such as myths, taboos, kinships and masks (Champagne 1987, Pace 1983). A recent explication of a general theory of semiotics can be found in Eco's work in which he presents it as a philosophy of language (Eco 1977, 1984). His work centres on the process of signification and the psychological investigation of signs. But it is heavily restricted to the formal methods of linguistics while ignoring the other branches of pragmatics and empirics.

A more practical exploitation of semiotics can be found in legal semiotics and marketing. The emphasis of legal semiotics lies in two distinct

areas. Firstly, it is concerned with the analysis of the language of law such as in constructing models of legal language and legal rules (Carzo 1985, Jackson 1985). The other application is in the studying of the interactions between legal systems and their referents such as the social, economic and political aspects and between the social values and judicial decisions (Kevelson 1987, 1988). The application of semiotics to marketing is restricted to the concern of achieving the commercial goal by exploiting appropriate signs such as in the design of packaging and in advertising (Umiker-Sebeok 1987).

As these explications of the theory of signs or semiotics are limited and biased to the main concern of the subject areas, they are not directly applicable to the context of business information systems. The explication of the theory of signs appropriate to the context of information systems has been presented by Stamper (1973) and Liebenau and Backhouse (1990). They provide a wider perspective for the application of the theory of signs in the business and social context. Additionally, other semiotic approaches and disciplines can be drawn upon in order to affect a richer theory of signs for the context of information systems.

Although semiotics are divided into four branches, the boundaries among these branches are not absolute as problems in one branch are related to others. The demarcation into different branches is simply for us to be able to look at the specific characteristics of signs similar to looking at the two sides of a coin or the different sides of a pyramid. The understanding of signs is based on various ways in which we use them so that we can draw on the wealth and diversity of other disciplines.

Pragmatics

Pragmatics deals with the relationships between signs and behaviour or the behavioural meanings of signs. The pragmatic property of a sign is reflected in the our ability to use a sign to refer to something else in order to influence a person's behaviour towards that which is referred to. The pragmatic meaning of signs are preserved and maintained in a culture which are transmitted through close contact and social intercourse. The mechanism of group pressure ensures that its attitudes and ways of doing things become the accepted norms.

For example, the smooth operation at an airport depends on the use of appropriate signs for affecting passengers' actions such as in directing passengers to go to the correct airline counters and departure gates, in using warning signs to prohibit smoking and detering the smuggling of drugs. The ignorance of these signs can be redressed by learning and experience such as when a person visits an airport for the first time. On the other hand, the failure to react approppriately according to these signs or their transgression may lead to a delay in departure or an arrest.

The diversity of the ways we use signs for communication and its importance in establishing an informal system of communication can be reflected in the everyday exchanges which are called 'phatic communion' by Malinowski (1944). The importance of informal communication has also been found to enhance the formal communication and as the most effective means in time of crisis (Vickery and Vickery 1987). For example, in an emergency at the airport, the informal contacts among the various sections of staff and their personal knowledge about the airport can facilitate the relay and execution of

instuctions for dealing with the situation.

The practical application of pragmatics can be found in the areas of advertising and marketing in which various types of signs are used to influence consumers' behaviour (Umiker-Sebeok 1987, Olins 1989). For example, a specially designed logo is used to affect comsumers' behaviour towards a company's image and its products. The importance of using the pragmatic property of words is important especially in situations where an ambiguity may lead to inappropriate actions (Whorf 1956). For example, the phrase 'empty gasoline drums' was interpreted by some workers as being safe for smoking; this consequently led to an unfortunate accident.

The disciplines of psycholinguistics, cognitive psychology and anthropology are the major sources of the knowledge of behavioural aspect of signs. For example, cognitive psychology gives us the knowledge about the human capacity of memory and processing, pattern recognition and learning (Eysenck 1986). Consequently, the consideration of human factors in the design of information technology and office automation has become the main concern of the industry (Christie 1985).

The other important aspect of pragmatics is its contribution to the study of the behavioural impacts of implementing changes or innovations which subsequently alter the previously established pattern of behaviour. The need for system designers to be aware of the political aspect of organisational changes as a result of an information system has been emphasised by Pettigrew (1980). The consideration of social impacts and problems of changes such as users' roles, the economic and cultural aspects in the implementation of information technology has been accepted as important to a successful outcome

(Sackman 1987). The positive and negative results of implementing changes in an organisation can be comprehensively and systematically investigated by using the cultural map devised by Hall (1973).

According to Hall (1973), the totality of signs in a community, what we call 'culture', stands for 'the way of life of a people, the sum of their learned behaviour patterns, attitudes and material things'. Different cultural and social groups have their own accepted patterns of behaviour and norms which are reflected in the cultural differences between the African countries and European countries, the sub-cultural grouping within a large organisation and between different professional communities. These patterns of behaviour act as a communication mechanism which Hall calls a 'silent language'. For example, a new recruit to an airline company has to learn and observe the norms and jargon which are shared among and acknowledged by other members of staff.

Hall classifies ten cultural message systems of human activity in which cultural differences can be recognised between groups. These message systems are association, subsistence, bisexuality, territoriality, temporality, learning, recreation and humour, defense, exploitation and interaction. In each of these categories, certain patterns of behaviour can be revealed within that particular context which makes it possible to understand how people will react towards changes in each aspect.

From these classifications, Hall creates a map of culture in which these cultural messages are put onto a two dimensional grid (see Appendix 4.1). Each of these categories can be subdivided to give another layer of more detailed investigation, by dividing the result of the first combination by the original ten categories.

For example, consider the behevioural consequences of a change in the territorial aspect when an airport undergoes a reconstruction; the new allocation of space to different airlines may lead to a dispute if it is not equitable to the old allocation. A change in the temporality aspect such as changes of flight time-table may lead to a strike or protest by pilots or supporting staff if the new cycles of work are too demanding or unacceptable. The decision to employ female security guards may produce the controversy on the aspect of bisexuality.

On the other hand, the airport public relations can benefit from improving the resources for communicating or interacting with passengers such as in making announcements in several languages and providing interpreters at immigration or customs. Therefore, the cultural map not only gives us a taxonomy for evaluating the consequences of changes but also the identification of appropriate actions necessary for bringing about the desired consequences.

The other element of pragmatics is in the inherent properties of verbal signs in affecting the hearers' behaviour. The understanding of this pragmatic aspect of signs can be found in the theory of speech acts which was first explicated by Austin (1962) and further developed by Searle (1969). Austin points out that 'in saying something we do something in three senses'. Firstly, by saying we perform a locutionary act which is equivalent to uttering a certain sentence with a sense and reference, for example, in making an assertion: 'Please issue me a ticket for New York'.

Secondly, as we say something we also perform illocutionary acts of making our intention known such as requesting, informing, ordering, promising

and warning. Thirdly, we may also perform a perlocutionary act which is the result of a successful illocutionary act in which the speaker succesfully influences the hearer to act accordingly. For example, a successful transaction of obtaining an air ticket to New York is a result of some perculotionary acts. The use of appropriate speech acts is vital in communicating instructions and warning to passengers in dealing with an emergency landing.

When performative utterances are used, the speakers are committed to a particular course of action. All such verbs have explicit illocutionary forces which Austin has classified as verdictives, exercitives, commissives, behabitives and expositives. Verdictives are typified by the giving of verdicts: to estimate, assess, appraise. Exercitives are the exercising of power, rights and influence: to order, appoint, warn, advise. Commissives are typified by promising or undertaking which declare the commitment of intention: to promise, plan or oppose. Behabitives are concerned with attitudes and social behaviour: to apologize, commend, curse. Expositives cover the concern of expository or elucidating: to illustrate, postulate, argue. These classifications fit under the headings of directing (exercitives and commissives), judging (verdicatives) and asserting (expositives) which have obvious role to play in business systems (Stamper 1985a).

Therefore, communication necessarily involves speech acts which depends on a rule-governed form of behaviour (Searle 1969). An illustration of this point in the analysis of the speech act is in that of a promise in which the result of a promise is a change in the expectations and intentions of those involved. A failure in keeping a promise can result in actions such as litigation when formalised promises as contracts are not honoured. Thus, the pragmatic

property of signs in communication acts play a role in creating and altering social reality. As most speech acts are culture-specific in that they depend upon the legal, religious, or ethical conventions in particular societies, illocutionary forces of speech acts are not the same in different cultures (Lyons 1981).

The application of speech act theory into information systems has been pioneered by Lyytinen et al (1986) whereby a speech-act based methodology has been developed for systems specification in the discourse analysis and formation. The other interesting application is by Lena Chen (1987) in which she explores the question 'how can we design a system to get users to understand what we mean?' She perceives that the designing of an information system is like speaking a language and investigates the presentation of information in a much more communicable ways to users so that the organisational goal can be achieved. Speech act theory can be applied in the use of the formal language in supporting actions, for example, by using the correct performatives, so that users can implement the output of information systems easily.

Thus the pragmatic property of signs allow us to consider the behavioral meaning of signs which can be exploited in the design of information system to affect the desired pattern of behaviour. It also provides a basis for investigating the introduction of changes to a system and the awareness of using appropriate signs for conveying the inherent forces in verbal communication.

Semantics

Semantics is concerned with the relationship between signs and what they are intended to represent. Our ability to use sophisticated systems of signs

such as languages gives us the potential to communicate our thoughts very extensively through words, statements, drawings and numbers to refer to the objects of discussion or to communicate how we see reality. The task of semantic analysis can become very complicated as signs can be used to denote things and to affect people's feeling at the same time (Stamper 1973). Statements of facts and evidence, forecasts and designs are denotative signs while affective signs include value judgments, appraisal, inducements and rewards. Therefore, a decision maker must be able to distinguish whether a conclusion in a report is simply a value judgment or deduction from facts.

The importance of semantics is reflected in legal proceedings such as in judging the relevance of evidence or statements and to discriminate between the references to facts and opinions. The caution and cross-examination exercised in the court of law can be beneficially applied to the context of information systems. This can raise the degree of critical examination of the validity and accuracy of information in reports and so on.

The contribution of semantics to the problem of relevance is in helping us to be clear about the meaning of the words we use to describe the state of the world before any further explication can be conducted in that context. For example, the analysis of the meaning of 'help' in the context of error messages is needed before the relevant features of 'help' messages can be investigated and specified (Trenner 1989).

The prevalence of semantic problems is reflected in the social, political and business activites in everyday life. For example, a distinction has to be made between an 'economic migrant' and 'political refugee' in order to judge who would be qualified for an asylum. In business affairs, the problems of

meanings can be serious and costly when a corporation which has taken over other companies is attempting to integrate the different computer systems. For example, an airline taking over another airline will have to check the meaning of entities and codes in the other computer files and reconcile the differences so that passengers can be booked on either airlines via a central computer system.

The semantic issues cannot be solved by giving names to things as this creates further problems as people can attach different meanings to the same name (Liebenau and Backhouse 1990). In addition, the formal methods of semantic analysis which is based on the logic and mathematical theories are found to be inadequate for dealing with the business and social meanings of signs (Stamper 1985a). Formal semantics is based upon the truth-condition and set-theoretic model with the dangerous assumption of possible worlds in which its population is assumed to be distinct entities.

The disputes in legal and business affairs about the boundaries of objects challenge the validity of the assumption of the distinct and easily identifiable entities in set theory (Stamper 1985b). The problem of individuation can be seen in the boundary between a batch or single item, for example, whether to count all the items in a package or only the one package in calculating the price for the customer. The other example is that of the dispute on the boundary of an airport and its liability in case of a claim for damages. The airport authority may argue that its boundary of responsibility stops at the departure lounge so that any accident occuring on the runway must belong to the particular airline.

The other objection to the model-theoretic assumption is that of

identity. The failure to preserve identity to individuals correctly can lead to confusion and inconvenience at the least. For example, two cousins reserved tickets to fly home on the same flight and day; they have the same initials and surnames so that the same record occured twice on the file. The operator intrepreted this as a mistake and deleted one of the bookings. With foresight, one cousin reconfirmed the reservation and put things right. The importance of identity is reflected by making sure that all the airlines do not happen to use the same codes for their flights, for example, the first two letters must be unique to the particular airline while the subsequent numbers may be the same.

The idea of possible worlds existing independently of their population whose meanings and identities can be identified under the given truth-condition implies the view of objective reality. But the problems of individuation and identity in practical affairs indicate that the assumption of objective reality is untenable. The perception of the social world is dependent upon the people who live and create that reality by their various actions and involvement (Schutz 1970).

The problems of semantics, such as the conflicts of meaning pervades in the business activities from the lower levels to the higher levels of management (Stamper 1987). Wynn (1979) shows that office work involves the reconciling of minor difference of opinion about the interpretation of rules and the drawing of boundaries even at the low level tasks. The semantic problems are reflected in small misunderstandings, minor conflicts which call for resolution such as in legal disputes, political debates, arbitrations and friendly discussions.

The importance of the need to resolve conflicts of meaning have been recognised by some writers in the field of information systems, especially in

systems analysis such as in the participative approach by Mumford and Weir (1979) and Checkland (1981). In the social sciences, the dispute on meanings among philosophers can be found in Lakatos and Musgrave (1970).

The inadequacy of formal semantics in dealing with the context of business information systems gives rise to a new approach to semantics proposed by Stamper (1985a, 1985b, 1985c). He stresses the need to put the observer or responsible agent back in the centre of the picture so that we are reminded of the subjectivity of meanings and their social orientation. This approach is based on the logic of NORM and Affordances (NORMA). The basic assumptions that there is no knowledge without a knower and there is no knowledge without action bring us to the root of the meaning of signs which is in cultural norms or patterns of behaviour. The philosophical basis and assumptions of this approach will be explained in detail in the final section of this chapter.

Syntactics

Syntactics deals with the formal aspect of signs in which they are treated in their own right as objects to be selected, reproduced, stored, retrieved, transformed and assembled in groups (Stamper 1973). Syntactics comprises of the study of formal languages and rules of syntax for transforming signs. The main concern is that of the formal relationships among signs and their operations which belongs to logic and mathematics. Therefore, syntactics is not concerned with semantic issues nor the consequences of implementing an information system which incorporates logical rules.

The advent of the post-industrial society has led to the proliferation of

technological knowledge and increased complexity of the socio-economic aspect of society. Consequently, there is a greater use of complex rules and instructions in organisational tasks such as in the routine coordinating tasks of accounting and preparing payrolls. The development of computer technology has also led to the proliferation of database systems and the use of computers which operates on the basis of logical rules and grammar.

The study of syntactics involves the application of logic in formal languages such as programming languages, in representing business reality in logical schemas and the use of logical rules and operators for deduction. Different programming languages have different levels of complex syntax or grammar for manipulating symbols and character strings. Higher level languages have more sophisticated rules and employ the logic of inference such as the use of predicate logic in Lisp (Winston and Horn 1981). Syntactics belongs to the programmers' concern as they have to establish the precise structure of all inputs and how the inputs are transformed by logical manipulation into outputs.

Although the role of syntactics is essential, formal logic is limited in the sense that it cannot establish the semantic truth of a statement. For example, the programmers are not concerned with the meanings of those symbols and strings of characters; they are only concerned with how these symbols are manipulated by computer systems. The limitation of logical tools lies in their only concern with the logical consequence, given the truth values of premisses, without referring to their validity in the real world. This leads to certain constraints such as the paradoxes of material implication discussed in chapter 2.

The quality of outputs from computer-based information systems

depends upon the quality of the programs or software. These must contain both the consistency of syntax and the validity of meanings of those strings of symbols or the semantics. As the task of software building is a specialised and self-contained activity, the concern of semantic issues belongs to the systems analysts or the information engineers who create the specifications for computer systems (Stamper 1985a). The information engineers' responsibility is to specify formal data structures and instructions which give the software engineers a syntactic context in order to create the appropriate logical solution or output.

The application of syntactics can range from a simple model of rules for selecting relevant documents to the complex rules in a decision-table. In the law of evidence, syntactics lies in the use of explicit rules for admission of relevant evidence and the use of deductive logic which can be applied to the problem of information retrieval. The discriminating use of logical implication as discussed in chapter 2 can help in the formalisation and mechanisation of rules while preventing the problem of paradoxes of material implication.

Empirics

Empirics deals with a specialsed category of problems in which signs are repeatedly used in a stable pattern. Empirics is based on the well-developed branch of communication engineering known as the statistical theory of signal transmission (Shannon and Weaver 1949), which is often called 'information theory'. The issues involved in empirics are limitied to the physical problem of the transmission of messages, the capacity of the communication channels, probabilities of frequency in transmission, the problem of coding and recoding.

Therefore, the application of empirics to information systems is limited to those aspects in which there are comparable characteristics.

The knowledge of engineering problems in communication can be applied to the business and organisational context in at least three ways. Business communication depends largely on human channels so that it is important to recognise that communicators, in some aspects, can be subject to the same laws of signal transmission as a telephone circuit in being overloaded or having crossed lines. The limit of performance or the capacity of people to be a communication channel plays an important role in achieving effective communication.

The second application is in the problem of modulation in which a message is transformed into another form, for example, the transformation of instructions for a reservation of an air-ticket into coded messgaes in the computer file. The third application is in the area of control systems in which the fault or inconsistency of behaviour in a channel has to be corrected. For example, an error in the mechanism for sorting baggages for loading onto airplanes must be quickly recognised and corrected.

The condition in applying empirics is that the pattern of signals must be statistically stable so that it is possible to evaluate their relative frequency of occurences. For example, the stable pattern of airplanes landing at an airport makes it possible to estimate the safe interval between the landing of each airplane. Other examples can be found in the way in which custom officers can spot the potential drug couriers or smugglers by their experience and the air-traffic controllers' ability in predicting the volume of air traffic on certain days.

The condition for a person to act as a comunication channel is that he

has to be able to distinguish between the different signals or stimuli which he has to transmit to other people. For example, the sensory capability of pilots in recognising the various indicators and to react appropriately towards these stimuli. In addition, a person's capacity of communication can be increased by using a number of stimuli or signs in describing a message in order to reinforce each other. In the context of written stimuli, the discriminating use of capital and lower case letters can improve the legibility by emphasising their distinctive characteristics (Reynolds 1979). An extreme example is in the ergonomic design of warning indicators on the control panel in order to draw the pilot's attention to special messages. However, this has to take into account the capacity of our short-term memory which affects our performance in information processing (Miller 1968).

The important application of empirics to information system is that of a control process in which feedback signals about aberration or inconsistency can be reported and redressed. The major point is that perfect control requires perfect communication channels for communicating feedback readily and accurately. The speed at which signals of errors or inconsistency are transmitted through the feed-back loop is crucial to the decision makers or controllers. But incomplete feedback signals are preferable to a complete but delayed message which only compounds the situation.

For example, in requesting for an emergency landing, a perfect channel is necessary for communicating the request and instructions for landing. A delay in the transmission of these messages increases the danger of the situation. Another example is that of the delay of an authority in transmitting a warning signal of the possible bomb threat to a particular airline to those

concerned with the safety and security measures.

The application of the statistical theory of communication to the business and administrative activities is constrained to those processes in which stable patterns of behaviour allow the application of relative frequency. The recognition of modulation processes and their carriers in an organisation can lead to the enquiry about their properties and ways in which these can be improved for more effective communication. The idea of signal transmission also points to the importance of the design of codes or messages, and the need to draw attention to special type of messages. The statistical theory and the probability of frequency of occurences also emphasise the need to be critical of the observation process.

Empirically, the degree of relevance depends on the appropriate usage of the channels of communication and the reduction of the risk of distortion. In a business environment, the questions concerned can be: what is the right amount of additional work load which could be managed by a person without leading to the distortion of the result? In designing a questionnaire, the list of questions are similar to the signal carrier of people's attitudes and responses. Therefore, these questions must not try to elicit too great a number of signals than the capacity of the channel of communication. The control mechanism can be applied to the design of feedback mechanisms for adjusting to the changing information needs of users.

The Logic of Norms and Affordances

The methods of NORMA (NORMs and Affordnaces) semantic analysis are based on Gibson's theory of affordance (1977). The theory of affordance is based on the idea that actions or behaviour are afforded by the features of the environment so that patterns of behaviour depend upon the series of affordances made available by objects in a certain place. In other words, an affordance is the behaviour or action that some feature of the environment makes available to an organism, for example, a hole in a tree affords a nesting site for birds, a pond affords a mating place for frogs.

This idea can be extended to the patterns of behaviour of people although the sophisticated and artificial setting in which we live provides more complicated affordances. A complicated set of affordances made available to us can be found in the provisions of the law, such as citizenship, consumers' right, pesdestrians' right of way and so on. Simpler examples of affordances can be found in everyday objects such as a bicycle which affords us locomotion, a chair and table, a telephone, a house and an airplane. The other source of affordances is in our social norms such as in the customary fashion in which people carry on with everyday routines, the way in which goods and services are exchanged, the methods of trading in the international market and the conventions or traditions of a society.

On this basis, a repertoire of affordances can be based in the legal and social norms which have the potential of affording a person an action or a series of actions. These affordances are inherent in the togetherness of the agent and environment and they are said to be realised when a person actually takes an action or accomplished an affordance. For example, a student realises the

affordance of buying an airplane ticket when he pays the money and the operator gives him his ticket; the initial affordance can enable him further affordances of travelling on the plane and arriving at another destination, including the meeting with his family and so on. Hence the realisation of an affordance opens up other affordances which enable an agent further actions. The richness of the reportoires of affordances depends upon the environment and the agent's capability in realising those potentials.

The theory of affordance is based on the theory of direct perception in which the mind-body dichotomy is rejected. According to this school, perception must be the study of the total system of organisms and the environment and it rejects the treatment of objects in isolation from the environment. The implication is that perceivers are interactive in that they actively explore their environments. In the social context, we cannot separate people from the custom or their culture in which they derive their repertoires of affordances. People and affordances exist in a wholeness of inter-relating relationships.

For a complex social agent, the direct knowledge of the world at present can be used together with other faculties to picture something beyond the present. These faculties consist of our ability to divide things into their parts and to add them to ourselves, for example, a person with a tool. The other is the ability to use signs which allow us to interact socially with others so as to have the knowledge of their worlds. Another important faculty is the complex agent's ability to share and build a world together within a community of people.

Basic assumptions of NORMA semantic analysis

The two key assumptions of the logic of norms and affordances (NORMA) are that knowledge depends on the existence of an agent or a knower and that knowledge depends on the agent's action. These bring the role of a responsible agent into the center of the situation in which knowledge is dependent upon the agent who acquires knowledge through some actions in the world. Therefore, knowledge does not exist in isolation but exists only in relation to someone doing something. The responsible agent can be a person, a team, a company or a whole jurisdiction.

Therefore, the new metaphysical basis of NORMA forces the systems analyst to approach the task of analysis in a totally different way. The analyst is compelled to find the agent responsible for the knowledge which enables him to realise an affordance or accomplish an action. As reality is relative to an agent, different views of meaning or how to do things can be very usual. This occurence points to the need to negotiate any possible difficulties in order to obtain a collective view of meanings or a consensus. The agreed ways of seeing things will be shared and maintained as do other norms which allow social activities to proceed smoothly.

Methods of NORMA semantic analysis

The goal of the methods of NORMA semantic analysis is to derive a semantic model which attempts to elicit the different meanings according to agents and their environments. Consequently, this approach seeks to discover the underlying patterns of behaviour in order to produce semantic models which will have sufficient generality for applying to similar situations.

In the analysis process, the analyst applies the logic of norms and affordances by thinking about the given context in terms of the agents involved and their affordances. The agents' norms which determine their behaviour are clarified by investigating the dependencies between affordances and their criteria, the agents' semiological roles, and the starts and finishes of the accomplishment of affordances.

The difficulties encountered in applying the principles of semantic analysis for the first time without a methodical formalism have led Backhouse (1985) to formulate a systematic guide for performing the analysis. According to Backhouse, we have to be able to capture the root agent's view of reality. These agents are those who would recognise the norms and rules upon which the information system depend for their successful operation.

Backhouse (1987) further recommends some basic steps for performing semantic analysis. These are the basis of semantic analysis in this work. These steps are as follows:

(a) Identifying all the possible candidate affordances

Within the context of the problem definition or situation, the analyst begins to list all the candidate affordances by weighing every term used in that context whether it functions as an affordance. The analyst has to check through these terms to ensure that they have not been wrongly excluded.

(b) Check each affordance for a start and/ or finish

Each candidate affordance is then subjected to further examination to see whether it has a start and/or finish which determines its duration of existence in a context. Where an affordance has a definite start and finish for the agent concerned, that is identified as an affordance.

Backhouse reminds us that the analyst should be aware of not imposing his own view of affordances in the analysis process. The analyst's task is to identify the physical and social objects that exist in the agent's situation which enable them a stable pattern of activities.

(c) Identify root agents and other agents

The root agents are those people who recognise, follow or sanction the pattern of norms which belong to their world. They have the knowledge which allow them to achieve their affordances or some actions. Root agents can consist of a single person, a large group of people or a complex organisation.

(d) Assemble the ontology structure

The purpose of ontology charts is to reveal the structure of the world or problem situation graphically. These charts show the ontological dependencies among affordances which become the basis on which the analyst derive the semantic schemas.

(e) Check for ontological consistency

The rule of ontological consistency is that directly experienced affordances must co-exist with their ontological antecedents. In other words, the existence of the affordance on the right-hand side depends on the existence of those affordances on the left-hand side. If the term on the left-hand side ceases to exist, so will those on the right-hand side.

(f) Establish the criteria for each affordance

Each affordance has a start and finish which is the period of its existence. The analyst has to find out the authority for an affordance to start and finish, including the rule for its existence. For example, the start and finish of a school term can be determined by the educational authority while the start of the

operation of a machine may depend on the criteria of total volume of raw material.

Therefore, by performing semantic analysis and drawing ontology charts, the analyst discovers the criteria for the patterns of behaviour, the relationships between affordances and their periods of existence which reflect the reality of the agents and their context. During the process of semantic analysis and drawing ontology charts, the analyst also has to keep in mind the underlying concepts of NORMA, such as the invariants, generic/specific, part-whole structure and roles. Currently, Backhouse is working on comprehensive and detailed guidelines for performing NORMA semantic analysis and drawing ontological structure which will take into account all these principles and concepts. However, at present the analysis work here has to be accomplished by depending on very simply recommended steps by Backhouse (1987). The concepts which the analyst must consider in performing semantic analysis are described below.

Invariants

For complex social agents, the invariants can be found in the pattern of behaviour inherent in physical objects and in social norms such as legal constraints and local tradition. Physical invariants are those features which can be interacted with in order to accomplish certain actions such as the use of a knife to afford the cutting of vegetables. These physical invariants can be objects which are modified in structure and form, for example, by using bricks and a plank of wood, one can construct a book shelf. Backhouse provides many

examples of objects which have changed physically but still serve the same functions (Lupolo 1987).

At the social and legal levels, invariants can be found in abstract notions such as copyright, ownership, leadership and marriage. The relationships underlying these patterns of affordances can be captured and represented in structured formalism of ontology charts and semantic schemas.

Partition or Part-whole

The relationship between part and whole can be experienced by an agent in taking an object and breaking it apart. A simple agent may be confined to realise the ability to partition other objects except itself. But a sophisticated social agent may use this ability to partition itself, for example, an academic institution partitions itself into different departments or a multinational company with many branches. The complex agents realise their affordances through their members or employees.

Although the members of an institution or organisation may change, for example, through death or resignation, the identity of the organisation is not affected by the changing parts or collectivities (Lupolo 1987). Therefore, the identity of a nation does not change as the population changes, and nor does the identity of a corporation change as its executives change. Therefore, a distinction between a role and its occupier must be made in order to avoid the difficulty of establishing the sameness of things. The role concept allows an organisation's structure to exist independently of its changing composition of members or employees.

Generic/Specific

The distinction between generic and specific terms of affordances helps in making the ontology charts more generally applicable to similar situations and avoid the constrains of specific terms. For example, a generic term such as facilities can be used to describe a whole range of equipments, rooms, and other objects for use in teaching (Lupolo 1987). Other example are the terms such as vehicle which consists of the specific terms of car, truck, van, motor-cycle; document which includes report, book, tape and notes. Each specific term may include another layer of more specfic terms, so the term car can include Peter's car, Ford, Golf or Mini.

The generic affordances allow the analyst to create a general and perhaps universal schemas depending on the context of the situation. These represent the invariants which afford the stable and predictable behaviour and norms of the agents. The use of generic and specific terms makes it possible to derive semantic schemas which are flexible for coping with the changing demand in the future.

Semiological affordances

Besides the ability to realise affordances in the here and now, people are capable of using semiological affordances to plan future actions or to predict future evants. For example, a person can either book or cancel an appointment by using signs to stand for the future event. Therefore, semiological affordances allow us to do something across time and space dimensions through our ability to use one affordance to stand for the realisation of another. This also enables us to have indirect knowledge about other things which are in

the here and now, such as in forecasting economic growth in five years' time. The importance of semiological affordances in representing future actions and creating future reality is reflected in our daily life and in our interactions in the legal and social affairs.

Time

An agent experiences time by direct physical experience which tells him of the knowledge of the here-and-now so that by sitting on a chair, he experiences the state of sitting at that moment. On the other hand, he can talk about times past, present or future by using signs or semiological affordances to build his past or future world, for example, to plan for a future trip or recall a past accident. For the logic of norms and affordances, the concept of time exists as a construct of the agents who create their own realities.

Thus, signs can be used by an agent to represent the beginning and the ending of a state of affairs so that he can have the direct knowledge of accomplishing a realisation. For example, the beginning of a concert can be the conductor's waving his baton which is a duration of experience. Therefore, the ending of a realisation can be the beginning of the other realisations such as the ending of a concert is the beginning of the audience leaving the hall. Beginnings and endings are not points in time but affordances we experience.

Consequently, the concept of time cannot be experienced directly but only as the starts and finishes of realisations in the world, for example, the start of the day, the end of the month, the beginning of the academic year, the second episode of a film. These starts and finishes are affordances which are used to construct a continuum of time which we can know semiologically.

The measurement of time is different for different cultures, so that the beginning of a fiscal year for two different countries may not necessarily be the same. In this complicated social world, the chronometer time of watches is commonly used for constructing patterns of reality and experiences. Social norms also plays an important role in determining the concept of time such as the beginning of ceremonies, the time for meals or sleeping. These underlying concepts of semantic analysis can be represented in ontology charts by a system of notations.

The graphical notations

In constructing ontology charts, a system of graphical notations are explioted in order to represent the relationships of affordances in the chart. Some of the notations have been drawn from the work of Tati Lupolo (1987) and some from the current work by Backhouse.

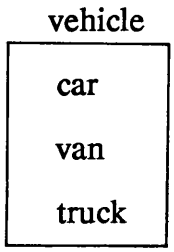
Agents

These are shown in the ontology chart in capital letters in a rectangular box, for example, a person is represented as:

Generic/Specific

The generic term is represented in an ontology chart by placing it above a rectangle in which the specific terms can be enclosed. This also indicates that

the specific terms share all the properties of the generic term. For example, the relationship between vehicle and car, van and truck can be represented as follows:



Part-Whole

A complex agent may be divided or partitioned into several parts, for example, a university can be sub-divided into departments while a company may have many branches. These part-whole relationships can be represented as follows:

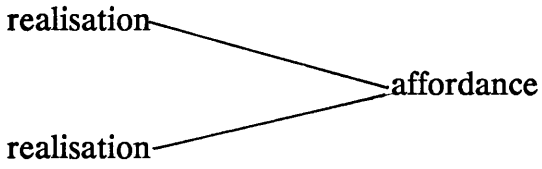
university——•——department

company——•——branch

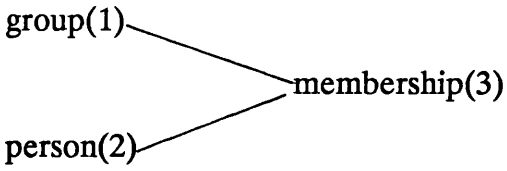
Extended restrictions

The convention adopted by Tati Lupolo is to attach a number by each term so that the process of building up semantic schemas can become easier and more organised for the analyst. The relationship of an affordance being

preceded by the realisation of antecedent affordances can be represented in this way:



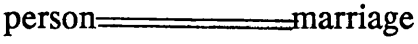
For example, the affordance of membership has two antecedents, a group and a person:-



In this structure, the affordance of membership is documented in the schema as:

(3) Membership (group,person)

When the antecedents are of the same type such as in a marriage in which there are two persons as antecedents, it can be represented as:

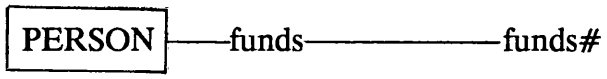


Determiner

The # sign is used to indicate that the affordance being referred to has a particular name, for example, a person mentioned is a particular person called David who is giving a party:

p#David————party

When the determiner is the identity such as the different code for the funds donated by a person:

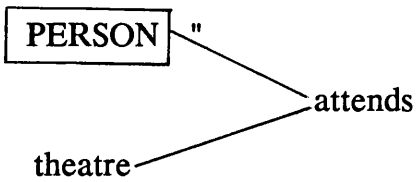


Sign

When an affordance is a semiological affordance, a quotation mark is used to indicate its property:

realisation——"————affordance

For example, a person books an advance ticket for attending a future show at a theatre can be represented as:



These graphical notations are simple but the mastering of the underlying assumptions and principles of NORMA semantic analysis is a difficult task which requires a considerable period of time. It is hoped that the forthcoming product of Backhouse' work will make the process of drawing ontology charts easier and less cumbersome. A more detailed account on further developement of the syntax and conventions of NORMA can be found in the MEASUR (Method for Eliciting, Analysing and Specifying Requirements) by Stamper et al (1988).

The methods of NORMA semantic analysis are used in performing the analysis of a case-study in detail in chapter 6. The result of this analysis will be shown to support the application of concepts of relevance based on the relationships among affordances in ontology charts in chapter 7. However, a new approach to the problem of relevance is essential for a systematic understanding and application of different concepts of relevance. The arguments for a unifying approach to the concepts of relevance and their application is the subject of the next chapter.

CHAPTER 5

A NEW APPROACH TO THE CONCEPT OF RELEVANCE

In this chapter a framework for the analysis and application of the different concepts of relevance is established in the semiotic approach as a result of investigating the object of relevance judgments, namely what we often call 'information'. Secondly, a new approach to the concept of relevance is found to lie in its recognition as an affordance which encompasses all the characteristics of relevance. Therefore, by considering an object as a sign, we can discuss its quality of relevance which is the ability to afford an agent the desired action on the basis of being semiotically relevant. On this combined basis of semiotics and affordance, the different concepts of relevance are classified and analysed in the last section in order to illustrate the existence of the implicit semiotic elements in each concept.

A Semiotic Framework for Concepts of Relevance

Most definitions of relevance are restricted to certain objects of relevance judgments such as stored statements and the elusive entity called information. These approaches to the problem of relevance do not clarify the meaning of 'information' which is taken as the basis upon which relevance judgment is made. The inadequacy of most definitions of information shown in chapter 4 has resulted in adopting the theory of signs or semiotics as a basis for investigating the various properties of signs. Therefore, a semiotic framework is considered to offer a comprehensive and systematic basis for analysing and applying these concepts of relevance.

Then we can investigate the quality of the relevance of signs according to the branches of semiotics. This means that we are not restricted to a particular type of objects or a particular condition which can be considered relevant. Based on the pragmatic property of signs, we are reminded that to communicate successfully, relevant signs must be used to attract people's attention to the intended messages or to influence their behaviour.

For example, the use of clear and distinctive signs to inform passengers of the different channels for immigration control at an airport and the use of suitable speech acts in affecting the desired behaviour such as in times of emergency. In addition, pragmatics reminds us that it is not enough to create an information system which is relevant on the basis of meeting all the assigned objectives; the effects on the behaviour of people as a result of implementing changes to their usual routines must be anticipated in advance. The impacts of a relevant information system must be acceptable to the users in order to achieve a successful implementation.

The importance of semantics in tackling the issue of relevance lies in its methods for identifying and clarifying the context or situation problem which is the basis for explicating the agents' situational relevances. Semantic analysis helps in identifying users' requirements which are the basis of the selection of relevant information. The critical analysis of different meanings in the given context also ensures our accurate understanding of the context and the issues of relevance therein. Therefore, semantically relevant signs or candidate affordances have to be used in representing the context of the situation and in its analysis.

The importance of the syntactic aspect of signs is reflected in the logical

concept of relevance in which appropriate logical operators and rules are used in the deduction of relevance. Syntactics offers us explicit tools for formulating criteria for making relevance judgments. For example, in choosing a relevant airline for a trip, the relevant criteria can be expressed as a conjunction of the price and the availability of a seat on a particular day.

The importance of empirics lies in the awareness that for the communication of relevance to be effective, we must pay attention to the capacity of channels of communication, the appropriate coding of messages and the transmission of feedback. For example, an air-hostess has a relevant announcement to communicate to the passengers but the channel of communication is defective; so the passengers are prevented from taking the relevant instructions for emergency landing.

By looking at the aggregate and loose term of 'information' in terms of the different properties of signs according to semiotics, we are able to investigate the qualities and relationships of an item of information in a richer and more comprehensive way. So, an item of information can be described as appropriate for a purpose according to one of the four branches of semiotics and the design of an information system can be viewed as attempting to satisfying users' requirements semiotically. In this way it is also possible to encompass all the different qualities of relevance within a semiotic framework. By examining an item of information according to the perspective of semiotics which analyses 'information' in its primitive term of 'sign', we can derive the judgment that such information is relevant either semantically or pragmatically or otherwise.

In the case-study of analysing and designing an information system to support the requirement of a research group, it will be shown that the use of the semiotic framework enables us to achieve a systematic and satisfying way of incorporating all the concepts of relevance in both the analysis and design processes. For example, we can apply syntactics to the establishment of criteria based on different concepts of relevance in selecting documents. Semantics will help us in investigating the nature of users' requirements and whether they are related to other things such as the relevance of authors cited by users.

In addition, the application of pragmatics enables us to design information systems which communicate messages to users effectively, for example, the use of appropriate codes or labels for organising a library and the study of the impacts of an information system on users. The application of empirics is in the control system for maintaining the relevance of the information system according to changing requirements.

Relevance as an Affordance

The important quality of relevance which emerges from the discussion of concepts of relevance is that an item of relevant information must have the potential of being useful for a person in achieving his goal or action. This quality of enabling a person or an agent to act or to further his pattern of behaviour makes the concept of relevance coincide with the underlying characteristics of an affordance.

The compatibility of the characteristics of the theory of affordance with qualities of relevance is reflected by, firstly, the recognition of an agent who realises the potentials afforded by the environments. Secondly, the realisation

of an affordance by a person gives him a direct knowledge of his environment which is reflected in the individual's relevance judgments according to his context and perception. Thirdly, the realisation of an affordance can lead to the realisation of other affordances which correspond to the characteristic of relevance in furthering an action such as in the use of relevant document in writing a paper.

Thus, 'relevance' can be considered as an affordance which has the potential of enabling a person to perform an appropriate action. In this way, we are also reminded that the concept of relevance must not be considered in isolation, it exists only when there is an agent seeking information which has the potential to enable him the accomplishment of his goal.

By combining the application of various concepts of relevance in a semiotic framework with the consideration of relevance as an affordance, a comprehensive approach for dealing with the issue of relevance is established. In this way, we can link concepts of relevance to the process of semantic analysis and investigate the semiotic aspects of signs which indicate the quality of relevance or makes the communication of relevance possible.

Semiotic Analysis of Concepts of Relevance

The different concepts of relevance discussed in chapter two and three can be analysed according to the branches of semiotics in order to see the extent to which each concept has incorporated the semiotic consideration of signs. As some concepts of relevance are orientated in particular disciplines, these tend to be concentrated on certain properties of signs. On the other hand, some concepts consider the semiotic only lightly or indirectly while a few

explicitly acknowledge the semiotic problems involved in relevance.

In addition to this analysis, each concept of relevance is represented in an ontology chart. The main principle for understanding ontology charts is that the existence of the entity on the right-hand side depends on its antecedents on the left-hand side. Each entity is an affordance which has to be realised by an agent in order to proceed to further affordances. For example, in order to wrap a parcel we have to have a piece of paper and a piece of string. Therefore, the affordance 'wrapping' has the antecedents of paper and string which have to be realised together by a person in order to do the wrapping.

The concept of relevance in phenomenology

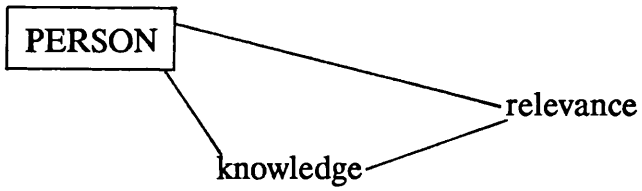
Schutz's concept of relevance includes all the elements of semiotics. He recognises that in seeking relevance, a person aims at affecting certain actions or plans; this is related to the pragmatic aspect. The role of empirics is implicit in the person's interpretation of his observation of the situation in relation to his accumulated knowledge.

On the other hand, the semantic aspect is implied in Schutz's belief that the knowledge of the social world is socially created and shared by members of the society so that the meaning of a situation has to be understood according to that context. The syntactic aspect is reflected in the deduction process in which a person comes to the conclusion or arrives at the solution. Therefore, Schutz's concept of relevance seems to underlie the general characteristics of relevance.

According to Schutz, there are three systems of relevance which are interdependent in that the process of bringing a solution to a situation involves

the individual's perception of topical relevance and his interpretation with regards to his background knowledge. This implicitly gives the authority for making relevance judgments to the particular person in a situation. In NORMA semantic analysis, a key issue is to clarify the authority for the start and finish of an affordance as there could be two different authorities.

Therefore, the antecedents of the affordance 'relevance' comprises the existence of a person which includes his perception of the situation and the accumulated knowledge. The ontology chart of this concept can be represented as:



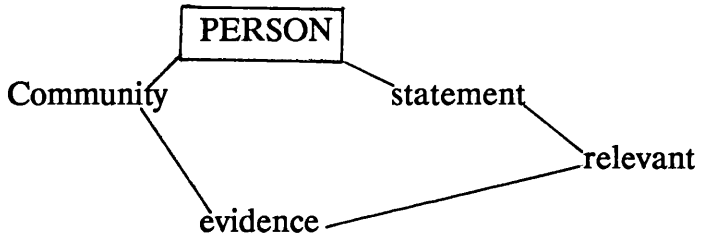
The concept of relevance in law

The English law of evidence can be said to include all the semiotic aspects in a most explicit way. By specifying what kind of evidence can be admitted in court and by establishing the validity of the evidence, the semantic approach is clearly involved. The pragmatic aspect can be readily seen in the process of cross examination in which the weight of evidence is judged in the light of the demeanor of the witnesses. The way in which the questions are put to the witnesses are also reflective of the pragmatic exploitation of signs.

The empiric aspect can be seen in the references and analogies made to similar cases and the legal experience of using precedents and judgments of

other judges on previous occasions. The syntactic aspect lies in the deduction of evidence and the standard of proof. The result of a case can depend largely on how skillful a barrister is in using signs or language in convincing the judge and jury of his conclusion or defence.

According to the law of evidence, not all relevant evidence is admissible in court; the admissibility of relevant evidence is decided by the judge. The authority for deciding the relevance of an evidence belongs to the judge in a particular case. The antecedents of 'relevant' can be expressed ontologically as:



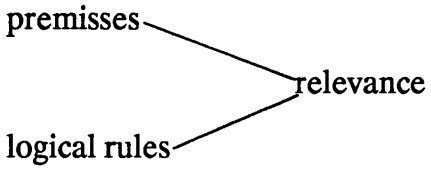
The statements made in court have to be proved or disproved by the corroboration of relevant evidence. The procedures and rules in law reflect the importance of the four semiotic issues.

The concept of relevance in logic

The logic of implication and Carnap's confirmation of hypothesis are both specifically in the domain of syntactics. The sematic and pragmatic issues are not considered in this context. However, Carnap's concept allows an element of empirics in which a person's estimation of probability according to observation and experience can contribute towards the conclusion of the degree

of confirmation.

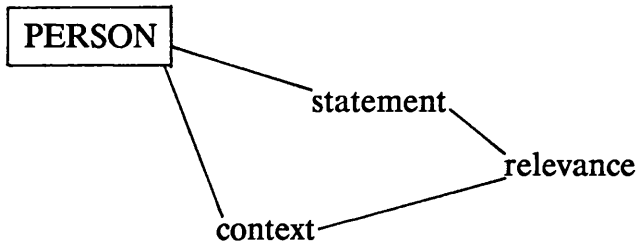
The conditions for deducing logical relevance are the existence of some propositions or premisses and logical rules. The authority for deciding the relevance between the given premisses implicitly belongs to the person who makes the deduction process. Therefore, the ontology chart of the affordance 'relevance' in logic can be represented as:



The concept of relevance in communication and cognition

The concept of relevance in communication and cognition proposed by Sperber and Wilson is confined to verbal communication. Their assumption that a tacit guarantee of relevance exists in verbal communication between two persons depends upon their assumption of ostensive communication. The pragmatic aspect of signs are implicitly reflected in the process of verbal communication. The syntactic property is inherent in the deductive process in which a hearer tries to find the context for interpreting the speaker's message. The empiric aspect of signs is also embedded in the communicators' knowledge and experience which become an element for interpretation. The semantic aspect is not explicitly stressed in the context of verbal communication. However, the problem of meaning can be seen in the search for the appropriate context for deriving the relevant message given by the speaker.

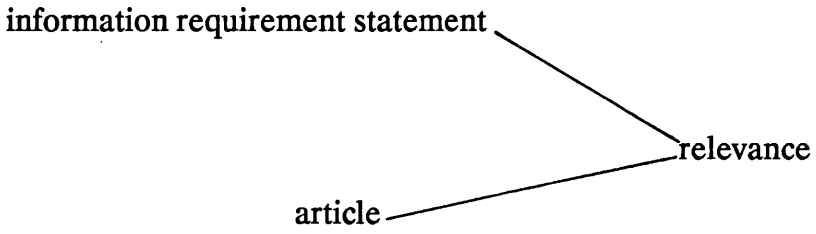
This approach places the role of an agent as significant in identifying relevance in a verbal message. The antecedents of 'relevance' consist of the existence of a context and the statements given by a speaker while a condition of contextual effect determines the degree of relevance. This can be represented as:



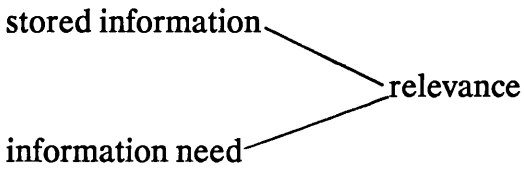
The concepts of relevance in information retrieval

Cuadra and Katter do not explicitly investigate the concept of relevance judgment according to the semiotic basis but we can see that their definition includes an element of semiotics. The five factors affecting relevance judgments reflect the semiotic concern. For example, document representation is related to pragmatics and the queries or requirement statements involves an element of semantics. The judgmental situation and the judge's knowledge reflect an element of empirics. The syntatic element is implicit in the process of deduction.

Cuadra and Katter's definition of relevance gives us two antecedents of an information requirement statement and an article. The authority for deciding on the relevance of an article is explicitly assigned to the judge or user. Their definition can be ontologically represented as follows:

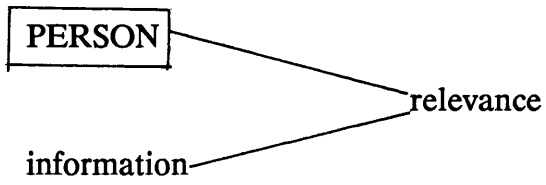


Cooper's definition is based on logical implication which concerns syntactics. He does not pay any attention to the meaning of information nor the subjective element of users. Therefore, his concept only deals with the syntactic or formal property of signs. His concept of relevance is narrowly defined for an information retrieval system. The authority for making relevance judgments is implicit in the existence of the person who makes the logical deduction. The two antecedents are stored information and information need. This definition can be expressed ontologically as follows:

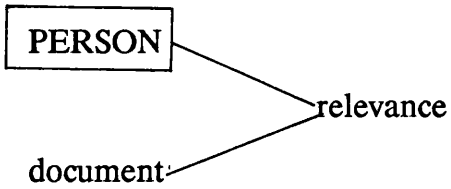


Wilson's definition of situational relevance stresses the subjective aspect of relevance, according to his situation and perception, which implicitly concerns the pragmatic and empiric aspects. However, his operational definition is dependent upon Cooper's logical relevance which is only

concerned with syntactics. The antecedents of 'relevance' are a person's concern, preferences and knowledge, and item of information. Wilson clearly recognises the authority of a person in deciding the relevance of information. We can think of the three factors as a part of a person so that the antecedent of 'person' includes these factors. This definition can be ontologically represented as follows:



Hillman's definition of relevance as conceptual relatedness involves all aspects of semiotics. This is because a concept class has to be constructed from the user's judgment and observed similarity between objects. The syntactic element is embedded in the rules for the deduction of similarity of concepts in some documents. Although the rules can be established by another person, the authority for making relevance judgments belongs to the person who applies these rules and make the logical deduction. Therefore, the two antecedents are a person and document which can be expressed ontologically as:



Conclusion

The discussion of semiotics has shown us its potential contribution towards the task of identifying relevant items of information and in communicating that to the appropriate receivers. The theory of signs offers a systematic and comprehensive approach to the problem of relevance by exploiting the different properties of signs. Therefore, we can regard the various aspects in which signs are judged as being semiotically relevant.

The consideration of 'relevance' as an affordance also affirms the underlying norms that we use signs to affect or to do something and that relevant information must have the potential of enabling an action. The semiotic approach to the phenomenon of 'information' and the theory of affordance allow us to accommodate the different concepts of relevance in a single framework.

The analysis of various concepts of relevance reflects the importance of semiotics which is either implicitly or explicitly considered in these concepts. The application of semantic analysis to the case-study in chapter 6 will demonstrate the benefit of this approach. Also, the application of concepts of relevance in chapter 7 will illustrate that the semiotic approach offers a friutful and practical exploitation of these concepts.

CHAPTER 6

THE APPLICATION OF NORMA SEMANTIC ANALYSIS TO THE FIRST CASE-STUDY

In this chapter, a case-study of a research group is introduced and analysed according to the methods of semantic analysis based on the logic of norms and affordances. This constitutes the first part of the first case-study. The second part of this case-study, which involves the application of concepts of relevance to the practical investigation, is represented in chapter 7. The results from the first part consist of ontology charts and semantic analysis of affordances which represent the substantive aspect of the situation problem.

The First Case-Study

A research group at the London School of Economics called LEGOL/NORMA is chosen as the case-study to which the principles of semantic analysis are applied. This research project was started in the early 70's whereby a formalism in a language called LEGOL (LEGally Oriented Language) was developed by the group of researchers at the London School of Economics. In the mid 80's, a new kind of logic called NORMA was developed so that the name of the project and group was changed to LEGOL/NORMA. A description of the goals of this project can be found in Appendix 6.0.

The context of this research group is that of a small academic group involved in academic activities such as producing research output and presenting papers at conferences; their tasks are supported by a specialised library. However, the researchers' information requirements are not effectively

met as a result of the absence of an information manager or a responsible agent who could consistently manage the information resources of the group. Therefore, the concern of semantic analysis is to systematically establish the context of the case-study in order to discover the researchers' information requirements and ways in which their tasks or objectives can be achieved efficiently.

The Steps of Semantic Analysis

The initial step is to think in terms of the concept of relevance by asking the question: 'what are the affordances available or required by the researchers in order to do their tasks?' This helps in bringing out the patterns of behaviour reflected in ontology charts. In addition, the other question which is kept in mind in this context is 'how can concepts of relevance contribute to the analysis of the problem?' This has also contributed to the assembling of ontology charts.

The recommended method of listing all the possible candidate affordances has been attempted but it did not seem to facilitate the process of discovering the patterns of norms in this case. This may be because the problem definition is not structured or well defined as are such cases as the analysis of legal contexts. Thinking on the basis of the concept of relevance, it is found that candidate affordances can be more naturally derived by listing the responsible agents and their affordances together, instead of the recommended method of listing the terms representing affordances and then identify the agents. Furthermore, the three recommended steps have to be performed together iteratively. The steps taken in the semantic analysis are as follows:

The first step: produce a list of agents and their affordances

This list becomes the basis from which suitable terms of affordances are derived. The concept of relevance imposes the question of 'what affordances are relevant to which agent?' so that the list can be gradually added and changed whenever new affordances or agents are identified, even though the description of the case may not be precise.

The preliminary list of agents and their affordances is shown in Table 6.1. This acts like a drawing or sketching board which means that this table does not have to be completed even though new affordances are later identified from the examining of the ontological consistency. The other advantage of this table is that it helps in grouping relating affordances together for drawing ontology charts.

Table 6.1 Preliminary List of Agents and their Affordances

1. The research group is attached to an institution.
2. A group consists of its members.
3. A group has certain objectives/goals/mission.
4. A member of a research group is assigned certain tasks.
5. A person researches on the topic which is related to his work.
6. A person produces or creates output or research papers.
7. A person is employed by an institution or organisation.
8. A person's work is published by an institution.
9. A member of the group collaborates with other research groups.
10. A person acquires the most up-to-date work.
11. A person obtains papers which are cited in relevant work.
12. A person keeps relevant work or article.
13. A person duplicates or makes a copy of the relevant articles.
14. A person withdraws/discards articles which are not relevant.
15. A person selects the relevant work or articles.
16. An institution organises a conference.
17. A person presents his work at a conference.
18. A group subscribes to others' published work.
19. A group applies for funding from a sponsor.
20. A person is responsible for maintaining the specialised library.
21. A person is familiar with other researchers and their work.
22. A group has a mailing list of contacts.
23. A person sends/distributes reports/ work to others.

24. A person anticipates/forecasts future research areas.

25. A person owns the copyright of his work.

26. A person corresponds or communicates with others.

Table 6.2 List of Candidate Affordances

1. group
2. membership (role name: member)
3. mission
4. task
5. allocated
6. relates
7. specialises
8. topic
9. creates
10. work
11. employs
12. publishes (role name: publisher)
13. collaborates
14. acquires
15. version
16. cited
17. keeps
18. copies
19. withdraws
10. discards
21. selects
22. conference
23. includes

24. subscribes
25. sponsorship (role name: sponsor)
26. funding (role name: funder)
27. responsible
28. library
29. familiar
30. address
31. telephone number
32. distributes
33. document
34. anticipates
35. owns
36. copyright
37. communicates
38. undecided

The second step: list the terms of affordances from the preliminary list of agents and their affordances

Each sentence regarding an agent and its affordance in Table 6.1 is investigated more closely in order to create a list of candidate affordances. The criteria for determining whether the term is qualified as an affordance is to check whether it has a start and/or finish. The terms of affordances should be generic terms; terms which are particulars or roles have to be distinguished as such.

During this step, attention is focused on making certain that substantive affordances have not been omitted and repetitive terms are checked and changed. These candidate affordances can be found in Table 6.2, these terms are subject to changes during the process of drawing ontology charts. An important recommendation is that the terms chosen as candidate affordances should belong to users' vocabulary (Backhouse 1989).

The third step: draw and assemble the ontology charts

The complexity of the case-study means that to draw a complete ontology chart would be confusing and inappropriate. So, different subsets of ontology charts are drawn separately; these can be linked together to give a comprehensive chart representing the whole picture of the case-study.

By looking at Table 6.1 which contains the list of agents and affordances, and the list of affordances in table 6.2, the analyst can decide which subset is to be drawn first, for example, by grouping a number of affordances together on the basis of their relationships. This contributes towards the process of checking for consistency in the chart as several sets of charts are drawn

separately and then assembled together to represent a single comprehensive chart.

The fourth step: check for ontological consistency

Each ontological chart is subjected to a consistency check in order to correct mistakes and inconsistency. The usual mistake found is the inconsistency of the relationship between affordances, namely that of causal relationship. In this process, the analyst has to continually ask the question: 'does this affordance depend on the existence of its antecedents?' or 'what has to exist for the particular affordance to exist?' This checking is carried out during and after drawing each chart.

The fifth step: perform semantic analysis of each affordance and clarify the criteria for its existence and establish its semantic schema

These criteria include clarifying the antecedents of an affordance, the authority for its existence, the start and/or finish of each affordance and the rules or condition for its existence.

The process of deriving and grouping candidate affordances

By investigating the preliminary list of agents and affordances in Table 6.1, we can derive the candidate affordances from each sentence in this table. A sentence can reveal more than one affordance. In choosing the suitable terms for candidate affordances, an implicit and basic semantic analysis of the meaning of each term is also necessary.

From the first sentence, we can derive 'group' as an affordance, the

second sentence gives 'membership' and from the third sentence 'mission' is chosen as it gives a broader meaning than those of 'purposes' or 'objectives'. The fourth sentence has another implicit affordance: tasks are either assigned or allocated among persons in the group. Therefore, 'allocated' is added to the list in Table 6.2. The fifth sentence we can add 'specialises' and 'topic' as affordances. This cluster of affordances seems to form a framework of the research group.

The sixth sentence, the term 'creates' is listed because 'produces' is the term normally used in the field of economics and manufacturing process while 'creates' is a more general and universal term. From the sentences no.7 to no.9, 'work', 'employs', 'publishes' and 'collaborates' can be derived. The repeating affordances such as 'group' or 'work' is listed only once in the list of candidate affordances.

This process continues to identify further affordances of 'acquires', 'version', 'cited', 'keeps' from other sentences in the table. The problem of choice is again presented by 'duplicates' and 'copies' in sentence no.13; the latter term is more suitable. The term 'copies' does not restrict the meaning to any particular tool or technology employed in making a copy of an article. In addition, the role name for this affordance is 'a copy' and 'copier' for the role of the person who makes the copy of a document.

An additional affordance discovered in sentence no.14 is due to the distinction of meaning between 'withdraws' and 'discards'. A person can withdraw a document without discarding it so that the document is still available. But to discard a document means that it is no longer available. These two terms represent entirely different affordances although one can

usually withdraw a thing before discarding it. However, the person who withdraws a document may not be the same person who discards it.

The next sentence gives a simple term 'selects'. The question arisen here is whether this affordance has somehow included the affordances of 'keeps', 'withdraws' and 'discards'. A closer examination indicates that perhaps the affordance of 'select' represents the substantive aspect while the others represent the procedural aspect. The substantive aspect is for a person to select a relevant document or article. There are also cases in which a person cannot decide whether to keep or to throw away an item, so 'undecided' is another affordance to be added to Table 6.2.

From the sentence no. 16 we can derive 'conference' and the term 'subscribes' is derived from sentence no. 18. The term of affordance of 'presents' is replaced by 'includes'. This is because a person's work can be included in a conference in different ways, for example, his work can be presented by the owner or someone else instead, or it could be printed or mentioned in the proceedings. Therefore, 'includes' is a more general term of affordance which does not restrict one to a particular ways of making one's work known at a conference.

Looking at sentence no.19, there is a difference between a sponsor and a funder as the two need not be the same person. A sponsor may only be lending his name to a person without giving any financial assistance. The term sponsor is a role name for the agent who lends his prestigious support; and funder is the role name of the person who gives the financial support. The affordance of sponsorship is added to the list and the additional term of 'funding' is also listed in Table 6.2.

The terms of additional affordances which are identified are 'responsible' and 'library'. The term 'familiar' is chosen because the normal usage of 'acquainted' is usually in relation to another person whereas one can be familiar with either a thing or a person.

The investigation of the sentence no.22 points to the fact that a mailing list is a role name for the addresses and telephone numbers while contacts can also be a role name for the people on the mailing list. Hence, the terms 'address', 'telephone number' are listed instead of contacts and mailing list.

The term 'distributes' is chosen from the sentence no.23 because this term represents the substantive aspect, i.e. a person can distribute documents by hand or send them by post or by electronic mail.

The term 'anticipates' seems more suitable than 'forecasts' in sentence no.24; the former has a more general meaning which includes the speculation and uncertainty while 'forecasts' implies a more definite degree of certainty, e.g. weather forecast.

The sentence no.25 gives an additional term of 'copyright' and 'owns' to the list. Sentence no.26 gives an affordance of 'communicates' which includes the procedural aspect of the process of corresponding, answering queries, exchanging ideas or giving opinions and information and so on.

Thus the list of candidate affordances in Table 6.2 is the result of the process of investigation illustrated above. This list is still subjected to other possible changes if any necessary improvements are discovered while drawing the ontology charts.

The Drawing and Assembling of Ontology Charts

The list of agents and candidate affordances in the two tables reflect the patterns of behaviour or actions available to members of a research group in their context. Each ontology chart is drawn by grouping together affordances which can be assembled into a meaningful picture for an aspect of the agents' activities. Then each ontology chart is checked for ontological consistency and subject to semantic analysis. The semantic schemas of these charts can be found in Appendix 6.1.

As the philosophical assumptions of the logic of norms and affordances including the concept of ontological dependencies are initially difficult to grasp, the mistakes and incorrect charts are represented in Appendix 6.2 for the purpose of contrasting with the correct charts. The most frequent mistake in drawing ontology charts is in mistaking ontological dependency for causal relationship. This results in drawing charts similar to dataflow diagrams.

The agents and their antecedents

In NORMA, the term 'agent' can be used to stand for a person, an organisation or other particulars such as the person called David or a college called King's College. According to the condition that there is no knowledge without a knower, we have to account for the existence of these agents. From the legal perspective, the word 'person' is used to describe a social agent or a legal entity which has a legal personality.

Legal personality involves the acceptance of the rights and obligations which are recognised and prescribed by the particular law; different legal systems have varying views of legal personality. In the English legal system,

legal person is divided into natural legal person or human beings, and artificial legal persons, such as a group of people recognised as having its own existence in law. Natural legal persons represent the largest group for which various branches of law are designed to deal with its behaviour.

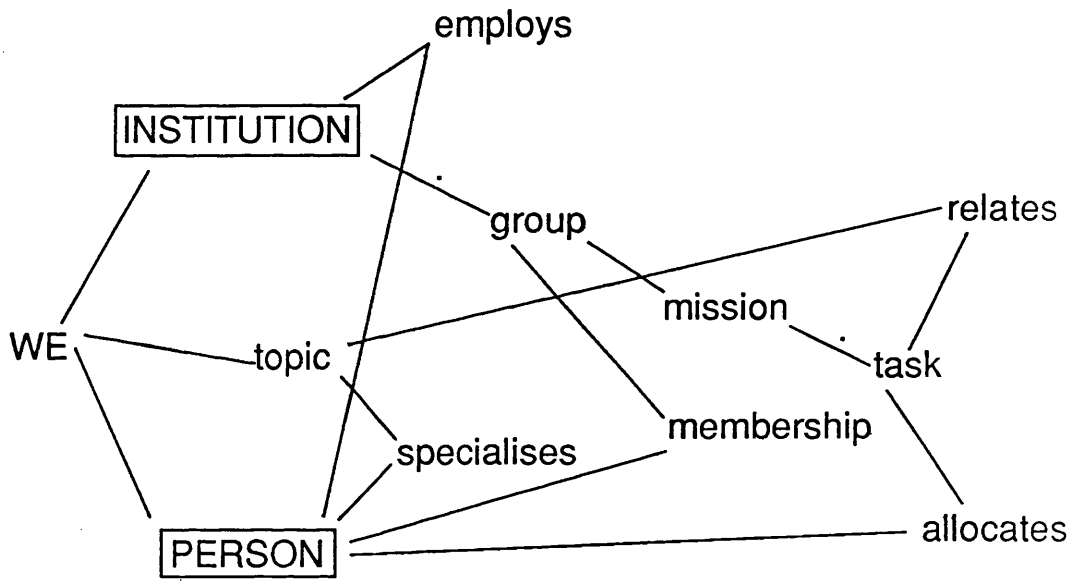
On the other hand, the artificial legal persons are recognised as having an independent status in law although they have no human characteristics. The term used to describe these artificial legal persons is 'corporation', for example, companies and public corporations. The existence of a corporation depends on the legal provision and the court. The other authority for the existence of corporations are a Monarch's prorogative power to grant a royal charter and Acts of Parliament. For example, a learned profession will be incorporated by royal charter such as the Royal Institute of British Architects, an Act of Parliament may specifically establish a corporation such as the Coal Industry Nationalisation Act 1964, and provisions of the Companies Act (1985).

Therefore, an agent or a person in this context can either be an individual or a legal person. The other generic term which is commonly used instead of an agent is 'institution' which can be used to represent a complex agent such as a governmental department, a university, a school or a multinational organisation. The antecedent or the authority for the existence of these agents is the state in which these agents exist.

The other important antecedent is the existence of the role of the analyst or a root agent who knows the existence of particular agents and their patterns of behaviour, including the existence of the knowledge of the community. This antecedent has been represented in two ways as 'WE' (Backhouse 1989) and 'State' (Lupolo 1987). Therefore, we are reminded that even the analysis

output is created by an agent whose values and personal judgment determine the particular way in which the work is produced; and that knowledge about a situation or activities of other people is accountable to an agent.

Figure 6.1B The Framework of the Research Group



The First Set of Ontology Charts

Figure 6.1B is assembled from grouping the candidate affordances which are reflective of the activities of the members of a research group and their context within an institution. This set of ontology charts represent the framework of a research group in which it is a part of an institution. The research group has certain objectives or mission which determine the nature of their tasks. The researchers have their own research interests or specialisations.

The two agents are an institution and a person whereby a group is part of an institution and a person is employed by an institution. Therefore, the antecedent of 'group' is an institution while an institution and a person afford 'employs'. A person and topic enable the affordance of 'specialises' and 'membership' is dependent upon the existence of a group and a person. The antecedent of 'topic' is a community of people who is responsible for that knowledge. The affordance 'mission' depends on the existence of a group, while 'task' is part-whole of 'mission'. A task and topic enable the affordance 'relates' while 'allocates' depends upon a task and a person.

These patterns of affordances are a means of investigating users' or researchers' requirements and ways in which concepts of relevance can contribute towards the design of an information system. For example, the knowledge about the members and their specialised topics including their tasks are sources of criteiria for the relevance of information.

For an academic research group, the tasks of its members involve academic undertakings within the institution or university and the production of research papers or reports. Being a small group, the allocation of tasks is on an

informal basis but the membership of the group is subject to frequent fluctuation which indicates that the topics of relevance are subject to changes according to the content of membership. The affordance 'topic' deserves a detailed semantic analysis as its scope and meaning can be varied, especially the authority for the existence of topics which are known in an academic field.

Semantic analysis of 'topic'

According to the English Dictionary, 'topic' means 'a subject or theme of a speech, essay, book, etc.; and, a subject of conversation; item of discussion' (Hanks 1979). But this leaves the question about the responsible agent who knows the exact theme or subject of discussion. Therefore, the existence of the content of the topic depends on the agent, namely someone has to determine what the actual topic is about. The antecedent of 'topic' can be expressed as 'WE' which is a generic term including members of a group and an information manager.

This dependence of the existence of a topic on responsible agents is clearly illustrated by considering the existence of topics which have been established by specialised institutions in the field of information systems. For example, the Institute of Engineering, Electrical and Electronics (IEEE) publishes the Computer and Control Abstracts, the Informatica e Diritto publishes the international bibliography for computers and law.

An institution which specialises in indexing the accumulated knowledge in various fields serving researchers and workers in the particular community can play a significant role in establishing the context within each field. A researcher can consult these tools to obtain the context of his topic of interest

and to ascertain the progress or any innovation in a particular topic. In the field of science and social sciences, researchers will invariably consult the Science Citation Index and Social Science Citation Index published by the Institute for Scientific Information (ISI).

An overlap of topics can occur when a several institutions produce bibliographic tools covering the same fields. The influence of the particular system for categorising knowledge depends on the economic and social status of that institution. For example, the influence of the Library of Congress classification system is reflected by it being adopted by other institutions such as the British Library of the Political and Economic Science and the Thai National Bibliography.

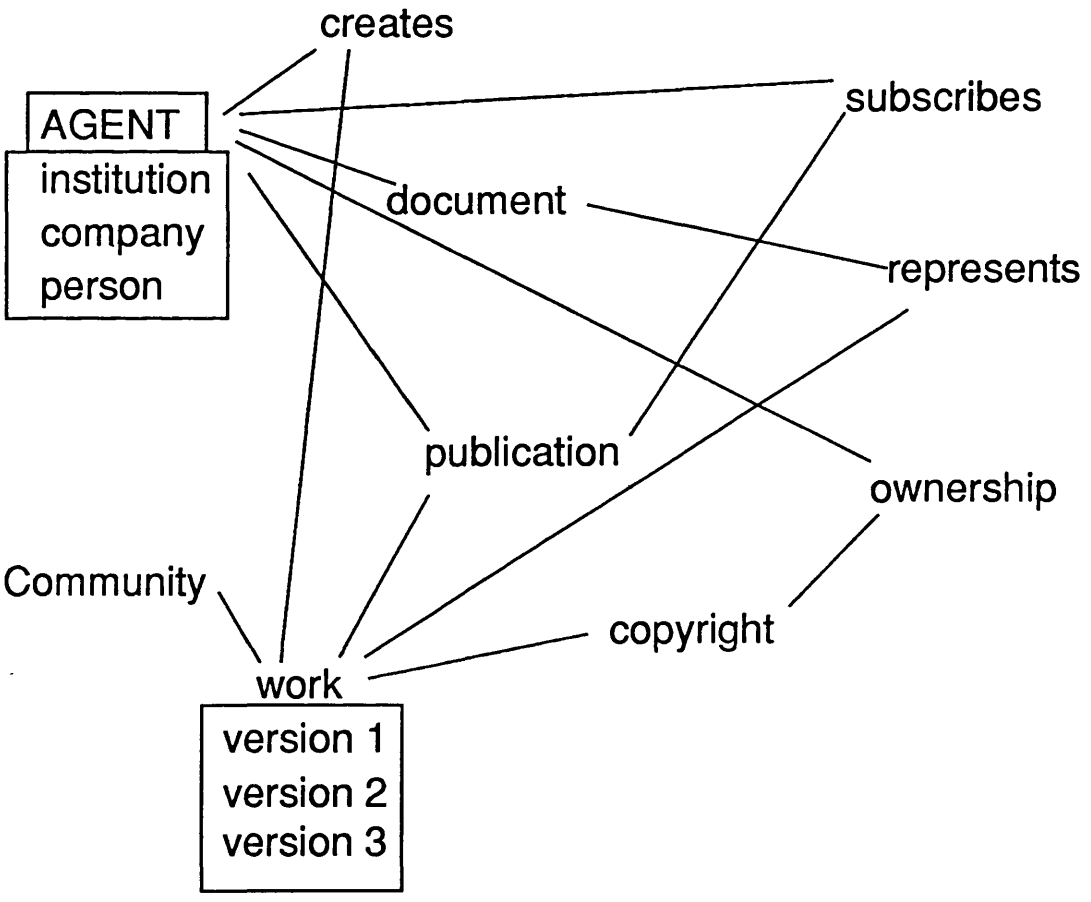
The need to establish the meaning of the available topics in a community is reflected by the existence of nationally established organisation for classifying and organising the existing knowledge. A complehensive list of world-wide national bibliographies can be found in An Annotated Guide to Current National Bibliographies.

The existence of formally established meanings in a particular field of knowledge serves as a source for researchers to discover the current interests and works, and possibly the trend in a topic. It is also the basis for discovering the future researches in a field and a very important means to create and enforce consensus among workers or academics. For example, in organising a conference, the organiser may have to consult the appropriate bibliographic tools in order to generate topics which should be included in a conference programme. The terminologies and concepts listed in the programme will be those currently acceptable or acknowledged by the appropriate community.

However, the meaning of a topic is also influenced by the works of individuals in that field. Their works which can either enforce the established meaning of a topic or introduce changes, and challenges will be open to discussion by their colleagues in the field. The result may be to bring a totally new concept in to a field or to invalidate certain established meanings. Through the process of debates and negotiations, a new meaning of a topic will become accepted by the community. The lack of consensus in meaning usually occurs when a new concept has just emerged at the frontier of the knowledge of that particular field. But it is the well-established institutions who have the authority and social status to enforce the existing topics and the evolution of these topics of knowledge.

The semantic analysis of 'topic' has shown us that although appearing to have a straightforward and simple meaning, it can have very different meanings depending on the different authorities or responsible agents. The semantic analysis of other ontology charts will also reflect the importance of analysis of what appears to be an uncomplicated term. The semantic schemas of these charts can be found in Appendix 6.1.

Figure 6.2B The Relationship between a Person and Work



The Second Set of Ontology Charts

The second set of ontology charts is based on the combination of candidate affordances from Table 6.2 in order to reflect the other aspect of relationships between an agent and a work. (The first version is represented in Figure 6.2A in Appendix 6.2). As a result of the existence of a work and a person, a repertoire of affordances are realisable such as the publication of a work and its subscription, a copyright of a work and its ownership, the use of documents to represent a work in other forms and the role of a person as a creater of that work.

In this chart, the semantic analysis of the simple terms proves to be more problematic than the initial expectation. The terms which require rigorous analysis are 'work' and 'copyright' as they are related to legal issues of rights and protection.

Semantic analysis of 'work'

As the existence of a copyright depends on the existence of a work, we have to investigate the legal definition of 'work'. However, the law does not provide a precise definition of this term. Instead, a classification of different types of work is used, that is by classifying a work into literary, dramatic, artistic and musical work which are protected by Part 1 of the Copyright Act 1956. In Part 2 of the Act, the four categories of works are sound recordings, cinematograph films, T.V. and sound broadcasts, and typographical arrangements. The Copyright Act 1956 has been amended to include proposals and changes for making it more logical and consistent with the Berne Convention for a better protection of works, the new Act is called the

Copyright, Designs and Patents Act 1988.

The Copyright law does not define the criteria for establishing whether a work is a literary work, it simply states 'any work, other than dramatic or musical work, which is written, spoken or sung' (Copyright Act 1988). It also adds that the term includes a table or compilation. Therefore, literary works have been used to describe items such as logarithmic tables, football pool coupons, examination questions and a list of horses. In addition, the Copyright (Computer Software) Amendment Act 1985 has added computer programs as literary works. Similarly, the copyright law gives categories of types of work which are qualified as dramatic, musical and artistic works.

Hence it is important to know to which category a work belongs as each one has different copyright protection. Furthermore, the different provisions for protecting different category of works cannot be interchanged. The analysis of 'work' according to the Part 1 of Copyright Act 1956 is sufficient for drawing our attention to the method of defining this term basing on the requirement to protect an individual's work in a legal context. However, there is a case for redefining 'work' differently from that given by lawyers in order to avoid the problem of not being able to categorise an innovative work into the existing categories.

The problems of the definition of 'work' in copyright law

The way in which the legislature defines the meaning of 'work' has created unforeseen difficulties and inadequacy in protecting certain kinds of works. This means that new amendments to the existing legislation have to be considered each time there is an outcry about the Copyright Act. This situation

can be seen as the problem of the distinction between a sign-type and sign-token.

In the context of normal usage, the meaning of the term 'work' in a literary work implicitly includes the ideas and intellectual efforts expressed in written words (sign-types) which the author used in his book (sign-token). An example of artistic work is the work by a painter; his ideas and effort were expressed by the strokes of his brushes in the form of a painting. For a dramatic work, the efforts and ideas of the play-writer are expressed in the organisation and interpretation of different parts of his work by the actors and actresses in the form of the acting of the play.

The term 'work' encompasses both the sign-type which is the ability to use language to express ideas and the sign-token, such as a novel or a poetry. Depending upon the context, 'work' is sometimes used to mean the sign-type such as when we talk about the quality of the literary expression in a poem. On the other hand, it is used to mean the sign-token, such as when we calculate the number of books written by a writer. Moreover, the existence of a sign-type does not depend on the existence of a sign-token (Backhouse 1989).

For example, the existence of a Pali scripture (sign-token) can be terminated by a fire, but the ability to reproduce the content of that Pali scripture (sign-types) through recitation and memory means that it is possible to reproduce a new token of that work. The absence of a different word to distinguish the separate meaning of the term 'work' has meant that we have to deal with the difficulties which arise from the uncertainty of the meaning of that word in certain situations. This is the case in copyright disputes in which loopholes could be found among the categories of work in order to escape from

the charge of infringement. The Copyright Act 1988 has been intended to redress these weaknesses in the law.

The first problem arises when a new type of work cannot be easily or clearly categorised according to the statute. This means that such work may not be adequately protected by law. A good example was the case of computer programs which were not adequately protected by the Copyright Act 1956. The Copyright Act (Computer Software) Amendment Act was passed in 1985 which clarifies the position of computer program by stating that the 1956 Act shall apply to computer programs as it applies to literary works, although the definition of a computer program is not to be found in this Act.

The problem was due to the fact that a literary work, under the Copyright Act 1956, has to be reduced to writing or some material form. Therefore, the source documents and the source code of a computer program had to be in writing or some form of printout to be called a literary work. The difficulty arose where the computer program was still in a magnetic form such as on a disc or in the computer memory. Therefore, it had been argued that the object code could not be a literary work (Lahore et al. 1984).

The problems arising from providing copyright according to the sign-token or category of a work were reflected in the majority of cases of infringement through the reproduction of work from one type of token into another token. For example, under the Copyright Act 1956, it was not considered an act of infringement by making a literary or musical work out of sound recordings or films. This was because infringement of copyright in this case had to be copying in like form or sign-token. The contradiction was that it was an infringement to make a sound recording or films out of a literary or

musical work (Cornish 1981).

The other problem of the inadequacy of The Copyright Act 1956 is that of 'reverse engineering'. The process of redesigning or re-creating a product such as a camera by taking it apart in order to find out about its mechanism and how it was constructed is called 'reverse engineering'. The well-known example which showed the inconsistency in the Copyright law was the case of British Leyland Motors Corpn Ltd. v Armstrong Patents Co. Ltd in 1986 (Phillips 1986). British Leyland designed an exhaust pipe in which it was represented by drawings and lists of measurement. The other company produced an exhaust pipe by deriving measurement of co-ordinates from one of British Leyland's exhaust pipes.

This was an act of copying, but under the Copyright Act 1956 it was not clear whether it was an infringement. It was argued that it could not be considered as an infringement of a literary work (British Leyland's drawings and measurement) since the product is a three dimensional work. It took the decision of the House of Lords to confirm that it was an infringement of copyright in a drawing which embodied the design of a functional article to reproduce it without due authorisation.

The Copyright Act 1988 restates the law of copyright and confers a design right in original design so that the problem of 'reverse engineering' can be resolved as the reproduction of a design by an unauthorised person whether it directly or indirectly constitutes an infringement. Therefore, we can see that the uncleared approach the legislation has taken in protecting works created unintended difficulty in legal disputes.

In everyday usage, when we talk about a person's work, we have in fact

used the term 'work' to include both the sign-types which convey the person's skill and labour, and the sign-tokens which represent the form of his work. So, when we talk about a work by Shakespeare such as Hamlet, we can discuss about certain lines of written words and the skill of his expression (sign-types) or refer to a particular copy of the play (sign-type). The limitations of our language dictate that we still have to use the same term to mean different things in different contexts in which we have to give some hint of the meaning we intend. The result of the analysis of the copyright law confirms the need to define 'work' in this context as the sign-types which can be represented in different forms of sign-tokens such as articles in journals, reports, or computer programs.

Semantic analysis of 'version'

The examining of ontological consistency has shown that 'version' is a particular term included in the generic term 'work'. As a work can be revised, edited, adapted, translated or have some changes made to it so several versions of a work can be available. For example, a play can be acted in different versions according to each director's interpretation, a detective story can be translated into many foreign languages, and a piece of classical music can be reproduced in various ways.

The classic example of a work with three distinct versions of inscriptions is the Rosetta Stone. The stone has three distinct inscriptions of a single text in hieroglyphs, demotic and Greek. The existence of the Rosetta Stone made it possible for the decipherment of hieroglyphs by using the Greek and demotic scripts as a key (Andrews 1981).

In this case, the meaning of the sign-tokens in the form of hieroglyphic inscription was revealed as the result of the existence of the particular sign-types which was the skill and intellectual labour of those who deciphered the hieroglyphs version. Had the Stone not contained the other two versions of inscriptions whose knowledge of their sign-types were available, the meaning of hieroglyphs would still not have been deciphered. This points to the importance of the antecedent of a work whereby its knowledge must be maintained and passed on to others.

The knowledge of the existence of a work

The knowledge of the existence of a work does not necessarily depend on its creator as it can still exist long after his death. The knowledge of the existence of a work depends on the existence of a community of people who have an interest in that work and shared their knowledge with other people.

This fact becomes even more apparent when we consider that some works are not generally known by other communities or are known among a small group of people. For example, the literary works by fifteen century Thai poets are not known outside their country, but are known by certain circles of historians and intellectuals. The existence of a community of people who record and share their knowledge of the past makes it possible for the other generations of people to exploit those works. Therefore, so long as there is someone who knows about a work even though it can not be understood or heard of by others, that work exists as there is an agent to account for it.

The different versions of a work such as the various translations of a book are entitled to the copyright protection according to the terms and

provisions established in a particular legislation.

Semantic analysis of 'copyright'

The existence of a copyright depends on the existence of a work rather than a person as a copyright can exist even though the person who owns it is dead. Copyright is a right based upon the provision of the law. In the United Kingdom, copyright comes into existence automatically without the need for formality. Consequently, the question of ownership would not arise until the copyright of a work becomes the subject of some legal dispute.

A copyright is the 'exclusive right of printing or otherwise multiplying copies of, inter alia, a published literary work; that is, the right of preventing all others from doing so' (Bird 1983). The Copyright Acts 1956 and 1988 give copyright protection to original work according to its categorisation such as artistic, dramatic, musical works, films, and so on. According to legal provisions, copyright can be given or licensed to another person in the same way as we treat a movevable property.

A copyright gives its owner the right to prevent unauthorised persons from copying the product of his effort, skill and judgment. In other words, it prevents others from illegally taking the benefit of the intellectual effort of an author or designer by means of adaptation or copying of the copyrighted work. The rights of the copyright owner includes the right to copy the work, issue copies of work to the public, perform, broadcast and adapt that work. These restricted acts are given to copyright owners and their licensees. The important condition is that the labour and effort of the author must be in some material form.

The difficulty arises when one asks how much of the 'work' can be derived from any particular author. This is because the other condition for copyright in work is that it has to be original. The basis for deciding whether a person has produced an original work is the part for which he is responsible. Originality in this context means that 'a direct causative link must exist between the author's mental conception and the work derived from his hands' (Phillips 1986).

The term 'original' is taken to mean that the work must be related to the expression of thoughts, but it does not mean that it must be the expression of original or inventive thought (White 1962). The requirement of the originality of a work is supposed to bring out the required characteristic of 'skill, labour and judgment' which is needed in expressing one's thought into a token of a work. Therefore, works which have been derived from an earlier source such as historical writing or a selection of poetry will attract copyright only when the 'skill, labour, judgment' spent in the arrangement of the source material is substantial.

The notion of originality is subject to different interpretations by judges and juries. For example, a newspaper reporter's record of the speech by a member of Parliament was considered an original literary work by that reporter. On the other hand, it was held that drawings which were modified and reproduced with a great deal of labour and technical skill were not original (Seaman 1988).

Copyright law does not protect ideas or concepts, it is the expression of work in some material form that are protected. In addition, it does not protect against the independent creation of a similar work. For example, two

programmers may independently write programs which have similar instructions, in which case each work is independently protected by copyright.

The other condition for a copyright in literary work is that it must be shown to be a work of an author. The word 'author' is not statutorily defined and has given rise to some problems in interpretation. It is generally agreed that the author is regarded as the person who actually writes or draws the original work, but this principle is subject to exceptions. The exception is in the case of an amanuensis in which the writer or drawer acts on behalf of another. For example, a secretary who types a complete work dictated by an author does not own the copyright of that work.

The Copyright Act protects mainly works which are first published in the United Kingdom or created by an author who is a 'qualified person', that means being a British subject at the time when the work was created (Sterling and Carpenter 1986). The Copyright Act 1988 also grants reciprocal protection to the authors of those countries which are members of the Berne Copyright Union.

The meaning of copyright is established through debates and negotiations both in the Houses of Parliament and in the public arena of interested parties. The term of copyright depends on the provisions of a particular legislation. For the United Kingdom, copyright in a literary, artistic, musical and dramatic work exists in that work during the author's life and for fifty years from the end of the calendar year in which the author dies. If a work has joint authors, the period is taken from the time of the author who dies last. Crown copyright has the protection for fifty years from publication. If the author of the work is unknown, the copyright in that work expires at the end of

the period of fifty years from the end of the year in which it is first made public. For a computer-generated work, copyright expires at the end of the period of fifty years from the end of the year in which it was created.

Semantic analysis of 'ownership' of a copyright

Ownership of copyright may be defined as 'ownership of the exclusive right to do and to authorise other person to do, the acts restricted by the copyright in a work' (Sterling and Carpenter 1986). The owner of the copyright is the person who has the exclusive right to do the restricted acts under the provision of the Copyright Act, for example, to copy the work, issue copies to the public, or make adaptation.

The ownership of a copyright can arise by virtue of the copyright law such as ownership by statute or transmission. The legal provisions for transmission of copyright include assignment and testamentary deposition. Besides some exceptional cases, copyright belongs primarily to the author or creator of the work. The author is the 'person who makes use of his labour, knowledge, skill or taste by virtue of which the work is copyright' (Cornish 1981). For example, the compiler of Who's Who is considered as the 'author' of all the entries in that book, although the content was supplied by those people who responded to questionnaires.

The exceptional cases in which the author is not the first owner of the copyright are in two categories. Firstly, these are cases where the work is an engraving, photograph or portrait, or a sound-recording which is commissioned under an agreement for payment with another person. In such cases, unless there is an agreement to the contrary, the copyright of the commissioned work

belongs to the commissioner.

Secondly, the exception occurs when the author of the work is working under a contract and his work is the product under the term of employment. In such cases, the copyright belongs to his employer. In addition, the copyright of a work which is either prepared or published under the direction of a Government Department belongs to the Crown. Therefore, when members of a group are commissioned to work on a project, an agreement concerning the ownership of the copyright of the work must be made clear. The information manager must be able to give appropriate information about the current situation of copyright law in order to support the mission of the group effectively.

Semantic analysis of 'publication'

According to the Copyright Act 1988, 'publication' means the issuing of copies of a work to the public. In the case of a literary, dramatic, musical and artistic works, it includes the act of making it available to the public by means of an electronic retrieval system. The Act also makes a distinction between publication and commercial publication. 'Commercial publication' means the 'issuing of the work to the public at a time when copies made in advance of the receipt of orders are generally available to the public' (Section 175). It also applies to making the work available via computerised systems.

It is considered that publication takes place wherever the publisher invites the public to acquire copies, not where the copies are received (Cornish 1981). In the legal context, a confirmation of the original intention to supply the demand of the public must be easily demonstrated.

However, in the context of ordinary usage, the term 'publication' can be used to include both the commercial and non-commercial publication; the underlying condition being the intention to make available copies of the work to the public in suitable forms. For example, a non-commercial organisation makes its works known by sending reports to their members and those who request information about the organisation; a learned society may publish their works and invite readers to subscribe to their journals. With the use of computers and telecommunications, the publication of works such as in the dissemination of scientific works can be achieved more effectively by the retrieval of information from databases of different oganisations.

Semantic analysis of 'document', 'represents', 'subscribes'

The meaning of 'document' is usually dominated by the notion that it must be some form of writing or something on paper. For example, it is considered as 'something on which things are written, printed or inscribed and which gives information; any written thing capable of being evidence' (Bird 1983). A more comprehensive category of what we call 'document' can be found in Roget Thesaurus in which it includes a dossier, case history, reports, memo, journal, microfiche, videotape, film, photograph, data bank, etc. (Carney and Waite 1987). However, the consensus is that a document has to be in the form which can be presented in court as a legal evidence.

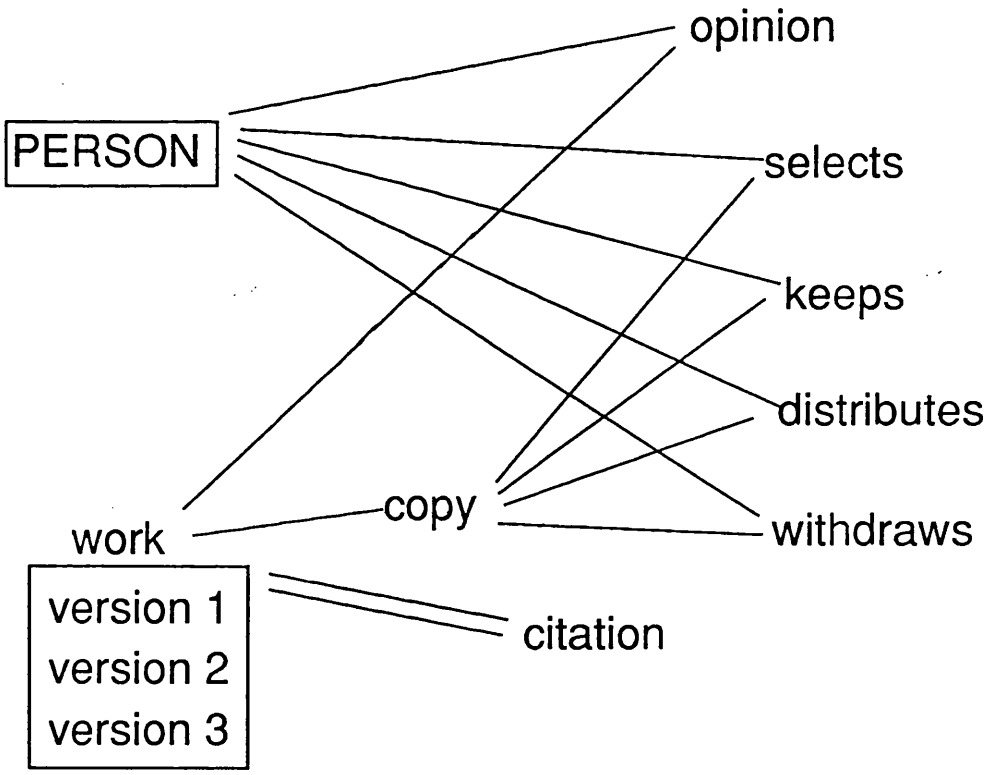
The term 'document' is a generic term which includes all the specific terms described in a dictionary or thesaurus. The form of a document is the sign-token which we use to represent our works (sign-types) whether they are written messages or official contracts or computer printouts. The existence of a

document (sign-token) and the existence of a work (sign-type) afford an agent the further affordance of 'represents'. For example, an artistic drawing can be represented in the form of a photograph so that prospective buyers can be enticed into purchasing a copy of the original work. The term 'represents' is a universal term which does not restrict any particular means of representation of a work.

The affordance 'subscribes' depends on the existence of an agent who makes it known to a publisher of his intention to acquire a copy or copies of their work. This is not restricted to any particular form of publication; for example, it may be a subscription to receiving journals or a particular kind of products such as collectable work of art.

The semantic analysis of affordances in this chart has demonstrated that we need to be clear even on the simple terms as they can turn out to be unexpectedly complicated and involve legal conditions. Also, the analysis of the meaning of 'work' is required prior to the understanding of the term 'copyright'. A group of researchers creating an original work and in the process having to consult other works must be aware of the legal implications of infringement and copyright protection. The information manager, in supporting users' tasks, must provide the necessary information on the legal aspect of working under contract or commission in order to avoid legal disputes between the institution and the group. These patterns of affordances portray the substantive aspect of the social and legal consequences of the existence of work. The other important aspect is the role of the information manager in acquiring and selecting those works which are appropriate for users' requirements.

Figure 6.3B The Management of Works



The Third set of Ontology Charts

This set of charts represents the pattern of affordances involved in the selecting of published works; this is one of the information manager's tasks in supporting the researchers' mission. The appropriate candidate affordances are grouped together to represent this aspect of behaviour in Figure 6.3B; the first version of this chart can be found in Appendix 6.2.

'Work' is a sign-type which affords a sign-token of 'copy' and 'citation'. On this basis, a person can select a copy of work from other sources, keep a copy for reference or withdraw it as it becomes out-of-date. The published work such as in journals or reports are copies of work which can be distributed to other people or subscribers. On the other hand, an information manager may become uncertain or undecided about the relevance of an article so that researchers' opinions are needed. Therefore, 'opinion' has the antcedents of 'work' and a person. This affordance reflects the need to have feedback mechanism for monitoring changes in the criteria for relevance judgments. Citation is one of these criteria; 'citation' has the same type of antecedents, namely 'work'. However, citation has to be used with scepticism and an awareness of its limitations.

Semantic analysis of 'citation'

As researchers communicate their ideas and results to others by publishing papers in journals, it is assumed that the knowledge of the particular field eventually ends up in the appropriate literature; such scientific knowledge would be found in scientific literature (Irvine and Martin 1983). Thus, citation is used to establish the quality of intellectual contributions by researchers and their impact on the field. The use of citation for measuring the quality of

research work has been the subject of much discussion and debate.

Garfield (1977) points out that there are several motives in citing others' works, such as to challenge their works, to provide background information, to pay homage to previous writers, or to criticise previous works. Brooks (1985, 1986) identifies the most important motivation in citation as persuasion and that writers' motives are often contradictory and complex. Others have raised the effect of bias in citation; for example, writers can select citations according to their political and personal goals instead of reviewing the intellectual ancestry (May 1967).

The other criticism of citation based measurement is that some writers over-rate the result or quality of cited works; writers are also influenced by the current fashion and opinions (Christensen-Szalanski and Beach 1984). The difficulty of using citation to measure accurately the quality of impacts of work leads to the consideration that citations are partial indicators and other methods have to be used in conjunction with citation analysis (Irvine and Martin 1985).

The limitations and problems concerning the quality of intellectual work have led some critics to conclude that it would lead to unacceptable error (MacRoberts and MacRoberts 1987). On the other hand, the suggestions for exposing the ambiguities and inconsistencies in using citations are to examine whether those references are really necessary or merely an acknowledgement of others' works, and to question whether the cited papers are for confirmative or negational purposes (Moravesik and Murugesen 1975).

Therefore, the use of citation by an agent in selecting works for researchers has to be done with caution. As the methods for presenting

intellectual work involve the reviewing of literature and the dispute or confirmation of previous theories or theses, citations are the easily available means for sifting works which may be potentially useful to others. In order to increase the degree of confirmation of the relevance of cited works, other descriptors can be used, such as keywords of titles and abstracts or texts, publication dates, publishers or sources of works, and the application of concepts of relevance.

However, a judge has to use the descriptors such as title or author's name with precaution since they can give an inaccurate result. For example, in judging a document by using author's name, an ambiguity can occur when the name is a very common name. A name such as D. Smith could be David Smith or Donald Smith, while Ann Bancroft can be used to identify two different persons; one an actress, the other a writer. In addition, there can be difficulty in identifying whether a foreign name is written with the first name or surname first, for example, Yoshida Noriaki and Pupul Jayakar.

The difficulty of identifying documents by authors' names is also reflected in the Source Index of the Science Citation Index (SCI) as they are listed under the same initials and name. The only way of identifying the relevant articles is by knowing the specialised topics of an author. Then we can distinguish which 'J.Anderson' is a marine biologist among others who include a mathematician and a physicist.

The essential indicator which will facilitate a person in identifying a document by an author more accurately is the name of the institution or organisation of which he is a member. Garfield (1977) urges authors to include their addresses in the front cover of their document rather than at the back

page.

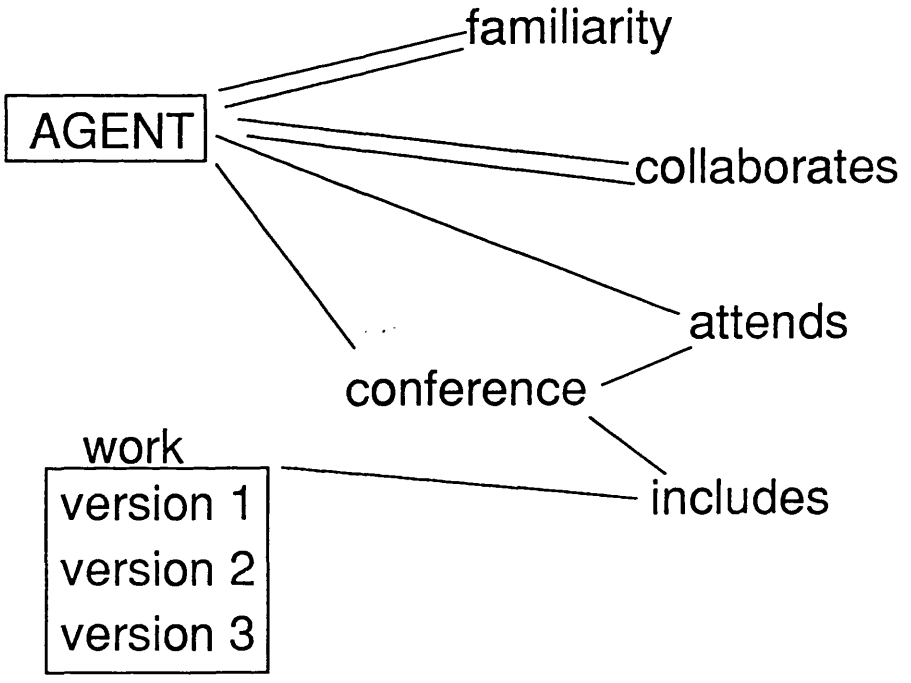
The other important descriptor of a document is its title which informs readers of its topics of discussion. But the informative quality of titles is limited by the acceptable number of keywords used in a title and the author's ability to give a highly informative and accurate title to indicate its content. A writer in the subject of information systems used an ironic title for his article: 'Pygmalian in a class room' which can be interpreted to mean a completely different subject. In addition, common and general keywords used in titles limit the ability of a judge to decide on the document accurately. Titles with low frequency words are more specially informative and through dissimilarity, are easier to retrieve (Garfield 1977).

The other source of difficulty in using keywords to identify appropriate works is due to the problem of putting names to new ideas. In an emerging field, especially in scientific literature, the names given to a new topic of research may switch from one to the other; for example, some terminologies which started with categorisation as physics and chemistry may change to the topic of bio-chemistry.

Therefore, in judging documents, an information has to examine several descriptors in order to confirm its relevance. The specific criteria for judging these descriptors are dependent upon the nature of the work of the researchers and their requirements.

Apart from supporting the group in this aspect, the responsible information manager has to deal with the external aspect of the group's relationship with other agents either in the exchanging of ideas or in joining effort on certain research programs.

Figure 6.4B The Relationship between a Person and external Agents



The Fourth Set of Ontology Charts

This set of ontology charts shows the affordances in the context of the relationships between members of a research group and other agents in terms of collaboration, participation at conferences, and the personal knowledge of colleagues in the field. The candidate affordances in Table 6.2 are grouped together to construct these relationships; the first version of this chart can be found in Appendix 6.2.

By checking for ontological consistency, the term 'agent' can be used to represent both the institution and person. The affordance 'conference' depends on the existence of an agent who organises such a gathering. An interested person may attend a conference but not necessarily participate in it by giving a paper or holding discussions. Therefore, the term 'attends' is chosen in place of 'participates'; the antecedents of 'attends' are an agent and a conference.

The possibility of having one's work presented at a conference is shown by the affordance 'includes'. A paper may be included in the conference either by reading it out or having someone else reading it on behalf of the author in case of his absence. The universal term 'agent' allows us to use it to indicate the specific author or the person who acts on the author's behalf. The antecedents of 'includes' are an agent and work; the term 'work' represents sign-types or the ideas of the author that are read out or communicated to the audience.

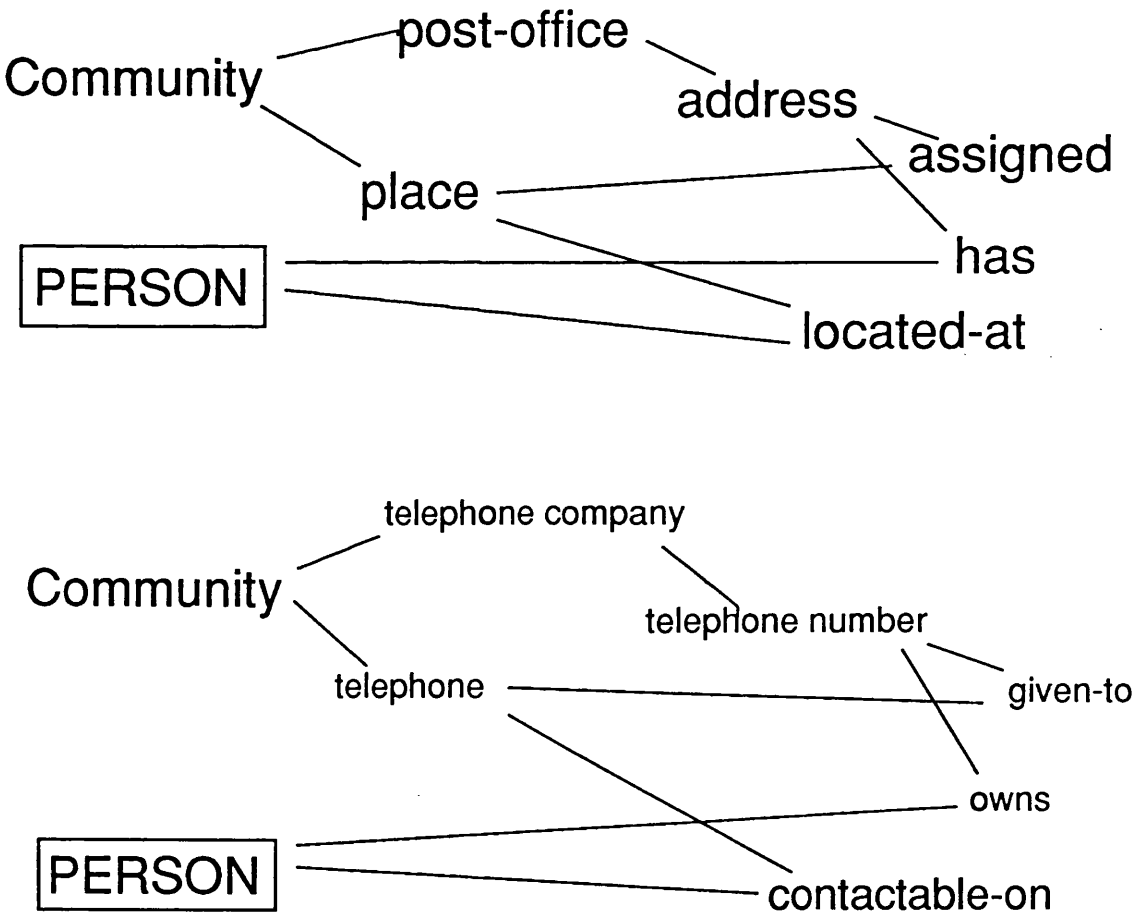
The informal aspect of interacting with other agents is that a person becomes familiar with other researchers in the field and knows their specialised topics or their associated organisations and works. This is represented by 'familiarity' in order to avoid the problem of choice between 'familiar' and

'familiar-with'. The affordance 'familiarity' has the same type of antecedents, namely agent, so does the affordance 'collaborates'.

These patterns of affordances give an information manager some indication of the researchers' requirements, for example, articles needed for writing papers to be read at conferences, the information about potential collabarators and their research interests. The familiarity of the information manager with researchers' works can facilitate the process of selecting relevant works.

In addition, the information manager has to find methods for eliciting the researchers' informal knowledge in order to acquire all the necessary criteria for maintaining the relevance of the information resources. In facilitating the exchange of ideas with appropriate agents, the information manager has to maintain a list of contacts for effective communication.

Figure 6.5B The Relationship between an Address and a Person



The Fifth Set of Ontology Charts

Figure 6.5B represents the affordances concerning the structure of a mailing list which is a role name for the relationship among a person, his address and telephone number. Backhouse (1989) recommends that the existence of an address and telephone number be represented in different charts, as in some countries these can be assigned by two different authorities.

The existence of an address depends on the authority that assigns addresses to houses or dwelling places. The assigned addresses such as house numbers and the names of the streets are fixed while the inhabitants can move to new addresses. Also, a person can have more than one address, for example, a home address and that of an office at which he can be contacted.

In the United Kingdom, the post-office has the authority of assigning addresses. The antecedent of 'post-office' is 'community' which reflects that some agents must have the knowledge of the existence of the post-office. The affordance 'place' is added to represent the physical location where a person can be located; its antecedent is 'community'. The affordance 'assigned' is dependent upon the existence of 'address' and 'place' while 'located-at' has the antecedents of a person and 'place'. The term 'has' is used to represent a person's ownership of an address.

In the United Kingdom, British Telecom is in charge of telephone systems. Therefore, the antecedent of 'telephone number' is the telephone company. Backhouse (1989) has pointed out that the advent of portable telephones makes it necessary to reflect the ability to contact a person at his address as well as while he is driving on the road. A person can also have several telephone numbers which allow him to be contactable on different

telephones. In addition, the telephone number can be transferred to another address so that when moving to a new address, a person may retain the same telephone number.

In Figure 6.5B, the existence of 'telephone number' depends on the 'telephone company'. 'Community' is the antecedent of 'telephone company' and 'telephone' (physical means for telecommunication). The affordance 'contactable-on' has the antecedents of a person and 'telephone'. The term 'contactable-on' is a generic term which includes the possibility of contacting a person not only by telephones but also by other telecommunication technologies such as fascimile and electronic mail. The term 'given-to' is added to the chart; its antecedents are 'telephone' and telephone number'. The term 'owns' is used to represent a person's ownership of telephone number.

This chart indicates that an information manager has to be aware that a person may have several addresses and telephone numbers; the telephone number may not be attached to a particular address. The mailing list is made up of these details of various types of agents such as researchers, governmental bodies, companies, and those bodies who give funding and financial supports to acedemic research.

Figure 6.6B The Relationship among a Person, Funder and Sponsor

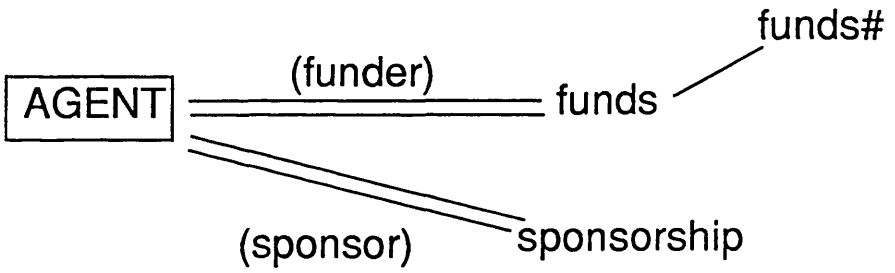
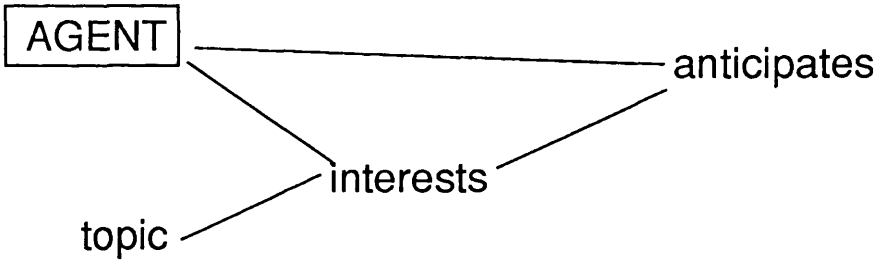


Figure 6.7B The Anticipation of Future Research



The Sixth Set of Ontology Charts

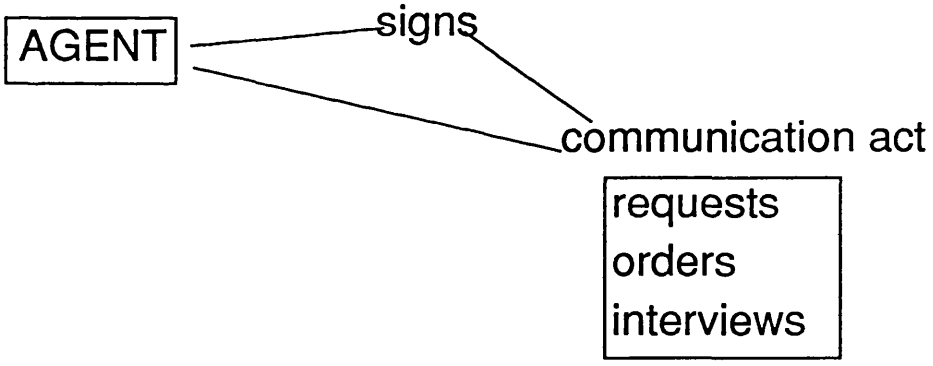
In Figure 6.6B, the generic term 'agent' can be used to represent a person, funder and sponsor; these latters are role names. A funder and sponsor need not always be the same person as a person can give sponsorship without any financial support. A sponsor can offer a person the prestige of his name or patronage which can then be a means for attracting funders. The affordance 'funds' depends on the existence of the same types of antecedents which is represented by parallel lines; the amount of money is expressed by 'funds#'. Similarly, 'sponsorship' has 'agent' as its two antecedents.

In supporting the researchers' activities, an information manager has to keep them up-to-date of the state of finance and the completion of certain amount of funds so that proper budgetting can be realised. The information on the organisations or institutions who give sponsorships and funds can be used to reflect the prestige or academic standing of the group and to attract other interested parties. The other aspect of support is in enabling members of the group to keep up-to-date and anticipate the direction of future development in their research.

The Seventh Set of Ontology Charts

Figure 6.7B shows the pattern of affordances involved in anticipating the topics which could become topics of future research. The term 'anticipates' has the antecednets of a person and 'interests'. The antecedent 'interests' represents the various interests a person may have in some topics. Therefore, the affordance 'interests' depends on the existence of a person and 'topic'. This chart indicates that the information manager's tasks include the identification of the researchers' need to anticipate their future work. Therefore, the important information resources needed for this purpose are those which keep the researchers informed of the current research work on the frontier of new knowledge. The accomplishment of this task can be enhanced by providing adequate channels for communication both among research groups and other agents.

Figure 6.8B The Communication between Agents

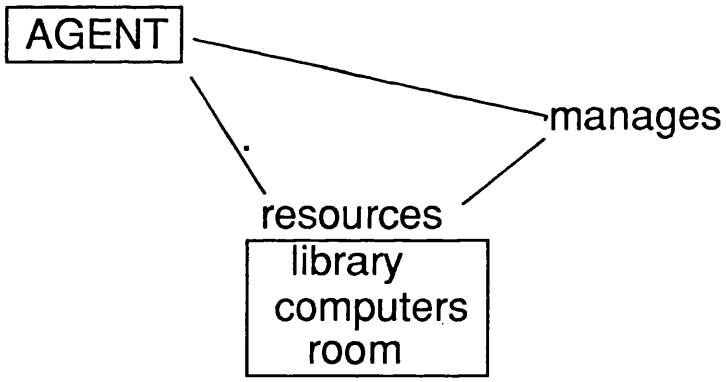


The Eighth Set of Ontology Charts

The chart in Figure 6.8B shows the context in which a person communicates with other people. The term 'communication act' is a generic term which includes all types and modes of exchanges of messages such as a request for papers, an interview, a broadcast or a conversation on the telephone and so on. Communication acts depend on the existence of an agent who must have the knowledge of signs which represent the capability to use language or systems of communicating a message or an intention. Therefore, the affordance 'signs' depends on 'agent' while 'communication act' has 'signs' and 'agent' as its antecedents.

The supporting task of an information manager in this aspect is to provide the channel for receiving the various types of messages. The availability of a telephone system is essential for rapid communication while other sophisticated means such as an electronic mailing system can be appropriate in certain cases depending on the nature of the work of the group. All the various responsibilities of an information manager can be represented in this context of ontological dependency.

Figure 6.9B The Responsibility of an Information Manager



The Ninth Set of Ontology Charts

The chart in Figure 6.9B shows the context in which an information manager or person is responsible for supporting a group of agents or researchers by managing the available resources.

In supporting a group of researchers, an information manager has to manage the information resources so that they can be used by researchers. The term 'manages' is used instead of 'responsibility' in Table 6.2. The antecedents of 'manages' are the existence of an agent such as an information manager and the resources which is part of the agent such as an academic institution. The term 'resources' is a generic term which includes a library, computer systems, halls and other particular entities. On the other hand, the term 'manages' can be used to include all the activities necessary for the management of given resources. In this context, the tasks involved in 'manages' are those which have been discussed in various ontology charts.

Therefore, it has been shown that ontology charts are a helpful means for establishing the pattern of activities or bahaviour in a given context. The explicit patterns of affordances give a clear indication of the ways in which a responsible manger can enable others to achieve their goals, that is by supporting or enhancing the realisation of these activities. These charts only show the substantive aspect of the situation while the procedural aspect or conditions of these activities are represented in semantic schemas (see Appendix 6.1).

The beneficial result of ontology charts in connection to the application of concepts of relevance is that they give us the indirect or implicit relationships

of things which are relevant, for example, the relationship between a person and his specialised topics. The use of generic terms make these charts capable of being applied to other similar contexts. The practical contribution of semantic analysis and ontology charts in the establishing of criteria for making relevance judgments and applying concepts of relevance will be demonstrated in the following chapter.

CHAPTER 7

THE APPLICATION OF CONCEPTS OF RELEVANCE TO CASE-STUDIES

In this chapter the results of semantic analysis and different concepts of relevance discussed in previous chapters are applied to the first case-study in detail. The role of an information manager in managing the information system means that the distinction between the relevance judgments made by users and an intermediary have to be made. The criteria of relevance are established through practical and theoretical work within the framework of semiotics and concepts of relevance. The results consist of different sets of rules for guiding an information manager in selecting information resources and ways of monitoring changes in relevance judgments.

In the last section, the results from the first case-study are tested for their applicability to similar situations by using a second case-study. This case concerns the existing methods by which the Information Officer adopts for disseminating research information published within the L.S.E. to an appropriate audience. The applicability of the results from the first case-study to the case of the L.S.E. is examined and contributions towards the improvement of the existing methods are proposed.

The First Case-Study

This section represents the second part of the first case-study, namely the practical investigation in which concepts of relevance are applied in order to discover the researchers' criteria of relevance. The results from this

investigation are then systematised into rules for guiding an information manager in maintaining the relevance of information resources in order to support researchers' objectives.

Firstly, a description of the state of the library of the LEGOL/NORMA research group is given so that we can appreciate the suitability of this case as a good candidate for the application of the different concepts of relevance. The library of the LEGOL/NORMA research group was in a state of flux as the whole collection had to be transfered to a new location. So, all the documents were packed in boxes stacked into crates which had to be unpacked and organised in the new location. Most of these are in the forms of printouts and photocopies of articles, books, journals, reports, newsletters, bulletins, some of which were already filed into small cardboard boxes. Some of these boxes had labels in alphabetical order and some had numbers. The other boxes had the labels of 'grey lit.' or 'q' which indicated that they were waiting for the process of selection.

The Method of Practical Investigation

In establishing the information requirements of the researchers, an initial procedure was to hold informal interviews with the existing members of the group. The LEGOL/NORMA group was in the state of transition, the number of the group was reduced to three researchers one of whom was leaving the group. However, a questionnaire was designed to formally acquire the two researchers' criteria of relevance judgments and information requirements. An example of the questionnaire can be found in Appendix 7.0 and the two replied questionnaires are in Appendix 7.1 and Appendix 7.2. These are used as a basis

from which further practical investigation of the case-study is undertaken.

The application of concepts of relevance and semiotics in designing the questionnaire

In designing the questionnaire, the fundamental characteristics of relevance are reflected in having to identify the agents, their requirements and topical relevance, together with their duration of existence. These are formalised into concrete questions by using the results of semantic analysis and ontology charts. The affordances in the first ontology chart indicate the range of questions which have to be asked, such as the questions about researchers' specialised topics and their present tasks.

The second chart indicates that we have to have some knowledge of the work published by the researchers. The third ontology chart indicates question about the use of citation. Other questions indicated by ontology charts are about collaborators and other emerging topics anticipated by researchers. Questions concerning the researchers' methodologies and tools used in their work are added for a more comprehensive background to their requirements.

The contribution of pragmatics in the design of questionnaire is reflected in the need of formulating clear and precise questions in order to reduce the researchers' processing effort. Attention was also paid to the layout and presentation of the questionnaire in order to attract a researcher's attention.

The contribution of empirics is in considering the channels of communication and their capacity. This is reflected in the number of questions included in the questionnaire. The reason is the limited capacity of a questionnaire as a communication channel which can bring about a decreasing

marginal return. For example, a long list of demanding questions can give rise to irritation and boredom among the recipients which may result in uncompleted questionnaires or inaccurate answers.

The Practical Investigation

In the early stage, the practical work was done in an intuitive manner in order to learn about the implicit characteristics of relevance. The initial sifting process was conducted randomly which did not help in the systematic accumulation of knowledge about the criteria of relevance judgments. So, attention was concentrated on boxes which had some sort of labels or numbers. By organising these boxes and labelling them according to the alphabetical order of authors' names, the selection process became more systematic.

The application of concepts of relevance and the theory of signs in the practical investigation is implicitly helpful in the process of organising the specialised library. For example, journals were easily distinguished for filing on shelves as each type of journals had certain names and logos. This indicated the conceptual relatedness of the physical appearance and the types of documents. Documents for reference such as bibliographies were also assigned to this location. Secondly, the established classification system such as printouts in labelled boxes became the precedents for filing documents from boxes containing grey literature. Thirdly, the frequency of occurences of publications from certain groups and institutions were filed according to institutions.

In addition, the help of a researcher was acquired in creating precedents of the types of documents which were considered out-of-date or irrelevant by discarding these documents in a special box. A list of some examples of

discarded documents can be found in Appendix 7.5 and a list of topics which were judged to be subjected to rapid development or out-of-date rather quickly is included in Appendix 7.6.

A description of the investigation on some of the boxes and their contents in which concepts of relevance are applicable in this process is given below. The results from this process are a list of labelled boxes of documents which can be found in Appendix 7.3 and a list of all the journals and other references in the collection, see Appendix 7.4.

The box with the label 'ESPRIT'

ESPRIT (A European Strategic Research Programme in Information Technology) is an official journal of the European Communities. The Esprit Monograph Series include the Alvey News Supplement, Alvey Program Annual Report and Alvey Conference Report. By comparing the description of the mission of ESPRIT with that of the research group, a conceptual relatedness between the research interests could be recognised. In addition, these documents are important in keeping the group informed of the development and progress in this field.

The box with the label 'Bibliographies'

This consisted of photocopies of references from various books and articles, including the order forms for books and hand written notes with details of particular books. For example, a note contains the information about a book by Stone, J., Legal Systems and Lawyers' Reasoning, Standford, 1964, was found among other photocopies of references.

The pragmatic use of informal indicator for indicating relevant material was found by a book which has been marked for ordering: Cohen, B., M. Jackson and W. Harwood, The Specification of Complex System. These bibliographies provided the background information of authors and topics relevant to the researchers.

The other type of documents found in this box is 'Call for Papers' from various institutions. The topics included in these conferences indicated the range of the researchers' interests. These topics could contribute towards the anticipation of the future research.

The box with the label 'Projects, Contacts, List'

This consisted of business cards, lists of working group members, delegates list for Expert Systems group, a list of participants at meeting by IFIP Working Group 2.6 (Data Bases), and letters of correspondence. The pragmatic clues for relevance judgments were found in a list of delegates to a conference, for example, hand written notes such as 'knows Sandra Cook', 'talks', tick signs besides certain names.

The box with lists of new books

This use of signs to express relevance judgments was also observed in examining a box containing publishers' lists of new books. Among these lists, the star symbols were found by those books which the researcher wished to acquire for the library. For example, the following books were marked out:
Ray J. Howard, Three Faces of Hermeneutics: An introduction to current thesis of understanding.

John Macnamara, Names for things: A study of human learning.

The formal use of signs as a monitoring mechanism of the relevance of a document was discovered on the front page of some of the offprints and articles. This was a form with the information on the name of the person who acquired the article, the date of acquisition, the source of the article and the date by which it could be discarded from the library.

The other semiotic approach which could be used to indicate the relevance of documents was the perception of signs according to empirics. This was done by noticing the frequencies of the occurence of certain kinds of works and their sources. From this collection, the existence of several reports from certain institutions and research groups was observed. A list of institutions and groups which appeared frequently in the collection includes the following:

SYSLAB (The System Development and Artificial Intelligence Laboratory), Stockholm

The Decision Analysis Unit at the L.S.E.

IFIP Working Group 8.3 (on knowledge representation and decision support system)

SERC (Science and Engineering Research Council)

Department of Artificial Intelligence, University of Edinburgh (There were several papers by Alan Bundy)

IBM Research Reports

United Nations Reports

MRC (Medical Research Council)

BCS (British Computer Society)

IEEE (Institute of Electrical and Electronics Engineers)

Rutherford Appleton Laboratory

NEDO (National Economic Development Council)

The investigation also included the selection of documents based on the accumulated knowledge acquired from the situation. This learning process gave further understanding of the process of making relevance judgments in which different concepts of relevance were used implicitly. A few examples of this process of relevance judgments are included for illustration.

G.B. Davies, Strategies for Information Requirement Determination, 1982.

Author: his name was not familiar nor included in the researchers' profiles, so the title had to be investigated.

Title: the keywords are conceptually related to the topic of system analysis and methodology.

Date of publication: for this topic, the article was considered out-of-date.

Decision: discard the article.

Charles Peron, The Short and Glorious History of Organisational Theory, 1976.

The decision was quickly arrived at by looking at the date of publication and title which was certainly out-of-date and not related to the researchers' interests.

decision: discard the article.

Surunjan De, Shuh-Shen Pan and A.B. Whinston, Natural Language Query Processing in a Temporal Database, Management Research Centre.

Authors: their names were not useful for making judgment.

Title: keywords of 'natural language' indicates that it could be related to the researchers' topics.

Abstract/Content: keywords such as 'semantics, problem solving, artificial intelligence' also added to the increasing degree of the relevance of this document.

Date of publication: not available.

Bibliography: some authors' names were familiar, these titles' keywords were also related to known topics of the group.

Decision: keep this article.

Jim Doran, The Computational Approach to Knowledge, Communication and Structures in Multi-Actor System, Cognitive Studies Centre, Dept. of Computer Science, University of Essex.

Author: the author was not cited by researchers and it was not familiar.

Title: keywords indicated a connection with the area of knowledge representation and artificial intelligence.

Bibliography: this included familiar authors which had been cited by the group.

Decision: keep this article.

A.S.Douglas, So you want to run your own software house, International Institute for Applied Systems Analysis, 1981.

This article was writen by a known member of the academic department. Even though it was quite old, it was kept as a historical record of development of ideas.

Richard Enwals, Logic and Programming, presented at Mind and Machine Conference, 1983. (Dept. of Computing, Imperial College)

Author: this had not been cited by the group.

Title: contained keywords relating to the topics of research.

Date and type of publication: they indicated that this article should be kept for reference purpose.

Decision: keep this article.

Discussion

From this experiment, it was found that the date of publication of certain topics was an important criterion for selecting a document. The other explicit criterion of relevance was the citation by researchers. In cases where personal knowledge could apply in the judging process, the decision could be derived quickly and confidently. In difficult cases, other descriptors of documents had to be investigated in making relevance judgments. There were also cases which could not be readily judged with certainty so that researchers' feedback had to be obtained.

The application of conceptual relatedness played an important role in judging the keywords of the title, abstract and content of a document. The application of Carnap's concept of relevance was reflected in using more descriptors as a basis of decision making. The use of logical deduction was

implicit in deriving the appropriate judgment for each document. The application of the legal approach to relevance was in the use of precedents in which established and acquired criteria of relevance were used to judge other documents.

By performing practical investigation, the acquired knowledge about the topics of interests, the types of journals and relevant works or authors formed a part of the informal knowledge which could be incorporated in the formal criteria. This process of learning reflected the concept of phenomenological relevance in which the accumulated knowledge plays an important role in the process of intrepretational relevance which was motivated by the goal of providing relevant documents.

The results from the informal interviews and questionnaires are applied in the practical work in which they are used to interpret and derive the criteria of relevance. The experience from the practical work has shown that there is no fixed order in which the concepts of relevance are applied in judging a document. It has been found that all the concepts of relevance can be combined, each reinforcing another, as an aggregate whole in selecting documents. This process was carried out without having to identify or being conscious of the various technical terms of the concept. The value of these formal expositions of various concepts of relevance in practice has been in coupling the informal ways of making relevance judgments with the theoretical context which consequently contributes to a better understanding and appreciation of this otherwise abstract notion.

From these findings, different sets of criteria for making relevance judgments on documents could be systematised and the monitoring mechanism

of changes can be created to ensure the relevance of information resources.

Users' Judgments and the Intermediary's Judgments

The advantage of having users judging or selecting documents themselves is that they can decide which items could satisfy their requirements with a greater degree of certainty. Users possess the accumulated knowledge about various academic topics and personal criteria of relevance which are used in deriving judgments intuitively and quickly. But this way of selecting documents can be very costly in terms of users' time and opportunity costs. Therefore, by formalising the knowledge about users' requirements and situations into explicit rules, an intermediary or an information manager can use these rules to select documents on behalf of users.

However, a drawback of the intermediary's judgments is that there is no guarantee that the results are the same as those selected by users. In other words, users' relevance judgments and intermediary's judgments are not always the same. The closeness of these judgments depends on the information manager's personal knowledge about users' works and interests, including some general knowledge about the academic field.

The other factor is the way in which the criteria or rules elicited from users can be made to capture changes in their requirements. Because these rules are static they cannot be as sensitive as the users' implicit rules, and it is not possible to elicit all these rules from users. Hence the information manager may sometimes feel uncertain whether a document should be selected or not. In such cases, the information manager may need to obtain users' feedback. To reduce this burden on the users and to maintain a high degree of relevance in

information resources, the information manager has to establish reliable criteria for making relevance judgments and find ways to monitor changes both within the group and in the environment.

The assessment of the degree of relevance is a subjective process which gives no standardised result as had been shown by numerous experiments on relevance judgments (Saracevic 1970, Cuadra and Katter 1967a). Even though we could devise a way to quantify the degree of relevance numerically by using some techniques such as the semantic differentials (Osgood et al. 1957), the problem of different interpretations of the measuring method and its results among different communities would still exist. More importantly, it is the discovery of practical ways for bringing together the information resources which have the quality of relevance to people so that they can accomplish their goals. Empirically, we would be safe to assume that a document which satisfies several major criteria is likely to be judged with a very high degree of relevance while a document satisfying only a minor criterion may be judged as insufficiently relevant.

The Criteria for Relevance Judgments

These syntactical rules are established on the basis of the practical investigation on the first case-study. They are guidelines for making relevance judgments on documents or information resources of the research group. This framework of rules can be useful for introducing a person who is totally unfamiliar to the work and requirements of the group. By experiencing and learning about the group and their work, these formal guidelines become part of the intermediary's informal knowledge. Therefore, these rules are meant to

be applied according to Schutz's concept of relevance in which they have to be interpreted in conjunction with a person's knowledge of the situation.

The legal approach to the concept of relevance is used as a framework for establishing criteria of relevance. Other concepts of relevance are applied within this framework of rules. The admissible evidence or objects of relevance judgments in the case-study are what we call documents which include articles, books, reports, working papers and so on.

The inclusionary rules

These rules state the conditions for which documents can be judged as relevant for selection or keeping in the specialised library. However, these rules must be considered with respect to the exclusionary rules which exclude certain types of documents for some reasons. The application of logic is in deducing the conclusion from a given rule and a document. Generally, if a document meets any of these inclusionary rules, with some exceptions, then it is kept in the library or notified to the appropriate researcher. These inclusionary rules are as follows:

1. Select documents which are conceptually related to the mission of the research group or are published by institutions whose aims are conceptually related to the mission of the group.

By acquiring the knowledge of the mission of the research group and comparing with the description of other groups or the aims of other publishers, we can deduce whether they are conceptually related. For example, the British Computer Society (BCS) and the International Federation of Information

Processing (IFIP) both include objectives which are conceptually related to those of the research group.

The IFIP working conferences on information systems often produce documents which are related to the work of researchers. Publications from the BCS include the Computer Journal, newsletters and reports by specialist groups, e.g. expert systems and databases. The other important publication is by the Informatica e Diritto whose aim of giving an up-to-date reference aid on legal informatics indicates a significant source for retrieving other documents.

In cases where some publications which are not familiar to the group, the description of their objectives and the interests are very important indicators for making relevance judgments. For example, in judging a journal such as the AI Magazine, we can look at their topics of interests. These include the topics on knowledge representation, natural language, problem solving, inference, learning, philosophy and methodology which are conceptually related to the work of the group.

Other criteria can be investigated in order to confirm the degree of relevance according to Carnap's concept. For example, the description of the research group gives useful keywords such as legal norms which confirms the conceptual relatedness of the article by A.J. Maxwell and P.Drew, 'Order in Court: the Organisation of Verbal Interaction in Judicial Settings', SSRC, 1975.

2. Select documents which publish work written by members of the group.

For example, in volume 1, no.1, of Information Privacy, there is an article written by a member of the group (Ronald Stamper) even though the

objectives of this publication are not conceptually related to the mission of the group. Therefore, the information manager has to take into account other indicators and rules in making relevance judgments.

3. Select documents of which the editorial board includes a member of the group.

For example, if a member of the research group is a member of an editorial board of a journal, it indicates a relationship between the researcher's interest and some topics included in that journal.

4. Select documents which cite the work of the research group.

For example, an article by Kalle Lyytinen (1984): 'Discourse Analysis as an Information System Specification Method' included in its citation some papers written by Stamper. The other examples are those reports written by MSc students: 'The Role of Speech Act Theory in System Development' by Lena Chan (1987) and 'Semantic Analysis and Mapping from a Semantic Schema into a Relational Database Schema' by Tati Lupolo (1987).

5. Select documents which were written by previous and present members of the group.

Previously published papers such as the Legol Papers and papers on Informatics by the group should be kept in the collection for references. These give the information manager an account of the development of the research work of the group. It is also possible that previous members of the group may continue on the same or related area of research elsewhere so that their newly

published works should be investigated. For example, some previous members include Susan Jones and Peter Mason who had worked on the area of complex rules in legislation.

6. Select documents which represent historical records of the development of an idea or approach in the field of information systems.

These documents include 'State of the Art' reports such as Infotech reports on the development of information technology and surveys of methodologies and the reports on systems specification and systems design. Documents representing an institution's view such as 'AI: An MIT Perspective', 1969, by Winston and Brown (eds.), and Esprit Monograph Series (Status Report of Ongoing Work) are also selected according to this category of works.

The works by members of the group from the early stage of the establishment of the group also contribute to the historical record of its progress and evolution of ideas.

7. Select documents which represent classical works in the field.

These include works which were once the authority in the field even though they may become out-of-date. However, they can be useful in describing the development of an idea or a theory. Different schools of thoughts have predominant proponents such as works published by James Martin in the field of information systems, and other writers such as Tom Forrester, De Marco, Enid Mumford.

8. Select documents which are related to the profiles of the present

members of the group, e.g. documents which contain in their bibliographies those authors mentioned by the researchers and/or whose contents are related to the researchers' topics in the profiles.

The importance of the profiles is that they give explicit indications of topics, works and authors that are considered to be relevant to existing researchers. These profiles may also indicate changes of requirements such as new topics for guiding relevance judgments. These become the keywords or indicators which the information manager relies on in judging other documents.

For example, Ronald Stamper's topics include 'computers and law', 'epistemology', and Jim Backhouse's topics include 'semiotics and information', 'formal languages in specification work'. These keywords are used in judging the relevance of the following articles by comparing the title of each article and keywords from profiles for their conceptual relatedness.

(a) Charniak, E. and Y. Wilks (eds.), Computational Semantics, North-Holland, 1976.

(b) Davis, R. and D. B. Lenat, Knowledge-Based Systems and AI, McGraw Hill, 1986.

(c) Stone, J., Legal Systems and Lawyers' Reasoning, Standford, 1964.

(d) Nijssen, J., (ed.), Models in Database Management Systems.

By looking at the bibliographies of the researchers' papers, we have both the names of relevant authors and their titles of works indicating the currently relevant topics. For example, in 'A Non-Classical Logic for Law based on the Structures of Behaviour' by Stamper, we can see that topics referred in the references range from the fields of linguistic, the psychology of perception to

logic.

The other way of using the cited authors in selecting documents specifically related to a researcher's topics is by focusing on the citation of a set of authors in documents. For example, a minimum number of well-known authors in a particular topic have to be cited in a document in order for it to be selected.

9. Select documents which have been presented or included in conferences/meetings in which a researcher has attended or indicated in their profiles.

The conferences in which members of the group have attended were IFIP conferences, e.g. on Database Semantics, on Knowledge Representation for Decision Support, IFIP Congress, Computer and Law, IFIP CRIS 88. Details about these conferences such as the lists of participants, titles or abstracts of proceedings and topics of conferences give the information manager additional basis on which to gather further criteria and indicators of the on-going research works and interests.

10. Select documents which are written by people who have collaborated or are still in collaboration with the research group.

Some of these collaborators may be previous members of the research group or colleagues from other institutions. By looking at the previously published works, the information manager can identify these collaborators, e.g. C. Tagg, P. Mason, S. Cook, J.O. Mark. The works published by these people and their collaborators should therefore be examined and perhaps included in

the collection.

11. Select documents which give information on the current development and news on the research topics and related fields.

These include newsletters, bulletins, publishers' lists of new books and titles, calls for papers, advertisements on conferences, seminars and so on. Publishers' lists of new books are very useful for surveying the development in the field, e.g. New books and Journals on Computer Science from Cambridge University Press, publication list on linguistics and languages by Edward Arnold, the BCS publications list, the MIT Press: Computer, Science, Robotics and AI.

12. Select documents which are considered as references in the research work and bibliographic sources.

From the investigation, the information manager can acquire the knowledge of these reference materials, for example, the various journals, bibliographies, and books. The criteria for judging a new journal have been discussed in other rules. The information manager has to bear in mind the changing requirements reflected in the duration of subscription to a journal. The journals of Social Epistemology and Computers and Law is subscribed by the group while Datamation and EDP Analyser has their subscription terminated for over a period of time.

13. Select documents which give details about participants of conferences and those which are potential contacts or could become potential

supporter or collaborators of the group.

The names and addresses of these people are normally maintained on the mailing list for distributing LEGOL papers. The information manager should obtain the lists of participants of particular conferences and ask the researchers to indicate those to whom they wish to send their papers. In this way, the exchange of ideas and communications with potential collaborators or contacts can be established. By distributing researchers' works to appropriate organisations, potential funders or sponsors are informed about the group's research areas.

Precedents

These are criteria which are established during the process of investigating the collection of documents in the library. The knowledge from the practical investigation includes some indications of topics and authors which are related to the interest of the group. For example, the range of topics of interest to the group includes expert systems, artificial intelligence, legal reasoning, complex systems specification, knowledge representation, the application of linguistics and epistemology. The investigation also gives some indications of institutions, bibliographies and documents which are currently relevant to the group.

However, the application of the rules of precedents have to be considered with respect to the condition that relevance has a duration according to changes in users' requirements. For example, the list of journals in Appendix 7.4 indicates the range of topics which were judged relevant in the past as well as current topics of relevance. A few journals concerned with the

topics of computer hardware and technical issues had their subscriptions terminated for a period of time. On the other hand, some other journals appeared to be recently subscribed to by the group. Furthermore, these precedents have to be judged in combination with other rules such as the exclusionary rules.

Estoppels

The rules of estoppels are concerned with users' intentions which are communicated to the information manager by verbal or written signs. These intentions are acknowledged as an indication of users' relevance judgments. The information manager can use both formal and informal means for detecting or gauging users' criteria.

The formal mechanism which can be used in the case of the research group is by attaching a form to each document, such as on the front page or inside cover. The form requires the person to fill in details about the source of that document, the name of the supplier and the date by which it should be kept in the library.

The informal mechanisms lies in the pragmatic use of signs in conveying the intention of relevance judgments. For example, in the practical investigation, scribbles and symbols are found along side certain books in lists of new books. This informal use of signs can be encouraged by the information manager so that he can monitor the changing research interests and development. Members of the group can be assigned different signs or initials which indicate their relevance judgments. Different symbols can be assigned for a range of the different degrees of relevance. A special sign such as a double

star sign can be used to indicate items which are highly relevant while a zero can be used to indicate their irrelevance.

The other informal way for acknowledging users' intention on relevance judgments is reflected in the application of Sperber and Wilson's concept of relevance in verbal communications. The contribution of the idea of estoppels is also in the establishing of feedback mechanisms in order to monitor changes in users' criteria of relevance.

The exclusionary rules

The exclusionary rules are the criteria for discarding documents which are considered to be irrelevant or insufficiently relevant. These rules include exceptions to the inclusionary rules. For example, Appendix 7.6 lists topics which are related to researchers' profiles but are considered to be out-of-date rapidly. Therefore, documents belonging to these topics are more likely to be discarded for being too remote from current interest. However, exclusionary rules have to be applied with respect to other inclusionary rules; some documents may be out-of-date but should be kept as historical records.

Documents can also be excluded if they are already available in the library. Depending on the situation, there may be a need to maintain at least two copies of a work in case several users need to consult them at the same time. Generally, the consideration of the cost of a second copy and the limited space for storage make the minimum number of one document sufficient.

The other pragmatic mechanism for obtaining criteria of exclusionary rules is by providing a means or channel, such as a special tray or labelled box in which users, while going through the retrieval process, can place documents

which they want to discard. On the other hand, the information manager can ask users about any reasons for excluding documents which otherwise would be judged as relevant.

Based on this legal framework of rules, an information manager who is unfamiliar with the research group can select documents on behalf of the researchers with some degree of confidence. As relevance is a matter of degree, a higher degree of relevance can be achieved by applying Carnap's concept by using several criteria in examining a document. The higher the number of descriptors satisfying these criteria, the higher the balance of probability for relevance judgments. In addition to these rules which include the general application concepts of relevance in information retrieval, the idea of conceptual relatedness can be used for selecting specific documents.

The specific application of conceptual relatedness

In order to select documents which are more specific to certain topics, the idea of the conceptual relatedness among some keywords can be used in selecting relevant documents. For example, 'semiotics', 'knowledge representation', 'knowledge acquisition' can be combined to select documents which are specifically related to the topic of the application of semiotics in the area of knowledge acquisition and representation.

The choice of keywords used in this process should be specific and unusual rather than general and common. The consequence of using general keywords such as 'information system' and 'computer' in automated retrieval is evident in the number of documents containing these terms. The more specific

and unusual the keywords, the fewer the number of retrieved documents. However, keywords which are previously rarely used can gradually become quite common as they are widely used and discussed in the community. In addition, it is difficult to generate very specific keywords which are conceptually related to each other in selecting documents for the purpose of anticipating new development in the field.

The interpretation of the conceptual relatedness of different keywords depends on the perception of the information manager and his knowledge. The other informal criteria for judging the relevance of a document is the surprise value or the rarity of that document. For example, the article 'The Concept of Legal Right Defined in Terms of a Variant of Anderson-Belnap Relevance Logic' by Allen Layman contains the conceptual relatedness to the topic of programming the law. It is also surprising to find the application of Anderson and Belnap work in this aspect. However, the surprise value of the document alone cannot determine its relevance which are subject to various criteria reflecting in the established framework of rules.

As these rules are subject to changing requirements and other variables in a situation, the information manager has to create some ways for monitoring these changes. These mechanisms must not give rise to extra burden to the already busy researchers. The simpler the mechanism, the easier and cheaper it would be to implement.

Ways of Monitoring the Criteria of Relevance

Changes in criteria for relevance judgments can be gathered through

some monitoring mechanisms based on the semiotic approach. The application of pragmatics is in the establishing of an informal system of communication. For a small research group, this can be achieved by encouraging researchers to use the library as a meeting place for discussions so that an information manager can gather the researchers' current interests.

The empiric aspect of monitoring mechanism is in the provision of channels of communication. In the first case-study, a blackboard or thinking board can be installed in the library in order to enable the exchanges of ideas while the presence of the information manager represents another channel for communication. In addition, the information manager can provide various channels for commnunication which are distinctively recognisable for different types of feedback. For the first case-study, the application of empirics and pragmatics in monitoring criteria of relevance are as follows:

1. The use of a form for attaching to the front page of documents which are supplied by researchers. This form requests basic questions, for example, the name or initials of the person who acquires the article and the date of its acquisition, the source of the article such as the author, title, date of publication, publisher, volume number and so on. Additional questions include the request for the date by which the article can be discarded and some comments to indicate its relevance to certain topics or a particular way it should be filed.

2. By providing a box for users to discard documents which are considered as irrelevant or insufficiently relevant. It should be explicitly

labelled and conveniently placed so that users will be encouraged to use it consistently. The information manager can acquire estoppels on topics of works and authors which are reflected in this way.

3. By providing a box for documents which have been supplied by users and which are waiting for filing. The information manager can observe changes in criteria of relevance while researchers can browse through documents judged as relevant by other suppliers.

4. By providing a channel for users' requests of documents. This can be either a special type of requesting form or a box for receiving any notice of such effect. The details of these requests indicate to the information manager the changing users' requirements. For a small group, the informal system of communication can function adequately without the need to use a formal means.

5. By providing a channel for displaying documents which are acquired by the information manager. This can be a specially designated location for displaying new acquisitions or a labelled box. The pragmatic use of signs will attract users' attention to the new documents so that their reactions can be observed. Users can be encouraged to judge these documents by using the various channels for expressing their conclusions. Hence the information manager's relevance judgments can either be confirmed or corrected.

6. By providing a channel for communicating news concerning the

opportunity of interacting with other agents. In a small research group, a notice board can be used to inform members of conferences, news about surprising development or unexpected news within the community and research areas. One section of the notice board can also be used for the setting up a time-table for monitoring the dates for submitting papers to conferences and journals.

The other application of empirics is by observing the frequencies of consultation for certain types of documents or in the requests for certain authors' works. For example, the usual method is to attach a form inside documents such as journals which record readers' initials and dates of consultation. In a small group of users, this method is redundant as informal communication is more efficient. The other way is by observing the physical state of documents, for example, much consulted books will look more tattered while those which are rarely used may be very dusty.

The semantic contribution to the monitoring process is in the recognition of the start and finish of each activity. By observing the start and finish of a project or membership, the information manager realises the ending of the relevance of certain topics and the start of others. Therefore, the changing requirements can be systematically acknowledged.

The other thing which the information manager has to monitor is the mailing list which consists of names and addresses of the recipients of working papers or publications. Feedback from recipients can also be elicited by using updating forms in order to request readers' comments and changes in their addresses.

The frequency for updating the mailing list depends on the nature of the

publications distributed to recipients. For quarterly or annual distribution, the updating can take place annually. On the other hand, informal updating of a mailing list can be undertaken by researchers. They can be requested to delete inappropriate recipients in the mailing list and add new names to the list. The design of an updating form depends on the requirements and purposes of the distribution of publications such as to keep others informed of progress, to stimulate exchanges of ideas or to create an awareness about the group.

Additional functions of such a form may include the possibility of ordering publications, recommending other new recipients, and creating profiles of these recipients. The different sets of questions to be included in updating forms can be found in Appendix 7.7. Besides establishing criteria for selecting documents and monitoring changes, these documents have to be organised for an easy and efficient retrieval by users.

The Organisation of the Specialised Library

Documents in the specialised library, such as that of the research group, can be organised according to the relevance of their relationships. Although there are well known systems of classifications such as the Library Congress, Dewey Decimal Classification and Universal Decimal Classification, they are not appropriate for a specialised library. These classifications cover numerous fields which make their schemes very wide and general. The specialised library is concerned with a limited range of topics which are more specialised than the general classifications.

The application of semiotics and conceptual relatedness can contribute towards the physical and logical organisation of documents. Firstly, documents

can be physically organised according to their categories of sign tokens, for example, journals, books, microfilms, manuals, references, reports, conference proceedings. The identification and retrieval of documents are facilitated by the physical appearance of each type of tokens. Secondly, documents can be logically organised on the basis of the conceptual relatedness between a group or institution and its works. Thirdly, documents can be classified according to the topics indicated in researchers' mission and profiles, for example, computer and laws, knowledge representation, artificial intelligence.

The idea of conceptual relatedness can also be applied to the physical arrangement of documents, for example, in locating documents which are closely related within the same location or proximity. On the other hand, the information manager has to consider the precedents or established organisation of existing information system. Any drastic changes may produce resentment or confusion among users.

The application of pragmatics in this context is in providing clear and helpful labels for pointing users to the relevant documents quickly. Empirically, the shelves or locations of documents can be seen as the channels of communication. Therefore, a discriminating use of these channels has to be made between the strategically important and the non-strategic locations.

The organisation of documents may be constrained by the available space so that the information manager has to be flexible in combining the different ways of organising the library. The important thing is to be consistent in the classification systems and to use signs explicitly and clearly for directing users in retrieving relevant documents.

These established rules for relevance judgments and the imposition of monitoring mechanisms on users can create both the positive and negative responses from users. The information manager has to anticipate or evaluate the likely reactions before implementing innovations in the existing system. As these can be perceived as signs which elicit certain users' actions and behaviour, the pragmatic implications have to be given due weight in order to ensure a successful implementation of an information system. In order to ensure users' acceptability, it is important to evaluate the impacts, whether economical or political, which an information system will have on the community as a whole so that appropriate modifications can be undertaken in good time.

The Evaluation of the Impacts of an Information System

These positive and negative consequences from implementing innovations can be evaluated by using the cultural system of messages proposed by Hall (1969). By evaluating the potential implications of an information system, the beneficial impacts can be appreciated while the adverse aspects can be identified in advance. The potential implications of implementing the management information system for the first case-study can be found in Appendix 7.8.

Form the Appendix 7.8, the consequences which can affect the effectiveness of the proposed information system can be systematically and thoroughly studied. For example, some of the adverse impacts which may be unacceptable to users include the increase in demand on the users' time for their feedback and the costs of operating a system of information dissemination. The extra burden on the working pattern of users at certain periods indicates

that the information manager has to be sensitive to the cycle of workload.

On the other hand, the benefits of such a system can be used to induce users' cooperation and acceptance of changes to their working patterns. In Appendix 7.8, these beneficial implications include those at the individual level to that of the group as a whole. For example, the availability of relevant documents will enhance users' work while the recognition of the work done by the group will contribute to their status and funding. The overall benefit of the information system lies in enabling the group to accomplish its mission.

These lists of potential consequences of implementing changes in Appendix 7.8 can also be applicable to similar situations or other academic groups. The framework of rules for establishing criteria for relevance judgments and the monitoring mechanisms can also be easily modified to suit the particular requirements of another case. The application of different concepts of relevance on a semiotic basis to the first case-study has shown that the notion of relevance can be made to contribute in practical and concrete ways to the management of an information system. The applicability of the results from this case-study can be gauged by using a second case-study with a similar context to ascertain their general applicability.

The Second Case-Study

A second case-study is used to test the general applicability and limitation of the results from the first case-study. The context of the second case-study involves the problem situation in which the London School of Economics attempts to disseminate academic output to the public domain in order to increase public awareness of the School's research contribution. The London School of Economics responded to this challenge by creating the posts of the Information Officer and the Press Officer in order to broaden contacts, encourage research commissions, consultancies and collaborations.

The means for accomplishing these objectives are the publication of two handbooks: Research at LSE and LSE Experts. The difference between the two publications is that the latter is distributed to journalists to be used as a manual or an index for identifying specialists or experts in various subjects. The exposure of academic to the publicity such as in giving public interviews on current affairs helps to reflect the intellectual contribution to the society. The former publication is distributed to the commercial companies, politicians, charitable trusts and management consultancy firms. This is aimed at communicating the various intellectual endeavours, academic involvement in practical projects and potential resources available for exploitation by the outside world.

The content of Research at LSE includes the main staff entries, lists of publications by staff, details of research grants and contracts, work in progress on grants and contracts, lists of theses titles, index of names and subject index. The LSE Expert has only the main staff entries, index of names and subject index. A sample of pages of Research at LSE can be found in Appendix 7.9.

The Evaluation of the Applicability of the First Case-Study

The problem domian of the two case studies are similar in that they are both concerned with the issue of relevance. In the case of the LSE, the information officer is concerned with the organisation of relevant information for both publications and their distribution to the appropriate recipients. By examining both publications, the implicit application of the different meanings of relevance can be identified including the applicability of the results of semantic analysis and the consideration of the pragmatic aspect of design. In addition, improvements to the existing channels for disseminating research output can be achieved by explicitly applying the concepts of relevance semiotically.

The applicability of ontology charts

The context of both cases are very similar so that the substantive aspects in the management of an information system in the second case-study are largely represented by the first case-study. Both cases share the main concerns of the dissemination of works to appropriate audience, although the first case aims at supporting researchers' tasks and their objectives while the second case is more concerned with the institution's objectives. In the first case-study, the intermediary is concerned with the relevance of information resources to researchers; in the latter case, the information officer is concerned with the relevance between information in the handbooks and their recipients.

The relationships among affordances in ontology charts are also reflected in the content of Research at LSE such as the relationship between an

agent and work, agent and membership to a group, agent and topic. The 'Main Staff Entries' of the handbook consists of some general description of the mission or objectives of each department, their members and topics of specialisations. This is similar to the profiles of researchers in the first case-study.

The membership of staff to a particular unit or department is reflected in the 'Index of Names' in which names are listed alphabetically followed by their appropriate departments. For example, by looking up 'Desai, Prof. Meghnad', we can see that he is a member of Department of Economics.

The 'Subject Index' reflects the relations between a person, his research subjects and membership to a unit. Keywords of subjects can be used to identify the staff specialising in those subjects and his department. For example, by looking at a keyword, 'Information Accounting' we can find two persons, Bromwich and Napier, who are specialists or experts in this subject.

The implicit relevance between an agent and work is also reflected in the section on 'Publications by Members of Staff', and the dynamic aspect of relevance has also been indicated by stating the period at which these works were published. The publications included are those published in the previous academic year. By looking at the particular department and author, a list of staff together with their recent publications can be found.

The other important relationship between a person and his work and the funder is also shown in the section on 'Research Grants and Contracts received in 1987/88'. Here, the information given includes funder's names, the amounts and funding periods, the names of grant-holders, their departments and research programmes. The other section of 'MPhil/PhD Thesis Titles' gives a

list of all thesis titles of the previous year for each department and their authors's names.

On this basis, readers can acquire information about a particular department and its research works by looking at publications together with thesis titles. A reader who wants to find out if there is anyone working on his particular area of interest can use the 'Subject Index' and 'Index of Names' to locate the relevant acedemics and departments.

The role of the information officer is that of an intermediary between enquirers and different academics or research units such as in referring queries to the appropriate staff or specialists. The information officer is also responsible for the compilation and design of the handbooks. The importance of acquiring feedback from readers is reflected in the explicit declaration in the handbooks for readers' comments. On the other hand, he must monitor changes within the insitutition such as the expiry of memberships of staff, changes in their academic interests or specialisations and the finishes of research programmes or the beginning of new commissions. The decision for selecting certain information for inclusion in the handbooks depends on the information officer's analysis and investigation.

The application of criteria for relevance judgments

The content of Research at LSE includes the information on collaborators, funders, academics and their units or departments, their publications and specialised topics. These are affordances which are shown in the ontology charts of the first case-study. As different contexts demand different requirements, so the criteria of relevance for the two cases are

different. However, the framework of rules can be used as a general guide, for example, in making explicit what is relevant for included in the publication and what the exceptions or constrains are in a given context.

The rules for judging which particular items are relevant for inclusion may also be subjected to the criteria established by the policy of the Research Committee and some financial constraints. The criteria for selecting items to be included in the handbooks are implicit and subjected to the consideration of feedback, changes of requirements and aims of the institution. By applying the semiotic approach in designing these handbooks, the information officer can enhance the effectiveness of these publications by using design techniques to attract readers's attention with easy access to the relevant items.

The semiotic aspect in the design of the handbooks

The design of the Research at LSE and LSE Experts also reflects the pragmatic property of signs such as in the use of logo of the LSE and the application of empirics in the use of bright colour and large print for their covers. Different type-faces and bold letters are used to attract readers' attention to different types of information such as in headings, titles of sections and author's names.

The other application of empirics is the use of different colours for distinguishing the three main sections: green paper is for the 'Main Staff Entries' and pink paper is for 'Index of Names' and 'Subject Index', white paper is for staff's publications. The different way of assigning page numbers to different sections also make it easier to reach the required page. The green section is numbered from G1 to the last page of this section; G stands for green

paper. The white section is numbered from W1 onwards and the pink section by P1 onwards. The location of these numbers are at the top right hand corner enhanced by being enclosed in a box.

The name, address and telephone number of the information officer is located inside the front cover allowing a rapid identification of the channel of communication by readers. These different techniques used in designing the handbooks facilitate an easy access to the required information. The availability of the information officer enables further enquiries and feedback from readers.

The innovation of these handbooks for achieving the institution's aims imposes certain changes to the working patterns of the staff such as the requirements of their cooperation in supplying the required information. Therefore, the impacts of the system for disseminating academic output on members of the institution have to be anticipated by the information officer. The evaluation of the benefits and adverse effects of the first case-study can be largely applied to the cae of the LSE as they share a similar context.

The common consequences are the likelihood of increasing workload on staff, the extra administrative work in responding to enquiries and supplying the information required for the handbooks. For those research centres or units which already have comprehensive contacts and adequate funding, the handbooks may seem to impose an unnecessary burden on their members. On the other hand, for less well-known units or academics can benefit from this exposure directly or indirectly. Members of different groups can also discover those working on related topics so that collaboration and closer contact within

the institution can begin to flourish. The beneficial impacts on the institution as a whole is an increase of public recognition and new sources of funding, collaborators and research programmes.

Therefore, we can see that the semantic analysis and the ontology charts of the first case-study can be applied to another similar context. The issues of relevance are also generally reflected in the organisation and management of information resources whether for internal or external purposes. In the second case-study, the effectiveness of the ways to accomplish the set objectives can be improved according to the explication of relevance.

As the second case-study does not explicitly explore the issues of relevance, its objectives are constrained by the limited concern with the relevance of the institution to the outside world. Further benefits can be gained by considering the relevance of the information system to members within the institutiton.

Ways of improving the relevance of the handbooks

The information officer can extend his role to promoting closer contacts among staff by establishing comprehensive profiles of staff. The profile of each academic in the handbook is very brief and the list of publications is only a limited guide to a person's academic interests. The information officer should also aim at identifying academics who are working in related areas in order to increase collaboration and exchanges of ideas within the institution.

Other improvement is in the expansion of the content of the handbook such as the inclusion of a brief abstract of thesis as well as some selected Msc.

dissertations to the section on thesis titles. At present this section is an inadequate representation of the research works and interests of a department. There could also be several alternative designs of the handbooks for different sets of readers.

There could be more than one design, each being suitable for a particular type of audience. The other publication is LSE Experts which is aimed at informing the media and journalists of the specialists or experts available in the LSE. This is for the specific purpose of public relation exercise and for creating the opportunity for public exposure of academic and intellectual contribution of the institution.

For a more selective type of audience who are involved in high level decision making such as in the ministerial position or directors, a more selective guide to research information could be specially important. There should be a more specific handbook which provides more sophisticated and detailed analysis of the current issues whether political, social, economic or technological issues.

The organisation of the contents of a handbook can be adapted to respond to different interests of various groups of readers. Instead of organising the content according to departments, the content can be organised according to specific topics such as politics, economics, etc., each with its own subdivision. For example, under the heading of 'Information Systems', a sub-division can include 'Information Systems and Law', 'Information Technology in Developing Countries', 'The Impacts of Information Technology'.

In this way, works from different units or departments can be found together in one particular subject heading, each with an abstract or conclusion.

In such a design the conceptual relatedness between several topics underlies each section which can help the readers in finding other useful works from different sources.

The other pragmatic consideration to design is to make it possible for certain sections of the book detachable, with the request to readers to forward those sections which may be related to their colleagues' interests. So, the appropriate readers can be reached and the dissemination of information becomes more effective. The other way of reaching relevant audience is by including a form for the present recipient to recommend another recipient to receive the publication.

The additional mechanism for monitoring the relevance of recipients is to have a profile of some of the recipients, especially their missions or objectives, their areas of interests and works. Therefore, information of newly published works, either in the form of a specialised guide book, which are highly relevant to these agents can be brought to their attention. Furthermore, comments or judgments from readers can be elicited by including a questionnaire requesting their feedback. This could be made a condition for remaining on the mailing list.

Conclusion

This chapter has shown that relevance is an important and indispensable quality of information resources. The different concepts of relevance can give practical contributions towards the analysis and design of an information system. The consideration of various properties of signs makes the process of

applying concepts of relevance more systematic and concrete.

The characteristic of ontology charts in representing only the substantive aspect of a context make it applicable to other similar problem situations. The second case-study has shown the implicit use of the notion of relevance such as the conceptual relatedness between agents and their affordances. The investigation of the second case-study reflects the applicability and limit of generalising the results from the first case-study. The examination of the Research at LSE has shown us that the notion of relevance underlines the analysis and design of an information system in which the problem of identifying the 'right' information for the 'right' people is its main concern.

By combining the different concepts of relevance in a semiotic framework, practical ways can be devised to identify the relevance of information resources on the basis of established criteria. These criteria can be used to maintain the quality of relevance which is subject to changes according to the dynamic of the situation. The characteristics of relevance are also reflected in the case-studies in which the meaning of relevance exists in a social world with agents being responsible for its pursuit and evaluation. The knowledge of the relevance of a resource enables the realisation of an agent's objectives or the accomplishment of further actions in the social or business affairs.

CHAPTER 8

CONCEPTS OF RELEVANCE IN A SEMIOTIC FRAMEWORK

The various disciplinary approaches to the concept of relevance have been discussed in chapter 2 and 3, and their semiotic analysis was carried out in chapter 5. These different concepts of relevance have been applied in two case-studies in chapter 7. As a result of these practical analyses, relevance has been firmly established as a very important quality of information resources. The consideration of relevance as an affordance contributes towards the linking among the different concepts of relevance in a semiotic framework. In addition, the case-studies also confirm the compatibility between the characteristics of relevance and the assumptions of the logic of norms and affordances (NORMA).

Therefore, in considering the existence of the quality of relevance, we must be aware that its judgment or perception depends on an agent and his context. In other words, relevance judgments are subjective to the context of the judge or agent, his requirements and changes in his situation. That is why different agents may have varying relevance judgments and that these judgments are relative or a matter of degree. However, it is possible to gauge relevance judgments on behalf of some agents by applying concepts of relevance in a systematic approach as shown by the first case-study.

The other conclusion is that relevance is a means to an end so that we not only have to be able to identify things which are relevant but also to use appropriate signs in conveying or indicating relevance to agents or users. A guideline for applying different concepts of relevance in a semiotic framework

can be established from previous practical analyses. There is no rigid order in which these guidelines should be applied; they are tools which can be chosen for use by a person according to his situation.

Guidelines for Applying Concepts of Relevance

Draw Ontology Charts and Perform Semantic Analysis

The characteristics of relevance remind us that the perception of relevance depends on an agent or judge and his situation in which the pursuit of relevance is motivated. In order to clarify these factors, NORMA semantic analysis is applied to the given context which gives a basis for applying different concepts of relevance.

By drawing ontology charts to represent the situation, the substantive aspect of the situation can be represented distinctly from the procedural aspect. For example, the basic pattern of behaviour representing the relationship among a research group, its members and an institution is represented by the first ontology chart. In this chart the rules governing the membership, the existence of a group and other affordances belonging to the procedural aspect are not represented in the same chart. Therefore, ontology charts give a picture of the repertoire of actions realisable in the given context without being constrained by the details of how these actions can be accomplished. The procedural aspect or the 'how' is analysed during the process of semantic analysis and documented in semantic schemas which can be changed without affecting the representation in ontology charts.

In the first case-study, the first ontology chart shows the basic framework of the research group, e.g. its mission, task, membership, and specialisation of

research topics by researchers. The other charts depict the various aspect of the repertoire of affordances, such as those concerning the existence of a work and an agent which afford the represention of that work and its selection, distribution, subcription and the ownership of copyright. Other affordances that arise as a result of the relationship between members of the group and other agents are also represented in ontology charts. Therefore, ontology charts offer a comprehensive and simple picture of the context of both case-studies.

On the basis of these charts, the analyst can identify those affordances which represent things which are required to be relevant to the agents. For example, researchers' specialised topics and the use of citations were identified as a basis for judging other documents in the first case-study. Ontology charts also point out other affordances which are implicitly essential for the researchers in achieving their mission. For example, the publication of researchers' works and the attendance at important conferences, the exchanges of ideas and communication with the appropriate audience play a role in furthering overall objectives.

These relationships give other indirect indicators of relevance, e.g. works which are included in certain conferences or published by collaborators. The analyst not only identifies the affordances which are directly indicative of relevance to agents' specific requirements but also other criteria which could be combined together in establishing criteria for making relevance judgments. On the basis of ontology charts, the analyst can proceed to find rules or criteria which allow the realisation of these patterns of affordances.

The semantic analysis of these affordances is necessary for discovering the meaning and rules governing the existence of each affordance in a

particular context. For example, the semantic analysis of work and copyright is requisite for establishing the legal right concerning a published work. The meaning of copyright is recognised as changeable according to legislation and legal amendments in a particular country. The copyright law influences the way in which researchers and librarians can reproduce or copy published works for using in research; it also gives protection for their own works.

The semantic analysis of simple terms whose meanings are often taken for granted also revealed an intricate shade and complexity of meaning. For example, in the semantic analysis of an address: a house can be assigned an address with a fixed telephone number in some countries while in others the telephone number is transferable. Other examples include a version of work and the difference between a sponsor and a funder. By recording the rules and authority for the existence an affordance in semantic schemas, any changes in these rules can be corrected without affecting the substantive representation in ontology charts. For example, the changing number of the group or of its mission will not affect the ontology chart, what is needed is to make changes in the semantic schemas. The documentation of the start and finish of an affordance also gives the indication of the period of the applicability of certain relevance judgments. The duration of a research project determines the period of time in which certain documents and topics are considered relevant to agents' requirements. A revolutionary change in the mission of the group would introduce a whole new perception of relevance judgments.

Semantic analysis is also important for clarifying the meaning of the indicators used as a basis for making relevance judgments such as the bibliographies or citation, titles of documents and authors' names. As these

indicators are not numerical measurements but qualitative measurement, their meanings have to be clarified so that the qualitative judgments are valid and reliable.

Establish Agents' Criteria of Relevance

The criteria of relevance judgements have to be elicited from those agents on behalf of whom the information manager has to provide relevant resources for their needs. There are two ways in which communications can be undertaken: the informal and formal methods. For a small group of people where there exists an informal system of communication, informal face-to-face conversation is an adequate method such as in the first case-study in which queries can be discussed with any researchers whenever it is necessary.

For a large organisation, the use of questionnaires are the usual means of eliciting user's requirements together with formal interviews. The existence of an informal system of communication will enhance the quality of the elicited criteria in terms of their completeness and accuracy. In addition, practical investigation into the existing information system also reveals the evolution or changes of the requirements of its users. In this way the background knowledge about the users and their concerns can be added to the newly acquired responses.

The application of pragmatics plays an important role in accomplishing these tasks. Firstly, appropriate speech acts must be used in communicating the information manager's or analyst's intentions to the users or agents. The knowledge of protocols and languages have to be exploited sensitively according to the particular cultural context. The awareness of the different

modes of languages, such as the affective and denotative modes, is vital for the success in using illocutionary or perlocutionary acts. These apply to both verbal and written communications as we saw in the choice of words for making a request and conveying the intention in the design of the questionnaire.

Secondly, the use of inducement or sanction must be communicated to users in order to ensure users' cooperation. For example, benefits of changes have to be acknowledged by users while a sanction from the appropriate authority may be needed in order to give authoritative support for innovation in a large and formal organisation.

Thirdly, we apply Sperber and Wilson's concept of relevance in forming the questions in both the interview and questionnaires so that the communication of intentions is more efficient. The analyst must ask questions which are related to the context of the situation. They must be concise so that the effort required in providing answers are kept to a minimum. The content and numbers of questions must be those essential to the context and be simple to understand. In addition, the design of questionnaires has to take into account the typographical arrangement and quality of printed letters; commercial design techniques should also be exploited to increase their effectiveness.

The empirical aspect of semiotics makes us pay attention to capacity of the channel of communication. By recognising the limit of human channels of communication, the problem of overloading these channels can be avoided. Therefore, the application of interviews and questionnaires has to be undertaken with the opportune timing. In the design of questionnaires, a variety of stimuli can be used to attract attention such as by using colours and

imaginative design including the ease in returning them to the analyst.

The semantic application is reflected in the questions included in questionnaires. The ontology charts and semantic analysis provide the basis upon which questions about the situation can be formulated in questionnaires. For example, the questionnaire of the first case-study includes questions on the membership of the group, the task or project of a researcher, the specialised topics, and other related works and contacts, including the finish of research project for indication of the duration of relevance. The questionnaire must contain the date of response and the agent's name as relevance judgments depend on the particular agent for a period of time.

Practical Investigation

Another way of acquiring the knowledge of users' criteria of relevance is by practical investigation into the existing information system which support their tasks. This offers a learning process in which the analyst or information manager can obtain more background knowledge about the evolution or history of the organisation. Some semiotic guidelines and application of concepts of relevance can facilitate a systematic acquisition of users' criteria of relevance from this process.

Firstly, the application of pragmatics helps in observing ways in which people use signs to indicate their interest or attention. Various sign-types may be used to indicate the distinction among various actions with regard to different types of information resources. For example, in the first case-study, hand-written notes, abbreviations and symbols (such as asterisks, crosses, and ticks) were found alongside certain names and books to be purchased, and lists

of references.

Secondly, the role of semantic aspect of the investigation is in identifying the types of resources or their classifications and labels. These are indices for the areas, topics and tasks of the users' concern. In the case of the research group, the list of journals, references and other materials in the library are indicators of the researchers' interests over a period of time.

Thirdly, the application of empirics can be exploited in discovering the bias towards certain kinds or areas of users' information requirements. By observing the frequency of occurences of certain items such as the names, sources, keywords of documents, it is possible to ascertain the major areas of users' interests.

Fourthly, by applying the dynamic characteristics of relevance, the information manager can ascertain changes in users' requirements and their relevance judgments. The starts and finishes of the relevance of information resources may be reflected by their appearances and a termination of their continuity. For example, some journals in the case-study are very old and dusty which indicates that they have not been consulted for a long time. The termination of the subscriptions of some journals also indicates changes in topics of research. On the other hand, the arrival or existence of an item which bears a recent date of publication may reflect the growing interest in a new area.

In addition, the existing or previous methods of management and control of the information system can also reveal how feedback from users is acquired and monitored whether formally or informally. The acquired knowledge from interviews, questionnaires and practical investigation becomes the basis upon

which formal criteria of relevance can be established for selecting and managing information resources.

Formulate the Criteria for Relevance Judgments

The accumulated knowledge gathered from users and investigation can be formalised into sets of rules for making relevance judgments systematically. The formulation of these criteria is based on the legal approach to the concept of relevance.

The inclusionary rules

These are rules which describe those criteria against which an item can be judged as being relevant, subject to exceptions of other rules. An item may not have to fulfil all these criteria but the greater the number of qualified criteria the higher the degree of its relevance. These are rules for guiding the intermediary or information manager in selecting items which are relevant according to the given context.

For example, the inclusionary rules of the first case-study are based on the discussions with researchers and their profiles such as their research topics and bibliographies and statements of their mission.

The rules of precedents

Rules of precedents are based on users' expressions of their relevance judgments either formally or informally. The basis of these rules can be observed from the pragmatic and empirical indicators observed from practical investigation. For example, the symbols used by researchers for indicating their

relevance judgments on certain documents and titles of books can be observed in the case-study.

The existing mechanism for monitoring the information system can also help in establishing rules of precedents of existing relevance judgments. For example, the estoppels of intention expressed in the formal mechanism for monitoring the content of the library. The feedback and inputs communicated between the information manager and users also act as estoppels whether by words or conducts.

The rules of exclusion

These are rules which state the conditions of exception to the criteria for relevance judgments. In other words, these are rules under which an item, though qualified under the inclusionary rules, is judged to be so insufficiently relevant that it is not selected or it can be discarded. For example, the exclusionary rules of the first case-study consist of a list of topics which are subject to rapid development so that published works in these subjects may be out-of-date quickly.

The other source of exclusionary rules is estoppel by users' actions such as their discarding of documents and direct communications conveying reasons for excluding certain documents. The exclusionary rules have to be considered in conjunction to other rules for relevance judgments. By combining these rules on the basis of logical operators, different results can be obtained from the process of selection.

Although these rules are helpful guidelines for making relevance judgments to a person who does not have any knowledge about users and their

work, one has to be aware that they are changeable. By working closely with the users and establishing systems for monitoring feedback and changes, the information manager can acquire knowledge to adjust these rules accordingly. Therefore, the information manager is able to maintain the relevance of information resources consistently.

The Application of Logic

By applying logical operators in manipulating criteria for making relevance judgments, different sets of decision rules can be formulated. The advantage of formalising these rules of logical deduction which are used intuitively in the reasoning process is that they become guidelines for those who have no experience in the given context.

In order to avoid the problem the paradoxes of material implication, the basic propositions have to be checked for their validity or meaning in the given context. For example, in the first case-study, a rule can say that if a document includes the name of a cited author (A), (then) it is relevant for selection (R). This can be represented by 'if A then R'. The information manager has to check the name appearing on that document against his knowledge of it being cited by a user before judging it as relevant for selection.

More criteria can be combined together in a rule by using other logical operators. The use of conjunction can enhance the degree of relevance judgments by adding more criteria in specifying the constituents for deduction. For example, a rule can state that if a document contains cited keywords and authors, (then) it is relevant for selection. The truth values or validity of these two propositions have to be accountable by the information manager or judge

so that the deduction is accurate.

The truth table for conjunction according to classical logic applies in this context. In other words, there is no logical constraint that there has to be a connection between the given keywords and authors although the information manager's knowledge of such connection may help in reaching a decision more quickly. For example, keywords such as 'decision support systems' are known to be connected to the author Scott Morton, so if a document contains both these elements, the deduction of its relevance can be easily reached.

On the other hand, the application of exclusionary rules or exceptions can be accommodated by using negation (not). For example, a rule says that if a document satisfies criteria in the inclusionary rules (P) with the exception of exclusionary rules (Q), then it is relevant for selection (R) can be expressed by if P & not-Q (then) R.

In cases where it is adequate for having either of the criteria fulfilled, the logical disjunction can be used in a decision rule. For example, a rule can say that if a document contains cited keywords (K) or references (A), (then) it is relevant for selection (R). This can be expressed by if K or A then R.

The classical truth table for logical disjunction can be applied in cases where it does not matter if it turns out that both premisses are true. Hence some documents can be judged to be relevant if they fulfil either the inclusionary rules or the precedents, or both.

These logical operators can be combined for different decision rules. For example, let P represent a document whose descriptors are included in the inclusionary rules, let Q be that which satisfies those of the exclusionary rules, let A be for the precedents, E stands for the estoppels for inclusion, and R

represents the relevance judgment. Some examples of different decision rules which can be formulated on such basis are as follows:

If P & not-Q, then R.

If (P v A) & not-Q, then R.

If (P v A v E) & not-Q, then R.

A higher degree of relevance can be achieved by applying the criteria of conceptual relatedness by specifying a set of specific criteria which are conceptually related to each other. This depends on the exploitation of the existing relationships among those descriptors and the knowledge of the context of the situation. In the first case-study, a set of related keywords can be combined in selecting a more specific set of documents. Similarly, a combination of authors can be used to select documents on the basis of their citation of these authors. The date of publication can also be used for selecting documents published during the specified period. Therefore, by defining the different patterns of relationships among the descriptors of an item, it is possible to derive relevance judgments which are specific to the given conditions.

The more criteria a document can qualify, the greater its degree of relevance. Logical operators can be used to combine additional criteria for which a document has to satisfy in order to be confirmed of their relevance. For example, a document whose author and keywords and citation are included in the researchers' profiles has a higher degree of relevance than another which only contains a few cited keywords. Additional knowledge about the conceptual relatedness of certain keywords or topics can also be a decisive

factor in confirming the degree of relevance of a given item.

Based on personal knowledge and users' feedback, the information manager acquires additional criteria for confirming his relevance judgments. In cases where the information manager is not familiar with the context of the situation such as the research topics, the formal rules have to be consulted. This helps in reducing the uncertainty in judging the relevance of documents. By learning and acquiring formal and informal knowledge about the given context, the information manager becomes more experienced in his tasks.

However these formal rules cannot guarantee the validity of the results from the deductive process. This is because they are normally static whereas requirements and situations are subject to changes. That is why these rules are merely guidelines based on the recognition of the need for flexibility and the making of relevance judgments as a learning process. Therefore, it is important to monitor these changes so that judging criteria can be adapted accordingly.

Monitor Changes in the Criteria of Relevance

In order to maintain the relevance of information resources, changes in agents' requirements and situations including changes in the environment have to be monitored continually. The monitoring mechanisms are based on semiotics; for example, empirics contributes towards the identification of channels of communication while pragmatics applies the use of signs for affecting users' feedback. The monitoring mechanisms can be through informal or formal systems of communication.

The prerequisites for informal communication are that there must be an opportunity for physical contact and the willingness to communicate. In a small

group of people, the informal system of communication can be encouraged by the existence of a specialised library and the availability of an information officer in the library acts as a destination for receiving feedback messages.

For a large organisation, the informal system is inadequate for handling the volume of informal communications on a consistent basis. However, the opportunity for face-to-face contact has to be available as an option for introducing the information manager to various users. An initial face-to-face meeting between the information manager and users may be necessary for encouraging users' feedback. Other channels for indirect contact such as the telephone has to be available for immediate communication of important or urgent messages. The limitation of and the uneconomical aspect of face-to-face communication means that other methods have to be exploited.

We can prescribe ways for monitoring changes affecting the criteria for relevance judgments based on semiotics.

(1) Identify sources and destinations of communications.

The existence of a source or sender and a destination or receiver is fundamental to the process of communication. The roles of a sender and receiver of a message can be alternated between the communicators. Changes in the members of a group of communicators has to be monitored so that messages can be modified to their requirements. For example, in the first case-study, any changes in the membership of the group affect the criteria for relevance as each researcher has his own specialised topics. Similarly, in the second case-study the departure of a member of a department or the arrival of

a new member will affect changes in the content of its handbook.

On the other hand, the existence or location of the receiver of feedback has to be explicit and easily reached by other people. For example, the name and address with telephone number of the Information Officer of the L.S.E. are printed in the inside cover of the handbook; the room-number and telephone extension are also available in the internal directory. The monitoring of recipients' addresses has to be carried out by indirect means of periodic request such as through the renewal of subscription or questionnaires.

(2) Check the availability of channels of communication.

The communication of signals or messages depends on the availability of existing channels of communication and their operations. For example, a strike or a breakdown in the postal system would delay the arrival of messages sent by post. The information manager must ascertain the availability of other channels of communications such as fascimile, cellular telephone, electronic mailing systems and couriers.

Therefore, appropriate channels can be chosen for transmitting urgent or special types of messages. It is also important to make certain that the chosen channel is in good working order. In monitoring changes, the kind of messages or signals used for communication can determine the type of channels chosen for this purpose.

(3) Exploit appropriate channels for communicating different aspects of changes of criteria for relevance judgments.

The criteria which have to be monitored are those which are used as the

basis for actions such as in the selection of documents in the first case-study. The monitoring can be based on both the formal and informal channels of communications depending on the judgment of the information manager. These are the ways in which different monitoring mechanisms can be created:

(a) Tagging.

For some channels of communications, a tag can be used either to register or request feedback or indications of changes in relevance judgments. For example, a form is to be attached to the front page of a document requesting details about its source, the duration of its relevance, and the name of researcher who acquires the document.

(b) Providing specific or distinct destinations for receiving different types of messages.

This can be achieved by identifying the types of messages which demand specific actions so that appropriate destinations can be chosen for particular messages. In the case of the research group, the pragmatic aspect applies in recommending the use of explicit labels, coloured codes for making the different channels distinctive. The different distinations or containers for these documents are used for conveying appropriate actions such as discarding, filing, requesting documents, and indicating new acquisition. In this way, changes in relevance judgments can be observed from the signals arriving at the different destinations.

The application of conceptual relatedness can be used in grouping messages or documents which are conceptually related so that users can benefit from their relationships. For example, in the first case-study, boxes of documents which are conceptually related such as expert systems and artificial

intelligence are placed together. The chosen system for designating locations of documents must also offer easy access to users and consistency in organising these documents.

(c) Requesting feedback from users directly.

This can be achieved by the informal system of verbal communication in a small group or by the use of telephone for a large organisation. In addition, the information manager is also opened to obtaining hearsay information or speculative opinion or judgment which have to be investigated for their reliability. By applying the various criteria of relevance and gathering additional evidence, the information manager can be justified in confirming its relevance or otherwise.

The formal method of request is the use of questionnaires either in a written form or electronically transferred form in requesting users' judgments and suggestions.

(d) Providing an open channel for users to share their ideas and inform each other of current interests.

For the first case-study, a blackboard or drawing board for users to scribble and discuss their ideas or issues is recommended. So, the information manager has another source for gathering feedback. In the case of a big organisation such as the L.S.E., an internal newsletter specially designed for raising new issues and topics of discussions informally among academics can be beneficial to both the academics and the information officer. The use of an electronic blackboard similar to the electronic mail can also be used for collaborative work with colleagues living at a long distance or overseas. The pragmatic aspect of this channel of communications lies in the ability to affect

users' interest or enthusiasm, including the ease in using this channel.

(4) Monitor changes in the related affordances.

As certain patterns of behaviour can be accomplished by realising other antecedent actions, changes in these antecedents and their complimentary affordances can produce a different result. These affordances can be identified by looking at the ontology charts for their interdependent relationships and by examining the result of semantic analysis. A change in one affordance will affect its related counterpart, a change in the mission or membership of the group will necessitate changes in the criteria of relevance for selecting documents.

The other indicator which has to be monitored is the start and finish of an affordance. For example, the ending of a project or task concerning a particular topic can have implications on the types of documents to be selected for users. The ending of a funding programme and the beginning of a new collaboration also have to be monitored for their effects in changing users' requirements.

(5) Monitoring by observing the frequency of occurences.

A special tag can be used for recording the frequency of consultations of certain items and perhaps users' judgments on their relevance. For example, a form can be attached to documents requesting users to fill in their initials and date for each consultation. A minimum number of consultations for a period of time, in combination with other criteria of relevance, can be arrived at by consensus or deduction. In the first case-study, this method can be used to

monitor the relevance of journals. For the second case-study, the information officer can record the types and volume of enquiries arising from the handbooks so that improvements can be made in the content of the publication.

(6) The frequency of monitoring and updating.

The pragmatic aspect of the consequences of the implementation of monitoring mechanisms and introduction of changes have to be considered in advance. This is to ensure that they are going to be accepted by users. For example, the information manager must choose the appropriate timing for requesting feedback such as in sending out questionnaires and the social consequences of changes in the information system.

The empirical aspect is that the information manager also has to be aware of the capacity of the channel of communication so as not to induce an unnecessary overload. For example, changes to the system must not create an unacceptable burden to the working pattern of users. The knowledge about the fluctuation of the volume of signal transmissions should be observed in order to implement changes at the appropriate intervals.

The different types of changes can be monitored as often as they are necessary. This is partly determined by the frequencies of their changes or the limits of their durations. For example, if some changes are known to be gradual or occur at certain intervals, the gathering of feedback can be planned accordingly. In the first case-study, the start and finish of a project are usually known in advanced while the beginning and ending of an academic year determine the volume of signal transmissions in existing channels.

The frequency for updating the content of an information system

depends partly on the demand of users and the nature of things which need to be updated. The feedback gathered from monitoring mechanisms gives an indication of the urgency for adjustment in the information system while the cycle of patterns of behaviour indicates the frequency for changes. The important precaution is to always have available a channel for communicating urgent feedback such as serious repercussions or costly aberration in the system. In addition, the information manager also has to be aware of the consequences of introducing these innovations or an information system into an organisation.

Evaluate the Impacts of Implementing Changes

By using Hall's taxonomy to evaluate the impacts of introducing an information system or changes into an organisation, the information manager can take appropriate actions to avoid negative results. In the first case-study, a list of potential negative and positive consequences of implementing an information management system can be found in Appendix 7.9. For example, a secondary impact of interaction (02) is the opportunity for acquiring and attracting financial support or sponsorship. The potential secondary impacts of association for the research group include the increase in wider social contact and recognition. On the other hand, the potentially negative consequences are the possibility of increased expenditure in maintaining the information system and the raising of the issue of security or accessibility to the information resources.

By taking into consideration these guidelines for managing and monitoring changes within and outside the organisation, the relevance of the information resources can be consistently maintained. Hence, these guidelines

for applying concepts of relevance in a semiotic framework can be compared to a tool-box in which an assortment of tools are available for utilisation according to the context of a situation.

The Applicability of these Guidelines to Different Areas

The semiotic framework for applying concepts of relevance can be applied to similar situations where there is a need to disseminate information to recipients, select or identify things which must be related to some agents' requirements or specifications, or to identify the set of requisites for achieving some actions. The recommended guidelines in this framework can be chosen or modified according to the context of the case.

The results of the semantic analysis and ontology charts of the case-study can be applied, with some modifications, to other organisations or insitutions which are concerned with the problem of the relevance of information resources and information dissemination. For example, a good candidate is a scientific institute or government research foundation which has the need for developing an information system for disseminating scientific information to relevant people and encouraging the co-operation between scientists and industrialists. The criteria for relevance judgments can be modified according to groups of users in the institution so that different sets of criteria can be documented. These criteria can also contribute towards the design of a database, e.g. by consulting rules for relevance judgments and documented rules in the semantic schemas.

This semiotic framework can contribute towards the analysis and design of advertisement. For example, it helps in identifying the different audiences

and the need to ascertain their patterns of behaviour or cycles of activities. Therefore, appropriate signs and speech acts can be exploited in designing an advertisement which has to be launched at the right time. In addition, the hidden messages and other impacts of an advertisement can also be anticipated from Hall's taxonomy in order to be evaluate or modify the particular design.

The other area of application is in the analysis and design of medical information systems for monitoring a population in order to call certain groups for medical examinations. For example, a system which monitors the recalling of women for smear-tests must be able to keep track of changes in their names, addresses, dates and result of previous tests. Other criteria may be needed for excluding certain group of women, e.g. by age or medical conditions; while some criteria for more frequent tests may be needed for certain category. An appropriate feedback mechanism must be designed within the system for recording these changes.

The framework for establishing criteria for making judgments can be applied to the elicitation of agents' rules in building a decision-table for medical diagnosis. The application of conceptual relatedness and the ways for increasing the degree of confirmation including logical deduction can contribute towards the formulation of decision rules. Appropriate signs can be used in the design of the presentation of the procedures in using the information systems. The success of its implementation depends on the repercussions, i.e. the benefits or loses, so that an evaluation of its implications are necessary in advance.

The criteria for establishing the duration of relevance can also be applied to the length of time in which records should be kept in an organisation.

This can be done by discovering the responsible agents and their criteria including an empirical investigation. For example, the database of the International Police keeps huge records of people who are known criminals and suspects. But it has no monitoring mechanism to update these records or correct mistakes in files. The incorrect details and descriptions of a person can lead to false arrest or failure to track down a terrorist. Therefore, some criteria about the different categories of criminals and suspects should be established and the authority responsible for supplying descriptions in these records have to be registered for reference. There should also be explicit rules for excluding certain types of information from being entered into the database so that it can be cross-examined for accuracy.

In the area of information retrieval, a contribution of this framework can be in the design of help messages for interactive retrieval systems. Trenner (1989) points out that further research lies in establishing a checklist of relevant topics to be included in the help facility of a particular system. This can be approached by performing semantic analysis of the case, eliciting criteria from users and by empirical investigation. The application of different concepts of relevance such as conceptual relatedness and logical relevance can be used in the deduction of the result. Certain messages may be relevant to the need of a group of users so that criteria for these levels have to be clarified. A monitoring mechanism for detecting users' levels can be based on the frequency and types of mistakes occuring in the retrieval process.

Further, a survey for users' feedback can also be carried out by specifying a time duration or the number of mistakes of a retrieval. Different indications for the extent of a mistake can also be helpful to users, e.g. if the same mistake

occurs more than three times, an appropriate message for guiding the user must be forthcoming; if the user is in danger of corrupting or losing his previous work, a warning message and the help for arresting the situation are essential.

The ways in which this framework can contribute towards the analysis and design process depend on the perception and judgment of the responsible agent. The basic conditions of relevance, i.e. the existence of an agent who is accountable for the criteria of relevance, its purpose and duration, contributes towards the perception that a socially oriented problem must be seen in the agent's context and not in isolation. The utility of concepts of relevance acccording to the semiotic approach can be enlarged by further research in other interesting areas.

CHAPTER 9

SOME OBSERVATIONS, REFLECTIONS AND FURTHER RESEARCH

The application of the methods of NORMA semantic analysis to case-studies has given some insights into their strong and weak points. These give rise to several questions and criticisms which are discussed in the first section. The second section includes some reflections on the various concepts of relevance and their contributions to the field of information systems. Additionally, the reflection on the connection between concepts of relevance and the process of writing the thesis seem to confirm the fundamental characteristics of relevance and its quality as an affordance. In the final section, some suggestions for further research are put forward for consideration.

Some Observations on NORMA Semantic Analysis

The first question raised during the application of NORMA semantic analysis is that of the boundary of the analysis. There is no explicit guidance in NORMA to determine when the analysis process can be stopped or to show the level of analysis represented in ontology charts are adequate. However, as the role of the responsible agent or an analyst is recognised in the analysis process and must be held accountable for the result, the decision on the boundary of the analysis depends on the analyst's judgment. In this context, the concept of relevance has been a guiding factor in which the level of analysis represented in ontology charts and semantic schemas are considered adequate for the purpose and depth of this work.

The second observation is that concerning the implicit condition in

drawing ontology charts in which the maximum number of antecedents is limited to two affordances. In practice, there are examples of three or four affordances needed for realising an objective, for example, in building a car. The reason for this restriction can be seen by considering the complexity of an ontology chart in which there are three or four antecedents for each affordance; the complication of the semantic schemas, especially the time of starts and finishes, may become too cumbersome and impractical.

The third observation is that there is no rule concerning the choice of terms used to represent candidate affordances whether they should consist of verbs or nouns or adjectives. The recommended guideline is that the terms used should be in the vocabulary of the users. Consequently, different analysts may produce different ontology charts with varying affordances for the same context. However, the restriction of ontological dependency may exert a control over the relationships between affordances. The result of Backhouse's work on the principles of NORMA semantic analysis is expected to give explicit explanations and more detailed guidelines for drawing ontology charts.

The fourth observation is that it is likely that different analysts will have different perceptions of the patterns of norms in a situation. Consequently, difficulty arises in judging the accuracy of ontology charts as each can be logically defensible according to the perception of each analyst. The other difficulty is in establishing the starts and finishes of informal and abstract affordances. In addition to the problem of different perceptions, the rules of these informal affordances can be so flexible that they can be different for each person.

Another interesting question is whether these methods are capable of

being applied to situations in which the patterns of behaviour or norms are not firmly established or are in the early stage of emergence. As the methods of NORMA were developed from the work concerning legal problems in which the descriptions or norms of the given contexts are generallly explicit and well defined, there are no strict guidelines on how these tools should be used to tackle unstructured problem situations. The identification of the responsible agents may not be adequate if they do not know what seems to be the 'problem' or could not describe their requirements.

On the other hand, the existing restrictions in NORMA help to ensure that an analyst has as little room for personal introspection as possible while working under the circumscribed condition. The use of generic terms, the relationship of part-whole and the semantic analysis of affordances help to clarify the meaning of these terms. The separation between the substantive and procedural aspects simplifies the structures of ontology charts and avoids the confusion between the patterns of affordances and how these can be achieved.

In addition, the criterion of time recorded in the start/finish of each affordance creates an awareness of the dynamic nature of the social world and the need for the analyst to be sensitive to the changes of meaning. These rules also make it possible to produce ontology charts which are generally usable in similar situations with some modifications whereby the procedural aspect recorded in semantic schemas needs to be altered according to the new criteria.

Other criticisms of NORMA are due to what is lacking in its methods. For NORMA, the participative condition is not mentioned explicitly nor are any guidelines available for the extent to which it should be a part of the analysis process. Although users' involvement is required in the elicitation of

their requirements and criteria for the semantic schemas, the participation of users depends on the analyst's judgment. One analyst may discuss the resulting ontology charts and semantic analysis with users while others may only involve users in the interviewing stage. In contrast, the Soft System Methodology (SSM) explicitly states that it is based on a participative process in which debates of different views on the conceptual models and issue-based definitions are compulsory (Checkland 1981, 1989).

Secondly, the methods of NORMA semantic analysis are not specifically concerned with the consideration whether changes are culturally desirable or acceptable. This is implicit in its absent recommendation of users' participation. In addition, the methods of NORMA do not include the questioning of the given objectives or problem situation.

Thirdly, NORMA does not distinguish among the different types of agents involved in a situation; the term 'agent' is used to represent all types of responsible agents in semantic schemas. In the Soft System Methodology, agents are distinguished into actors, customers and owners which clarify the role of each agent in the case.

A considerable amount of work still needs to be carried out on improving the methods of NORMA semantic analysis. However, the basic assumptions of NORMA reflect the positive trend of thinking in which participants or users recover their rightful recognition in the process of the analysing and designing of information systems.

Reflections on Concepts of Relevance

The process of writing this thesis can itself be seen to be underlaid by concepts of relevance. Based on Schutz's concept, the motivational relevance was the goal of completing the thesis. The topical relevance was represented by the title of the thesis. The interpretational relevance included the process of performing the literature survey of concepts and ideas which were used in the writing of the thesis.

Within the interpretational relevance, other concepts of relevance were applied in selecting the appropriate literature for the topics in the title. For example, judgments had to be made on the conceptual relatedness between an article and the written topic; logical deduction and empirical observations from research helped in deciding what had to be included in the thesis. These judgments were conditioned by the personal perception, knowledge and the requirements of the situation (situational relevance).

The knowledge gained through the writing and reading process gave rise to the informal rules for selecting literature. For example, certain authors' works were known to be relevant; certain topics were not sufficeintly relevant for inclusion even though some of their keywords were used in the thesis. Several writers had set up some precedents of the issues involved in explicating relevance which helped in defining the boundary of literature survey. On the other hand, the scope of the research was determined by the perception of the relevance of the chosen literature for the purpose of completing the thesis.

The importance of the informal system of communication can never be over estimated. Sperber and Wilson's concept of relevance in verbal communication was reflected in conversation and discussion. The experience of

this process confirmed the underlying characteristics of relevance which has to be considered in a context of an agent and his motivation to accomplish some actions or goals.

The two case-studies have shown us that relevance is an essential quality of valuable information resources. The explicit recognition of the importance of concepts of relevance will affect the ways in which we approach the task of building information systems. Analysts will have to ask the questions concerning the relevance of the proposed information systems, for example, the agents to whom information has to be relevant, what the criteria of relevance are, and how these can be acquired. The application of concepts of relevance in a semiotic framework offers a systematic approach for dealing with these questions.

The identification of responsible agents and the explication of their situations can be facilitated by applying methods of NORMA semantic analysis which contribute towards the explication of different meanings of relevance in a given context. The legal framework of rules offer guidelines for making relevance judgments. On the other hand, the application of syntactics such as in logical operators make it possible to formulate logical rules for making the judging process more mechanisable and consistent. The important point is that we have to distinguish between the 'relevantistic' logic and classical logic in logical deduction. This helps in avoiding logical conclusions which are logically consistent but invalid in the social context.

In addition, the awareness of the dynamic characteristic of relevance will make analysts and information managers see the need to monitor changes in agents' requirements and criteria of relevance. The pragmatic aspect of

semiotics reminds us of the behavioural and cultural impacts of implementing changes. Therefore, relevant changes not only have to be logically relevant but also pragmatically relevant to users.

The conscious application of concepts of relevance will ensure that the available resources can be effectively used for building information systems which will be semiotically relevant to users' requirements.

Further Research

The framework for applying concepts of relavance in this work does not extend to the automation of the process of making relevance judgments. Further research into the automation of all the processes involved in identifying and supplying relevant information to appropriate users would be greatly appreciated by those working on semantic analysis. This research has to consider the automatic monitoring of changes of criteria of relevance and the notification of relevant documents to appropriate users. This may be feasible in the age of fifth generation computers and artificial intelligence. One of the major tasks is to formulate logical rules which accurately comprise all the criteria of relevance judgements for all users of the organisation and to be able to automatically adjust these rules accordingly.

The other issue is the way in which the degree and meaning of relevance of each document, derived by the computer, must be explained to the users. For example, a ranking system may be used such as R1 to indicate that a particular document is relevant as its author and keywords in its title are cited in users' profiles, R2 for documents being relevant on the basis that they have both the authors, keywords and references cited in users' profiles, and so on.

Documents can be ranked higher according to the number of qualified criteria. In addition, other variable factors affecting the duration of relevance judgments such as the start and finish of a user's task or project must also be monitored by the computer system.

There must also be some ways of detecting the shifting of conceptual relatedness and the evolving perception of relevance on users' topics and the emergence of new topics of relevance. The feasibility of such a computer system depends on the limitation or progress of technology and the practicability of devising numerous sets of rules. Then, a long term vision may be the ability of computer systems automatically to retrieve relevant documents from other databases. The result of this research may alter the role of an intermediary and the ways in which people seek relevant information.

The discovery of the need to distinguish between the different approaches for applying logical operators has given rise to another suggestion for further research. This is the investigation of problems of logical inconsistency which results in programming errors or bugs in software. Further work in 'relevantistic' logic and classical logic may yield the syntactical reasons for these logical problems. The result of this research can provide a framework for detecting errors in programming and also leads to guidelines for programmers in avoiding the problem of viruses in computer programmes and for identifying potential viruses.

In this work, the semantic analysis of a chosen system is needed in order to distinguish between the substantial and procedural aspects. A semantic analysis of errors and their categories has to be rigorous so that causes of errors can be investigated. The use of syntactics or logical deduction plays an

important part in this process. Therefore, the meaningfulness of these formal rules has to be justifiable in their relationships to the real world. The misunderstanding or misrepresentation of the meanings of these logical relationships may turn out to be a major source of errors in software.

Although meanings have been shown to be subjective to agents, the application of conceptual relatedness and logical relevance allows us to establish connections among different topics. Further work can be carried out to discover whether these concepts of relevance are capable of dealing with the problem of merging different databases into an effective information system. The problem in this situation would be the divergent meanings attached to different databases. This can lead to guidelines for designing flexibility into databases in order to allow the convergence of information which offers conceptual relatedness. Rules which can be used as a basis in deciding for or against the combining of different database systems should also be established.

Concepts of relevance can be exploited for bringing about the necessary affordances for the completion of a goal, whether it is a simple requirement or complicated series of actions. The semiotic basis for applying these concepts in a systematic and practical way has made it evident that relevance is not an elusive quality. The recognition of its importance can further enhance our effort in analysing and designing information systems which are more effective and friendly to mankind.

Primary Message Systems	Interactional 0	Organizational 1	Economic 2	Sexual 3
Interaction 0	Communication Vocal qualifiers Kinesics Language 00	Status and Role 01	Exchange 02	How the sexes interact 03
Association 1	Community 10	Society Class Caste Government 11	Economic roles 12	Sexual roles 13
Subsistence 2	Ecological community 20	Occupational groupings 21	Work Formal work Maintenance Occupations 22	Sexual division of labor 23
Bisexuality 3	Sex community (clans, sibs) 30	Marriage groupings 31	Family 32	The Sexes Masc. vs. Fem. Sex (biological) Sex (technical) 33
Territoriality 4	Community territory 40	Group territory 41	Economic areas 42	Men's and women's territories 43
Temporality 5	Community cycles 50	Group cycles 51	Economic cycles 52	Men's and women's cyclical activities 53
Learning 6	Community lore—what gets taught and learned 60	Learning groups—educational institutions 61	Reward for teaching and learning 62	What the sexes are taught 63
Play 7	Community play—the arts and sports 70	Play groups—teams and troupes 71	Professional sports and entertainment 72	Men's and women's play, fun, and games 73
Defense 8	Community defenses—structured defense systems 80	Defense groups—armies, police, public health, organized religion 81	Economic patterns of defense 82	What the sexes defend (home, honor, etc.) 83
Exploitation 9	Communication networks 90	Organizational networks (cities, building groups, etc.) 91	Food, resources, and industrial equipment 92	What men and women are concerned with and own 93

Territorial 4	Temporal 5	Instructional 6	Recreational 7	Protective 8	Exploitational 9
Places of interaction 04	Times of interaction 05	Teaching and learning 06	Participation in the arts and sports (active and passive) 07	Protecting and being protected 08	Use of telephones, signals, writing, etc. 09
Local group roles 14	Age groups roles 15	Teachers and learners 16	Entertainers and athletes 17	Protectors (doctors, clergy, soldiers, police, etc.) 18	Use of group property 19
Where the individual eats, cooks, etc. 24	When the individual eats, cooks, etc. 25	Learning from working 26	Pleasure from working 27	Care of health, protection of livelihood 28	Use of foods, resources, and equipment 29
Areas assigned to individuals by virtue of sex 34	Periods assigned to individuals by virtue of sex 35	Teaching and learning sex roles 36	Participation in recreation by sex 37	Protection of sex and fertility 38	Use of sex differentiating decoration and adornment 39
Space Formal space Informal space Boundaries 44	Scheduling of space 45	Teaching and learning individual space assignments 46	Fun, playing games, etc., in terms of space 47	Privacy 48	Use of fences and markers 49
Territorially determined cycles 54	Time Sequence Cycles Calendar 55	When the individual learns 56	When the individual plays 57	Rest, vacations, holidays 58	Use of time-telling devices, etc. 59
Places for learning 64	Scheduling of learning (group) 65	Enculturation Rearing Informal learning Education 66	Making learning fun 67	Learning self-defense and to stay healthy 68	Use of training aids 69
Recreational areas 74	Play seasons 75	Instructional play 76	Recreation Fun Playing Games 77	Exercise 78	Use of recreational materials (playthings) 79
What places are defended 84	The When of defense 85	Scientific, religious, and military training 86	Mass exercises and military games 87	Protection Formal defenses Informal defenses Technical defenses 88	Use of materials for protection 89
Property--what is enclosed, counted, and measured 94	What periods are measured and recorded 95	School buildings, training aids, etc. 96	Amusement and sporting goods and their industries 97	Fortifications, armaments, medical equipment, safety devices 98	Material Systems Contact w/ environment Motor habits Technology 99

Appendix 6.0 The LEGOL/NORMA Project

The Project started in 1973 as a personal research interest and subsequently was funded by IBM, the UK Science Research Council, later the Science and Engineering Research Council. The members of the team who contributed to the research were Peter Mason, Paddy Mudarth, Susan Jones, Sandra Cook and Clare Tagg. Karl Althus is now funded by the Computer Board and Jim Backhouse is working on the NORMA semantic analysis methodology.

The project is a long term, fundamental research study of some key issues in Information Systems. They are:

1. How do we describe a social system as an information system with the maximum formal precision compatible with the intrinsically informal nature of social interactions?

2. How do we deal analytically with the problems of semantics that must be solved by the system analysts and designers with the users whenever a computer-based system is developed?

3. How can we improve the methodologies for analysing and specifying business requirements before the software engineering task is undertaken?

The research method has to study systems of legal, business and other social norms and to create a series of general languages to represent norms and specify norm systems. It is intended to provide a sound theoretical basis for work in systems analysis and information systems.

Goals of the Project

The work opens up the possibility of aiming at many important practical goals:-

P1 to devise a formalism for specifying business information requirements,

P2 to create a method of analysing information requirements including,

P3 a method for knowledge elicitation based upon a procedure for semantic analysis,

P4 to apply these methods to the special task of drafting legislation,

P5 to produce an implementation of the formal language to function as a

prototyping language for computer applications,
P6 to create a nearly natural language for a 'semantic' database.

The Project produced three versions of the legally oriented language, LEGOL, and implemented two of them. The latest version of the formalism NORMA a logic of norms and affordances is now being implemented. It incorporates solutions to many of the theoretical issues investigated and should serve as a basis for tools to attack the interesting practical problems. Some ninty papers have been produced by the group. A historical development of the LEGOL project can be found in LEGOL Paper, L40 by Stamper et al (1980).

Appendix 6.1 Semantic Schemas of Ontology Charts

Figure 6.1B The framework of the research group
Affordance name: institution (universal)
Antecedent 1: state
Antecedent 2: -
Authority start: legal provisions such as Acts of Parliament or Charters of a state.
Authority finish: state or the board of directors of an institution.
Start: when an agent's application for the establishing an institution is legally binding.
Finish: when the authority of the state withdraws its legal sanction or an agent ends the existence of an institution.

Affordance name: group (universal, part-whole of an institution)
Antecedent 1: institution
Antecedent 2: -
Authority start: an agent such as as executive committe.
Authority finish: an agent.
Start: when an institution or its official makes provision for setting up a group or delegates its authority and resources to a group.
Finish: when the institution decides to withdraw its support and resources from a group.

Affordance name: mission (universal)
Antecedent 1: group
Antecedent 2: -
Authority start: the chairman of a group or its members.
Authority finish: the chairman of a group or its members.
Start: when a group agrees to adopt a certain outline of long-term goals.
Finish: when a group decides to terminate or change its goals.

Affordance name: task (universal; a part-whole of mission)
Antecedent 1: mission
Antecedent 2: -
Authority start: a group or the chairman of the group.
Authority finish: a group or the person responsible for the task.
Start: when a person agrees to do his task.
Finish: when a person completes his task or decides to stop doing it.

Affordance name: allocates (universal)
Antecedent 1: person
Antecedent 2: task
Authority start: a group or chairman of the group
Authority finish: a group or its chairman.
Start: when the responsibility of a task has been given to a person.
Finish: when the responsibility of a task is accepted by a person.

Affordance name: membership (universal; role name: member)
Antecedent 1: person
Antecedent 2: group
Authority start: an agent or a chairman of a group.
Authority finish: an agent or its chairman.
Start: when a person has been accepted to join the group.
Finish: when a person resigns from the group or is dead or retired, or when a person has been expelled from a group or when the group ceases to exist.

Affordance name: employs (universal; role name: employee, employer)
Antecedent 1: person
Antecedent 2: institution
Authority start: an authorised official or a committee of an institution.
Authority finish: an authorised person or committee.
Start: when a person has been accepted to work in an institution.
Finish: when a person resigns from his job or is expelled by the employer, or he

is dead or retired, or when the institution ceases to exist.

Affordance name: topic (universal)
Antecedent 1: community
Antecedent 2: -
Authority start: an agent.
Authority finish: an agent.
Start: when an agent makes public its knowledge such as bibliographic tools.
Finish: when the agents who are responsible for such knowledge cease to exist or their knowledge of sign-types is lost.

Affordance name: relates (universal)
Antecedent 1: topic
Antecedent 2: task
Authority start: an agent.
Authority finish: an agent.
Start: when a person finds that a topic enables him to do his task.
Finish: when a person changes to a different task.

Affordance name: specialises (universal)
Antecedent 1: person
Antecedent 2: topic
Authority start: a person
Authority finish: a person
Start: when a person begins to study a topic with certain depth.
Finish: when a person changes to study other things or ceases to exist.

Figure 6.2A The relationship between a person and work
Affordance name: publication
Antecedent 1: agent
Antecedent 2: work
Authority start: an agent

Authority finish: an agent
Start: when an agent makes his work public or available to others.
Finish: when an agent stops making his work available to the public.

Affordance name: document (sign-token)
Antecedent 1: agent
Antecedent 2: -
Authority start: an agent (role name: author, writer, creater)
Authority finish: an agent
Start: when an agent writes, inscribes or prints his work in some material form.
Finish: when an agent destroys or discards the document.

Affordance name: represents
Antecedent 1: document
Antecedent 2: work
Authority start: an agent
Authority finish: an agent
Start: when an agent sanctions the validity of a document.
Finish: when an agent withdraws that document from the public domain.

Affordance name: copyright
Antecedent 1: work
Antecedent 2: -
Authority start: Copyright Act (1956)
Authority finish: Copyright Act (1956)
Start: when the work is published in some form.
Finish: fifty years after the year of publication or after the year of the author's death.

Affordance name: ownership
Antecedent 1: agent
Antecedent 2: copyright

Authority start: Copyright Act 1956.
Authority finish: Copyright Act 1956.
Start: after the publication of a work or on the date that a copyright is transferred to a person.
Finish: the date of expiry according to the provision of copyright law or a contract.

Affordance name: subscribes
Antecedent 1: agent
Antecedent 2: publication
Authority start: an agent
Authority finish : an agent
Start: when an agent's application to receive a publication is accepted by the publisher.
Finish: when an agent withdraws or stops the subscription, or publisher ends the subscription.

Figure 6.3B The management of works
Affordance name: selects
Antecedent 1: person
Antecedent 2: copy
Authority start: a person
Authority finish: a person
Start: when a person examines a work according to certain criteria.
Finish: when a person makes a decision on that work.
Criteria: a person selects works according to a set of rules whether implicit or explicit such as the criteria of relevance.

Affordance name: copy
Antecedent 1: work
Antecedent 2: -
Authority start: a person

Authority finish: a person
Start: when a person produces work in some material form such as a duplicate.
Finish: when the material representation of a work is destroyed or discarded.

Affordance name: keeps
Antecedent 1: person
Antecedent 2: copy
Authority start: a person
Authority finish: a person
Start: when the person acquires a copy of a work.
Finish: when the person discards a copy of a work.
Criteria: the person keeps a copy of work according to the established criteria of relevance.

Affordance name: distributes
Antecedent 1: person
Antecedent 2: copy
Authority start: a person
Authority finish: a person
Start: when a person prepares copies of work for despatching them to other agents.
Finish: when a person hands over copies of work to the authorised distributers.
Criteria: the distribution can be based on a subscription or on requests.

Affordance name: withdraws
Antecedent 1: person
Antecedent 2: copy
Authority start: a person
Authority finish: a person
Start: a person takes a copy of work from its location.
Finish: a person returns a copy of work back to its location.

Affordance name: citation
Antecedent 1: work
Antecedent 2: work
Authority start: a person
Authority finish: a person
Start: when a person refers to another's work in his writing.
Finish: when a person changes his reference to another's work.

Affordance name: opinion
Antecedent 1: person
Antecedent 2: work
Authority start: a person
Authority finish: a person
Start: when a person expresses his thoughts or comments on a work.
Finish: when a person changes his thoughts on a work.

Figure 6.4B The relationship between a person and external agents
Affordance name: collaborates
Antecedent 1: an agent
Antecedent 2: an agent
Authority start: an agent
Authority finish: an agent
Start: when the two different agents decide to work together on a certain project or to exchange ideas and results.
Finish: when an agent decides to end his collaboration.

Affordance name: familiarity
Antecedent 1: an agent
Antecedent 2: an agent
Authority start: an agent
Authority finish: an agent

Start: when a person acqiures the knowledge about an agent's work or his research interest.
Finish: when a person who has this knowledge ceases to exist.

Affordance name: conference
Antecedent 1: agent
Antecedent 2: -
Authority start: an agent such as executive committee or a board of director.
Authority finish: an agent
Start: when an agent officially opens a purposeful gathering.
Finish: when a conference is declared close.

Affordance name: includes
Antecedent 1: conference
Antecedent 2: work
Authority start: an agent
Authority finish: an agent
Start: when a person' work is made public at a conference.
Finish: when the reading of a person's work is completed or brought to an end.

Affordance name: attends
Antecedent 1: person
Antecedent 2: conference
Authority start: an agent
Authority finish: an agent
Start: when a person has registered at a conference.
Finish: when a person departs from the conference.

Figure 6.5B The relationship between an address and agent
Affordance name: Post-Office
Antecedent 1: Community
Antecedent 2: -

Authority start: an agent
Authority finish: an agent
Start: when an agent gives the authority necessary for opening a post-office.
Finish: when an agent withdraws the authority vested in a post-office.

Affordance name: place
Antecedent 1: Community
Antecedent 2: -
Authority start: an agent
Authority finish: an agent
Start: when an agent builds a dwelling construction such as a house or an office or a block of flats.
Finish: when the established dwelling construction is demolished or destroyed.

Affordance name: address
Antecedent 1: an agent or the post-office
Antecedent 2: -
Authority start: an agent or a post-office official
Authority finish: an agent or a post-office official
Start: when the number and name of a street in which a house or a place of dwelling have been assigned by the post-office authority.
Finish: when there is a change in the number and name of the street or there is a change in the reconstruction of the location.

Affordance name: assigned
Antecedent 1: address
Antecedent 2: place
Authority start: an agent or the post-office official
Authority finish: an agent
Start: when an agent allots a number, street name and post code to a place.
Finish: when an agent invalidates or changes the established address of a place.

Affordance name: has
Antecedent 1: person
Antecedent 2: address
Authority start: an agent
Authority finish: an agent
Start: when a person moves into a dwelling place.
Finish: when a person no longer exists or changes his dwelling place.

Affordance name: located-at
Antecedent 1: person
Antecedent 2: place
Authority start: a person
Authority finish: a person
Start: when a person is staying at a place such as his house or office.
Finish: when a person departs from the place where he could be reached.

Affordance name: telephone company
Antecedent 1: Community
Antecedent 2: -
Authority start: an agent
Authority finish : an agent
Start: when an agent receives the necessary authority or permission to open a telephone company.
Finish: when that authorisation is withdrawn or the company goes into liquidation.

Affordance name: telephone
Antecedent 1: Community
Antecedent 2: -
Authority start: an agent
Authority finish: an agent
Start: when an agent knows where a telephone can be found.

Finish: when an agent removes the telephone or the existence of a telephone is not known by anyone.

Affordance name: owns
Antecedent 1: person
Antecedent 2: telephone number
Authority start: an agent or the telephone company
Authoroity finish: an agent
Start: when a person subscribes to the telephone company.
Finish: when a person withdraws his subscription to the telephone company or the telephone company withdraws its service.

Affordance name: telephone number
Antecedent 1: a telephone company
Antecedent 2: -
Authority start: a telephone company
Authority finish: a telephone company
Start: when a person has been asssigned a set of numbers for telecommunication.
Finish: when the telephone company decides to withdraw the telephone number from a person or when that person terminates his contract with the telephone company.

Affordance name: given-to
Antecedent 1: telephone number
Antecedent 2: telephone
Authority start: an agent
Authority finish: an agent
Start: when an official allots a set of numbers to a telephone.
Finish: when an official withdraws a given set of numbers from a telephone or when a person gives up his right to that set of numbers.

Affordance name: contactable-on
Antecedent 1: person
Antecedent 2: telephone
Authority start: an agent
Authority finish: an agent
Start: when a person succeeds in connecting a telephone line to a destination.
Finish: when the telephone company ends the validity of that the telephone number or the telephone company accepts the customer's request for ending his contract of the service.

Figure 6.6B The relationship among a person, funder and sponsor
Affordance name: funds (role name: funder)
Antecedent 1: an agent
Antecedent 2: an agent
Authority start: an agent or a funder
Authority finish: a funder
Start: when a funder gives financial support to an agent.
Finish: when a funder withdraws the financial support or when the funding contract has expired, or the receiver ends the contract.

Affordance name: sponsorship (role name: sponsor)
Antecedent 1: an agent
Antecedent 2: an agent
Authority start: a sponsor
Authority finish: a sponsor
Start: when an agent agrees to give sponsorship to another.
Finish: when the sponsor withdraws the sponsorship or the term of a sponsorship has expired or the receiver ends the contract.

Figure 6.7 The anticipation of future research
Affordance name: interests
Antecedent 1: person

Antecedent 2: topic
Authority start: a person
Authority finish: a person
Start: when the person pays attention and spends time and energy or effort to understand or know a topic of knowledge.
Finish: when the person ceases to exist or when he changes his attention or effort from that particular topic.

Affordance name: anticipates
Antecedent 1: person
Antecedent 2: interests
Authority start: a person
Authority finish: a person
Start: when a person tries to speculate about or ascertain future trend or development of the topic in which he has an interest.
Finish: when a person ceases to exist or changes his attention to other activity.

Figure 6.8 The communication between agents
Affordance name: signs
Antecedent 1: agent
Antecedent 2: -
Authority start: an agent
Authority finish: an agent
Start: when an agent acquires or learns about the use of some systems of systems of signs such as a language.
Finish: when an agent ceases to exist, or loses the ability to use signs or a language to convey his intention.

Affordance name: communication act
Antecedent 1: agent
Antecedent 2: signs
Authority start: an agent

Authority finish: an agent
Start: when an agent uses his knowledge of signs to communicate his intention.
Finish: when an agent ceases to exist or ends the process of communication.

Figure 6.9B The responsibility of an information manager
Affordance name: resources (part-whole of an agent)
Antecedent 1: an agent or an institution
Antecedent 2: -
Authority start: an agent
Authority finish: an agent
Start: when an agent or institution acquires or makes available the tools for the operation of an organisation such as a building, computer systems.
Finish: when as institution closes down or when it decides to dispose of its resources.

Affordance name: manages (role name: manager)
Antecedent 1: agent
Antecedent 2: resources
Authority start: an agent
Authority finish: an agent
Start: when a person or executive committee assigns the responsibility of management to a person.
Finish: when an agent resigns from the responsibility or is dead or when the authorised agent terminates the contract.

Appendix 6.2 The Incorrect Versions of Ontology Charts

In Figure 6.1A, the affordance 'task' is incorrectly placed as ontologically dependent upon 'group'; a task can exist witout a group but a task is determined by the mission of a group. Therefore, 'task' is a part of 'mission'. Consequently, the antecedents of 'relates' should be 'task' and 'topic' in order to represent the relationship between a topic and 'task'. The other incorrect representaion is that of 'specialises' which should be dependent upon the existence of a person and topic. The allocation of a task is made to a person who is also a member of the group; the term 'allocates' is used to replace 'allocated' so as to make it consistent with other affordances. The correct version of this chart can be found in Figure 6.1B.

In Figure 6.2A, it is obvious that 'person' and 'institution' can be replaced by the universal term 'agent' which can be used to represent a specific person or institution. The initial investigation of ontological dependency of 'work' reveals that it needs not depend on an agent as the author of a work can stop to exist while his work is still available in various libraries. As 'version' is a particular term of a work so it should be represented in a regtangle under 'work'. A copyright can be owned by or transferred to another person, the affordance 'ownership' which depends on an agent and a copyright is added to this chart.

As the representation of 'version' is corrected so the affordance 'publishes' has to be corrected accordingly; it is replaced by 'publication' in Figure 6.2B. The affordance 'subscribes' also depends on an agent and 'publication'. Two additional affordances of 'document' and 'represents' are added to the chart as a result of an initial semantic analysis of work. A work can be represented in various forms, for example, as a drawing, a book or a painting. The term 'document' can be used to include all types of work tokens.

Figure 6.1A The Framework of the Research Group

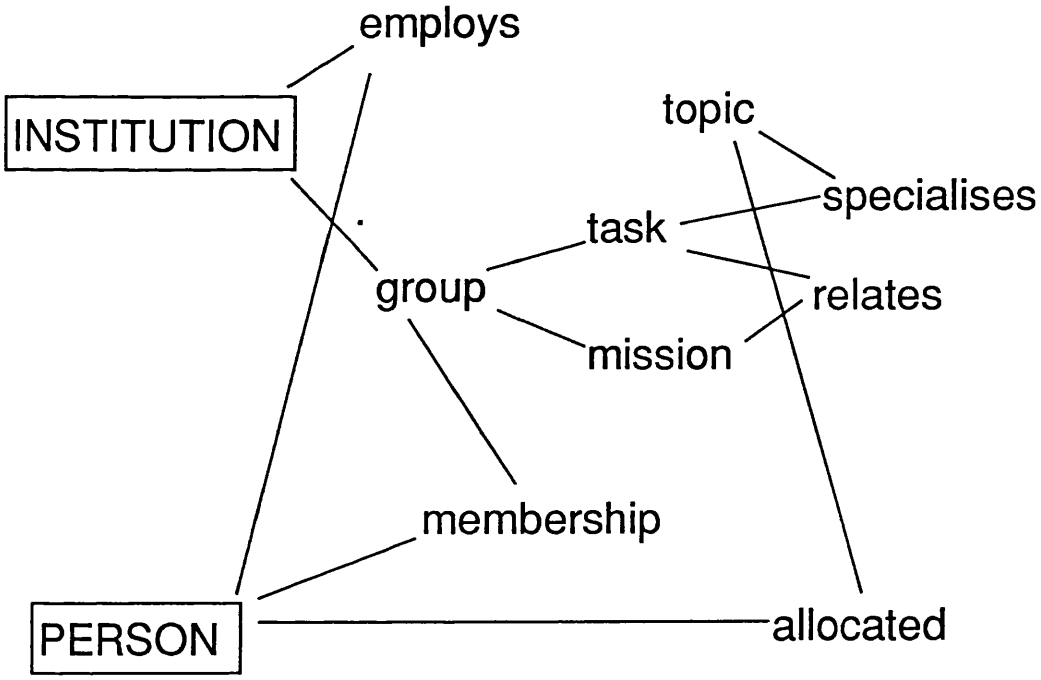


Figure 6.2A The Relationship between a Person and Work

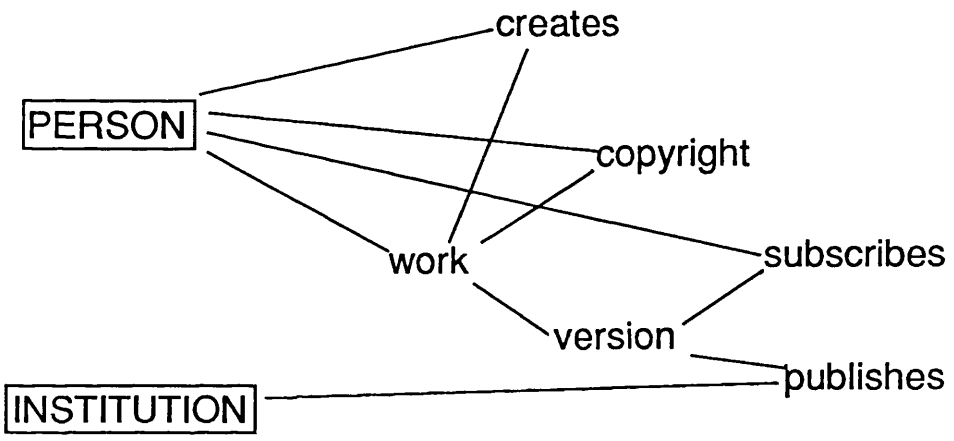
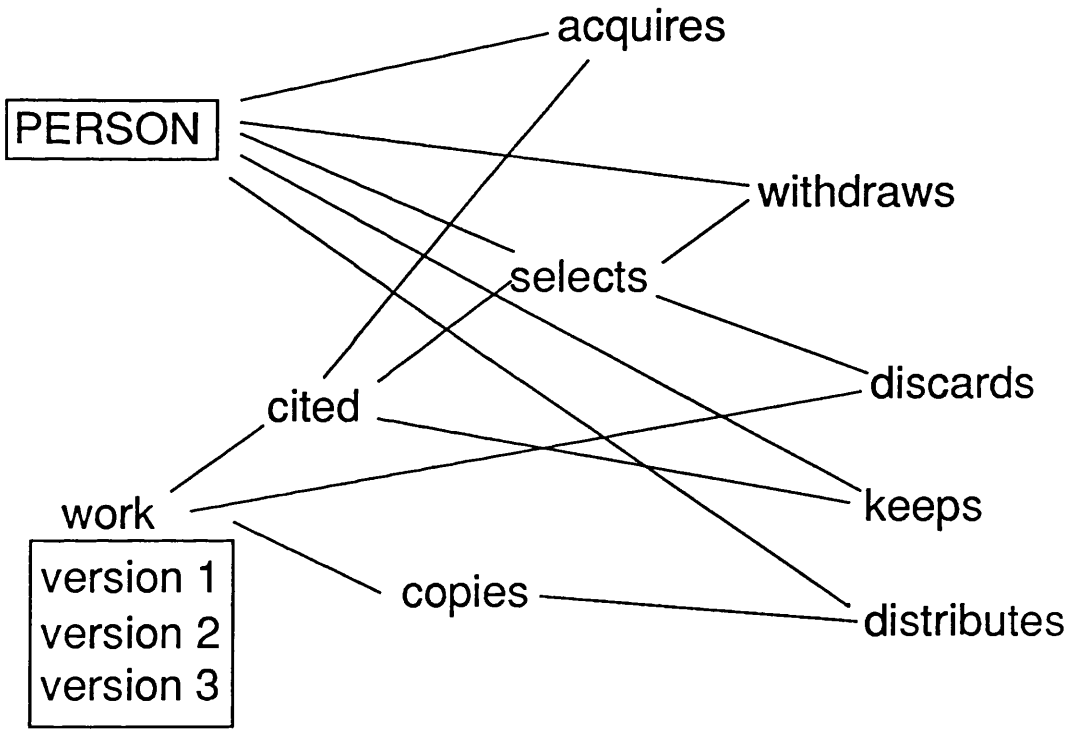


Figure 6.3A The Management of Works



In Figure 6.3A, the first incorrect relationship is that of 'cited' which must depend on the existence of two works, the one citing the other. The initial semantic analysis indicates that 'citatiòn' is a better term to employ in order to make the relationship of two works clearer; 'citation' is represented by using two parallel lines to indicate the same type of antecedents. The affordance 'citation' does not depend on 'person' because the writer can cease to exist while the cited work is still available.

The other incorrect relationship is the dependence of 'selects' on the existence of a citation. Although a work can be selected on the basis of citation, there are other reasons for choosing a work, for example, the surprise value or the innovative ideas. Therefore, citation is only one of the criteria for selecting a work.

The sign-token of 'work' which is 'copies' is also changed to 'copy' which is generic term that includes several copies of a work and the reproduction of a work such as in photocopies. The affordance 'selects' depends on the existence of a person and 'copy' of a work. Similarly, the keeping of a work depends on the existence of an agent or person and that work; the keeping of a work can also depends on reason other than citation.

After keeping a work for a period of time, a person or an information manager may decide that it should be withdrawn or discarded from the library for various reasons. But, the term 'discards' is the ending of the act of keeping a work while the term 'acquires' is the start of 'keeps'. On the other hand, the affordance 'withdraws' does not depend on 'selects', for example, books can be withdrawn for the purpose of repairing, making photocopies, or consultation.

The affordance 'opinion' is added to Figure 6.3B to represent the activity taken by an agent such as an information manager when he cannot decide whether an article is relevant for selection.

Indirectly connected with this aspect is the activity of distributing or sending copies of published work such as reporst to people on the mailing list or enquirers. The antecedents of 'distributes' are the existence of 'copy' and 'person'.

Figure 6.4A The Relationship between a Person and External Agents

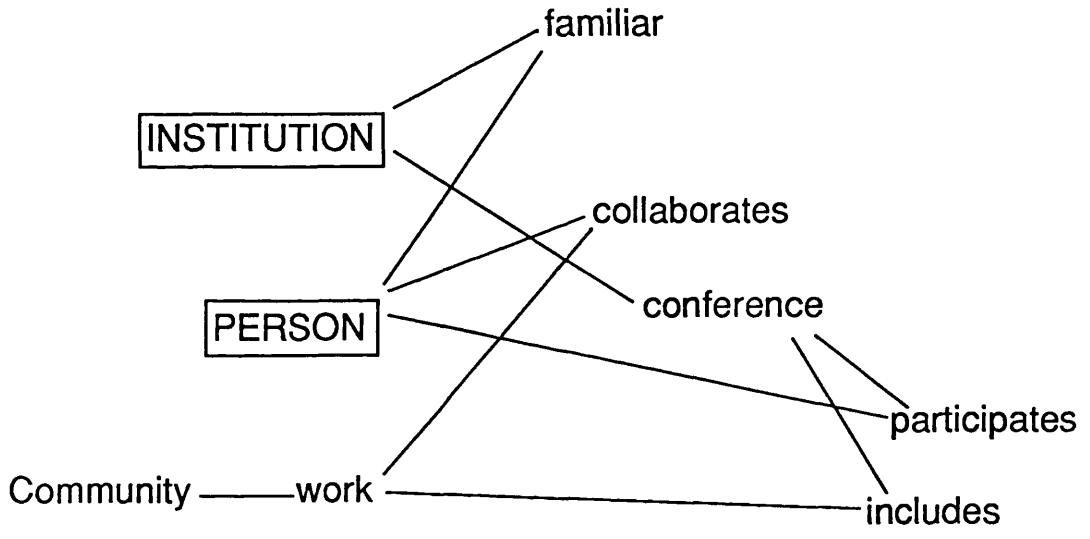
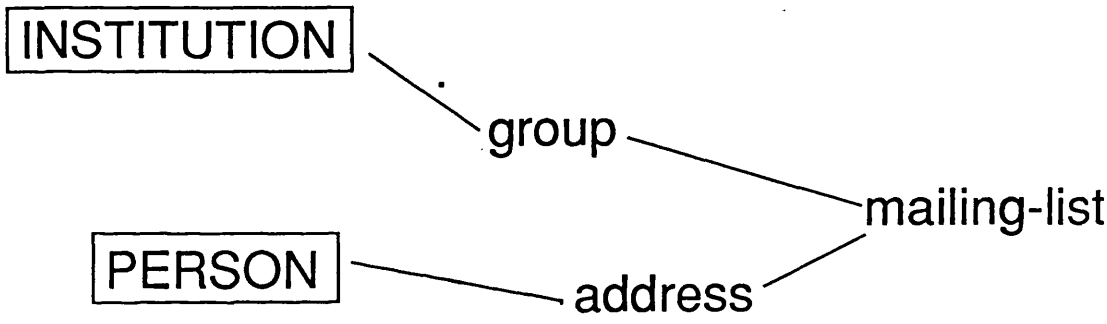


Figure 6.5A The Relationship between an Address and a Person



In Figure 6.4A, the affordance 'collaborates' is incorrectly represented, as a collaboration depends on some agents agreeing to work together or merely to exchange ideas. Therefore, the antecedents of 'collaborates' are 'agent' which is represented by two parallel lines in Figure 6.4B. In addition, the generic term 'agent' is better for representing both an institution and a person in this context. The terms 'familiar' is replaced by 'familiarity' and 'participates' is replaced by 'attends' in Figure 6.4B.

In Figure 6.5A, the first incorrect representation is that of an address which is shown to be dependent on a person. An address depends on the authority or agent who assigns numbers and names to houses and streets. The representation of telephone numbers is missing; there may be a different authority for assigning telephone numbers so that we cannot assume that 'address' includes telephone numbers. Further, the term 'mailing list' is a role name for the knowledge of people's addresses and telephone numbers.

Figure 6.6A The Relationship among a Person, Funder and Sponsor

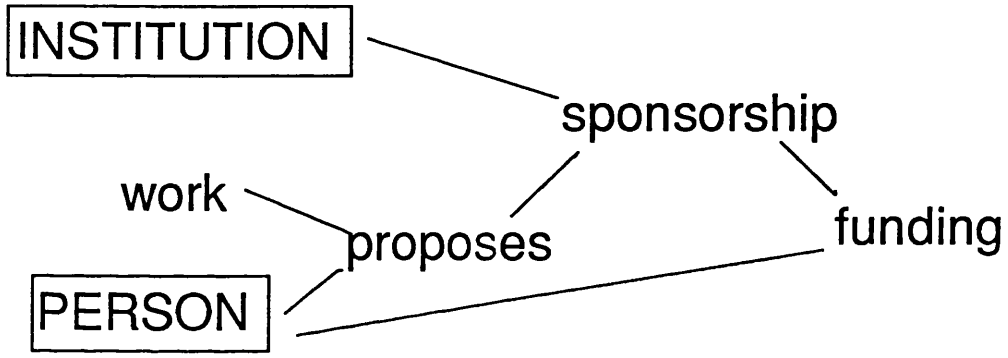
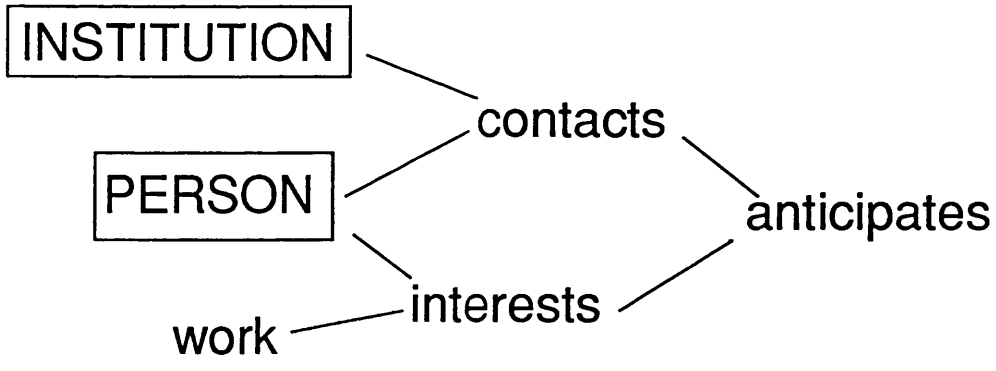


Figure 6.7A The Anticipation of Future Research



In Figure 6.6A, the pattern of affordances involved in acquiring a sponsorship and financial support for the work of a researcher. The existence of a sponsorship is reflected as depending on an institution and a proposal of a research work. The funding is available as a result of the agreed sponsorship.

But a closer investigation reveals that this chart is based on causal relationship rather than ontological dependency. A sponsorship does not necessarily depend on the researcher's proposing a project; and 'proposes' is the procedural aspect involved in the substantive aspect of sponsorship. In addition, a funding does not always depend on 'sponsorship' as a funder can only give the financial support without the sanction of moral support of a sponsor. On the other hand, a sponsor may only lend his name and status without any funding. So, the correct version of Figure 6.6B represents 'funds' and 'sponsorship' as being depending on the same type of antecedents.

In Figure 6.7A, the causal relationships are quite explicit in that 'contacts' are available as a result of the existence of an institution and a person; contacts are seen as an antecedent of 'anticipates'. The other antecedent of 'anticipates' is the interest a person has in certain works. But 'contacts' is a role name for people with whom researchers has been in communication. The antecedent of 'interests' are an agent and 'topic' which is a more appropriate term as a person may not be interested in any particular work but in some vague or new topics.

Figure 6.8A The Communication between Agents

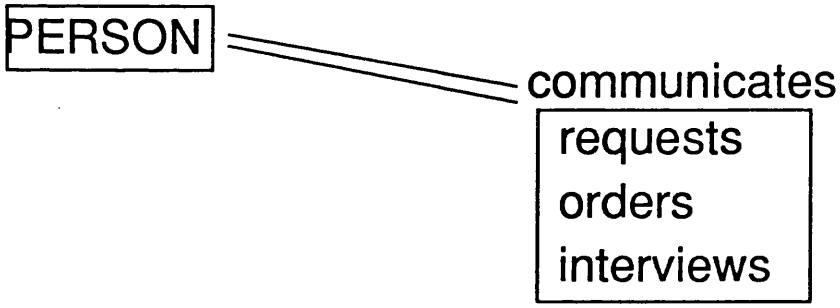
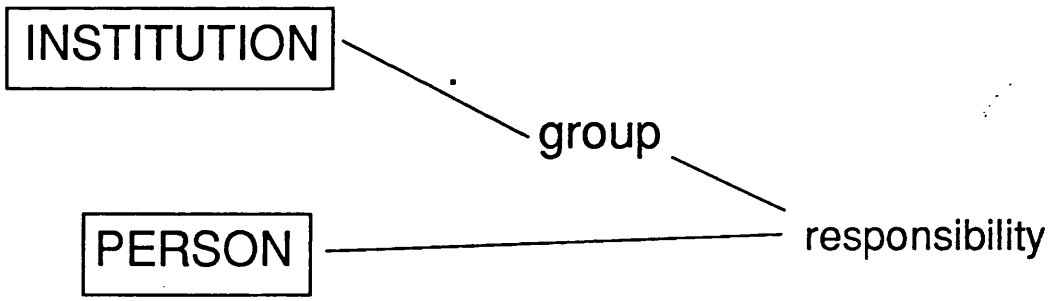


Figure 6.9A The Responsibility of an Information Manager



In Figure 6.8A, the communication between two persons are represented by the affordance 'communicates' being dependent on the 'person'. This chart can be improved by using the generic term 'agent' in order to include all types of communicators such as a legal person or a corporation. The term 'communicates' is replaced by 'communication act' which makes explicit that we perform certain acts of communication such as the perlocutionary acts in getting things done or the illucotionary in delivering a statement. On this basis, the affordance 'signs' must be added to this chart to reflect a person's dependence on the ability to use signs in communication.

In Figure 6.9A, a group is a part of an institution so that the affordance 'responsibility' depends on the existence of 'group' and 'person'. This representation is incorrect in that it does not account for the object of responsibility or management. Therefore, the affordance 'resources' which is a part of a complex agent is added to Figure 6.9B; the term 'manages' which reflects a comprehensive task of a responsible agent in this context is used to replace 'responsibility'.

Appendix 6.2 The Incorrect Versions of Ontology Charts

In Figure 6.1A, the affordance 'task' is incorrectly placed as ontologically dependent upon 'group'; a task can exist witout a group but a task is determined by the mission of a group. Therefore, 'task' is a part of 'mission'. Consequently, the antecedents of 'relates' should be 'task' and 'topic' in order to represent the relationship between a topic and 'task'. The other incorrect representaion is that of 'specialises' which should be dependent upon the existence of a person and topic. The allocation of a task is made to a person who is also a member of the group; the term 'allocates' is used to replace 'allocated' so as to make it consistent with other affordances. The correct version of this chart can be found in Figure 6.1B.

In Figure 6.2A, it is obvious that 'person' and 'institution' can be replaced by the universal term 'agent' which can be used to represent a specific person or institution. The initial investigation of ontological dependency of 'work' reveals that it needs not depend on an agent as the author of a work can stop to exist while his work is still available in various libraries. As 'version' is a particular term of a work so it should be represented in a regtangle under 'work'. A copyright can be owned by or transferred to another person, the affordance 'ownership' which depends on an agent and a copyright is added to this chart.

As the representation of 'version' is corrected so the affordance 'publishes' has to be corrected accordingly; it is replaced by 'publication' in Figure 6.2B. The affordance 'subscribes' also depends on an agent and 'publication'. Two additional affordances of 'document' and 'represents' are added to the chart as a result of an initial semantic analysis of work. A work can be represented in various forms, for example, as a drawing, a book or a painting. The term 'document' can be used to include all types of work tokens.

Figure 6.1A The Framework of the Research Group

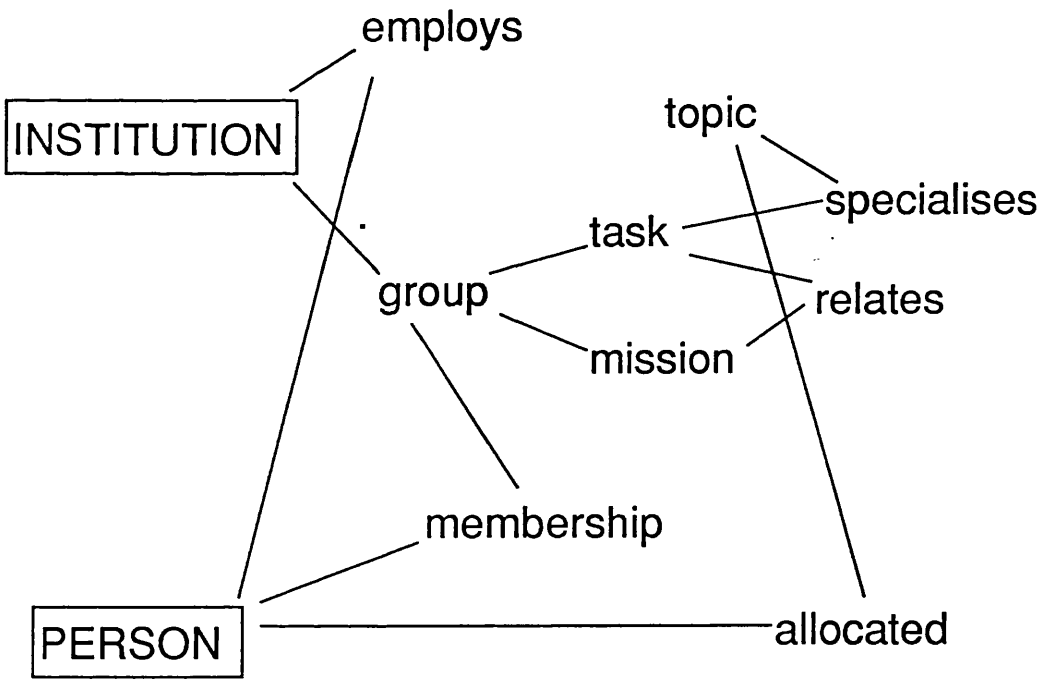


Figure 6.2A The Relationship between a Person and Work

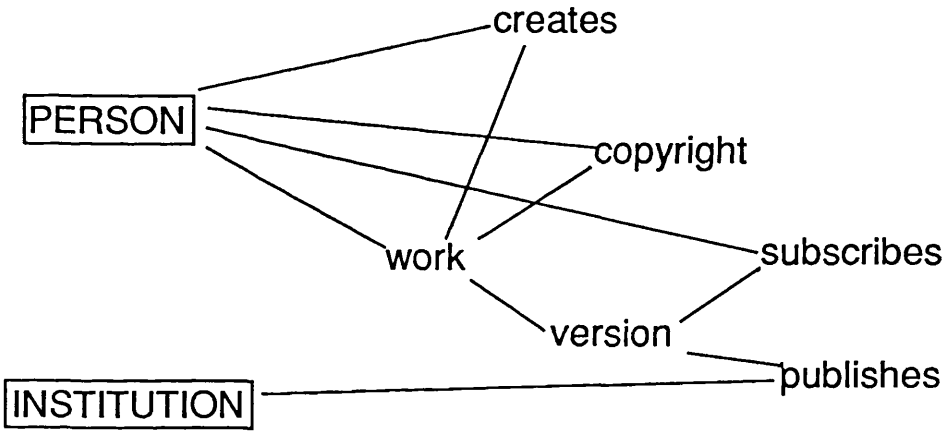
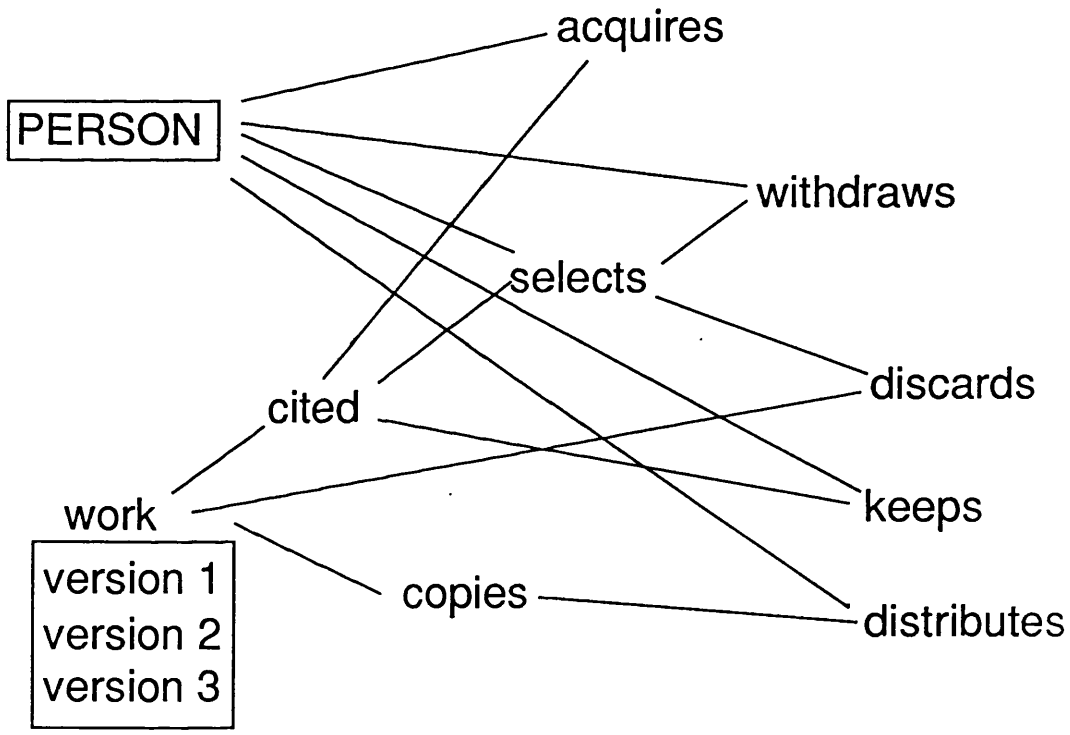


Figure 6.3A The Management of Works



In Figure 6.3A, the first incorrect relationship is that of 'cited' which must depend on the existence of two works, the one citing the other. The initial semantic analysis indicates that 'citation' is a better term to employ in order to make the relationship of two works clearer; 'citation' is represented by using two parallel lines to indicate the same type of antecedents. The affordance 'citation' does not depend on 'person' because the writer can cease to exist while the cited work is still available.

The other incorrect relationship is the dependence of 'selects' on the existence of a citation. Although a work can be selected on the basis of citation, there are other reasons for choosing a work, for example, the surprise value or the innovative ideas. Therefore, citation is only one of the criteria for selecting a work.

The sign-token of 'work' which is 'copies' is also changed to 'copy' which is generic term that includes several copies of a work and the reproduction of a work such as in photocopies. The affordance 'selects' depends on the existence of a person and 'copy' of a work. Similarly, the keeping of a work depends on the existence of an agent or person and that work; the keeping of a work can also depends on reason other than citation.

After keeping a work for a period of time, a person or an information manager may decide that it should be withdrawn or discarded from the library for various reasons. But, the term 'discards' is the ending of the act of keeping a work while the term 'acquires' is the start of 'keeps'. On the other hand, the affordance 'withdraws' does not depend on 'selects', for example, books can be withdrawn for the purpose of repairing, making photocopies, or consultation.

The affordance 'opinion' is added to Figure 6.3B to represent the activity taken by an agent such as an information manager when he cannot decide whether an article is relevant for selection.

Indirectly connected with this aspect is the activity of distributing or sending copies of published work such as reporst to people on the mailing list or enquirers. The antecedents of 'distributes' are the existence of 'copy' and 'person'.

Figure 6.4A The Relationship between a Person and External Agents

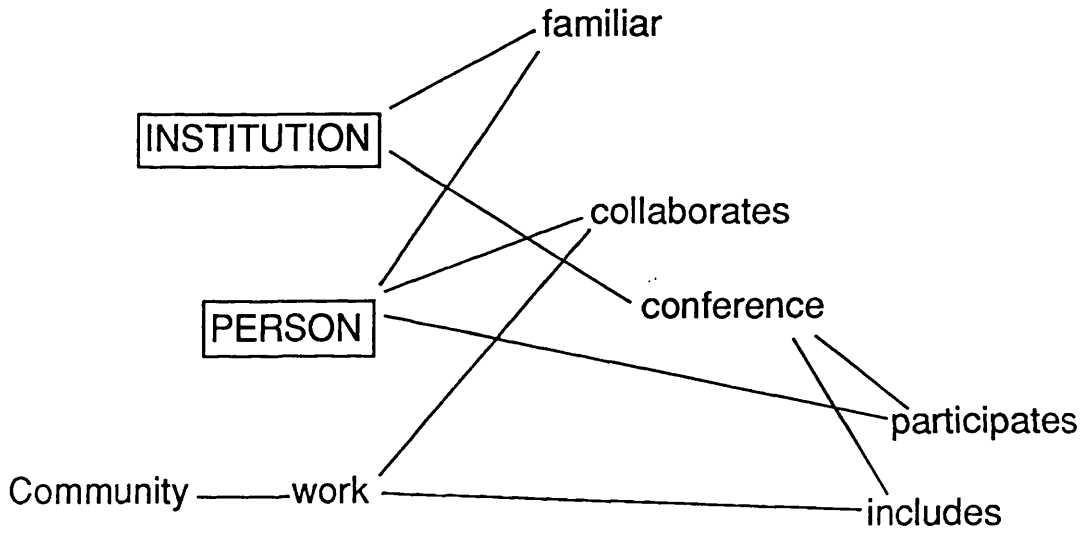
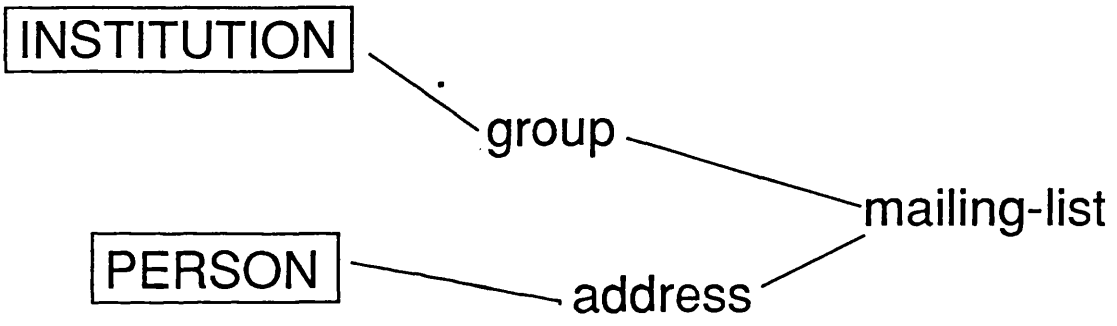


Figure 6.5A The Relationship between an Address and a Person



In Figure 6.4A, the affordance 'collaborates' is incorrectly represented, as a collaboration depends on some agents agreeing to work together or merely to exchange ideas. Therefore, the antecedents of 'collaborates' are 'agent' which is represented by two parallel lines in Figure 6.4B. In addition, the generic term 'agent' is better for representing both an institution and a person in this context. The terms 'familiar' is replaced by 'familiarity' and 'participates' is replaced by 'attends' in Figure 6.4B.

In Figure 6.5A, the first incorrect representation is that of an address which is shown to be dependent on a person. An address depends on the authority or agent who assigns numbers and names to houses and streets. The representation of telephone numbers is missing; there may be a different authority for assigning telephone numbers so that we cannot assume that 'address' includes telephone numbers. Further, the term 'mailing list' is a role name for the knowledge of people's addresses and telephone numbers.

Figure 6.6A The Relationship among a Person, Funder and Sponsor

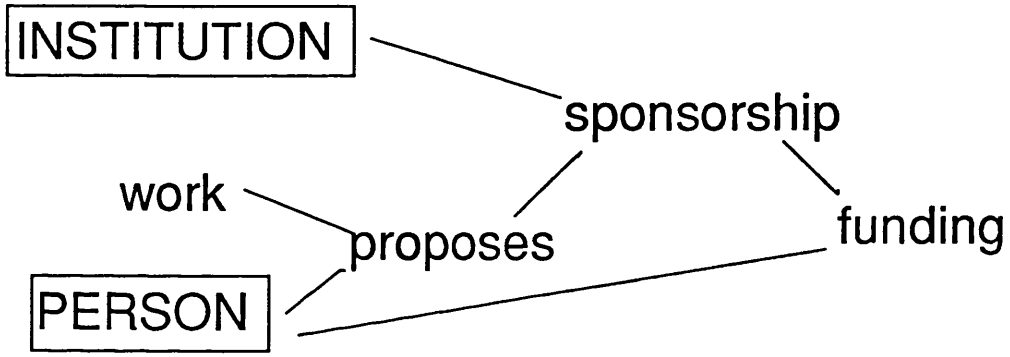
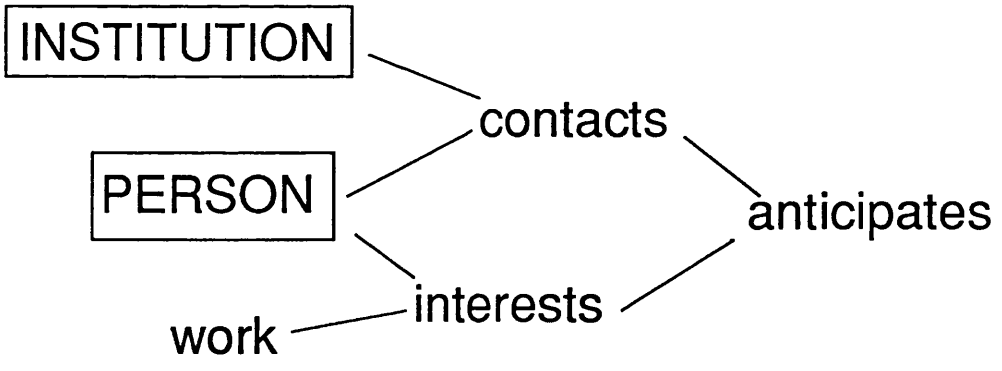


Figure 6.7A The Anticipation of Future Research



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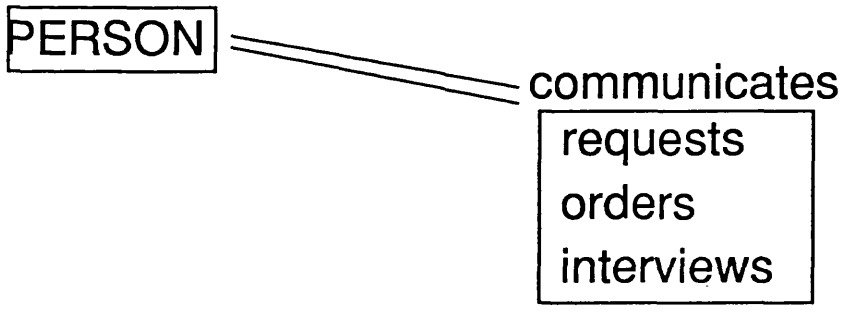
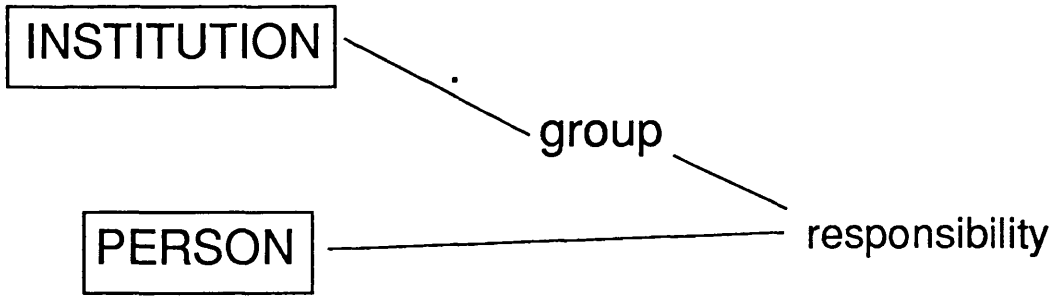


Figure 6.9A The Responsibility of an Information Manager



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Appendix 7.0 An Example of Questionnaire

Please answer the following questions which will be help in creating the profile of your research interests.

Your name:

1. Please describe the topics of your present research work, for example, thesis title, topics of work or project titles.

Date of the start of this work:
Date of the finish of this work:

2. What are the philosophies or assumptions of your research work?

3. Please supply a bibliography indicating the range of authors and topics which are related to your research.

4. Please supply the names of institutional contacts and their addresses which are not indicated by the bibliography you have supplied.

5. Please supply details of conferences which are relevant to you or which you have attened (e.g. list of partipants, etc.)

6. Please list the tools which you use in your work, e.g. software, hardware, methodologies, etc.

7. Please indicate which the method of your research work.

....theoretical
....mathematical model
....experiments
....surveys
Others (please describe):

8. What do you feel need to be gathered for you as background materials which will help you anticipate the development of your research work in the future?

Date: Signature:

Appendix 7.1 Replied Questionnaire by Ronald Stamper

Please answer the following questions which will help in creating the profile of your research interests.

Your name: Ronald Stamper

1. Please describe the topics of your present research work, e.g. thesis title, topics of work or project.

LEGOL/NORMA/MEASUR
Analysis and design methodology
Epistemology
Non standard logic, especially of action
Information management
Computers and law

Date of the start of this work: 1965
Date of the finish of this work: end of Ronald.

2. What are the philosophies or assumptions of your research work?

Subjectivist view of reality
Practical use is (in long run may be) essential to meaning and value of results.

3. Please supply a bibliography indicating the range of authors and topics which are related to your research.

Please see ref. lists of more recent publications.

4. Please supply the names of institutional contacts and their addresses which

are not indicated by the bibliography you have supplied.

INSEC research group under Sernadas, Lisbon.

5. Please supply details of conferences which are relevant to you or which you have attended, e.g. list of participants, etc.

6. Please list the tools which you use in your research, e.g. software, hardware, methodologies, etc.

Vax Station
RDB

7. Please indicate which is the method of your research work.

....theoretical
....mathematical model
....experiments
....surveys
Others(please describe):

8. What do you feel need to be gathered for you as background materials which will help you anticipate the future development of your research work in the future?

Date: 14 June 1988 Signature: Ronald Stamper

Appendix 7.2 Replied Questionnaire by Jim Backhouse

Please answer the following questions which will help in creating the profile of your research interests.

Your name: Jim Backhouse

1. Please describe the topics of your present research work, for example, thesis title, topics of work or project titles.

Semiotics and information
The use of semantic analysis in information systems
Formal languages in specification work.

Date of the start of this work: 1987
Date of the finish of this work: 1989?

2. What are the philosophies or assumptions of your research work?

Systems are social systems
Signs are used in the communication of intentions.

3. Please supply a bibliography indicating the range of authors and topics which related to your research.

Winograd, Flores, Stamper, W. Kent, Barwise & Perry,
G. Lukacs, E.F. Codd (Dec. 1979, ACM on Databases), Fodor, Schank and in the supplied bibliographies.

4. Please supply the names of institutional contacts and their addresses which

are not indicated by the bibliography you have supplied.

S.R.L., B.C.S.

5. Please supply details of conferences which are relevant to you or which you have attened, e.g. list of partipants, etc.

Rome 'Computers in Law' May, 1988.
IFIP CRIS -September, 1988.

6. Please list the tools which you use in your research, e.g. software, hardware, methodologies, etc.

Wordperfect, Norma

7. Please indicate which is the method of your research work.

/...theoretical
...mathematical model
/...experiments
/...surveys
Others (please describe):

8. What do you feel need to be gathered for you as background materials which will help you in anticipating the development of your research work in the future?

Semantics and Information Systems (integration of materials)

| |

Linguistics.....Computers

Date: 14/12/1988 Signature: JB.

Appendix 7.3 List of Boxes of Materials in the Library

1. Some boxes have the following labels:
Offprints
Q/Grey lit.
Current Teaching
LSE Papers in Informatics
Legol Monthly Reports and Bulletins
LEGOL/NORMA Project Papers
RKS Papers for Distribution
Lee & Ronald
Esprit Papers
Alvey Papers
Publishers' Blurb
Bibliographies
IFIP Conference : Human Choice and Computer Reports
Neddy

2. Several boxes have been alphabetically labelled and numbered.
3. Journals are classified into boxes.
4. The majority of the boxes have the label Q/Grey lit. which contain materials waiting to be organised and classified.

Appendix 7.4 List of Journals and other References in the Library

Journals:

A I Magazine(an official publication of the American Association for Artificial Intelligence)

Business Computing

Communications of the ACM

Computer Age

Computer Bulletin

Computer Journal

Computing Reviews

Computing Surveys(ACM)

Computers and Law

'Current Law' Statutes Annotated

International Journal of Management Science

Datamation

Ergonomics

IBM Journal of Research and Development

IFIP Newsletter

Information & Management (the international Journal of Information Systems Applications)

Information Privacy (integrity,availability,security), vol.1, no.1,1978 included an article by Ronald Stamper 'The Meaning of Privacy'

International Journal of Information Management

Journal of Information Technology

Journal of the Association of Computing Machinery

Journal of Law and Information Service (1 copy)

Management Education and Development

Management Informatics

Questioning Exchange(1 copy)

Sigplan Notices (a monthly publication of the Special Interest Group on Programming Language)

Social Epistemology
Social Sciences Information Studies
Telecommunications Policy
Transactions on Database System

Other References:
A Catalogue of Artificial Intelligence Tools:Spring 1983.
Alvey Conference Report.
Alvey Directorate Infrastructure Policy.
Alvey News Supplement.
Alvey Programme Annual Reports.
Artificial Intelligence in Project Support(Brian Phillips,Jeff Staley and Eric Gold: Computer Research Laboratory, Tektronix,Inc).
BCS Newsletters (Specialist Group on Expert Systems, The Knowledge enginerring review).
Datafair 73 Conference Papers on Scientific Research Paper.
Esprit Information Exchange Systems News(ICS news).
IBM Research Reports.
IFIP Working Group 8.3(Working Conference on Knowledge Representation for decision Support Systems).
Information E Diritto(International Bibliography on Computer and Law).
INFOTECH State of the Art Report.
Information Processing 77(North-Holland).
IEEE Technical Papers(Institute of elactrical and Electronics Engineers).
NEDO 's Reports (Software Engineering and CADMAT:a guide to collaborarion research initiatives and new developments).
NCC Reports.
Proceedings of the ACM-Sigplan Symposium on the ADA Programming Language (Sigplan Notices,vol.5,no.11,1981).
Proceedings of the Eighth International Joint Conference on Artificial intelligence (1983).
Proceedings of the Sixth International Conference on computer

Communication: 'Pathways to the Information Society' (1982).
Proceedings of the second workshop on Architectures for large knowledge Bases(sponsored by the Alvey Directorate).
Proceedings Research AREA review Meetings on 'Intelligence Knowledge-Based Systems' and Reports(SERC).
Reserach Papers of the Department of Artificial Intelligence, University of Edinburgh.
Publication list: Artificial Intelligence in Medicine Group (University of sussex, School of Engineering and Applied science).
Reports of the Msc. students at LSE (ADMIS).
Reports from the Intergovernmental Conference on Strategies and Policies for Informatics.
Rutherford Appleton Laboratory Reports.
SYSLAB reports.
Imperial Research Fund Laboratories: Reports.
Medical Research Council(MRC) Reports.
The Principles of Linguistic Philosophy (a book by F. Waismann)
Butterworths Yellow Tax handbook 1981-82 (a Butterworth Taxbook Annual).
Consumer Credit Act 1974.
Income and Corporation Taxes Act 1970.
Tolley's Income Tax 1981-82(66th edition).
Select Committee on Science and technology (A Sub-Committee).
Working Papers of the Decision Analysis Unit, LSE. ('Methods and Tools for Structuring and Analysing decision problems' by P.C. Humphreys and A.D. Wisudha).
Working Papers of the United Nations(The Application of Computer Technology for development).
Working Papers:interim reports of the International Institute for Aplied Systems Analysis (Data and Language in Organisations: Epistemological Aspects of Manegement Support Systems by R.M. Lee,1983).

Appendix 7.5 List of Discarded Documents

NCC Report (Systems Analysis), 1967.
SYSLAB's list of report, 1983.
ICERD's report on Microelectronics, 1983.
A quanity of off-prints marked 'withdrawn' from the BLPES.
Organisational Structure and Technology by D. Gerwin, 1974.
Implementation Considerations in Electronic Mail by W.E. Ulrich, 1979.
Structured Ananlysis for DB Design by T.R. Finneran, 1977.
A General Model for Integrity Control, ICI Technical Journal, 1978.
The Production of Better Software, EDP Analyzer, 1979.
A Methodology for the Design of Logical Database Structures by I. Mijares, 1976.
IBM,ICL: the OS Future, a special report, 1982.
The Behavioural Side of MIS by G.W. Dickson and J.K. Simmons, 1970.
Research Report: The Design of a Canonical Data Model with Local Interfaces, 1979.
Face to File Communication by B. Christie, 1981.
The Future of Computer Communications by V.G. Cerf and A. Curran, 1977. (Datamation)
Computer Databases: the future is now, by R.Nolan, Harvard Business Review,1973.
Research Review, NCS DCT, 1981.
Abstract Formaulation of Data Processing problems,by J.W. Young, 1958.
Keeping Ahead of the Computer, by B.Nevitt, 1978.

Appendix 7.6 List of Topics which are Out-of-Date Rapidly

Data Base Reliability, Integrity and Control
Data Security
Data Structureand Organisation
Data Processing
Manual for Computer
Man-Computer Communication/ Interaction
Model of Human Performance
Office Automation Systems
Organisation and Management of Computer Systems
Techniques and tools in Data Base Designs
Technological development and application of development tools
Telecommunication Systems

Appendix 7.7 The Design of Updating Forms for Monitoring the Mailing List

The principles of semiotics applied in the design of questionnaire can also be applied to the updating form. This form can range from the very simple to demanding design depending on its purpose. A simple form must elicit the minimum feedback from recipients: the confirmation of their names and addresses, and the wish to remain on the mailing list.

A more complicated form can be designed to create the profile of each recipient. Therefore, it has to asked the following questions:

-name and address

-present position and institution's address

-topics of research or areas of expertise

-list of recent publications (if possible)

-recommendation of names to be added to the mailing list

-the wish to remain on the mailing list

The form should be designed with the consideration of the ease in returning it to the information manager. Some of the commercial design of using self-address card seems viable for a simple form. For a more demanding design, the provision of self-address envelop is more appropriate.

Another design can incorporate other features or services available to readers. For example, the possibility of subsribing to newsletters or bulletins, a request for a list of published reports which are for sale to readers, and the request for readers' comments can be included in the form. In addition, appropriate speech acts such as date line for sending in the form can be used to induce a quick reply.

The design of the updating form will depend on the purpose and cost-benefit consideration of the group. For a group with a large public interest, there may a need for two types of mailing lists. One list is for those who are closely related to the group's work such as other researchers, governmental bodies and sponsors. These recipients should receive more comprehensive publications about the work of the group such as annual reports, working papers. The other mailing list is for new recipients whose names have been

added on an experimental basis as their interests in the group have not yet been confirmed. They should receive a general report or leaflet about the research group. This may stimulate those who are seriously interested in the group to contact the information manager.

Appendix 7.8 The Cultural Impacts of an Information System

0. Interaction (main impact): the interaction between the information manager and users occurs on both formal and informal levels, for example in the formal documentation of profiles and informally via the pragmatic mechanism for monitoring changes in relevance criteria.
Secondary impacts:
01. The information manager acquires an important role of supplying relevant information and managing the information system for the users. The prestige of the research group increases as their works are recognised by the public.
02. The opportunity of gaining financial support, sponsorship on particular projects.
04. The information centre becomes the focus of communication among users and the information manager.
05. There will be an increase in the work load for the information mamager as more people become interested in the works of the group. There will be a need to set up a schedule for monitoring formal feedback from users and updating the mailing list.
06. The information manager has to continually learn about users' information requirements and their interests by informal communication.
07. The information manager facilitates the tasks of the users and free them from administrative tasks which gives them more time for creative intellectual pursuits.
08. The information system provides highly relevant information to support the work of the group. The probability of being informed of any new development and intelligence will also be increased.
09. The use of computers for online database retrieval, and other telecommunication network, including the use of management skill in affecting an effective information system.

1. Association (main impact): the sense of cohesion within the group will become stronger and so does the sense of its mission.

Secondary impacts:
10. The contact with other groups and institutions in the field will be more wide spread.
11. The recognition of the research group's contribution by other groups within the institution and within the community.
112. There will be an increase in the operating costs as more people become interested in the work of the group, or request to be on the mailing list.
12. The works of the group may attract funding and published reports can become a source of income for the group.
14. The awareness of other groups which are interested in the same area of work.
19. The use of the information centre by the group will cause a strain on the information manager's workload. There is a need for consistently maintaining the information system.

2. Subsistence (main impact): The availability of relevant information enable the group to accomplish their tasks. The maintenance of an effective information system may create extra financial burden on the group.
Secondary impacts:
20. The contacts with relevant people and institutions can be beneficial to the group financially.
22. The need to employ an agent to be responsible for the maintenance of an effective information system.
24. The information centre becomes the fundamental basis of working effectively.
27. The users gain more satisfaction from having adequate and efficient support from the information manager.
271. The information manager has the satisfaction of being in charge and has the responsibility for the information system.
29. The use of information as a resource becomes an increasingly important factor in the operation of the group.

4. Territoriality (main impact): the devision of space into an information centre which becomes the territory of the information manager. Different areas in the library are classified for different purposes.
Secondary impacts:
41. The responsibility of managing the information centre has to be assigned explicitly.
44. The use of space in the information centre to formally and informally to convey different types of messages to users and to monitor their feedback.
45. The location of the information centre has to be convenient to users and stable.
46. Users get to know the locations of different types of information available in the information centre.
48. The demand for feedback may impose extra burden onto the normal working pattern of users.
49. There is the need to control the access of the information centre by outsiders. The issue of security has to be discussed if the centre contains highly confidential information.

5. Temporality (main impact): the information manager has to recognise the working pattern of users so that the fine tuning of the information system does not impose extra burden on the users.
Secondary impacts:
50. The updating of information on criteria for judging relevance becomes important in the workimg pattern of the community.
51. A new pattern of working relationship with the information manager has to be established in such a way that it does not interfere with the normal working pattern.
52. The research group may be commissioned by other agents to work on related research areas.
55. The publication of the group's works and news bulletin and communications with recipients will increase workload for the group as a whole during certain period of the year.

58. The communication with other agents will be affected by the working pattern such as conventional period for holidays, opening and closing times of institutions.
59. The mechanism for checking and controlling when certain things such as topics and agents are no longer relevant has to be explioted, for example, the finish of the relevance of a topic may depend on the completion of a report.

6. Learning (main impact): users learn about the different ways, both formal and informal, in which they can communicate their changing information need and relevant criteria to the information manager.
Secondary impacts:
60. The rules about the use of the information centres have to be acceptable to the users and easily applicable.
61. The group is informed about relevant conferences, meetings, seminars organised by other institutions by the information manager.
67. The use of imaginative ways to make users learn about the information available in the centre an enjoyable experience.
68. The existence of an information system and its manager helps to keep the group in touch with any surprising news in the field.

7. Play (main impact): the possibility that the information system and the information manager may become the source for information on recreational activities for the group on an informal basis such as sports competition between different institutions and clubs' meeting.
Secondary impacts:
70. A closer contact and collaboration among members of the group and other colleagues may lead to participation in recreational activities or sports club.
74. The information centre may become adopted as a place for coffee break and informal interactions.

8. Defense (main impact): The group is kept informed of up-to-date development in the field and its works are publicised to appropraiate audience.

Secondary impacts:
80. The information system must have some mechanism for monitoring the changes in the criteria of relevance within the group and for tuning the system to these changes.
81. The information manager has the task of ensuring that the group can work effectively and smoothly so that his role is highly appreciated.
82. The relevant sponsors are identified so that the group can seek financial support and collaborations.
84. The information centre becomes an important asset for the group.
86. The information manager must be regularly informed by users of their particular or urgent requirements of certain information and relevant feedback.
88. The creation of formal and informal mechanisms and rules for monitoring changes in relevance.
89. The acquisition of relevant publications and documents for the information centre and the use of computer databases for information retrieval.

9. Exploitation (main impact): the use of computers and databases to support the information system, and the informal interactions between the information manager and users become an important basis of monitoring the changing criteria of relevance.
Secondary impacts:
90. The rules for establishing criteria of relevance underline the feedback mechanisms used in the information system. The circulation of bulletins or research papers becomes the mechanism for communicating with relevant people.
91. The possibility of using computer networks for communicating with other agents.
92. The importance of relevant information as an economic resource is enhanced by the role of the information system and its manager.
94. The group's works are selected for circulation to the public and documents are selected according to criteria of relevance.
95. The recognition of the pattern of users' workload so that the request for

their involvement in tuning the information system can be initiated at the right time.

98. The information system and its manager plays an essential role in the progress of the group's mission.

99. The use of appropriate media for publicising the works of the group, such as interviews, public debates and documentary films.

Appendix 7.9 Samples of Pages from Research at LSE

ACCOUNTING AND FINANCE

An interdisciplinary perspective is adopted in much of the Department's research. One special concern is the interface between accounting, finance and economics, with studies of both a theoretical and empirical nature. Such work includes testing innovations in accounting using security price data. Research is being undertaken encompassing the measurement of the profitability, accountability and control of new financial instruments, particularly those encompassing options and future components. This involves research into the pricing and hedging of complex securities and financial risk management systems. These interests are complemented by major interests in the behavioural, organizational and societal facets of accounting. Indeed, *Accounting, Organizations and Society*, the key international journal in this field, is edited in the Department. Research into the historical development of accounting is also of interest to several members of staff. The research projects of the staff are such that they form informal and overlapping teams concerned with each of the Department's main fields of interest. Currently more stress is being placed on achieving a comparative and international perspective in research. A major objective of the Department is to continue to enhance and develop links with other universities, particularly those overseas.

Mr. Alnoor Bhimani Lecturer in Accounting and Finance	Accounting Techniques in the New Manufacturing Environment; Accounting and Control in French Companies; the Social Analysis of Accounting Systems
Dr. John L G Board Lecturer in Accounting and Finance with special reference to Information Technology	Efficient Capital Markets and Accounting Policy; Portfolio Selection Rules; Stock Market Integration; Political Business Cycles; Ill - Conditioning in Portfolio Selection
Prof. Michael Bromwich CIMA Professor of Accounting and Financial Management	Economics of Accounting Standards; Economic Aspects of Accounting Theory; Economics of Information & Organisations Management Control; Accounting for Price Changes; Management Accounting for High Technology Industries Other Expertise: The Accounting Profession; Pricing in Nationalised Industries; Corporate Strategy and Business Policy

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PUBLICATIONS BY MEMBERS OF STAFF CALENDAR YEAR 1988

N.B.: This is not an exhaustive listing.

ACCOUNTING AND FINANCE

Mr. Paul Bircher
'Company Law Reform and the Board of Trade, 1929-1943' (*Accounting and Business Research*, Spring 1988)

Dr. John L.G. Board
'The Weekend Effect in UK Stock Prices' *Journal of Business Finance and Accounting* (Summer 1988) pp14.
'Forced Diversification' *Quarterly Review of Economics and Business* (Autumn 1988) pp10.
'The Zoning Decision' *Educational Management and Administration* (Autumn 1988) pp11.

Prof. Michael Bromwich
'Current Accounting Theory and Practice in a Standard Setting Context in the United Kingdom' in A.G. Hopwood and Hein Schreuder (Eds.), *Accounting Research and Practice: European Perspectives* (Prentice-Hall and the Institute of Chartered Accountants in England and Wales, 1988)
(With A. Bhimani) 'Accounting for Just-In-Time Manufacturing Systems' (CMA, *The Management Accounting Magazine*, July/August 1988)
'Presidential Statement, Chartered Institute of Management Accountants, *Management Accounting* (July/August 1988) pp2
'Managerial Accounting, Definition and Scope from a Managerial Perspective', *Management Accounting* (September 1988) pp5.

Mr. James Haslam
'Towards a Marxian Theory of Accounting: A Comment' in A. Belkaoui (Ed.), *Accounting Enquiries* (Quorum Books, 1988)
'An Insight into Critical Accounting Studies in Japan: A Contribution to the International Discourse on Radical Accounting: A Comment' in *Proceedings of the Second Interdisciplinary Conference in Accounting* (University of Manchester, July 1988)
'The Aura of the Published Accounting Report in the Context of a Crisis Situation: Germany and Developments in the First World War', *Proceedings of the 2nd Interdisciplinary Perspectives in Accounting Conference*, held at the University of Manchester, June 1988 (with S. Gallhofer).
'Accounting Regulation in the FRG' in *op. cit.* (with S. Gallhofer, E.A. Lowe, D.J. Cooper, A.G. Puxty, K. Robson and H.C. Willmott).
'Discussants' comments on T. Oguri's "Radical Accounting Theory in Japan", in *op. cit.*

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EXTERNALLY FUNDED RESEARCH IN PROGRESS 1989/90

[Grants marked with an asterisk (*) were awarded in academic year 1988/89]

Name	Department	Title	£	Period
AIDS VIRUS EDUCATION AND RESEARCH TRUST				
Prof M Bloch	Anthropology	Female Prostitution in Britain and the Transmission of AIDS	44,000	01/08/86 31/07/89
ALFRED P SLOAN FOUNDATION				
*Dr J Hardman Moore	Economics	US/UK Economics: to Support the Establishment of a Conference and Publication Programme Involving Outstanding Young British and American Economists	56,800	06/12/89 31/12/91
*Prof R Layard	Centre for Labour Economics	Support for the European Unemployment Programme 1988-92 being Conducted by the Centre for Labour Economics	88,235	01/04/89 31/12/92
*Mr N Macrae	Philosophy, Logic and Scientific Method	Von Neuman Biography: to Enable Mr Macrae to Write a Biography of John Von Neuman	73,800	01/16/88 31/12/90
ANGLO-GERMAN FOUNDATION				
*Prof R Bennett	Geography	To fund a Conference to be Held in West Germany in Autumn 1989 on Local Economic Development Initiatives	13,700	01/09/89 31/10/89
Prof R Bennett	Geography	British and German Local Authorities and Economic Development: Similarities and Differences in Approaches to its Encouragement	41,883	01/04/87 31/03/89

THESES TITLES 1988

PhD

ANTHROPOLOGY

J F Carsten	Women, Kinship and Community in a Malay Fishing Village on Pulau Langkawi, Malaysia
Peter George Gow	The Social Organisation of the Native Communities of the Bajo Urubamba River, Eastern Peru
Eric Louis Hirsch	Landscapes of Exchange: Fuyuge Ritual and Society
Ying-Kuei Huang	Conversion and Religious Change among the Bunun of Taiwan
Euthymios Papataxiarchis	Kinship, Friendship and Gender Relations in Two East Aegean Village Communities (Lesbos, Greece)
Christopher Pinney	Time, Work and the Gods: Temporal Strategies and Industrialisation in Central India
Michael Sinclair	Brothers in Song: The Persistence of (Vlach) Gypsy Identity and Community in Socialist Hungary
Maila Katrin Vanessa	Women, Kinship and Economy in Rembau, Negeri Sembilan, Malaysia

ECONOMICS

Mat Alter	Methodology and Theory in Economics: Towards a History of the Austrian School of Economics
Orazio Pietro	Price Behaviour in Real and Financial Markets
Stephen Laurence Bazen	Minimum Wage Legislation: The Likely Impact on Earnings, Poverty and Employment in the UK
Dominique Marie Pierre Frecaut	Wages, Profits and Macroeconomic Performance
James Peter Fraser Gordon	The Economic Theory of Tax Administration and Taxpayer Compliance

INDEX OF NAMES

Note: The five sub-departments of the Department of Statistical and Mathematical Sciences are abbreviated as follows:

IS	*Information Systems*
OR	*Operational Research*
Maths	*Mathematics*
Pop	*Population Studies*
Stats	*Statistics*

SUBJECT INDEX

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