Cognitive orientation type as a source of individual differences in information processing.

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The introduction of technological change in the workplace has raised the question of how easily people can adapt to changes in paper-based information processing. The research assessed the suitability of the Myers Briggs Type Indicator (MBTI) for identifying individual differences in cognitive information processing style. Behavioural evidence for differences in information processing between the four types was obtained from the performance of forty subjects on a word association task, sorting and recall task, and from their perceptions of their cognitive sorting strategy. The Jungian-based personality inventory gave four cognitive orientation types. Each type was defined by two cognitive functions associated with characteristic ways of evaluating and organizing information. (People evaluated through Sensing or Intuition and organized through Thinking or Feeling). The cognitive functions were each associated with the processing of particular kinds of information. People who evaluated through the Sensing function found it easier to process concrete, object-specific information than Intuitive persons who were oriented to more abstract information. Intuitive people were characterized by more flexible information processing than Sensing persons and, consequently, the former are probably more adaptable to change. The same subjects organized information: if through Thinking, by emphasizing distinctive features and if through Feeling, by stressing shared features. Discernable differences were found between two types, Sensing-Feeling and Intuition-Thinking, whose cognitive processing tended to be independent of each other. The former had superior recall performance when compared with the other types; the latter had the poorest recall performance but the most original word association response style.

The results were discussed in terms of their significance for Jung's speculations as a cognitive theory of personality that links cognition and affect through the concept of cognitive orientation. The correspondence between Jungian personality concepts and aspects of cognitive style was discussed as well as the ease with which the different information processing types can adapt to change.

KEYWORDS.
MYERS BRIGGS TYPE INDICATOR (MBTI).
PERSONALITY, COGNITIVE MODELS OF
COGNITIVE ORIENTATION
INFORMATION PROCESSING (HUMAN).

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Chapter 1. Introduction.

1.1. The research problem defined.

The modern office is a physical setting for information processing activities and can be defined as a social environment whose functions are to control, co-ordinate and communicate information. These functions have been reflected in distinct trends in office design: the landscaped office -popular in the 1960's - was designed as an information processing centre whereas the automated office of the 1980's is intended for the organization of ever increasing amounts of information. The gradual automation of the modern office involves radical change at work and office workers are having to rethink the ways in which they process paper-based information.

Traditional understanding of what is involved in office work is being changed because of the introduction of new technology into the workplace. An 'office worker' is traditionally that person who processes paper-based information under the behavioural constraints imposed by the work organization. However, the term of 'information processors' may soon be preferable to that of 'office workers', particularly if Information Technology fulfils its promise of allowing customary office activities to be performed outside the traditional work environment.

Paper-based information is the chief physical resource of the modern office and can be physically moved from place to place. In the office, papers that are used often are kept near to the user and what is needed once is, in all probability, going to be needed again and again. As a result, frequently used files are kept close at hand but the physical limitations of the workspace restrict the number of items that can be kept, for example, on the desk. Most everyday cognitive processing uses only a small fraction of the available resources because, among other things, people fail to spontaneously retrieve and utilize all relevant information. An '80/20' rule-of-thumb has developed

that postulates that about 80% of information processing activities use only some 20% of the available information (Kenner, 1986). Likewise, without a suitable indexing system, people forget that much of the paper-based information they have collected even exists.

The sorting, categorization and retrieval of paper-based information are representative of the information processing activities carried out every day in the traditional office. There is an essential symmetry between the actions of storing and retrieving cognitive or paper-based information in that both attempt to clarify information (Jones, 1986). The general belief that paper-based information must be sorted and categorized so that it can be efficiently retrieved and communicated at a later date is complicated by the presumption of individual differences in the way information is processed. In most everyday situations, there is no best possible way to sort and categorize: instead, the processing style favoured by one person does not necessarily suit another. At this point it is convenient to define the research problem as that of investigating the suitability of one personality inventory, the Myers Briggs Type Indicator, as a tool for identifying differences between types of people in how they orient to and process paper-based information.

1.2. Personality at work.

There is an accumulating body of evidence that job conditions affect personality (Jackson and Schuler, 1985). There is another body of research that suggests that certain disciplines or occupations tend to attract a certain type of person (Holland, 1973). Problems can arise at work when there is a clash of personalities and particularly when the members of a team differ in their understanding of what are, or should be, team goals and how to achieve them. So, in the hypothetical example of a cross-disciplinary research team, there will probably be a number of conflicting or

complementary personality types present. The individual members differ in their perception of the ultimate goal and what information they will use to achieve that goal. Consequently, each will process information differently and reach different conclusions. This potential source of conflict between group members can be reduced if individuals are prepared to re-evaluate their ideas in order to see the worth of the others point of view. Alternatively, people re-evaluate the relative worth of their own ideas and recognize that some of their thoughts should be discarded as worthless or irrelevant. Information as a commodity in the workplace is discussed in the next section.

1.3. Information in the workplace.

Office information is a resource that needs structuring. In a conventional office, the processing and organization of information is usually initiated and controlled by a person sitting at a desk. Information in use at the time or frequently referred to is typically kept on the desk in heaps. The desk is the control point of the office in the sense that it organizes, filters, integrates, and helps the person to find and remember paper-based information. It has the additional functions of acting as a workspace, as a temporary storage area for materials being processed, and as a convenient area for the access of office equipment.

The existence of information does not necessarily mean that it will be used (Stonier, 1983). People with a common goal do not necessarily use the same information with the same frequency to achieve their ends. Information needs are said to arise when existing physical resources or cognitive structures are inadequate. However, the term 'information *needs*' seems to imply a passive, rather than an active, model of man, causing some authors to prefer the expression 'seeking information to satisfy the needs' (Wilson, 1985).

In order to cope with rapid technological change, people need continually to update

their cognitive representations of their work and, in addition, they need further instruction to modify their preferred ways of working and mode of processing information. There is fierce competition to develop software programmes for the lucrative office market that minimize the need for users to change their personal style of information processing. The analogy between the way information is sorted, categorized and retrieved at the conventional desk and by the computer has become an important theme in software research and development. For information to have broadly the same meaning, all the people using it must process it according to the same principles and office efficiency may suffer if they do not and if misunderstandings arise. In so far as people show distinct and consistent preferences for certain ways of categorizing office information, they can be said to have distinctive cognitive styles.

1.4. Cognitive information processing.

Personality, or the structure of cognition, manifests itself through characteristic modes of mental functioning. Information can be defined in the light of information processing models of personality as a stimulus capable of altering the cognitive structure of the receiver (Paisley, 1980).

The construct of 'cognitive style' can be defined as a cognitive manifestation of personality which mediates between stimulus and response and accounts for information taking on psychological meaning. The preferred 'style' of sorting paper-based information soon becomes a habit and, reinforced by experience, may become a capacity. When cognitive style operates in response to the needs of the workplace or to the intellectual demands of the job, it can be termed 'workstyle'. There are claims (Matczak, 1980) that, during the period of adaptation to changing work conditions, the importance of individual differences in shaping workstyle is temporarily

weakened. This does not change the overall need for the evaluation of intellectual strategies and skills in light of alleged changes in the nature of work.

1.5. Adaptation to change.

People have to cope constantly with changing work conditions and need to update their cognitive representation of the world to do this. It seems fairly obvious that people's ability to adapt to new technology is largely determined by their attitudes or frame of mind (Abler and Sedlacek, 1987). The same types of problems tend to be encountered when introducing any type of change to the workplace and there are a number of interesting similarities between the problems encountered during the introduction of both the landscaped office in the 1960's (White, 1983) and the automated office in the 1980's (Rubin, 1983) such as common concern over opportunities for supervision of staff or the impact of the new environment on communications.

Any failure to adapt to change at work can be partly attributed to the way in which the physical environment is organized to support that work. The Steelcase National Study of Office Environments (Harris and Associates, 1978) showed that many office workers viewed the physical setting as a major impediment to their personal efficiency. There are many problems in trying to understand the conflict between resources and demands, both physical and human, not least the fact that evaluation studies are often concerned with finding ways of increasing levels of productivity (Harris and Associates, 1980) rather than with discovering areas of *personal* importance to office workers.

Individuals have typically been expected to adapt themselves to their surroundings and the difficulties faced by people in having to orient themselves to change were observed in the open-plan office by Quinan, Clayton, Alessi, Mandel and Brill

(1982). They usually learn to *cope* with a difficult environment but this can be both an effortful and stressful process. Alternatively, they may try to avoid the problem of adaptation altogether, for example in the case of the person who likes variety and so avoids self-selecting himself into a routine job. People who believe that they cannot cope with their work, perhaps because of feelings of lack of control, are more vulnerable to stress (Broadbent, 1985). Among office workers, this kind of problem can be partly attributed to a mismatch between the demands of work and the preferred cognitive style of the people concerned and, in particular, to the overload of the cognitive processing system. The person may have to reorganize his or her cognitive strategies to cope with, or master, change and the demands of processing unfamiliar information.

1.6. Conclusions.

The introduction of new technology in the workplace is an example of the sort of difficult or ambiguous setting for which personality becomes an increasingly important determinant of behaviour (Mischel, 1977). We can postulate a relationship between personality and information processing and suggest that the ways in which people chose to sort and organize paper-based information can be regarded as one aspect of their personality. Personality itself can be regarded as a dynamic interrelated whole with inbuilt values, expectations and attitudes which manifests itself through cognitive style.

Organizing information confers stability. The idea that the achievement of stability by the most economical means possible is the primary aim governing human behaviour is a widespread one and is found in psychology and related disciplines (Zipf, 1949). Stability contributes to the overall survival of the organism which, when facing a complex and uncertain world, must learn to perceive the consistencies in a pattern if it is to maintain organization and so reduce the effort necessary for the fulfillment of its

plans. Paper-based information must be organized in such a way that it can be accessed at a later date with the minimum of time and effort because papers that cannot be found have no use. The following chapters discuss some of the differences between people in their cognitive processes for the categorization of paper-based information.

Chapter 2. Sorting paper-based information.

2.1. Introduction.

The modern office should be designed to support the processing and organization of information (Rubin, 1983) because utilizing information is the most important thing that office workers do (Mintzberg, 1975). To many people, the office is simply a place to work, but it is also a place to access information, its main functions being to stabilize, control, co-ordinate and communicate organizational goals by using informational resources.

The modern office is, in a sense, a consequence of limited human information processing abilities. The cognitive processing analogy is particularly appropriate for describing the functioning of the office, in that the generation, communication, processing and organization of paper-based information. The individual, who is responsible for the conduct and initiation of each process, also acts as a fundamental constraint on the system. He or she can be conceptualized as a nodal point in the communications channel, producing, processing and distributing data at a 'workstation'. The workstation is the physical 'checkpoint' in the systems channel where a machine or person contributes to the further transformation of information. The office environment has been defined as a set of variables affecting messages into, within, and outside any organization (Taylor, 1981). There is also discussion in the literature of an 'information environment' (Goldstein, 1980) which is the physical area in which papers and documents are organized, where the location of paper-based information in relation to the worker reflects the relative importance of the former to the latter. Figure 1 shows a schematic representation of the information environment of a typical office worker.

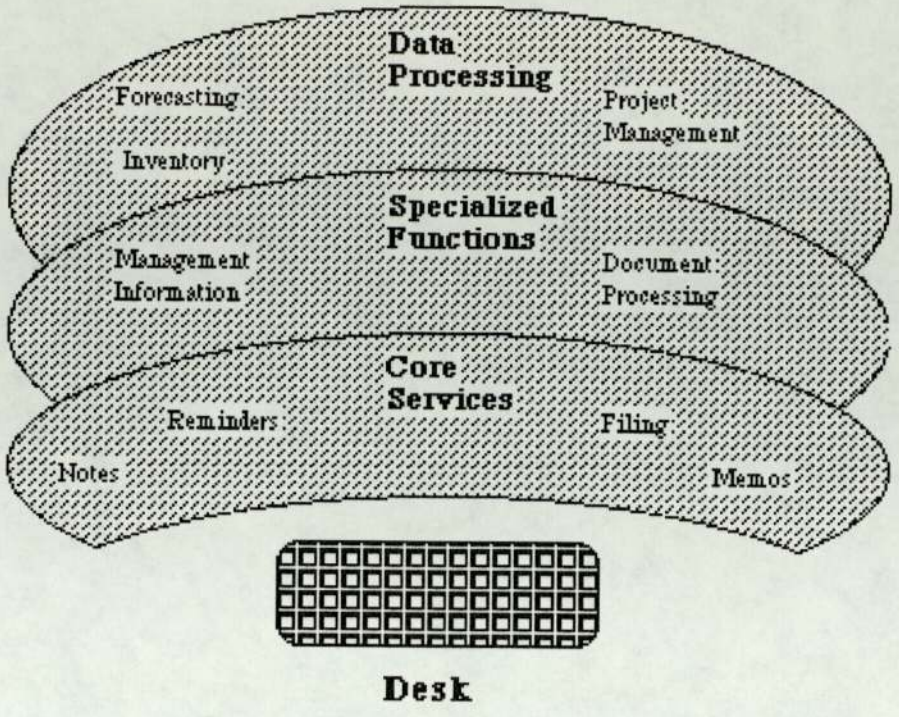


Figure 1. *Schematic representation of interface between desk (or workstation) and information environment. (Adapted from Blair, 1978.)*

The design of the workstation inevitably influences the flow and organization of information. If, for example, the workstation takes the form of a cellular office with clearly delineated spatial parameters, then the occupant has a clearly defined personal space and is able to 'spread out' without interfering with the work of others. It has been estimated (Hodges and Angalet, 1968) that about half of the paper-based information needed to meet most job requirements is kept physically close to hand, for example, in the piles that accumulate when office workers have the opportunity to 'spread out'.

The resources of the physical environment can be used to support information processing activities. In the conventional office, the use of information repositories such as filing cabinets or in-baskets implies status and meaning for that paper-based information in the sense that a specific physical location has been selected for it.

Additionally, it is possible that people who make greater use of information repositories for the storage of paper-based information also perceive that information as more fixed in time and space, as 'orientation-free' or 'orientation-bound' (Takano, 1989). Sorting or categorizing items into files, piles or repositories is a physical procedure that is representative of information processing activities in the office.

2.2. Sorting information.

Computer programmers traditionally define sorting in the sense of putting things into ascending or descending order. Sorting involves finding patterns and grouping together facts or concepts sharing similar attributes and is thus the process of separating or arranging things according to class depending on the relative value of the items in question. That value can be a personal one or one mutually agreed upon by a group; at work, the standards of value tend to be imposed by the organization. Classification is the specific process of assigning values to items and, once an item has been classified, it can be assigned to the appropriate category (Sokal, 1977). Some items can be categorized more easily than others. Judgements concerning the similarities between items are more ambiguous and take longer than identification judgements (Ashby and Perrin, 1988) because the former require some sort of abstraction.

The tendency to categorize perceived similarities and to differentiate among stimuli in terms of many differentiated concepts or dimensions is called conceptual differentiation. Messick and Kogan (1963) identified two processes at work in sorting tasks. The first, conceptual differentiation, referred to the number of groups into which items were sorted and the second, compartmentalization, referred to the number of single items within each group or the breadth of categories. Office 'piles' are categories which are relatively unstructured whereas 'files' are more hierarchical.

Having to sort paper-based information into files encourages the processing of similarities (McDaniel, Einstein and Lollis, 1988). In contrast, sorting into piles serves to emphasize the distinctiveness of each item (Lui and Brewer, 1983) but the content of individual items in piles tends to be remembered at the expense of their location (Winograd and Soloway, 1986).

By sorting paper-based information into categories, the person builds up a system that can be used for retrieving those same items later. In spite of various aids, retrieval is often a random process and the perceptual element remains important for finding things (Tenney, 1984). Instead of looking at the structure of information, some researchers (Cosier and Dalton, 1988) argue that we should talk instead about the effect on recall of levels of uncertainty inherent in the meaning of information. From this, it is clear that the identification and measurement of types and styles of information organization is a complex matter and the next section describes some of the difficulties inherent in doing psychological research on how people process paper-based information.

2.3. The identification and measurement of information sorting activities.

Information has to be sorted and ordered because of the vast amounts in circulation and because of the need for particular items of information to be accessed on demand. The difficulties involved in identifying and describing the organization, storage and retrieval of information are best illustrated by describing a near perfect example of an information environment - that of the library - where large quantities of paper-based information are organized according to a pre-existing classification system that is common to all environments of this type. The information is stored in a specified spatial location, so that it can be easily accessed, in its correct position, by all potential users including those unfamiliar with the library's physical layout. The stability of this

'ideal' organization system must then be contrasted with the rapid input and output of information in the office. The functions of the office make it difficult to develop a taxonomy that can be used to classify *all* information processing activities in *all* examples of this particular working environment.

The completeness of any research in the office must remain suspect if there is no agreement on the actual number of activities carried out in the typical office or what the functions of the office actually are. The different methodological approaches presumably explain the wildly differing estimates of the number of human functions carried out in an office. In most studies, it is not made clear whether the estimates were based on random sampling of activities or whether they included cognitive, social, procedural or physical activities. It could even be argued that much office work is imprecise, uncertain and therefore not even suited to classification. If that is the case, then we must discover the psychological meaning of those ambiguities. For example, the debate on what managers actually 'do' and on the extent of consciously motivated cognitive activity in achieving their goals is important for deciding whether their tasks and functions can be replicated by the computer (Uhlig, Farber and Bair, 1979). Mintzberg (1975) is probably the most famous proponent of the hypothesis that managers do not reflect and systematically plan because their jobs involve a great deal of discontinuous activity and so there are no regular patterns in the ways in which they organize their work.

Difficulties in developing a taxonomy of paper-based processing activities are compounded by the fact that not all useful information is recorded on paper. For example, verbal communication is another efficient way of conveying information, particularly if it is of only temporary importance. Mintzberg argued that managers lock a great deal of knowledge in their minds this way and, because this information is not available on paper for all to use, it is irretrievably lost to the organization when the manager leaves his job. Difficulties in doing psychological research on how people sort and organize paper-based information are therefore compounded by the lack of

agreement between taxonomies of processing activities.

Taxonomies of sorting activities are concerned with 'what' information workers do, but taxonomies of people can help us to answer 'why' types of people sort in such a distinctive style.

2.4. Styles of organizing information.

People can be classified as belonging to a cognitive or personality type characterized by a distinctive style of evaluating and organizing information. One of the stated aims of new office technology is to improve the organization, and hence the retrieval, of paper-based information. However, the degree of organization that is actually perceived to exist depends on the cognitive structure of the information user. Wide ranging definitions of 'organization' are all linked by a common concern with structure, that is, with the patterned relations among elements (Puff, 1979). Results from previous research on information organization are generally consistent in identifying a highly formal and a relatively informal style of organization. For example, people with the formal style classify, note spatial arrangement and are unmoved by personal feelings; those characterized by the informal style prefer disorder, note meaning and are 'person-oriented' (Gittins, 1965).

Malone (1983) drew the terms 'filing' and 'piling' from observations of paper-based offices to describe a structured and unstructured style of information organization respectively. Trying to explain how loosely structured piles come into existence, he argued that they are caused by the mechanical difficulties of creating files, the cognitive difficulties of classifying, the desire to be reminded and the wish to have frequently used information readily accessible. Despite this, attitudes towards piling as undesirable and inefficient seem to be widespread (Heimstra and McFarling, 1978). This is in spite of filing being a time-consuming process and the stress that it is

capable of causing the worker might cancel out any potential gains in efficiency. Cole's (1982) identification of two corresponding styles of office organization where items were either spatially organized (like piles) or categorically organized (like files) was based on the distinction between the schematic and categorical memory systems respectively (Mandler, 1979).

Ideally there should be some correspondence between the organization of the paper-based storage system and a persons cognitive processes, because no matter how sophisticated a filing system is, it is of very little help unless the user remembers the *what* or *where* of the desired item of information. We therefore come to a discussion of mental organization which has traditionally been entitled 'long-term memory' in psychology and is required as an aid to integrate the world and to discover new knowledge.

2.5. Recall of information.

People must be adaptable to the constantly occurring changes in everyday life (Bartlett, 1967) because, in a constantly changing environment, literal recall becomes quite unimportant. People do not have to experience every potential situation or environment to learn about it, but can use memory to transfer knowledge from one situation to another (Hunt, 1984).

Two types of memory storage systems have been identified, corresponding to the relatively structured and unstructured organization of paper-based information (Lui and Brewer, 1983). The more structured storage system corresponds to the abstract concept of 'categorical memory': organization is based on hierarchically arranged cognitive structures and both systems are for the retrieval of consistent or categorized information. The other storage system, for inconsistent or unexpected information, is more unstructured. In the office, the pile of papers is the classic example of this type of organization. People tend to remember the location of items in piles and the

contents of files (Cole, 1982). Problems arise when people decline to use a filing system and continually pile large amounts of paper-based information in the expectation that they can find an item by remembering its physical location (Malone, 1983). Unfortunately for them, frequently used paper-based information moves from one location to another within the office to such an extent that the spatial model used to locate and retrieve that information needs updating constantly.

The need for cognitive maps to find papers arises because memory for spatial location is not automatic. Cognitive mapping is the process of acquiring, mentally storing, assessing and using spatial knowledge and the maps themselves have been described as 'coathangers for associated memories', 'vehicles for recall' and a 'filing system' (Downs and Stea, 1977). The cognitive map is often conceptualized as a cartographic representation and, because of that, tends to be used exclusively in an environmental context. Neisser (1976) preferred the term 'orienting schema'.

There are two other postulated memory storage systems which must be mentioned in the context of retrieving paper-based information. Episodic and semantic memory are the means of indexing knowledge about things and events (Tulving, 1984). Semantic memory is the system whose function is essentially one of interpreting incoming stimuli as a basis for relevant action; thus 'learning' corresponds to a change in structure of semantic memory (Lockhart, Craik and Jacoby 1976). Episodic memory, on the other hand, holds copies of those interpretations, and thus corresponds to what is usually understood by the term 'memory'. The relationship between semantic and spatial memory for the organization of objects or items in memory has been investigated by Merrill and Baird (1987).

Some memory models (Craik and Lockhart, 1972) propose that the depth of processing is the main determinant of the durability of stored information. Recoding can be discussed as a creative process that depends on the ability to discover the similarities or differences in an environmental pattern. There are two broad styles of perceptual and memory coding - reductive and elaborative. An analogy can be drawn

between reductive coding - or the reduction of information into smaller units (Heriott, 1974) - and the mechanics of filing or piling in the sense that both have the common goal of making large amounts of information more manageable and easier to retrieve. Elaborative coding, on the other hand, helps improve retrieval by endowing material with distinctiveness (Walker, 1986) and is comparable with keywords or category titles acting as a code for distinguishing items before sorting them into the appropriate category; the same 'code' is used later to retrieve the items.

As there are limits on the amount of information that can be stored in memory, so too the capacity of an office's filing system can reach saturation point. When that point has been reached, the system must either discard information or rearrange it for future reference. Whatever the case, the worker needs an efficient system whereby he knows what information is to hand and where it is. If people could rely on a file always being found in the same fixed location, then it would be easier to retrieve, so it is worth asking why people in information processing jobs continue to pile in spite of the advantages supposedly offered by storing information in some systematic order.

2.6. Retrieval from categories.

The chief aim of organizing any information is so that it can be found by the system's users at a later date. The retrieval process can be viewed as a two-stage process: the user must firstly discriminate between categories and then, once a category has been selected, between the component items. This suggests the existence of two retrieval processes, one for category and one for item information, with information from one process being used to improve the efficiency of the other (Burrows and Okada, 1982).

The method of organizing paper-based information that demands the minimum effort is that of storing and retrieving items according to their spatial location, for example,

by keeping useful papers close to hand. The problem with retrieving items from their spatial location is that, although this arrangement may be ideal for one person, it is much less efficient for group recall because schematic organization is a comparatively personalized way of storing information. Alternatively, items can be stored by grouping them together in a manner that highlights their similarities or differences. There is more group agreement about where to find information that has been categorically organized (Rabinowitz and Mandler, 1983) mainly because retrieval cues are external and can be used by all potential users, whereas the cues to locating spatially organized objects are locked inside someone else's mind. An example that illustrates the advantages of categorical organization is how library books on similar topics can be quickly retrieved because they have similar or identical classification numbers (Norman, 1971). Once the person knows how to use the system, then he or she should be able to retrieve the correct information every time with the minimum trouble. This hierarchical format is also illustrated by the method of lexical storage used for Roget's Thesaurus. Concepts function as semantic markers and words having similar meaning have similar or identical paths through the tree of markers. It is generally helpful for people to able to generate their own concepts for retrieval, but too much freedom in creating these keywords may actually interfere with the recall of non-generated items (D'Agostino and Elmes, 1987).

It seems likely that there is some sort of relation between the organization of information and how much of it can be retrieved at a later date. There is a body of evidence from cognitive processing theory (Homa and Cultice, 1984) that imposing order on information makes learning easier but people are limited in that they cannot organize and remember simultaneously (Reddy and Bellezza, 1986). However, people must have their reasons for choosing to arrange and store paper-based information in the ways that they do.

2.7. Conclusions.

Research models appropriate for investigating how office workers sort and categorize information include the mechanistic one where workers are viewed as funnels of external information (and similar to an information processing approach) and the humanistic one which describes office work in terms of individual characteristics (Newman, 1980). The two models can be married by information processing theories of personality which link cognitive processes with individual differences in personality. A preferential mode for sorting behaviour has long been claimed (Gardner, 1954).

Information processing models of personality place great emphasis on how people encode, store and retrieve information and have been identified as an important issue in current personality theory (Pervin, 1985). Changes in ways of processing arise because of changes in the affective state of the person or in the environment in which they function. The social context of cognition is discussed in the next chapter.

Chapter 3. Social cognition.

3.1. Introduction.

The popularity of the analogy between the computer and human information processing can be attributed in part to the increased use of computers since the 1960's. An unfortunate side effect has been that many cognitive psychologists have come to overlook the fact that people have to exist in a social and physical environment and present 'man as an information processor' arriving at a decision in the absence of information from other people (Shaver, 1975). In reality, people must act within the context of a culture, that is, a social and physical setting whose values become incorporated into the cognitive response set of the individual (Bartunek, 1986). Ongoing efforts to conceptualize human cognition in its social context include the work by Wyer and Srull (1986).

Information processing procedure is flexible (Hasher and Zacks, 1979) and constantly anticipating or adapting to external factors which was recognized long ago by cognitive personality theorists such as George Kelly (e.g., 1955; 1969). A 'processing bias' appears to pervade an individual's anticipation, perception and memory of any particular task (Dworkin and Goldfinger, 1985), the most likely source of which lies in the structure of personality. There is an obvious analogy to be drawn between cognitive processing and the ways in which people sort, organize and retrieve paper-based information.

Information can be conceptualized as an abstract concept or as a physical object with its origins in the external environment. Information processing theory is directed at elucidating the properties of those mechanisms for the apprehension, storage, retrieval and utilization of information (Haber, 1974) which are ultimately responsible for adaptation to changing external environmental conditions.

3.2. Social information processing.

Information is processed with the aim of successfully adapting to the world and so-called intelligent behaviour reflects both personal knowledge of the world and basic information processing abilities. Intelligence arises from the use of a large store of specific knowledge or from the repeated use of a limited number of processes (Minsky, 1975). However, apparently intelligent people do not always respond appropriately to a particular situation or correctly answer a problem. This is because people use only a small proportion of the available informational resources to solve that problem. If it is argued that information is processed in order to yield a sense of valid knowledge, then we must hypothesize the existence of a sequence of cognitive operations intended to assess the possibilities of new information.

The acquisition of knowledge can be explained in terms of skill in manipulating concepts or specific symbol systems. This ability to go beyond the information perceived is fundamental to all types of thought and calls for some abstract thinking on the part of the individual concerned. However, processing ability and the ability to acquire knowledge from incoming information is constrained by the notion of capacity limitation (Miller, 1960).

Klinger (1975) introduced the concept of 'current concern' or changes in ways of information processing which arise when cognitive overload makes the perceptual processes increasingly selective; this filtering can be hypothesized to influence the internal affective state. Klinger was particularly concerned with changes in motivation and what happens when the overloaded person is unable to cope.

3.2.1. Information overload.

If the system reaches saturation point, then overload can result in the breakdown of processing (Broadbent, 1958). Stress is one consequence of an overloaded processing system - a tangible and measurable result of what happens when the adaptive processes between man and environment break down. The self-initiated interruption of work is often simply an attempt to regain control of a stressful work situation (Schaible-Rapp and Kugelman, 1982).

Neisser (1967) has rejected the notion of overload arguing that it should be unnecessary if information is firstly filtered through a pre-attentive 'information pickup' process. Reasoning can be considered a filtering process (Evans, Ball and Brooks, 1987) in so far as we reason to justify certain actions to ourselves by dismissing information that is inconsistent with our goals. Attention is essential for clarity of perception because it acts as a screening mechanism for filtering and organizing information (Kahneman, 1973) and so biases perceptual input and information processing.

3.2.2. The cognitive representation.

The question of how perceptual input is coded arises because there may be some discrepancy between the 'real-life' organization of physical features and their mental representation (Hirtle and Kallman, 1988). The differences might arise because people are not attentive enough towards external cues.

Cognitive models for the representation of perceptual information differ with regard to the extent to which the cognitive representation is abstracted from what is perceived to exist (Marschark, Richman, Yuille and Reedhunt, 1987). Representations of the analogical type are relatively concrete and bear some rough correspondence to the

actual physical world whereas propositional representations are encoded in a more abstract form. There seems to be a greater body of evidence in favour of the analogical model (Cooper and Shepherd, 1978). When learning new information, people tend to organize the material using concrete constructs such as physical attributes (Clement and Fasmagne, 1986) because a concrete stimulus is more directly related to perceptual experiences and has a more reliable and definite meaning (Clark and Paivio, 1989). Furthermore, the concrete stimulus is more easily used to discriminate between other stimuli (Paivio, Yuille and Madigan, 1968) and is better recalled than the abstract item (Marschark et al, 1987).

Although concrete stimuli are more easily organized and remembered, greater expertise in a particular area of knowledge is characterized by more abstraction from the perceptual representation. The expert in a particular topic, in contrast to the learner, is further characterized by the ability to manipulate symbols, to see large meaningful patterns and to perceive the links between knowledge domains (Murphy and Wright, 1984).

Neisser (1976) suggested that the selection and processing of information are linked by cognitive schemata which fulfill a vital function for the categorizing and patterning of information. The ability to classify, or to see patterns, is a vital component of biological fitness and is probably as old as the ability to perceive (Sokal, 1977). We have to impose some sort of organization on information because of our limited information processing capacity.

3.3. Categorization.

Encoding the differences and similarities between items is the first step towards categorizing information. However, people are often uncertain about category membership and in uncertain conditions they tend to evaluate and organize on the

basis of past experience (Metcalfe and Fisher, 1986). Furthermore, they may not answer consistently when asked to judge membership on different occasions. These problems were not thoroughly tackled by classical theories of concept attainment (e.g., Bruner, Goodnow and Austin, 1956). Current models presume complex ill-defined classes as the norm and postulate classification by similarity to prototypes, which offer the most information for the least cognitive effort and provide that information in a single concrete image (Rosch, 1977).

Categorizations change because people need to differentiate current information from out-of-date information (Bjork and Landauer, 1978). The efficiency of the organism therefore lies in its ability to perceive the central tendency and variations of a physical pattern. The perceptual processes preserve the continuity and stability of the perceived world by achieving 'for us a world that is relatively stable by excluding as far as possible contradictory evidence' (Hilgard, 1982). People do this by selecting and using information that is congruent with already existing impressions (Pyszcyzynski, La Prelle and Greenberg, 1987).

As people acquire more perceptual skills, they become more sensitive to environmental irregularities. Information is filtered and the features of a pattern are recognized by discriminating the focus of attention from its 'background'. This ability to recognize inconsistencies is said to characterize creative individuals (Mednick, 1962) those good at insightful problem-solving (Metcalfe and Wiebe, 1987) and 'reflective' people (Holmstrom and Karp, 1986).

Repeated interaction with the environment reinforces the association between a physical stimulus and the corresponding behavioural response. The external organization of categories is based on the idea that the cognitive categories underlying semantic relations are derived ultimately from modes of perceiving (Deese, 1976), that is, through sensory experience whereas the internal organization of categories is emphasized by semantic network theories (Johnson-Laird et al, 1984). Much of what is regarded as cognitive activity is actually a process of matching perceptual patterns to memory patterns. The efficient retrieval of paper-based information is likewise a

matter of matching a cognitive representation to a physical environment, using external prompts and cues such as 'when' and 'how' reminders (Kelley and Chapanis, 1982). An 'efficient' representation is characterized by that special quality variously known as connectedness, structural integration or coherence (McGuiness, 1986). However, office filing systems are not always that well-organized and furthermore people are idiosyncratic in the way they sort and arrange papers. The cognitive processes of planning and problem-solving are discussed in the next section to illustrate the difficulties in assessing how and why people evaluate, process and organize information.

3.4. Efficiency of information processing.

The efficiency of an information processing strategy is determined by how quickly and accurately the demands of a particular situation are met. The office is a place for the processing and organization of information, where economic necessity means that workers must be able to quickly retrieve the correct information in order to deal efficiently with any problems. Any attempt to infer from large amounts of unclassified information in order to solve problems, even of only limited complexity, will cause confusion. It therefore makes sense that paper-based information should be categorized.

A difficulty with the argument that papers are more efficient if they are organized is that 'an ordinary person almost never approaches a problem systematically and exhaustively unless he has been specifically educated to do so' (Miller, Galanter and Pribram, 1960, p.174). In particular, women are claimed to solve problems by guessing more than men do (Miller and Santoni, 1986). As the problem complexity increases, efficient representation becomes increasingly important for the successful solution of the problem (McGuiness, 1986) but, if they fail to approach the problem in

a systematic manner, people may not always respond with the correct answer.

Planning is a type of problem-solving activity, defined by Newell and Simon (1972) in terms of symbolic structures which are available from long-term storage and are used to guide action in exploring the individual problem space. Newell and Simon made the first detailed information processing approach to human problem-solving but pointed out that 'individual differences is not a topic that is tacked on to the main body of our theory' (p.10). However, other researchers claim that planning or 'action style' (Frese, Stewart and Hannover, 1987) can be viewed as a manifestation of personality. Other conceptualizations of the plan tend to define it as a series of units which are internal to the person, classified, and hierarchically organized (Dixon 1987). Many people find it easier to plan and think systematically if they can use information with which they are familiar (Mednick, 1962).

The ways in which people use paper-based filing systems beg consideration of whether they will maximize the potential of computerized filing systems. The objective of the latter should be to free people from having to categorize information in the hierarchical manner imposed by many paper-based filing systems (Broadbent and Broadbent, 1978). Different types of people are characterized by attitudes that determine how that type will react to a computerized system and to the associated environmental changes (Abler and Sedlacek, 1987).

Not only do types of people respond differently to new technology in the office, but they also differ in the extent to which they structure information. Consequently, we need to consider personality or cognitive type as a source of differences between people in their information processing style.

3.5. Conclusions.

Social information processing can be viewed as cognitive orientation to the outside world with the ultimate intention of at least coping or at best achieving mastery over a

particular situation. People differ in how successfully they orient to different kinds of environment and they have highly individualized ways of processing, categorizing and retrieving information from that situation. Differences in personality are one probable source of variance in cognitive information processing and in the procedures for sorting paper-based information.

We need a personality theory that manages to link the affective and cognitive elements of behaviour. The next chapter discusses the speculations of the Swiss psychoanalyst, Carl Jung, in the context of cognitive theories of personality and the hypothesis that people differ in their reasons for choosing information. The main constructs of Jung's theory are operationalized by a personality inventory, the Myers Briggs Type Indicator (MBTI) which is also discussed.

Chapter 4. Personality and cognition.

4.1. Introduction.

The cognitive skills employed in typical office tasks, such as sorting and recalling paper-based information, are probably the same as those which the individual uses for assimilating, categorizing and utilizing everyday environmental information.

The importance of conceptualizing human cognition in its social context was discussed in the previous chapter. In the present chapter, some of the effects of what is known as 'personality' on information processing are considered. Personal values and feelings (that is, the cognitive component of the emotions) are important to a discussion of processing because, like attention, they screen the entry of information into the system (Gilligan and Bower, 1984). The internal affective state has been reported as a source of individual differences in recall performance (Alexander and Guenther, 1986), in how people evaluate the environment (Espe and Schulz, 1983), in spatial orientation (Dodd and Bucci, 1987) and in attention and arousal (Derryberry and Rothbart, 1988).

Personality - the organization of values, attitudes and feelings - is hypothesized to pervade all cognitive activity in the form of a processing bias. People's speech, for example, is pervaded by a distinct processing bias that seems to reflect their preferred style of organizing information (Seegmiller and Epperson, 1987). We need a personality theory that recognizes the affective and cognitive elements that make up the information processing procedure, whilst recognizing the complex relationship between personality and cognition. The ideas of Carl Jung (1971) take into account both cognition and affect as determinants of behaviour and thus can be adapted to put information processing into a more social context. His conceptualization of personality is of interest to those psychologists who maintain that 'a great deal of the variety in

personality and interpersonal behaviour (is) attributable to differences in cognitive-affective style' (Helson, 1982, p.409). Cognitive style is a temperament as well as a process in that it describes cognitive manifestations of personality as characteristic modes of information processing.

A concern with structure, or with the organization of variables within the individual, is common to most definitions of personality and of cognitive style (Epstein, 1977). A view which goes further is that the structure of personality corresponds to the organization of cognition (Heim, 1970). The nature of the relationship is unclear and must be set against other arguments which claim that the two concepts can be distinguished (McCrae and Costa, 1985). There is no explicit statement of the nature of the relationship in Jungian personality theory.

4.2. Jungian personality traits.

Jung described four bipolar personality dimensions: Extraversion/Introversion, Sensing/Intuition, Thinking/Feeling and Judging/Perceiving. Extraversion/Introversion was conceptualized as an attitude and the other three dimensions as cognitive functions. Some Jungian personality theorists argue that attitudes and functions are related (Myers and Myers, 1980) and others that they are independent (Loomis, 1982). The dominant attitude is analogous to the preferred way of experiencing the world and the dominant functions to the preferred way of understanding that experience. The eight personality traits are now defined in terms of their commonly understood meaning in Jungian theory (e.g., Fordham, 1953).

(1) The attitude as Extraverted or Introverted.

Jung was the first to use the terms of Extraversion and Introversion and the concepts were originally defined as referring to the preferred *direction* of attention. The direction of attention influences the manner and the subject matter of thought.

Extraversion is characterized by orientation in the concrete and physical and Introversion by interest in the world of ideas.

(2) Cognitive orientation through Sensing or Intuition.

Both Sensing and Intuition are Perceiving functions. Sensing is perception through the senses while the Intuitive function tells us of future possibilities while giving information about the atmosphere which surrounds all experience.

(3) Cognitive orientation through Thinking or Feeling.

Thinking and Feeling are Judging functions. Jung emphasized that, despite the attached cultural assumptions, Thinking is not superior to Feeling. Feeling is defined as the psychological function that individuates and Thinking as the psychological function that generalizes.

Thinking/Feeling is the only Jungian dimension to show marked gender differences with women being typically more Feeling than men. The uneven distribution of the two functions reflects the traditional 'cognitive-affective' dichotomy alleged to pervade the responses of males and females (Haste, 1987).

(4) Understanding the world through Judging/Perceiving.

The Judging/Perceiving dimension represents the instinctive intention to control the environment. How people understand the world is related to how they orient to the environment.

Having described the eight personality traits, we can now discuss their usefulness for identifying individual differences in cognitive processing.

4.3. The terminology for a cognitive theory of personality.

Jung's speculations on personality offer a potential framework for examining the possibilities for bringing about change in patterns and modes of thinking. Although Jung himself showed little interest in the dynamics that contributed to the organization of personality, his theory provides one potential explanation for the development of

cognitive style as part of an ongoing process of adaptation.

Jung can correctly be criticized for a lack of clarity in expressing his ideas and for the lack of empirical evidence behind them. He used concepts in a specific sense that is not always compatible with the meaning commonly associated with that same term by cognitive psychologists today and this may be one reason why his ideas have not gained widespread credence among mainstream psychologists. Furthermore, the meaning of some Jungian terms may have been lost in translation from the original German.

The theoretical argument behind the present research draws on the twin threads of cognitive information processing and Jungian personality theory and is based on the premise that personality is the organization of cognition and that a person 'is' what he or she thinks. On which grounds, personality traits can be equated with cognitive functions. The personality descriptors used by Jung have both personality and cognitive elements but unfortunately he did not make his understanding of the relationship between cognition and personality explicit. Because there are some incompatibilities between Jungian terminology and that current in cognitive psychology, some decisions about terminology have to be made for the sake of consistency and clarity. The descriptor 'cognitive functions' is preferred in the context of information processing over that of 'personality traits'.

The Jungian personality dimensions were operationalized as cognitive constructs by the authors of the Myers Briggs Type Indicator (MBTI). This inventory claims to classify people into a finite number of types each of which shares the same cognitive functions. The aim of the present research is to evaluate the MBTI as a means of identifying differences between the types in cognition.

4.4. The Myers Briggs Type Indicator (MBTI).

The Myers Briggs Type Indicator (MBTI) was first distributed for professional purposes in 1975 and a copy is shown in Appendix A. It was developed on the basis of personal observation by an American team of mother and daughter, Katherine Briggs and Isabel Briggs Myers. When Jung's 'Theory of Psychological Types' was translated into English in 1923, they realized that his typology seemed congruent with the one that they had developed independently. The validity of their inventory as a measure of Jungian personality theory depends on the authors interpretation of how their typology matched with his.

The MBTI purports to measure a person's preferred way of processing information about the world along the bipolar dimensions of Extraversion/Introversion, Sensing/Intuition, Thinking/Feeling and Judging/Perceiving. Jungian theory argues that all psychological processes cannot be used equally. Instead, each person has four dominant and four auxiliary functions which are determined thus: for each dimension, two bipolar functions lie at opposite ends of a continuum with the midpoint represented by zero. Inventory scores determine which end of the continuum is the preferred one and, because the two components of each polarity tend towards incompatibility, one comes to be used over the other. Each end of the continuum has different implications for cognitive functioning under different circumstances. Jung's hypothesis was that inferior and superior functions were negatively correlated but this has not always been confirmed (Loomis, 1982).

Claims have been made for the successful construction of the scale (Stricker and Ross, 1964). Myers hypothesized that adults who have achieved high levels of development would be clearer in their type preferences and that their scores would yield higher internal consistency reliabilities. Reliability coefficients for the four scales tend to vary between .80 and .90 (Thompson and Borrello, 1986). Carskadon (1977) tested and retested students after a moderate time interval and then calculated test-retest correlation coefficients: he found that all coefficients were significant at $p < .01$ but that the Thinking/Feeling dimension was the most unstable. The inventory was claimed to be situation-independent so there should be no spurious correlations with task scores. The available norms (of which the most comprehensive collection is in McCaulley's Atlas of Norms, published in 1986) are mostly American.

4.5. The cognitive orientation functions.

In Jungian theory, people have distinct personality preferences which correspond to their dominant cognitive functions. To recapitulate, the theory describes one attitude, which can be Extraverted or Introverted, and the three functions of Sensing or Intuition, Thinking or Feeling and Judging or Perceiving. It is important to deal with one source of confusion here and that is the interrelationship between the three functions. People understand the world through the Judging or Perceiving functions. If Judging is dominant, then the organization of information (through Thinking or Feeling) is emphasized at the expense of the perception of information (through the Sensing or Intuitive functions). In other words, Judging and Perceiving are each associated with the orientation functions for organizing and evaluating information respectively. The relationship is schematically represented in Figure 2.

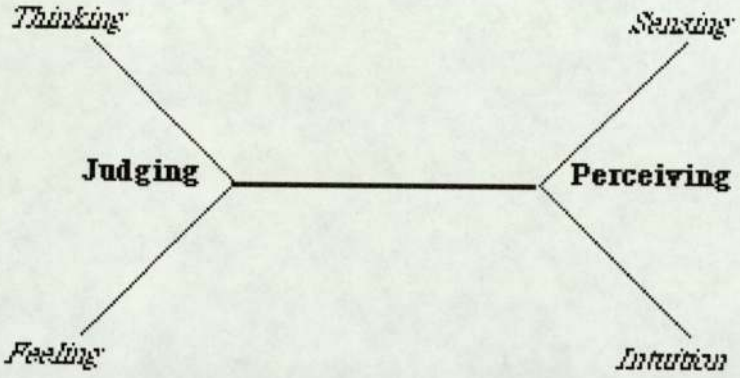


Figure 2. *Schematic representation of the relationship between Judging, Perceiving and their associated functions.*

The dominant cognitive functions are an indicator of the style of cognitive orientation. People orient to the environment by evaluating information, through Sensing or Intuition, and organizing it, through Thinking or Feeling. Those sharing the same cognitive orientation style can be classified together as belonging to the same type.

4.5.1. Jungian cognitive functions and information processing theory.

Jung hypothesized that consciousness obtains its orientation to experience through the dominant functions which correspond to ways of receiving and processing information. A study reported by Thorndyke and Stasz (1980) can be used to illustrate the close correspondence between the Jungian attitude and functions and information processing. The authors identified four cognitive processes - attention, evaluation, encoding and control - used in daily life to process environmental information and invoked by people when learning a cognitive map. These four processes can be shown to be analogous to the four Jungian dimensions.

Thorndyke and Statz defined their first cognitive process, attention, in terms of the subprocesses of arousal, focus of attention and attention switching. The Jungian dimension of Extraversion/Introversion refers to the focus of attention, that is, to whether attention is oriented to the internal or external world. However, a person is able to switch the focus of attention depending on the requirements of the situation. This is because the focus of attention reflects a preference and is not a fixed characteristic. Attention corresponds to the direction of orientation and the other three processes - evaluation, encoding and control - are analogous with cognitive orientation itself.

The second process, evaluation, was defined by Thorndyke and Statz in terms of the subprocesses of retrieval and comparison. The Jungian dimension of Sensing/Intuition has also been equated with the concept of evaluating information (Carlson, 1980) in the sense that both 'construe' the world. A preference for Sensing or Intuition indicates the type of constructs - which can be concrete or abstract respectively - chosen to represent reality. Understanding is achieved by using stable and easily retrieved constructs. Sensing types possess soundness of understanding whereas Intuitive types are characterized by quickness of understanding.

Myers and Myers (1980) claimed that children perceive before they learn to judge. If this interpretation of Jung's speculations is then applied to an information processing paradigm, it implies that people must perceive and evaluate information before it can be judged and organized. If the Jungian hypothesis that Perceiving must develop before Judging is correct, then information is evaluated before it is coded.

Thorndyke and Statz defined their third cognitive process, encoding, in terms of the subprocesses of maintenance and elaboration. There are similarities between encoding and the judging functions of Thinking and Feeling, which have been equated by McKenny and Keen (1974) with the organization of concepts along dimensions that reflect the perceived degree of truth or falsity (if the person judges through Thinking) or of agreeableness or disagreeableness (if through Feeling).

One of the most important issues governing human behaviour is the urge to control the environment (White, 1959). The concept of control was the fourth of Thorndyke and Statz's cognitive processes and was defined in terms of the subprocesses of procedure selection and switching. Because these control processes share a limited attentional capacity with memory, switching attention from one procedure to another is an effortful and time-consuming process (Weber, Burt and Noll, 1986). The functions of Judging and Perceiving correspond to different ways of understanding and controlling the external world. The former prefer to plan ahead and work single-mindedly whereas the latter are more adaptable and open to change (Myers and Myers, 1980).

There are probably as many corresponding information processing styles as there are cognitive orientation types. The next section goes on to discuss some specific differences in how people process and organize paper-based information.

4.6. Individual differences in processing paper-based information.

The MBTI has been used to find individual differences in information processing style (McKenny and Keen, 1974). There are four styles based on combinations of functions where each cognitive function corresponds to an information processing procedure (Figure 3).

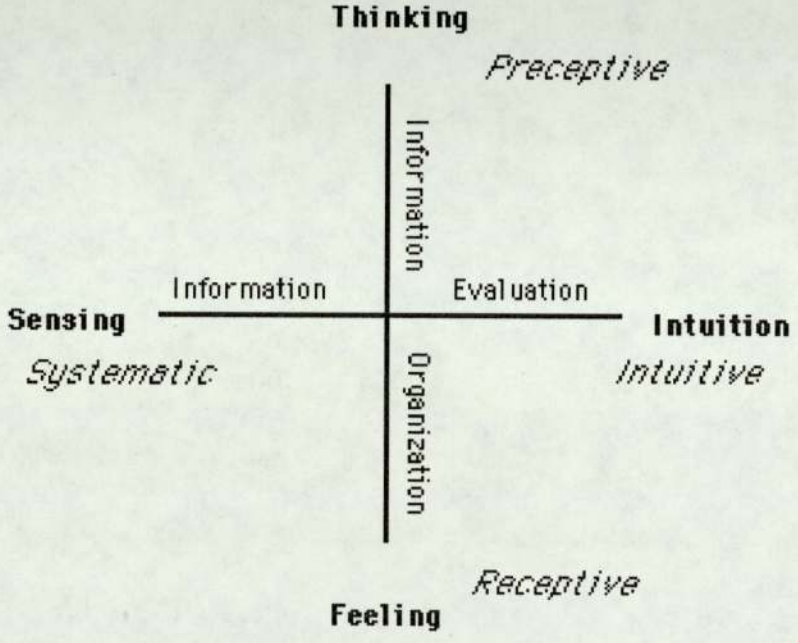


Figure 3. *Schematic representation showing the styles of information evaluation and information organization associated with the Sensing/Intuition and Thinking/Feeling dimensions of the MBTI respectively (after McKenny and Keen, 1974).*

From Figure 3, it can be seen that there are two bipolar styles of information evaluation. Which one people use depends on their mode of perception (Carlson, 1980). Sensing types, who favour the systematic style, evaluate on the basis of observed facts while those who evaluate intuitively try to 'recognize the possibilities in any situation' (Agor, 1986). Intuitive persons are representative of those who are characterized by broad categories and openness to new information (called 'neophilia'

by Walker and Gibbons, 1989) and who find novel or unusual information satisfying. Likewise, there are two broad styles of information organization. One style, termed 'preceptive' by McKenny and Keen, is associated with a preference for Thinking and is based on conducting a hierarchical search for specific details of the stimulus attribute and then analyzing the facts. Learning for examinations requires the serial recall of specific details and thus students who use the preceptive style may have the advantage. The Feeling person uses the alternative 'receptive' style where the type of information gathered reflects personal interests and preferences and is then analyzed in terms of personal needs. It has been suggested that Feeling persons do better on verbal-based tests (Ferguson and Fletcher, 1987). Although the Feeling mode sounds the more obviously affective style of information organization, there is evidence to suggest that the Thinking function is also egocentric. Kerin and Slocum (1981) found that Thinking persons are more likely to solicit data highly congruent with their own personality when confronted with an unstructured problem

Bruner's (1960) 'spiral curriculum' included the proposal of periodic return to the main concern by review and elaboration and prescribed frequent 'zooming' from the most general view of contents to selected specific details. The 'zoom' analogy best describes the information gathering characteristics of the Thinking preceptive style, while the Feeling receptive person focuses on the shared features of information by global scanning (Murphy and Wright, 1984).

Well-developed cognitive functions are associated with mobility or flexibility of information processing (Werner, 1957). The stronger the preference for one bipolar function over the corresponding one, then the easier it should be to process the kind of information to which that function is oriented. For example, the person for whom Sensing is dominant over Intuition will find it comparatively easy to evaluate facts but more difficult to master theoretical information.

The four functions of Sensing, Intuition, Thinking and Feeling can be combined to give four possible styles of cognitive orientation each of which characterizes a

personality type. The style of cognitive orientation itself is manifested through distinctive information processing strategies. An important point to be made is that Jung's personality typology does not prescribe any one type as superior to the others and consequently no one way of processing information is better than the others for all situations. It is clear, however, that people have different emphases and biases in how they sort and categorize paper-based information. The significance of innate differences in information processing style at work may be compounded by the unequal distribution of males and females in office jobs (Bird, 1980).

Cognition and personality interact - in a complex way that is not fully understood - to influence the way in which people respond to information. Personality has been discussed in the present chapter as the organization of cognition and related to information processing by the suggestion that personal needs and values orient a person to process certain kinds of information more easily than others.

4.7. Conclusions.

The literature on Jungian theory is very complex and has been considerably simplified in the course of the discussion but, to recapitulate, a total of eight cognitive constructs are operationalized by the MBTI which is an inventory compatible with Jungian personality theory. The constructs are arranged into four bipolar dimensions in such a way that each person has four dominant characteristics. The four constructs can be reduced to two in order to identify a person's orientation style. Consequently, there are a maximum of four cognitive orientation types (but it is important to remember that these four types are not mutually exclusive). The hypothesis to be tested is that discernable differences in cognition do exist between types of people.

Personality has been defined in cognitive terms and conceptualized as an abstract system of cognitive structures formed under the impact of received information. A Jungian model of personality accounts for relationships with the external world by

assuming that information processing is initiated to understand the meaning inherent in environmental information (Jung, 1971). A Jungian model of personality has the further advantage of accounting for the influence of internal states on cognition but instead of trying to explain the motivational function of emotions on the ways in which people acquire knowledge, it implies that the four types are oriented to, or prone, to selecting and processing certain kinds of information.

The relationship between cognition and personality is often mentioned but rarely discussed in depth or made explicit. The MBTI is one standardized inventory that links personality and cognition, but articles and reports on the measure rarely discuss the theoretical background. The present chapter has attempted to fill in some of those gaps. The literature survey is concluded with this discussion of the implications of Jungian personality theory for understanding individual differences in cognitive functions and processes.

Chapter 5. Preliminary empirical work.

5.1. Introduction.

Carl Jung's theory has been used to link personality and cognition within an information processing framework (Carlson, 1980; Helson, 1982). The Jungian-based personality inventory, the MBTI, is a standardized means of classifying people into personality types, each of which has a distinctive cognitive orientation style.
This chapter describes the evaluation of the MBTI as an indicator of differences between the types in cognition and of potential techniques of testing for those differences.

5.2. Rationale.

It has been argued that the personality characteristics of workers determine how they use their working environment (McElroy, Morrow and Ackerman, 1983). Using the MBTI, Williams, Armstrong and Malcolm (1985) identified four types, each of which was associated with a 'work style' and a corresponding 'work culture'. They classified subjects into one of the four cognitive orientation types of Jungian theory. Cognitive orientation style is a construct that mediates between person and environment and explains how people conceptually evaluate and organize the environment so that it takes on psychological meaning. Those people characterized by the functions of Sensing and Thinking were called 'Stabilizers' by Williams et al; those by Sensing and Feeling were 'Co-operators'; by Intuition and Thinking, 'Visionaries'; and by Intuition and Feeling, 'Catalysts'. Stabilizers are found in

hierarchical organizations. They need an environment that is geared to action and use their desks for working rather than for piling. Co-operators are claimed to be typical of people who work in family businesses. They do not need a great deal of privacy at work and emphasize the receipt and transmission of information rather than its storage. Visionaries work best in offices housing reference material where they tend to accumulate piles because of their tendency to keep papers. Catalysts also gather reference material but their decisions are concerned with personal values and they keep personal items about the office.

This four-way classification of types was adopted for the preliminary study. The primary aim of the evaluation study was to assess the usefulness of the MBTI as an indicator of differences in the organization of cognition. Subjects were classified as belonging to one of four cognitive orientation types, each of which was hypothesized to be associated with a distinctive mode of information processing.

The two other techniques evaluated for their usefulness as behavioural indicators of cognitive style were those of the interview and a sketch map to externalize a person's cognitive representation of their 'information environment'. The interviews were intended to be exploratory in that they would help the experimenter to identify issues associated with the processing of paper-based information that were suitable for further investigation. The researcher would be able to identify the range of paper-based information processing activities carried out in a working environment where paper was the most important medium for communicating information. The responses were discussed as information processing strategies: that is, as those decision making regularities (that is, the dominant cognitive functions) that are in part a function of the conditions of a particular situation (such as a working environment).

The other tool, the sketch map might be suitable for finding how people differ in the ways in which they organize the spatial resources of the workplace. The sketch map externalizes the cognitive map which is a concept postulated as one means of overcoming limited information processing capacity by differentiating and integrating

environmental information (Neisser, 1976). Cognitive maps are organized in such a way that they can be used to easily retrieve information (Canter, 1977). Individuals who are relatively slow in acquiring well-organized maps may be hindered by their cognitive style in the selection of concepts. An interesting analogy can be drawn between the functions of the cognitive map and those of the office filing system. Both are organized along similar principles and both are an ideal way of retrieving information by content or location. Psychological research on cognitive maps should primarily focus on their subjective usefulness for finding things rather than on their objective accuracy.

5.3. Aims.

The preliminary evaluation study had three aims. The first was to investigate the usefulness of the MBTI for evaluating individual differences between types in the way they processed and organized paper-based information; the second was to identify specific paper-based information processing activities; and the third was to evaluate the usefulness of the sketch map as a means of representing the space in which people process information.

5.4. Design.

A study was carried out to evaluate the suitability of a personality inventory, the MBTI, as a means of identifying cognitive orientation type and of the sketch map as a means of investigating how people represented paper-based information within their workplace. A brief structured interview was also conducted to identify important constructs for the processing of paper-based information. Nine subjects were classified on the basis of their MBTI scores as belonging to one of four cognitive

orientation types and qualitative analysis of their interview responses revealed whether there was any correspondence between the responses and the alleged personal or cognitive characteristics associated with their type.

5.5. Instruments.

The three techniques for investigating differences in cognitive orientation and the processing of paper-based information were: the personality inventory, the interview and the sketch map. The MBTI was administered first to identify cognitive orientation type. The evidence for differences between the types in their style of processing paper-based information was found in their interview responses. In this interview, subjects were asked how they used their desk to sort and process paper-based information. Finally, it was hoped that drawn representations of the cognitive map would indicate subjects spatial orientation to the paper-based information stored in their workplace.

5.5.1. The MBTI.

The Jungian-based personality inventory, the MBTI, was used to identify dominant cognitive functions so that subjects could be classified as belonging to one of four orientation types (Myers, 1976). Cognitive orientation was defined by the dominant style of evaluating information (which could be through Sensing or Intuition) and by the dominant style of organizing information (through Thinking or Feeling). A copy of the inventory is shown in Appendix A.

5.5.2. Interview.

Each subject was asked the same six questions, based on those used by Malone (1983) who had tried to find, without any explicit reference to personality, 'how people use their desks'. Malone's questions were sufficiently general for answers in the present study to incorporate mention of how the office was organized to support information processing activities.

The questions were:

(1) How well organized would you say your office is?

(2) What are the biggest problems you have with your office?

(3) Do you keep a diary?

(4) Do you make lists of things to do?

(5) Do you often forget to do something?

(6) How often are you are unable to find something?

During the interviews, subjects were asked to stress how they sorted and organized paper-based information within the physical confines of the workplace.

5.5.3. Sketch map.

When subjects were asked to sketch a schematic representation of information located in their workplace 'as it actually is', they were expected to also indicate those physical features of the working place that they used to help organize and retrieve paper-based information. A second map of how subjects 'would like it to be' would show whether the available resources satisfied all their needs. The maps would be compared to see if there was any discrepancy between them.

5.6. Subjects.

The aim of the preliminary study was to examine whether types of people reported any differences in how they processed paper-based information. Office workers were not interviewed on the grounds that environmental or organizational demands in the workplace may outweigh cognition as the main source of variance in behaviour.

Nine people agreed to be interviewed of whom six were female and three male. All were university research students in the social sciences. They were in the second or third year of their research and this meant that they had all acquired much knowledge and large amounts of paper-based information on their chosen topic of research. The relative absence of external constraints on their working behaviour meant that subjects had been able to develop their own way of processing and storing papers.

The subjects worked in an office that they shared with between two to four other people. Each had his or her own desk. They also had access to a filing cabinet and a bookcase, although this might have to be shared with one other person.

5.7. Procedure.

Subjects self-administered the MBTI at a time convenient to themselves. They reported that this took approximately thirty minutes. Subjects were asked to note on the back of their response sheet any general comments that they had to make concerning the structure or contents of the inventory. The experimenter scored the inventory.

A loosely structured interview was conducted in the subjects workplace. The quickest interview lasted approximately thirty minutes, the longest some ninety minutes. Differences in how long the interview lasted depended on how fully the subjects chose to answer the questions. The experimenter recorded subject responses on paper and on tape.

While still in the workplace, the subjects were then given two A4 sheets of graph paper so that they could draw the two cognitive maps. The first sheet was titled *'the workplace as it actually is'*. They were asked: 'please draw the place where you work as it actually is. Show and label features of your workplace such as your desk, filing cabinets, windows, doors, bins and anything else you can think of. Try to show details such as what you have on your desk top and what is in the different drawers of your desk or filing cabinet'.

On the other sheet, marked *'the workplace as you would like it to be'*, subjects were asked: 'please sketch your workplace as you would like it to be if given unlimited resources and complete freedom'. Subjects found this second part of the task very difficult to complete.

5.8. Results.

The results were examined to see if there was a correspondence between interview responses and those personal or cognitive characteristics attributed to each type in the literature.

5.8.1. MBTI scores.

Twelve scores were obtained for each subject. There was one score for the two attitudes and for each of the six cognitive functions. The remaining four scores were obtained as follows: the eight dimensions were arranged into four bipolar pairs and the four scores therefore indicated the strength of preference for the more important function from each of the four pairs. Interviewee characteristics derived from MBTI scores are shown in Table 1.

	Min.	Max.	Range	Median	Mean	S.D.
Attitudes and functions						
Extrav...	1	20	19	14	12.44	6.17
Introv...	6	26	20	16	14.78	6.74
Sensing	0	20	20	10	9.89	6.70
Intuition	5	23	18	13	13	6.02
Thinking	3	28	25	9	11.89	8.15
Feeling	0	19	19	11	10	6.02
Judging	0	27	27	10	12.78	10.02
Perceiving	1	28	27	20	16.33	10.15
Dominance scores for:						
Extrav/Introv	13	57	44	39	36.11	13.65
Sens/Intuition	1	55	54	15	19.67	15.70
Think/Feel	3	47	44	15	21	17.46
Judg/Perc	5	51	46	19	21.22	15.07

Table 1. *Table showing descriptive statistics for the two attitudes and six cognitive functions of the MBTI and strength of preference for four dominant functions for interviewees (n=9).*

It can be seen from Table 1 that the greatest dispersion of scores was for the Judging and the Perceiving functions. The greatest dispersion of scores for any one of the four preferences was along the Sensing/Intuition continuum.

In theory, the two constructs at each end of the continuum that represents a cognitive dimension are bipolar. For each of the four dimensions, the dominant and the auxiliary functions were found to be inversely related as indicated by the negative correlations. (Table 2). It will be observed that there was a perfect negative correlation between between Judging and Perceiving.

Cognitive dimensions:	Extrav...	Sensing	Thinking	Judging
Introv...	-0.970*			
Intuition		-0.831*		
Feeling			-0.769*	
Perceiving				-1.000*

Table 2. *Table showing correlations between bipolar constructs of the four dimensions of the MBTI. All correlations significant at $p < .05$.*

The correlations in Table 2 were interpreted as meaning that the cognitive orientation functions (i.e., Sensing/Intuition and Thinking/Feeling) were more complex variables than indicators of the focus of attention (Extraversion/Introversion) and the type of understanding (Judging/Perceiving). The Thinking/Feeling function is considered to be the least stable dimension (Carskadon, 1977).

There is some disagreement in the literature about whether the Jungian attitude, or direction of attention, is related to, or independent, of the three cognitive functions. (The direction of attention is denoted by the preference for Extraversion or Introversion.) The attitudes of the nine interviewees were inversely related to the three cognitive functions. This can be seen from the negative correlations in the first column of Table 3.

Dimension:	Ext/Introv	Sens/Intui	Think/Feel	Judg/Perc
Ext/Introv	-	-	-	-
Sens/Intui	-0.42*	-	-	-
Think/Feel	-0.06	0.17	-	-
Judg/Perc	-0.79*	0.48*	0.08	-

Table 3. *Correlations between the four dimensions of the MBTI. All correlations based on strength of preference for the dominant function (*, $p < .05$).*

Having described the inventory scores for all subjects, MBTI scores were next used to classify subjects as belonging to a cognitive orientation type, on the basis of their dominant style of evaluating and organizing information (i.e. along the Sensing/Intuition and Thinking/Feeling dimensions respectively).

The four types (which were not mutually exclusive) were labelled thus: as Type I (where Sensing and Thinking were the dominant modes of evaluating and organizing respectively), Type II (with Sensing and Feeling), Type III (with Intuition and Thinking) and Type IV (with Intuition and Feeling). There were two Type I, two Type II, two Type III, and three Type IV subjects.

5.8.2. Interview responses.

The interview responses from each of the four types are described in turn. The qualitative responses are compared with the cognitive functions and workstyle characteristics associated with the four types by Myers and Myers (1980) and Williams et al (1985) respectively. The workstyle associated by Williams et al with the four types is described in section 5.2. Responses are discussed as evidence for discernable differences between the types in cognition.

5.8.2.1. Type I information processing strategies.

So-called Type I subjects evaluated through Sensing and organized through Thinking. There were two subjects characterized by this type, one male and one female. From their responses, it was clear that both subjects were clearly 'filers'. Their work was characterized by listing and planning, both on a day-to-day and a long-term basis, and they tended to think in terms of dates rather than events. They seemed to do this in

order to anticipate future needs.

Both Type I subjects were 'hoarders'. They were unwilling to throw anything away, which suggested that they had problems in deciding on the relative usefulness of their accumulated files and papers. This failure to discriminate the worth of items is an alleged characteristic of Thinking types.

Their workplace was characterized by little personalization and was geared to action. They tended to 'compartmentalize' information: ongoing work was kept physically separate and there seemed to be little effort put into obtaining a global picture by integrating work, either physically or mentally.

5.8.2.2. Type II information processing strategies.

There were two Type II subjects who evaluated through Sensing and organized through Feeling. One subject was male, the other female.

They tended to pile while they worked, keeping paper-based information close at hand for convenient reference, and then tidying up at regular intervals. They made daily lists only, in contrast to the long-term planning of Type I subjects. Because the organization of information was biased by the Feeling function, they were more prepared to take into account the needs of others and this readiness to change plans at short notice naturally reduced the value of long-term planning.

They reported that they kept ongoing work physically separate. This was expected of people who evaluated through Sensing and are alleged to be concerned with specific details of information rather than with the integration of information (Myers and Myers, 1980).

Both Type II subjects claimed to file items, but at the same time admitted to difficulties in deciding how to categorize information. The female subject circumvented this problem by creating sub-categories whenever necessary. Their problems in

categorizing may arise because of their tendency not to reevaluate and reorganize schema when updating knowledge.

The ability to discriminate the relative worth of things is an alleged feature of Feeling types. However, the Type II male was the only subject to discriminate the value of the paper-based information that he read, claiming that only some 10% of the information was relevant to his present needs and worth making notes on.

Both Type II subjects used diaries but in different ways. The female used the diary to plan, motivate and remind. The male used it as a prompt, to remind himself of any meetings he had to attend, or people he must see or telephone.

Both reported general dissatisfaction with, and a lack of commitment to, their workplace which was reflected in the amount of time that they reported spending there. This was surprising, in light of the co-operative nature ascribed to this type by Williams et al (1985).

5.8.2.3. Type III information processing strategies.

There were two Type III subjects - one male, the other female - who evaluated and organized information through Intuition and Thinking respectively. For the male subject, the organizing Thinking function was more important than Intuition and, as expected, he claimed to be well-organized at work. For the female, the Intuitive function was dominant over Thinking and, not surprisingly, she stressed the importance of being flexible. However, both reported often finding themselves behind schedule.

They disliked having to work at a desk and associated filing with enforced rigidity and a subsequent loss of originality. They attributed these reservations about filing to the time and effort necessary to keep such a system up to date.

The male subject claimed he needed to 'spread out' when working which made it easier to scan his data and so stimulate original thought. This desire for more room

seems consistent with the report that males want a larger personal space than women (Gal, Benedict and Supinski, 1986). However, other male subjects did not feel the need to comment on this aspect of their workspace.

5.8.2.4. Type IV information processing strategies.

There were three Type IV subjects, all female, who evaluated and organized information through Intuition and Feeling respectively. They reported wanting separate well-defined areas for the conflicting needs of work and leisure. The dominant Feeling function may be an important factor in their ability to discriminate work from relaxation. If stress is viewed as the mechanism by which work spills over into leisure, then making this distinction was an attempt - probably unconscious - to avoid stress.

All used their desk to access things but also cleared it regularly so that things could be found and to remind themselves of anything that needed completion.

All paper-based information was scanned at intervals so as to stimulate new ideas. Subjects attributed to this frequent scanning their perceived ability to find papers. Interestingly, all three described filing information according to its broad *physical* form, which suggested that this type might rely on perceptual cues to find things. Their frequent scanning of filed papers probably facilitated the acquisition of an efficient representation for locating items.

Although the interview responses were analyzed qualitatively, there were clearly discernable differences between the four types in how they claimed to organize paper-based information.

5.8.3. Sketch map.

Subjects were asked to draw two maps: the first of their working environment 'as it really is' and the second as they would 'like it to be'. They found it very difficult to draw a sketch of their ideal working environment and, after an initial attempt, three subjects out of the nine said that they were unable to draw a representation of their workspace as they 'would like it to be'. Their justifications for this reflected their lack of experience at drawing such sketch maps; or it indicated a lack of any strong feelings about the workplace. Alternatively, their difficulties in projecting themselves into their 'ideal work place' may simply have reflected a lack of experience with this sort of environment.

It was hoped to compare the sketch maps of the different types with regard to how they organized papers in their place of work. However, the indication that 'files' were stored in the repository marked 'filing cabinet' did not convey any further data about the content of those files or about their organization in relation to each other. Subjects found it difficult to discriminate *types* of paper-based information (characterized by physical form) from the *contents* of paper-based information. A decision was made to abandon this technique as a means of representing the content and location of paper-based information.

5.9. Discussion.

The suitability of each of the instruments for investigating individual differences in cognition will be discussed in turn. The sketch map, although administered last, is dealt with first. There was an unfortunate lack of success with the cognitive map, attributable to difficulties experienced by subjects in projecting themselves into an ideal situation 'without being there' and it was consequently abandoned as a technique

for further research on how people organize their paper-based information. The problems pointed to the need for a more structured investigation of how people represented the content and location of information. Those interviewees who had what they perceived to be a well-organized paper-based retrieval system also claimed that they were able to find information without any real difficulties. This correlation may exist more 'in the mind' than in the real world but highlights one important criteria for judging the efficiency of a sorting strategy - namely, how successfully people retrieve papers from the categories (piles or files) into which items were sorted. The validity and reliability of the inventory, the MBTI, was supported by a considerable body of literature. One feature, widely commented on by subjects to whom it was administered, was the item transparency of the MBTI. Although used for research purposes with subjects up to the post-doctoral level of academic achievement (McCaulley, 1986) four of the subjects did comment on the obviousness and simplistic nature of some of the questions. This could become something of a problem if subjects tried to respond in socially desirable ways, for example by presenting themselves as more caring or more logical than they actually were. Another point to be borne in mind is that the MBTI is not situation-specific. This is a common fault of many personality inventories and, it could be argued, is why they are not always accurate at predicting behaviour. However, the overall conclusion was that the MBTI was both easy to administer and score (from the researchers point of view) and interesting enough to warrant completing (from the subjects point of view).

Qualitative analysis indicated that the reported informational strategies of the four types corresponded to those characteristics attributed to the types in the literature. On the basis of interview responses, Sensing types (Types I and II) were found to be characterized by an interest in specific details whereas people for whom the bipolar function of Intuition was dominant (Types III and IV) reported scanning information which might help them to discover abstract patterns or trends. People sharing the same function for evaluating or for organizing differed in other respects. Of the two

Thinking types, Type I subjects said that they preferred to file information, whereas Type III subjects did not: the difference in attitude is probably attributable to their different style of evaluation. The Feeling function was dominant for subjects (Types II and IV) who personalized their work. They described clearing their desk regularly so as to keep up to date with their work. To do this, they discriminated between which items to clear away and which to keep for reference.

The interviews were useful in that they identified important constructs (sorting, categorization and recall) for a quantitative analysis of information processing behaviour. In conclusion, the responses associated with each MBTI type generally corresponded to the cognitive and personal properties attributed to those types in the literature.

5.10. Conclusions.

This preliminary study investigated the usefulness of the MBTI as a tool for identifying individual differences between people in the way they evaluate and organize paper-based information. On the basis of their MBTI scores, subjects were classified into one of four cognitive orientation types. Discernable differences between the types were found in how they reported processing, sorting and retrieving paper-based information. The tentative conclusion to be drawn from this preliminary study is that the MBTI is a suitable and easy-to-administer tool for distinguishing between people in such a way that different information processing strategies can be discerned.

The preliminary study had the other aim of identifying specific paper-based information sorting activities. All subjects described categorizing and retrieving papers but differed, for example, in *how* they said they organized and stored those papers. Sorting paper is representative of information processing activities and is hypothesized to be a source of differences in cognition: consequently, this activity will be subjected to further investigation. However, the lack of success with the cognitive map

technique means that it must be discontinued as the proposed method of examining differences in the retrieval of information.

In conclusion, it should be possible to classify people as belonging to a cognitive orientation type and, from this, to predict observable differences in behaviour. No one type or style is superior to the others; instead each has its own advantages and disadvantages for different situations. These differences are worth investigating because all people cannot be expected to adapt to change in the same way or with uniform success.

Chapter 6. Methodology for experimental work.

6.1. Introduction.

The preliminary study offered support for the Jungian-based MBTI as a personality inventory suitable for the investigation of individual differences in processing style. The next phase of the research was concerned with some of the behavioural implications of belonging to a cognitive orientation type. However, the actual evidence for the classification of types was found, not in the MBTI, but in subjects performance on the three consecutive behavioural tasks described in chapters 8-10.
The techniques used for investigating the extent of individual differences in processing style are now introduced and the rationale for their use is explained.

6.2. The identification of cognitive orientation types.

The MBTI is hypothesized to be a valid indicator of differences between types of people in how they process information. The theoretical background to the inventory was discussed in detail in section 4.4.
Some personality types are more common than others (McCaulley, 1986) and sampling from a very large population would be necessary before a sufficiently large number of subjects could be obtained to represent each of the sixteen Jungian personality types. Consequently, results comparing all sixteen types are infrequently reported in the literature. Since each of the sixteen personality types is characterized by one of four styles of cognitive orientation, it is more usual (e.g. Williams et al, 1985) to classify subjects as belonging to one of four types characterized by combinations of cognitive functions: that is, by Sensing and Thinking, Sensing and

Feeling, Intuition and Thinking, and Intuition and Feeling respectively. In each case, the first function is for evaluating and the second for organizing information. The implication of this is that each type has a characteristic way of processing information. The experiments investigated some of the behavioural implications of belonging to a type, where behavioural differences between the types were hypothesized to reflect differences in the organization of cognition.

6.3. Behavioural implications of belonging to a type.

The distribution of types was indicated by subject scores on the MBTI. To complete the inventory, participants had to discriminate between categories of behaviour and to choose which ones best described their own behaviour. Three tasks were devised to show up individual differences between subjects in how they evaluated and organized information. The first of these tasks required subjects to make word associations and was included because making the link between stimulus and response is essential and 'perception, thinking, and doing cease as soon as association is impeded' (Bleuler, 1969). A sorting task required the same subjects to sort forty items of paper-based information into categories; the efficiency of a person's sorting strategy was judged in terms of the number of items he or she later retrieved. Finally, a questionnaire required subjects to make judgements about categories which best described their sorting strategy.

6.3.1. Word associations.

Jung (whose personality theory was standardized in the form of the MBTI) was something of a pioneer in using association experiments in the belief that the latter

could throw light upon the structure of cognition. Response style can be assessed in terms of the quantity or quality (strength) of association. A distinctive word association style is one likely behavioural implication of belonging to a type. The four cognitive orientation types were hypothesized to differ in how they evaluated and organized information; behavioural evidence for these differences would have to be found in subjects response style.

6.3.2. Sorting and recall performance.

Sorting and recall performance was measured with the aim of identifying the characteristic processing strategy associated with each cognitive orientation type. The task simulated one aspect of traditional office work by requiring the subjects to sort paper-based items of information into categories and then to recall the 'what' and 'where' of those items. (This meant that there were two different criteria for recall - the number of items remembered and the number located.) Recall performance was taken as an index of subjects sorting efficiency on the grounds that information is sorted and categorized with the ultimate aim of being able to retrieve specific items at a later date.

Factors internal to the person are one source of differences in sorting style but external factors, such as conditions of work, can be equally decisive. Examples of the former are when unstructured piles accumulate because people are disinclined to file (Malone, 1983) and of the latter when they are distracted from routine tasks such as filing by more immediate jobs such as answering a ringing phone. Attempts have been made to simulate the sorting tasks carried out by 'administrators' in the In basket test (Frederiksen, Jensen and Beaton, 1972).

Individual sorting strategy was examined in a controlled setting where subjects were not required to respond to other environmental stimuli. The aim of administering the task was to investigate subjects preferred way of sorting and categorizing paper-based

information rather than how they coped with other examples of the environmental stimuli found in the traditional office.

6.3.3. Perceptions of sorting strategy.

Subjects were questioned about certain aspects of the strategy that they used for the sorting task to see whether subject perceptions of what they thought they had done corresponded to what they actually did. There was general agreement in the relevant literature that there is no direct introspective access to the higher order cognitive processes. The problems experienced by those subjects who took part in the preliminary study in articulating their cognitive strategies made clear, among other things, the need for a more structured approach to the investigation of cognitive information processing style. A structured questionnaire was included to investigate subject perceptions of how and why they sorted information. Style of cognitive orientation was hypothesized to be a source of differences between subjects in their perceptions of how they sorted paper-based information.

6.4. Aims.

The personality inventory, the MBTI, was administered to classify subjects as belonging to one of four cognitive orientation types (defined by combinations of their dominant cognitive functions). The four types were hypothesized to differ in their cognitive information processing and evidence for these differences were expected to be found in their performance on a series of cognitive task indicators.

6.5. Method.

Four studies were run in parallel with the aim of relating information processing style to cognitive orientation type (that is, to personality). The experimental design and the development of the instruments is now discussed.

6.5.1. Design.

Measures were collected from forty subjects, controlled for differences in gender and their area of academic interest. They were classified on the basis of their MBTI scores as belonging to one of four cognitive orientation types. Individual differences in cognitive processing were investigated as a source of differences between subjects in how they evaluated and organized paper-based information. A questionnaire was administered to investigate subjects perceptions of their sorting strategy. A word association task acted as an independent check on the presence of differences in response style.

6.5.2. Exploratory hypothesis.

The exploratory hypothesis was that a relationship existed between cognitive orientation type (identified on the basis of MBTI scores) and behavioural response. The experimental results were analyzed so as to predict, on the basis of the three cognitive tasks at least, how the four cognitive orientation types will process and categorize information.

6.5.3. Instruments and materials.

The Myers Briggs Type Indicator (MBTI) is a pre-existing inventory for identifying Jungian personality type but the present research will evaluate its suitability for identifying cognitive orientation type. The administration and scoring of the inventory is discussed first. The materials for the three cognitive tasks had to be specially devised and, where appropriate, their content, evaluation and scoring system is discussed.

6.5.3.1. The MBTI.

The MBTI measured the strength of each of eight cognitive functions, using forced-choice items. The essence of the method was that sets of pairs of stimuli, representing items of different values on a single continuum, were presented to subjects who had instructions to choose one member of each pair on the basis of some stated criterion. The forced-choice format can irk some subjects, particularly if they believe that neither item represents what they would choose. The dominance of a cognitive function was calculated on the basis of the subject's responses to *all* the questions measuring that particular function.

The scoring system for the MBTI was quick and simple. The experimenter had four scoring cards, one for each of the cognitive dimensions. Each of these cards was placed in turn over the completed answer sheet. The experimenter counted up the scores associated with, for example, Extraversion and then with Introversion. Finally a table was presented as part of the scoring card to help the experimenter calculate the relative strength of preference for the dominant function over the auxiliary one.

A copy of the inventory can be seen in Appendix A.

6.5.3.2. Word association task.

There were a number of important issues to be decided on before administering the word association task, for example, how many stimulus words should be used; whether the test should be controlled or free; and how many responses should be required from each subject.

Six pilot subjects were asked: 'please think of as many words as you can that you associate with the idea of sorting and organizing papers, files, documents, etc'. The drawback of asking this question in the workplace was that the quantity of responses reflected the availability of perceptual cues; those who were asked the same question outside the workplace commented on the difficulty of 'thinking without being there'. This difficulty was reminiscent of that faced by the subjects in the preliminary study when asked to sketch a cognitive map of their ideal work place.

It was decided to focus attention on one relatively concrete concept, that of the *office*, and to repeat the task by focussing on one that was relatively abstract, namely that of *information*. Associating all responses with one stimulus necessarily implied the use of a controlled association test. A maximum number of ten responses to each concept from each subject was decided, on the grounds that responses were drawn from a comparatively limited knowledge domain.

Another problem was that of whether the stimulus word should be presented in written or spoken form. To make sure that all responses were associated with the original stimulus word only, and were not contaminated by previous responses, it was decided that subjects should respond orally to the stimulus and that their 'verbal reaction' should be recorded by the experimenter and not by the subject personally. The format of the response sheet is shown in Appendix B.

Responses to the association test were scored. The meaningfulness of the *stimulus word* was defined as the number of associations, or responses, that it provoked. The meaningfulness of *response words* was also calculated. There was a maximum of

ten responses from each subject: ten points was allocated to the first response, nine points to the second and so on. The meaningfulness of each response word was defined as its frequency of occurrence (that is, quantity of association to stimulus) or as the strength of association (that is, quality of association to stimulus).

Responses were also classified depending on whether they referred to an *object, person, function* or an *abstract* concept. The criteria for classification were as follows: a response classified as *object* typically referred to a physical component of the office or information environment. A response classified as *person* referred to the human component of that environment, for example, when people were referred to by their job title. A response classified as a *function* referred to a behavioural component, that is, to office work or information processing activities typically carried out by people. Those responses classified as *abstract* referred either to feelings and emotions associated with the stimulus words, or to abstract functions of the office.

6.5.3.3. Sorting and recall task.

Sorting was judged to be representative of paper-based information processing activities because it encompassed both the evaluation and organization of paper-based information.

The sorting task attempted to simulate some of the features of behaviour in a traditional office in so far as subjects were required to sort paper-based information but in conditions that were as uncontaminated as possible by external distractions. Recall performance was judged on the twin criteria of the number of items remembered and the number located.

The design of the tools for the investigation of sorting and recall are now described.

6.5.3.3.1. The forty memos.

Forty memos were devised (and are shown in Appendix C). The memos were adapted from paper-based information found in the files of a medium-sized vending engineering company. The original documents were not used because distinctive features - such as differences in size or colour or the presence of headings - might act as perceptual or memory cues. All the memos were reproduced using the same format and were printed on white paper with black typeface in Times font, size 12. The memo title was made more distinctive than the rest of the text, being in capital letters and underlined.

The contents were unfamiliar to subjects, but neither were they particularly complex or specialized on the grounds that many items of information at work do not make great intellectual demands on the reader. The memos were randomly shuffled and then chronologically ordered from 1 to 40. The number allocated was written on the back of the memo and was used to standardize the order of presentation to subjects.

6.5.3.3.2. Frequency count chart.

Behavioural occurrences, representative of sorting paper-based information, had been chosen after a thorough literature survey and after conversation with the interviewees who took part in the preliminary study. The sampled behaviours are shown in the frequency chart in Appendix D. Subjects were scored for the number of times that they carried out each of the following six actions.

(1) The forty memos were presented in a stack to subjects at the start of the sorting task. When the subject *read an item in the stack* this meant that no further action was taken and the item was not sorted into a pile. One score was allotted every time a memo was read.

(2) To *reread an item in a pile* was to read or check on an item after it had been sorted into a category. This activity involved either physically sorting through a pile to find

an item (sorting through one pile was counted as one score only) or looking at the memo on top of a pile to remind oneself of the contents of that pile.

(3) When an *item was put in a new pile* referred to the number of new categories or piles created. The final frequency count for this behaviour was not necessarily the same as the final number of categories because some piles might be amalgamated towards the end of the task.

(4) When an *item was put into an existing pile* referred to the number of times that a memo was sorted into an already existing category.

(5) When an *item was moved from pile to pile* referred to reorganization by removing a memo from one pile into another already existing one. Although the number of categories remained the same, the internal structure of two categories was altered.

(6) When an *item was moved from pile to new pile* referred to the number of times that subjects reorganized - after deciding that a memo was not in the appropriate pile - by creating an additional pile for the memo in question.

One score was counted every time one of the six activities was carried out. A total frequency score was arrived at for the number of times that each of the six activities was carried out and for the total number of activities carried out by each subject.

The sorting task was followed by a recall task, when subjects were asked to remember the content and location of as many of the memos as possible. By counting up the number of memos correctly remembered and the number correctly located, the experimenter was able to arrive at a measure of the accuracy of recall. Accuracy of location was determined objectively by whether an item was recalled as belonging to the category into which it had been sorted but the criterion of accuracy for content was more subjective. The experimenter and an independent rater compared the details recalled by each subject for each memo with details from the original memo, such as names, job descriptions, places and organizations, or a brief summary of the contents. Subjects were expected to differ in the amount of detail that they recalled, so each correctly recalled memo was to be counted as worth one point only, regardless of the

amount of detail recalled.

6.5.3.4. Questionnaire.

The questionnaire was devised with the aim of discovering how subjects perceived their strategy for sorting paper-based information.

The questions were based on themes that had emerged in the pilot interviews. As with the MBTI, a forced-choice format was used to describe behaviour. The format of the inventory obliged subjects to make broad categorizations about how they perceived their own behaviour and they were asked to chose one of several options that best described the decisions they made during the sorting task. (There were no direct questions on recall.)

The questionnaire is shown in Appendix E. Section A is concerned with the subject's preferred working environment and its inclusion was justified on the grounds that preferred conditions of work can influence or modify sorting strategy.

Subjects were asked whether they preferred a shared or private workplace. The amount of space that they have can influence their style of organizing paper-based information. Their habitual response style to the everyday problems of organizing papers could influence their experimental sorting strategy.

Subjects were then asked whether or not they liked routine in their work. Sorting papers tends to be a relatively routine task and people who do not mind this sort of work may show greater willingness and patience with the experiment. It has been suggested that Extraverts find routine clerical work more boring than Introverts do (Sterns, Alexander, Bartlett and Dambrot, 1983).

The subject was asked whether he or she organized the items with any past, present or future use in mind. The temporal aspect of the cognitive model has received little attention except that, in uncertain conditions, people tend to classify on the basis of

past experience (Caplan et al, 1985). Answers to this question would partly depend on whether subjects projected themselves into a hypothetical long-term work situation and adapted their strategy accordingly, or whether they organized for short-term experimental purposes only. They had not been advised on what approach to adopt during the sorting experiment as this would bias their response.

They were asked whether they chose to organize information on the basis of item content or function. Organizing around content was defined as organizing around attributes such as the meaning of words. Organizing for function was defined as organizing for a purpose such as anticipating future uses of the information. Cole (1982) made the point that managerial staff know the 'what' of paper-based information, which suggests that their mental model is content-oriented.

Certain memos (numbers 10, 11, 22, 40 in Appendix E) presented to the subjects were incomplete in that they referred to a document that was not physically present among the stack of forty memos. Subjects were asked which of the available responses best described the action that they had taken: whether they piled those items into a separate pile as incomplete; whether they piled them as appropriate with the most closely related items; whether they made a mental note of the location of incomplete items; or whether they took other action (including failure to recognize the presence of incomplete items).

Subjects were asked what they had done with memos whose meaning they perceived as being 'category inconsistent' because they were unable to associate the item with other items or piles. They were asked whether inconsistent information was put in a separate pile; whether it was put in 'general' pile for miscellaneous or difficult items; whether such items were put with the most closely related information; or whether other action was taken (including whether subjects recognized the presence of incomplete items).

Subjects were asked to choose which of four alternatives best described the relative mobility in time and space of the items and/or categories once the sorting task was completed. They were asked whether all information was perceived in a fixed place,

whether most information was in a fixed place or mostly loosely arranged or all loosely arranged. Low mobility, or fixity, is thought to denote the use of a limited set of mental operations (Werner, 1957).

The scoring system for the questionnaire is seen in Appendix E. The numerical coding assigned to the responses had no meaning beyond the presence or absence of the property or attribute being measured. Although it could not be assumed that equal intervals existed between all potential responses to a question, nonetheless, all persons responding in the same way were alike with respect to some attribute. Different responses were therefore one indication of individual differences in the organization of cognition.

6.6. Subjects.

Gender and intellectual interests are both sources of individual differences in cognition (Deaux, 1985; Richek, 1969). These two sources of variance were controlled when subjects were selected. There were forty subjects of whom twenty were male and twenty were female. Half the male subjects described themselves, on the basis of their area of academic study, as 'scientists', the other half as 'non-scientists'. The same was true for female subjects.

The forty subjects were independent of those who had taken part in the evaluation study. They were selected on the grounds that they were familiar with paper-based information because, despite the growing use of computers, the majority of people continue to record and transmit paper-based information.

Some vocational theories (e.g. Holland, 1973) argue that people self-select themselves into occupations which are particularly suited to their type. If correct, then we could not expect a normal distribution of MBTI types for any sample drawn from an occupational group. It was important to emphasize that office workers were *not* used

as subjects because other research (e.g., Mortensen and Stevens, 1982) suggests that their chosen sorting strategy is modified by organizational requirements. Research students, on the other hand, had more chance to develop highly individualized ways of sorting paper-based information.

All subjects were postgraduate students who were used to processing a heavy information load and were aged from eighteen to thirty-one years. Additionally, all were native English speakers - an important consideration for tasks requiring the classification of verbal concepts.

6.7. Procedure.

Subjects self-administered the MBTI in their own time. The experimenter scored the inventory and informed the subjects of their cognitive orientation type.

The experimental tasks and the questionnaire were carried out consecutively in a place and at a time that was mutually convenient for both subject and experimenter.

The word association task was the first to be completed. Subjects responded with a maximum of up to ten responses to each of the two stimulus words of *office* and *information*. The experimenter addressed each subject individually: 'please think of as many words as you can - up to ten if possible - that you associate with the word *office*. The words you choose can be nouns, verbs or adjectives. Please speak out loud and I will write your responses down'. The subject responded verbally to the stimulus word of *office* and the experimenter listed the responses on the score sheet shown in Appendix B. The procedure was repeated for the second stimulus word, *information*.

The sorting and recall task was carried out next. The subject was presented with a stack of forty memos (which were presented in the same order for all participants). The memos were sorted at a desk which had been cleared of other papers or objects.

Subjects were not given a strict time limit in which to complete the task but it was suggested that at least twenty minutes should be allowed. Instead of being given elaborate instructions, they were told to sort the items in whatever way they preferred. However, they were informed that there were no constraints on the number or size of categories or on how often they reorganized items. They were told in advance that they would be asked to recall the content and location of as many items as possible.

Subjects then began to sort and, at the same time, the experimenter observed their behaviour and recorded the frequency with which the six activities occurred on the chart shown in Appendix D. Every observed activity was marked in the appropriate row of the frequency chart and a score of one was allocated. After the task had been completed, the total number of times each action was performed was added up for each subject.

Categories or piles were created spontaneously while sorting. Once the subject had sorted all the memos, he or she was asked to choose a title for each category. The experimenter wrote the given titles on a blank piece of A4 paper, leaving sufficient space underneath and between the titles for subjects to list the contents of each category. Once the experimenter had done this, the sheet was handed to the subject who was asked to recall as many memos as he or she could and write them under the appropriate heading. While the subject was doing that, the experimenter noted on paper how the subject had sorted the forty memos (each of which had a number on the back to make identification easy). This list of what items were sorted where was used to check the accuracy of each subject's recall performance.

The structured questionnaire (Appendix E) was administered by the experimenter. The questions were asked after the recall task, rather than before, so as to avoid interference with recall performance.

6.8. Analysis of data.

The raw data was analyzed using the Statview 512+ statistical package (Feldman and Gagnon, 1986). One-way analysis of variance was used to investigate differences between the four cognitive orientation types, where personal characteristics were a source of between groups variance and performance measures were a source of within group variance. Where it furthered the investigation, subjects were classified and compared on the basis of their cognitive functions (combinations of which defined the their type).

The question of the level of significance that should be adopted for *F* ratios shown in ANOVA summary tables arose because Type II errors are more likely where the sample size is small. In exploratory research the .10 and .20 levels may be more appropriate than the conventional .05 or .01 levels of significance (Roscoe, 1975). Results are typically discussed as significant when $p < .05$; however, results significant at $p > .05$ are also discussed in cases where there were few discernable differences because of the small sample size.

Post hoc comparisons of means employed the robust Scheffé's method (1959) which was abbreviated as *S* and Fisher's test of least significant differences, abbreviated as *LSD*. When testing for differences between means, Scheffé recommended using the $p<.10$ level of significance, on the grounds that the $p<.05$ level is very rigorous and will lead to fewer significant differences. It must be noted that reservations have been expressed concerning Fisher's test on the grounds that it may capitalize on chance differences (Roscoe, 1975). Results are shown abbreviated to two decimal places.

6.9. Conclusions.

This chapter described the design of three cognitive tasks and the administration of those tasks and of the MBTI personality inventory. The aim of the research was to investigate whether the inventory is suitable for identifying differences between types of people in their information processing strategies. The results are described in Chapters 7-10.

Chapter 7. Results I: Cognitive orientation type.

7.1. Introduction.

The relationship between personality and cognition is a complex one that has been discussed (in chapter 4) in terms of the personality theory of Carl Jung. The MBTI is a Jungian-based personality inventory suitable for identifying personality type. Type is defined by preferences for Extraversion or Introversion (one of which describes the direction of attention), the orientation functions of Sensing or Intuition and Thinking or Feeling and for understanding the environment through Judging or Perceiving. For each bipolar dimension, there is a dominant and an auxiliary function. In contrast to their personality type, people's cognitive orientation types are indicated by their scores on the inventory for the dimensions of Sensing/Intuition and Thinking/Feeling only (Myers, 1976).

The characteristics of a sample of forty people are described in the present chapter. Later experimental work investigates the hypothesis that each cognitive orientation type is characterized by a distinctive style of information processing.

7.2. Results.

The distribution of Jungian personality types is determined by scores for each of the four MBTI dimensions and is described first. Two of those dimensions indicate the dominant cognitive orientation functions. The distribution of dominant functions was established and then subjects were classified as belonging to one of four types. Finally, the four cognitive orientation types were differentiated on the basis of gender and area of academic interest. Scores were analyzed with the aim of determining the

relative importance of the evaluating and organizing functions to a type's information processing.(See Appendix F for personality scores.)

7.2.1. Distribution of personality types.

Cross-classification along all four personality dimensions gives a maximum of 16 personality types. In the present sample, the Introverted-Intuitive-Feeling-Perceiving (INFP) personality type occurred most frequently (n=9). The Introverted-Sensing-Thinking-Judging (ISTJ) type was the second most frequently occurring type for this sample (n=5). It is to be noted that the ISTJ type is the most common among a normally distributed population (McCaulley, 1986). The small numbers of subjects rendered a four-way classification undesirable.

7.2.2. Distribution of cognitive functions.

To have clearly differentiated preferences for cognitive processing, people must habitually use a cognitive function over the complementary one, for example, they consistently use Thinking over Feeling. Combinations of these functions determined a person's cognitive orientation type.

When the 40 subjects were classified according to their dominant cognitive functions, there were 18 subjects for whom Sensing and 22 for whom Intuition was the dominant mode of evaluation. For the same subjects, there were 22 subjects for whom Thinking and 18 for whom Feeling was the dominant mode of organization.

7.2.3. Distribution of cognitive orientation types.

Subjects were classified along the two orientation functions - of Sensing or Intuition and Thinking or Feeling - to determine their cognitive orientation type to give four possible cognitive orientation types. Subjects with Sensing and Thinking dominant were referred to as Type I subjects; with Sensing and Feeling dominant as Type II; with Intuition and Thinking dominant as Type III; and with Intuition and Feeling dominant as Type IV.

The distribution of subjects across the four types can be seen in Figure 4. The four types were unequally distributed and it will be observed that were fewer Type II subjects than in the other groups.

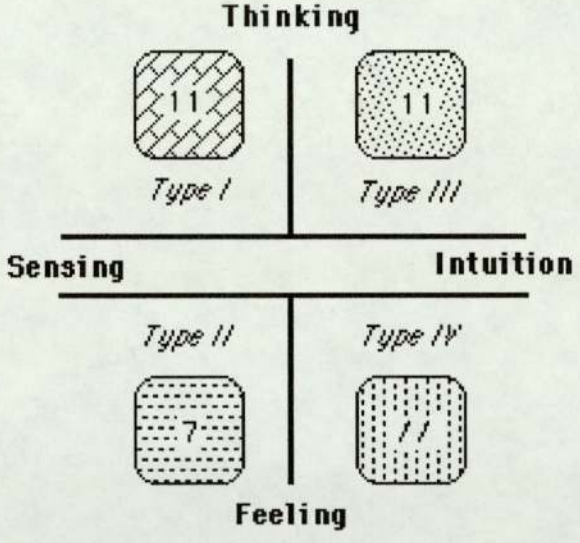


Figure 4. *Schematic representation showing the frequency distribution of subjects in each of the four cognitive orientation types. Type was defined by the dominant style of evaluating and gathering information.*

The relative strength of each of the four functions in each of the four types is shown in Figure 5. Each type had a dominant and an auxiliary function for evaluating information and the same for organizing information.

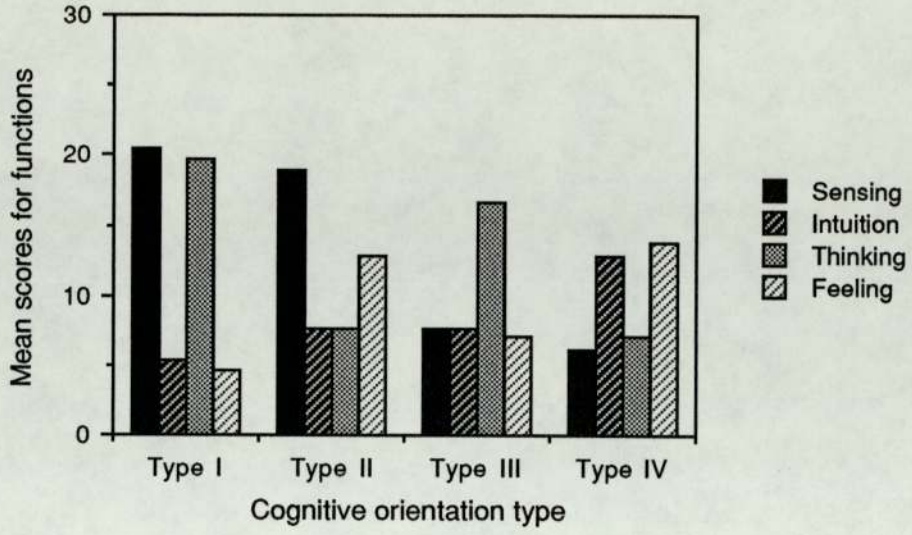


Figure 5. *Mean scores (in points) for the cognitive functions of Sensing, Intuition, Thinking and Feeling for each of the four cognitive orientation types.*

From Figure 5, it was observed that the Sensing and Thinking functions were most highly developed by Type I subjects, whereas the Intuition and Feeling functions were strongest in the case of Type IV persons. These two types tended to be mutually exclusive.

7.2.4. The association between attention and the cognitive functions.

It was decided above not to include Extraversion/Introversion scores in the classification resulting in the identification of four distinct types. However, it is necessary to compare types on the Extraversion/Introversion scales. This was done by calculating the differences between subjects scores for Extraversion and Introversion. This difference score provides a simple index of differentiation. The magnitude of the difference between Extraversion and Introversion reflects the strength of the direction of attention, or the clarity with which a person focuses attention on information in one

direction or the other.Product-moment correlations between Extraversion/Introversion difference scores and function scores (Sensing, Intuiton, Thinking and Feeling) were calculated for each cognitive orientation type. The results are shown in Table 4.

	Cognitive orientation type			
	Type I (S, T)	Type II (S, F)	Type III (N, T)	Type IV (N, F)
Functions x attitude				
Sensing *x* Extrav/Introv	.13	-.44*	-	-
Intuition (N) *x* Extrav/Introv	-	-	.28	-.14
Thinking *x* Extrav/Introv	.56*	-	.50*	-
Feeling *x* Extrav/Introv	-	.38*	-	.13

Table 4. *Product-moment correlations between direction of attention preference (i.e., Extraversion/Introversion) and dominant cognitive functions for each of the four types (*, $p < .05$).*

There were positive correlations between the mode of organizing information (which was through Thinking or Feeling) and the focus of attention for Types I, II and III. From this, it was inferred that there was an association between the clarity with which those persons focussed on information and the way in which they judged and organized it.

7.2.5. Dominance of cognitive functions for the types.

As we have seen, each of the four Jungian dimensions was envisaged as a continuum, with a dominant and an auxiliary function at opposing ends of the continuum. Type characteristics, or dominant cognitive functions, are shown in Table 5. The Extraversion/Introversion dimension was excluded because it represents subject attitudes. The Judging/Perceiving dimension is included because of its relationship with the cognitive functions. A person who is predominantly Judging is said to emphasize the

organization of information rather its evaluation; the Perceiving person emphasizes the evaluation process at the expense of organization.

	Cognitive orientation type			
	Type I (S, T)	Type II (S, F)	Type III (N, T)	Type IV (N, F)
Relative strength of cognitive functions:				
Sensing or Intuition (N)	28.46	21.29	20.64	25.55
Thinking or Feeling	34.46	11.29	18.09	16.27
Judging or Perceiving	35.91	22.43	27.73	35.55

Table 5. *Mean scores (in points) for strength of preference for dominant cognitive functions for the four cognitive orientation types.*

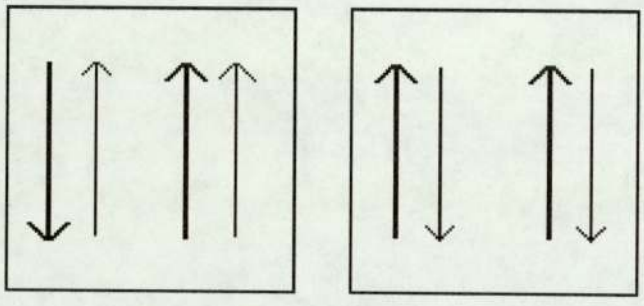
The means shown in Table 5, which reflect the strength of the dominant function, were derived from scores automatically calculated as part of the scoring procedure for the MBTI. The higher this mean score, then the greater the differentiation between dominant and auxiliary functions and the more differentiated that type's style of cognitive orientation.

The strength of the Judging/Perceiving function shown in Table 5 indicated the strength of the function for evaluation over organization or vice versa. The judging Thinking function was the single most important cognitive function for the average Type I subject. Perceiving functions were more important to the other three types: Sensing for Type II and Intuition for Types III and IV.

From Table 5, it can be seen again that the dominant functions were stronger, or more well-developed for Type I and for Type IV. The developmental origins of type development are not really known and are beyond the scope of this study, excepting consideration of the effect of strongly defined cognitive functions on the flexibility of information processing.

7.2.6. Bipolarity of cognitive functions for the types.

Jungian theory recognizes the existence of a dominant and an auxiliary function for each dimension. Bipolarity assumes that there is an inverse relation between the dominant and the auxiliary function, for example, the more important Sensing becomes, then the less important the bipolar function of Intuition becomes and vice versa. Correlation coefficients between the functions for each of the four types are shown in Table 6, from which further information about the structure of cognition for each type can be inferred. The higher the negative correlation between two functions, then the higher the bipolarity. The bipolarity of the cognitive functions was confirmed in the case of Types III and IV, that is, for those persons for whom Intuition is the dominant mode of evaluating information. The bipolarity of one function only could be confirmed in the case of subjects who evaluated through Sensing, that is, Types I and II.



TYPES I AND II ***TYPES III AND IV.***

Figure 6. *Schematic representation of the bipolarity of the two cognitive orientation functions. The dominant function was shown in bold line and the corresponding auxiliary function in plain line. Bipolar functions are shown with the arrows facing in opposite directions.*

The relationship between the functions is represented schematically in Figure 6. The bipolarity of both cognitive functions is indicated for the Intuitive types, III and IV. For Sensing types, there was one bipolar cognitive function only: Type I subjects placed undue emphasis on the Thinking function, that is, on organizing information; Type II subjects appear to emphasize the Sensing function, that is, the evaluation of

Cognitive functions:	Sens.	Intuit.	Think.	Feel.	Judg.	Perc
Type						
Sensing	I	-.09	.00	-.44*	-.09	-.08
	II	-.53*	.18	.82*	.22	-.03
	III	-.48	-.32	.53*	.45*	-.45
	IV	-.82*	.27	-.24	.76*	-.57
Intuition	I		.18	.06	.00	.14
	II		.29	-.72*	-.36	.27
	III		.32	-.52	-.29	.32
	IV		-.11	.33*	-.68*	.41*
Thinking	I			-.68*	.28	-.19
	II			-.22	-.04	.46*
	III			-.67*	.32	-.22
	IV			-.54*	-.28*	.49*
Feeling	I				-.15	.24
	II				.54*	-.45*
	III				.02	-.08
	IV				-.27	.49*
Judging	I					-.94*
	II					-.87*
	III					-.99*
	IV					-.84*

Table 6. *Correlations between the three cognitive functions for subjects classified according to cognitive orientation type (*, $p < 0.05$).*

concrete and observable data. One purpose of the present investigation is to explore the implications of this finding for cognitive information processing.

7.2.7. Gender and area of academic interest as a source of differences between the types.

Of 20 male and 20 female subjects, ten male subjects were research students in scientific topics and the other ten in non-scientific projects. The same division was true for female subjects. The experimental subjects were more Introverted, more Feeling and more Perceiving than might be expected for the normal population for this age group (McCaulley, 1986).

The number of males and females, scientists and non-scientists, in each of the four cognitive orientation types is graphically represented in Figure 7. There was a striking preponderance of male scientists in the Type I group and of female non-scientists in the Intuitive Types III and IV.

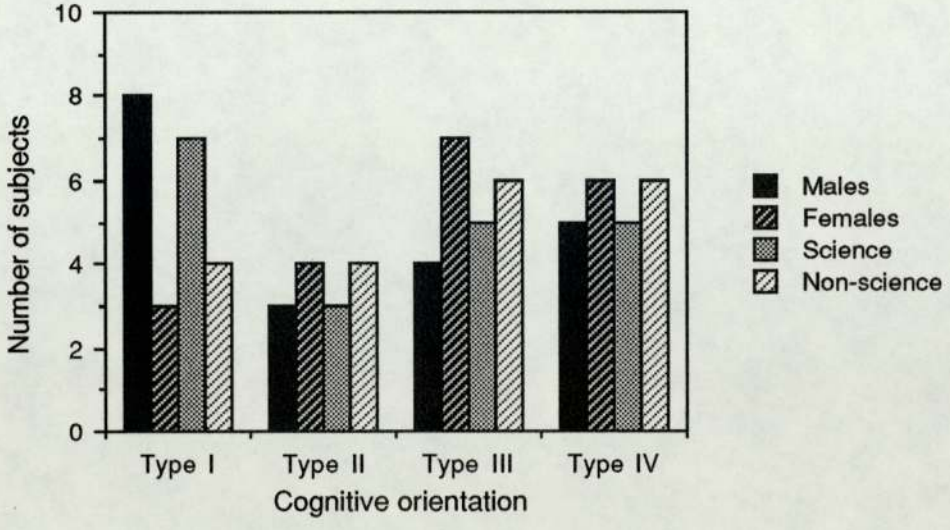


Figure 7. *Histogram showing the distribution of cognitive orientation types according to gender and area of academic interest.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Cognitive orientation type	2.5	1	2.5	51.4	38	1.35	53.9	1.85	(p <.18)
Functions:									
(1) Sensing	81.23	1	81.23	2446.75	38	64.39	2527.98	1.26	(p <.27)
(2) Intuition	50.63	1	50.63	1825.35	38	48.04	1875.98	1.05	(p <. 31)
(3) Thinking	313.6	1	313.6	2192.4	38	57.70	2506	5.44	(p <.03)
(4) Feeling	65.03	1	65.03	925.95	38	24.37	990.98	2.67	(p <.11)

Table 7. *Gender as a source of differences between subjects in their cognitive orientation type and in the strength of each of the four cognitive functions.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Cognitive orientation type	.9	1	.9	53	38	1.40	53.9	.65	(p <.43)
Functions:									
(1) Sensing	180.63	1	180.63	2347.35	38	61.77	2527.98	2.92	(p <.10)
(2) Intuition	55.23	1	55.23	1820.75	38	47.91	1875.98	1.15	(p <.29)
(3) Thinking	8.1	1	8.1	2497.9	38	65.73	2506	.12	(p <.70)
(4) Feeling	15.63	1	15.63	975.35	38	25.67	990.98	.61	(p <.44)

Table 8. *Preferred area of academic interest as source of differences between subjects in their cognitive orientation type and in the strength of each of the four cognitive functions.*

One-way analysis of variance was calculated with gender as a source of variance between subjects in their MBTI scores (Table 7). From the *F* ratios shown in Table 7, it can be seen that males and females differed in their preference for the Thinking function as the mode for organizing information ($p < .03$). A post hoc comparison of the means using the robust Scheffé's test indicated that males were significantly more Thinking than females (S 5.44, $p < .05$). This result supported Jung's speculation that males and females differ only on the distribution of the Thinking/Feeling dimension and that males are more Thinking than females. From Table 8, it can be seen that area of academic interest was not a significant source of differences in the distribution of cognitive types or functions and that any differences were due to chance.

To conclude, males and females differed significantly in their preferred mode of judging and organizing information: males were more Thinking and females were more Feeling. Apart from that, the processing similarities between males and females, 'scientists' and 'non-scientists' were greater than the differences.

7.3. Discussion.

Cognitive orientation type was defined in terms of a persons dominant style of evaluating and organizing information. Four types were identified and referred to as Types I, II, III and IV for the sake of parsimony. Type I subjects were those with Sensing and Thinking dominant; Type II with Sensing and Feeling; Type III with Intuition and Thinking and Type IV with Intuition and Feeling dominant. This classification of MBTI scores overlooks the *relative* influence of evaluation and organization on cognitive processing. Examination of the Judging/Perceiving dimension indicated that the organization of information was more important to Sensing-Thinking (Type I) subjects in contrast to the other three groups who

emphasized its evaluation.

The following discussion suggests some of the implications of belonging to a cognitive orientation type for cognitive information processing. Evidence for the MBTI as an indicator of individual differences in processing will be found in the subjects performance on the behavioural tasks described in the following chapters. The dominant cognitive functions consciously orient to the environment. Behavioural evidence will be sought to show that the different functions are oriented to the processing of certain aspects of information at the expense of other aspects. Some kinds of information are more difficult to process because they are associated with the person's auxiliary cognitive functions.

Jung defined Extraversion/Introversion as the focus of attention. Eysenck has been highly critical of the Jungian dimension but independent research suggests that Eysenck's formulation of this concept is synonymous with Jung's (Steele and Kelly, 1976). In Jungian terms, the direction of attention determines the environmental information to which a person orients. According to Jungian theory, an Introvert's dominant functions are oriented to the 'inside world' and he or she uses their auxiliary functions to interact with outside world. The real world implication of this is that Introverts find it more difficult to interact and communicate with others. A decision was made to exclude consideration of the role of attention in cognitive information processing. There are contradictory reports in the literature about whether the cognitive functions and attention are related and the present results were inconclusive. Nonetheless, the focus of orientation remains of obvious significance and importance to the question of how people learn.

Subjects who evaluated through Intuition (i.e., Types III and IV) were found to have developed strong preferences for *both* cognitive functions. In contrast, those who evaluated through Sensing (i.e., Types I and II) had developed one strong preference only: they emphasized evaluation *or* organization but at the expense of the other function. This was interpreted as meaning that they tended to process information through one cognitive function only. This speculation, if correct, is expected to have

important implications for differences between the cognitive information processing of Sensing and Intuitive subjects. Evidence will be sought to show that the information processing of Intuitive persons is more flexible and mobile than that of Sensing persons because the former habitually use both cognitive functions to process. In contrast, Sensing subjects in the Type I group had neglected the evaluation of cognitive information; those in the Type II group had neglected its organization. This neglect of the development of one function does not mean that those subjects never use their less developed function (i.e., for evaluation in the case of Sensing-Thinking subjects and for organization in the case of Sensing-Feeling persons). Instead, this limitation will probably have the effect of diminishing the flexibility of their cognitive processing. It seems likely that Sensing-Thinking subjects will emphasize the judging of information on the basis of whether it is true or false when compared with some criterion; Sensing-Feeling subjects will probably be oriented to the processing of information derived from concrete and observable objects.

Evidence for these exploratory hypotheses of information processing differences between the four types must be found in the subjects performance on cognitive tasks. It must be emphasized at this point that the information processing strategies of the four types were not mutually exclusive. For example, Sensing-Thinking (Type I) and Sensing-Feeling (Type II) share the same mode for evaluation although they organize information in different ways. This means that there will be considerable theoretical difficulties in comparing the task responses of the four types. Despite its complexities, one of the chief advantages of using the MBTI as an indicator of individual differences in how people process paper-based information is that it provides for the measurement of both personal characteristics and cognitive processes along commensurate dimensions.

7.4. Conclusions.

The advantage of classifying subjects, not on personality type, but on style of cognitive orientation was that the number of potential types was reduced from the maximum of 16 to a more economic four (labelled Types I-IV). Cognitive orientation type was defined by two dominant functions which were hypothesized to be associated with a dominant mode of acquiring, processing and organizing information. It is speculated that the information processing of Intuitive persons will be more flexible than that of Sensing subjects because the former have developed both functions - for evaluating and organizing information - whereas the latter have developed one function but neglected the other. Male subjects were found to organize cognitive information through the Thinking function and females through the Feeling function; apart from that, the similarities between the cognitive profiles of the sexes were greater than the differences.

One behavioural implication of belonging to a type is that there are discernable differences between people in their performance on cognitive tasks, related to office type work. This exploratory hypothesis is investigated and the results, described in chapters 8-10, are interpreted to support claims for the MBTI as a measure of cognitive orientation type.

Chapter 8. Results II: Word association task.

8.1. Introduction.

Subjects were characterized, on the basis of their MBTI scores, as belonging to one of four cognitive orientation types. Evidence was sought to show that cognitive orientation was a source of differences between types of people in their word association response style. The aim of the word association task was to validate the claims of the MBTI by differentiating the four cognitive orientation types in terms of their performance on an independent cognitive task.

8.2. Results.

Subjects participated in a word association test, by responding with up to ten words that they associated firstly with *office* and then another ten with *information*. The results were interpreted as evidence for four discernable cognitive orientation types. The following strategy of analysis was followed in this chapter: the words given as responses, and their frequency of occurrence, were listed. Then the responses by the four types were compared; when it furthered the analysis, the subjects were distinguished on the basis of their dominant functions for evaluating and organizing cognitive information. Subjects were compared on the basis of the originality of their responses, which were further subjected to a four-way classification as referring to an abstract concept, a function, an object or a person.

8.2.1. The words used in response.

A total of 121 different words were used as responses, of which 66 were given in response to *office* and 55 to *information*.

These words, and their frequency of occurrence, are listed in Appendix G.

8.2.2. Quantity of association to stimulus words by all subjects.

Quantity of Association referred to the number of times that a response was given to a stimulus word. The 40 subjects responded 427 times in all. The quantity of association by all subjects, by the four types and by subjects classified according to how they evaluate and organize, is shown in Table 9.

Responses:	Office		Information		All responses	
	Total	*Mean*	*Total*	*Mean*	*Total*	*Total mean*
All subjects	247	6.18	180	4.50	427	5.34
Cognitive orientation type.						
Type I	66	6.6	45	4.09	111	5.05
Type II	49	7	39	5.57	88	6.29
Type III	70	6.36	50	4.55	120	5.45
Type IV	62	5.64	46	4.18	108	4.91
Cognitive functions.						
Sensing	113	6.28	88	4.89	201	5.59
Intuitive	132	6	95	4.32	227	5.16
Thinking	137	6.23	99	4.5	236	5.34
Feeling	108	6	84	4.67	192	5.33

Table 9. *Frequency and mean number of responses given to stimuli words of 'office' and 'information' by all subjects, by subjects when classified according to type of cognitive orientation, and by subjects differentiated by cognitive functions. There were 11 Type I, seven Type II, 11 Type III and 11 Type IV subjects. Of the same subjects, 18 evaluated through Sensing and 22 through Intuition while 22 of the same subjects organized through Thinking and 18 through Feeling.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
No. of responses	20.58	3	6.86	21.82	36	7.27	282.4	.94	(p <.43)
No. of 'office' resps	12.38	3	4.13	86	36	2.39	98.38	1.73	(p <.18)
No. of 'information' resps	1.59	3	.53	82.18	36	2.28	83.78	.23	(p <.87)
Group B. Style of evaluation									
No. of responses	7.13	1	7.13	275.27	38	7.24	282.4	.98	(p <.33)
No. of 'office' resps	.76	1	.76	97.61	38	2.57	98.38	.30	(p <.59)
No. of 'information' resps	3.22	1	3.22	80.55	38	2.12	83.78	1.52	(p <.23)
Group C. Style of organization									
No. of responses	.04	1	.04	282.36	38	7.43	282.4	.01	(p <.95)
No. of 'office' resps	.51	1	.51	97.86	38	2.58	98.38	.20	(p <.66)
No. of 'information' resps	.28	1	.28	83.5	38	2.20	83.78	.13	(p <.73)

Table 10. *One-way ANOVA summary table for cognition as a source of differences between subjects in their total number of responses, in the number of responses to 'office' and to 'information'. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

As subjects responded more often to the stimulus word of *office* than to that of *information*, it was concluded that the former was the more meaningful, or concrete, concept. Meaningfulness was defined as the number of responses associated with the stimulus word (after Paivio et al, 1968). The greater meaningfulness of *office*, when compared with *information*, was also characteristic of each of the four types.

One-way analysis of variance was calculated where cognitive orientation was the source of between groups variance and the quantity of responses was the source of within groups variance. From the *F* ratios shown in Table 10, it can be seen that cognition was not an important source of differences between subjects in the quantity of their association. Post hoc comparison of the means using Fishers test of least significant differences indicated that Type II subjects responded significantly more often to *office* whereas Type IV responded least often. The difference between the two types was significant (*LSD* 1.52, $p < 0.05$).

There was, at this stage, little evidence for cognition as a source of differences between the types in their response style.

8.2.3. Quantity of association for the four most frequently occurring words.

The focus of this section was to show that the four cognitive orientation types differed in their choice of responses. For this purpose, the four words most commonly associated with *office* and *information* were taken to illustrate differences in response style (see Appendix G for responses ordered in terms of quantity).

8.2.3.1. The most frequently occurring responses to *office*.

For all subjects, the four most frequently occurring responses to *office* were: 'desk' (n=25), 'typewriter' (n=20), 'secretary' (n=19), and 'paper' (n=17). The frequency with which these words were given in response to the stimulus word by each of the four cognitive orientation types is shown in Figure 8.

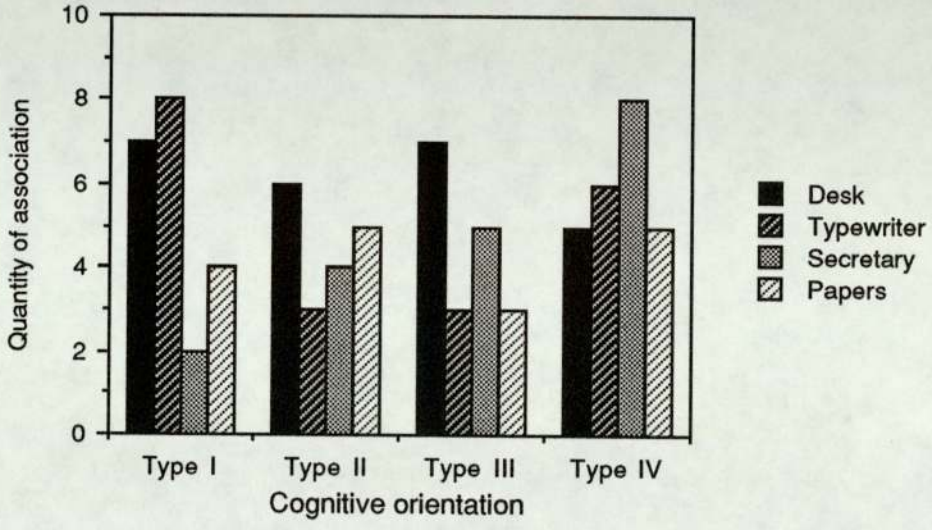


Figure 8. *Histogram showing how often the the four most frequently occurring responses to 'office' were given by each of the four cognitive orientation types.*

One-way ANOVA was calculated where cognitive orientation type was a source of between groups variance in the quantity of association to the more concrete concept of *office*. *F* ratios are shown in Table 11, from which it was observed that the four types differed in the number of times they responded with 'secretary' ($p < .02$). Type IV choose 'secretary' as a response significantly more often than the mutually exclusive Type I (*S* 2.82, $p < .10$).

F ratios for style of evaluation and style of organization as sources of variance in the quantity of association to *office* are also shown in Table 10. The way in which subjects organized, or judged, information was significant ($p < .03$) for the choice of

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Desk	.38	3	.13	9.22	36	.26	9.6	.49	(p <.69)
Typewriter	.79	3	.26	9.21	36	.26	10	1.03	(p <.39)
Secretary	2.3	3	.77	7.68	36	.21	9.98	3.59	(p <.02)
Paper	.14	3	.05	9.46	36	.26	9.6	.18	(p <.91)
Group B. Style of evaluation									
Desk	.15	1	.15	9.46	38	.25	9.6	.59	(p <.45)
Typewriter	.40	1	.40	9.60	38	.25	10	1.60	(p <.21)
Secretary	.66	1	.66	9.32	38	.25	9.98	2.68	(p <.11)
Paper	.07	1	.07	9.54	38	.25	9.6	.26	(p <.62)
Group C. Style of organization									
Desk	.07	1	.07	9.54	38	.25	9.6	.26	(p <.62)
Typewriter	0	1	0	10	38	.26	10	.0	
Secretary	1.20	1	1.20	8.77	38	.23	9.98	5.21	(p <.03)
Paper	.33	1	.33	9.27	38	.24	9.6	1.34	(p <.25)

Table 11. *One-way ANOVA summary table for cognition as a source of differences between subjects in the frequency with which they used the four most frequently occurring responses (listed in order of frequency) associated with 'office'. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

'secretary'. Post hoc comparison of means using Scheffé's test revealed that Feeling persons selected this response more often than the predominantly male Thinking persons (S 5.21, $p < .05$). In conclusion, the quality of association for the four most frequently occurring responses to *office* indicated that subjects differed most in whether or not they chose 'secretary' as a response and that Type IV subjects responded with the personal concept 'secretary' more often than the mutually exclusive (and typically male) Type I.

8.2.3.2. The most frequently occurring responses to *information*.

The four most frequently occurring responses to *information* were: 'computer' (n=19), 'books' (n = 17), 'paper' (n = 15) and 'files' (n = 12). The frequency with which these words were chosen as responses to the stimulus word by each of the four cognitive orientation types is shown in Figure 9.

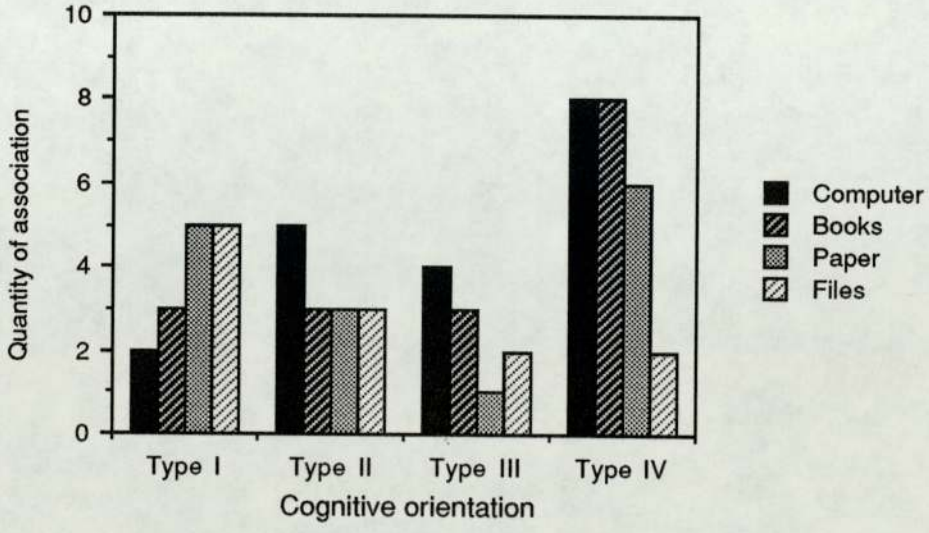


Figure 9. *Histogram showing the four most frequently occurring responses to 'information' by subjects who were classified according to cognitive orientation type.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Computer	1.43	3	.48	8.55	36	.24	9.98	2.01	(p <.13)
Books	1.40	3	.47	8.38	36	.23	9.78	2.00	(p <.13)
Paper(s)	1.18	3	.39	7.59	36	.21	8.78	1.87	(p <.15)
Files	.58	3	.19	6.92	36	.19	7.5	1.01	(p <.40)
Group B. Style of evaluation									
Computer	.24	1	.24	9.73	38	.26	9.98	.95	(p <.34)
Books	.28	1	.28	9.5	38	.25	9.78	1.1	(p <.30)
Paper(s)	.00	1	.00	8.77	38	.23	8.78	.01	(p <.92)
Files	.63	1	.63	6.87	38	.18	7.5	3.49	(p <.07)
Group C. Style of organization									
Computer	2	1	2	7.98	38	.21	9.98	9.53	(p <.01)
Books	1.13	1	1.13	8.64	38	.23	9.78	4.99	(p <.03)
Paper(s)	1.00	1	1.00	7.77	38	.21	8.78	4.90	(p <.03)
Files	.03	1	.03	7.48	38	.20	7.5	.13	(p <.72)

Table 12. *One-way ANOVA summary table for cognition as a source of differences between subjects in the frequency with which they used the four most frequently occurring responses (listed in order of frequency) associated with 'information'. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

Again, one-way analysis of variance was computed with cognitive orientation as a source of between groups variance in the number of responses associated with *information*. As can be seen from the *F* ratios shown in Table 12, differences were not highly significant. However, it can be seen from the same table that styles of evaluation and organization were more important sources of variance. Comparison of the means using Scheffé's test indicated that Sensing persons chose 'files' more often than Intuitive subjects (*S* 2.82, $p < .10$). Feeling persons chose 'computer, 'books' and 'paper(s)' more often than Thinking subjects (*S* 9.53, $p < .01$; *S* 4.99, $p < .05$; *S* 4.9, $p < .05$ respectively).

Cognitive orientation was a more significant source of differences between subjects in how they responded to the comparatively abstract concept of *information* than it had been for responses to *office*.

8.2.4. Quality of association for the four most frequently occurring words.

Quality of association was defined as the strength of association between stimulus and response and was calculated on the basis of the mean number of points allocated during the scoring process to each of the four most frequently occurring responses. Results in the following two sections reflect the quality of association between the stimulus word and the four responses.

8.2.4.1. Quality of association for *office*.

One-way analysis of variance was computed for cognitive orientation as a source of differences in the quality of association to the more concrete concept of *office*. *F* ratios shown in Table 13 indicate that there were no differences significant at the $p \leq .10$ level. Post hoc comparison of means using Fishers test of least significant differences revealed that the association between 'secretary' and *office* was significantly stronger for Type IV subjects than for Type I (*LSD* 3.59, $p < .05$). Examination of *F* ratios (also in Table 13) for the orienting styles of evaluation and organization as sources of variance led to the conclusion that subjects did not differ significantly in the quality of their associations to *office*.

8.2.4.2. Quality of association for *information*.

One-way analysis of variance was computed to investigate cognitive orientation as a source of differences in the strength of association between the stimulus word of *information* and its four most frequently occurring responses. Firstly, *F* ratios in Table 14 show that cognitive orientation type was a significant source ($p < .06$) of differences in the quality of association of 'books'. Scheffé's test was used to compare the means and Type IV subjects were found to associate 'books' with *information* more than the mutually exclusive Type I (*S* 2.41, $p < .10$).

The histogram in Figure 10 compares quality of association for the four most frequently occurring responses to *information* between subjects differentiated on the basis of their evaluation and organization.

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Desk	36.19	3	12.06	779.71	36	21.66	815.9	.56	(p <.65)
Typewriter	23.06	3	7.69	689.71	36	19.16	712.78	.40	(p <.75)
Secretary	75.05	3	25.02	621.35	36	17.26	696.4	1.45	(p <.25)
Papers	41.31	3	13.77	659.79	36	18.33	701.1	.75	(p <.53)
Group B. Style of evaluation									
Desk	53.9	1	53.9	762	38	20.05	815.9	2.69	(p <.11)
Typewriter	.13	1	.13	712.64	38	18.75	712.78	.01	(p <.93)
Secretary	27.83	1	27.83	668.57	38	17.59	696.4	1.58	(p <.22)
Papers	.17	1	.17	700.93	38	18.45	701.1	.01	(p <.92)
Group C.Style of organization									
Desk	.45	1	.45	815.46	38	21.46	815.9	.02	(p <.89)
Typewriter	1.00	1	1.00	711.77	38	18.73	712.78	.05	(p <.82)
Secretary	30.58	1	30.58	665.82	38	17.52	696.4	1.75	(p <.19)
Papers	1.87	1	1.87	69.23	38	18.40	701.1	.10	(p <.75)

Table 13. *One-way ANOVA summary table for cognition as a source of differences between subjects in the strength of association of the four most frequently occurring words associated with 'office'. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Computer	76.64	3	24.88	796.34	36	22.12	870.97	1.12	(p <.35)
Books	121.21	3	40.4	543.77	36	15.1	664.97	2.67	(p <.06)
Paper(s)	109.27	3	36.42	692.73	36	19.24	802	1.89	(p <.15)
Files	55.99	3	18.66	432.99	36	12.03	488.98	1.55	(p <.22)
Group B. Style of evaluation									
Computer	53.2	1	53.2	817.77	38	21.52	870.97	2.47	(p <.12)
Books	70.67	1	70.67	594.31	38	15.64	664.97	4.52	(p <.04)
Paper(s)	8.18	1	8.18	793.82	38	20.89	802.00	.39	(p <.54)
Files	44.43	1	44.43	444.64	38	11.7	488.98	3.79	(p <.06)
Group C. Style of organization									
Computer	36.66	1	36.66	834.32	38	21.96	870.97	1.67	(p <.20)
Books	56.02	1	56.02	608.95	38	16.03	664.97	3.50	(p <.07)
Paper(s)	58.18	1	58.18	743.82	38	19.57	802	2.97	(p <.09)
Files	3.58	1	3.58	485.40	38	12.77	488.98	.28	(p <.60)

Table 14. *One-way ANOVA summary table for cognition as a source of differences between subjects in the strength of association of the four most frequently occurring words associated with 'information'. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

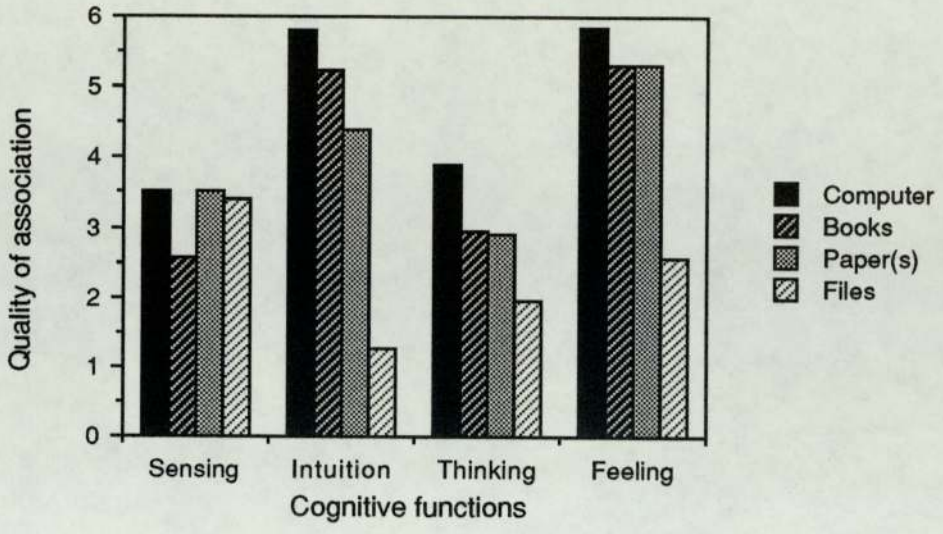


Figure 10. *Quality of association for the four most frequently occurring words to 'information'. Subjects were classified according to their dominant cognitive functions.*

One-way ANOVA was again calculated, this time for the functions as sources of differences in quality of association to *information.*

F ratios in Table 14 indicated that the style of evaluation - which could be Sensing or Intuitive - was a significant source of differences in the strength of association between *information* and 'books' ($p < .04$) and 'files' ($p < .06$). When the Scheffé test was administered to test for mean differences, the strength of association between 'books' and *information* was found to be greater for Intuitive (S 4.52, $p < .05$) and Feeling persons (S 3.50, $p < .05$). The strength of association between *information* and 'files' was greater for Sensing subjects than for Intuitive persons (S 3.20, $p < .05$). Style of organization - which could be Thinking or Feeling - was a source of differences in the quality of association for 'books' ($p < .07$) and 'paper(s)' ($p < .09$).

To conclude, cognitive orientation was more important as a source of differences between subjects in the quality of their responses to *information* than to *office*, which confirmed the trend noted for quantity of association. This meant that subjects differed more in how they responded to more abstract of the two stimulus words.

8.2.5. The proportion of unique and shared responses.

There was an overlap between the responses associated with *office* and *information*. However, other words were uniquely associated with each of the stimulus words. The results described in this section investigated whether subjects differed in the originality of their responses.

8.2.5.1. Responses associated with both *office* and *information*.

Of the 121 different words used in response, 14 (11.57%) were chosen as responses to *office* and to *information* (Table 15).

		F. occurrence of responses common to:	
		office	*information*
Words:	Desk	25	4
	Typewriter	20	1
	Paper	17	15
	Computer	15	19
	Telephone	13	8
	Files	6	12
	Invoices	5	2
	Filing cabinets	4	3
	Mess	3	3
	Organization	2	2
	Books	2	17
	Data	2	7
	Piles	2	4
	Bins	2	2

Table 15. *Response words associated with both 'office' and 'information'.*

Those 14 words given in response to both *office* and *information* made up by far the greatest proportion of the responses chosen by each of the four types (Figure 11).

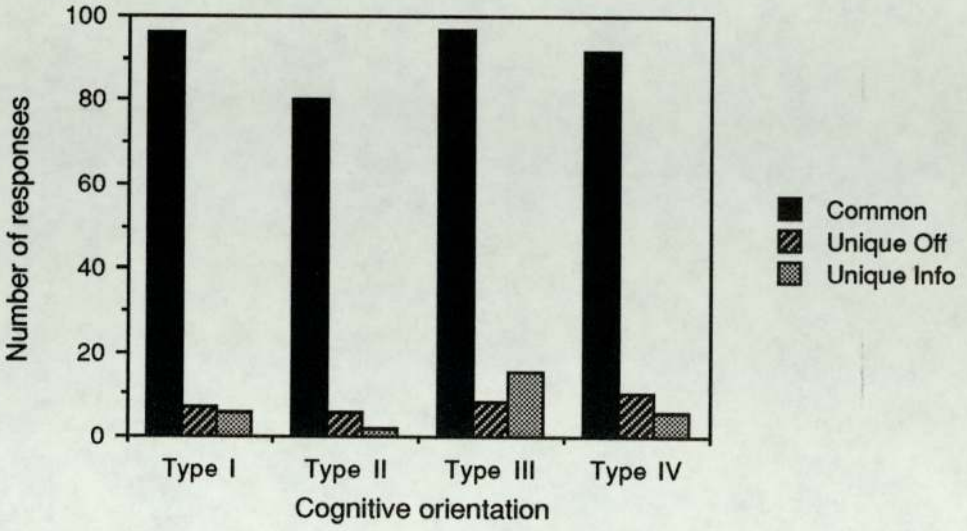


Figure 11. *Histogram showing the numerical distribution of responses for each of the four cognitive orientation types. The graph shows the total number of responses that were common to both 'office' and 'information' for each type, and the number of 'office' and 'information' responses that were unique to that type.*

From Figure 11, it was observed that subjects had more unique responses associated with *office*, excepting Type III subjects who had more unique responses associated with the more abstract concept of *information*. Type II subjects had fewer original responses than the other types.

8.2.5.2. Responses unique to a type.

Certain responses were unique to one type only. The following list indicates those responses to *office* that were unique to a cognitive orientation type.

Type I	*Type II*	*Type III*	*Type IV*
Lifts	Bookcase	Paper clips	Orders
Reception	Windows	Quiet	Pencils
In trays	Door	Bustle	Coloured stickers
Shredder	Coffee	Headache	Diary
Dark	Lunch break	Wd/processing	Uncomfortable
Clutter	Coats	Communication	Cramped
Routine		Buying	Space
		Professionals	Workers
			Typing pool
			Plants

The following list indicates those *information* responses that were unique to a cognitive orientation type.

Type I	*Type II*	*Type III*	*Type IV*
Tannoy	(To) ask	Help	Conferences
Service	Office	Notice boards	Exhibitions
Folders		Technology	Newspaper
Mail		Spies	Journals
(To) loose		Interests	(To) give information
Timetable		Sorting	Typewriter
		Classifying	
		Recalling	
		(To) find out	
		Encyclopedia	
		Index cards	
		Radio	
		Announcements	
		Out trays	
		Telesales	

It was immediately observed from the above list that Type III subjects responded with more original words to *information* than other subjects did.

8.2.5.3. Quality of unique responses.

An indication was obtained of how *early* subjects thought of unique, or original, words: that is, of the quality of association between the stimulus and original words. The mean strength of each unique response was determined by the score allocated to that word on a scale of one to ten whenever it was chosen as a response: the higher the score, then the greater the quality of the unique response.

	Stimuli			
	Office		Information	
Cognitive type	*Mean*	*S.D*	*Mean*	*S.D.*
Type I	5.27	2.49	6.64	2.38
Type II	4.29	1.60	4.57	2.07
Type III	7.00	1.41	7.82	1.40
Type IV	6.09	2.02	6.91	2.47
Cognitive functions				
Sensing	4.77	2.20	5.94	2.46
Intuition	6.57	1.73	7.22	2.09
Thinking	6.14	2.17	7.23	2.00
Feeling	5.39	2.03	6.00	2.54

Table 16. *Table of mean scores (max of 10 points) showing how early unique or original responses were thought of, based on the strength of association between stimulus and response. The higher the mean score, then the earlier that the response was thought of. Subjects classified according to cognitive orientation type (Type I =11; Type II =7; Type III =11; Type IV =11) and cognitive functions (Sensing =18 and Intuition =22; Thinking = 22 and Feeling 18 subjects).*

One-way ANOVA was carried out to investigate whether subjects differed in the speed with which they thought of unique words. *F* ratios shown in Table 17 indicate that the four types differed in how quickly they thought of original words. These differences were highly significant ($p < .003$). Type III subjects were the quickest to think of original words; Type II (who are mutually exclusive to Type III) were the slowest. Scheffé's test compared the means and the difference between the two types

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Total number of unique resps.	158.87	3	52.86	345.40	36	9.60	503.98	5.51	(p <.003)
Unique to 'office'	35.88	3	11.96	138.52	36	3.85	174.4	3.11	(p < .04)
Unique to 'information'	45.97	3	15.32	162.82	36	3.85	174.4	3.11	(p < .04)

Table 17. *One-way ANOVA summary table for cognitive orientation type as source of differences between subjects in how quickly they thought of responses that were unique. F ratios shown for the total number of unique responses and for responses unique to 'office' and to 'information'.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Total no. of unique resps.	92.53	1	92.53	411.44	38	10.83	503.98	8.55	(p <.006)
Unique to 'office'	31.69	1	31.69	142.71	38	3.76	174.40	8.44	(p < .006)
Unique to 'information'	15.92	1	15.92	192.85	38	5.08	208.78	3.14	(p < .09)

Table 18. *One-way ANOVA summary table for style of evaluation as source of differences between subjects in how quickly they thought of responses that were unique to their style. F ratios shown for the total number of unique responses and for responses unique to 'office' and to 'information'.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Total no. of resps.	38.61	1	38.61	465.37	38	12.25	503.98	3.15	(p <.08)
Unique to 'office'	5.53	1	5.53	168.87	38	4.44	174.40	1.25	(p <.27)
Unique to 'information'	14.91	1	14.91	193.86	38	5.10	208.78	2.92	(p <.10)

Table 19. *One-way ANOVA summary table for style of organization as source of differences between subjects in how quickly they thought of responses that were unique to their style. F ratios shown for the total number of unique responses and for responses unique to 'office' and to 'information'.*

was shown to be significant (S 5.28 $p < .01$). Unique responses were distinguished as responses to *office* and *information* and one-way analysis of variance was again computed. The four types differed in how quickly they thought of unique *office* responses ($p < .04$) and original *information* responses ($p < .04$) respectively. Once again, Type III subjects were the quickest to think and Type II the slowest (S 3.32, $p < .05$; S 3.32, $p < .10$ respectively).

Each type evaluated and organized the responses in its own way. F ratios shown in Table 18 and 19 indicated that how all unique responses were evaluated was more significant ($p < .006$) for their uniqueness than how they were judged and organized ($p < .08$). As might be expected, post hoc comparison of the means showed that Intuitive persons thought of unique words more quickly than Sensing subjects (S 8.55, $p < .01$). Style of organization was not so important for originality. When mean scores were compared using Scheffé's test, Thinking persons were found to think of unique responses more quickly than Feeling persons to *office* and to *information* (S 3.15, $p < .10$; S 2.92, $p < .10$ respectively).

Analysis of the originality of responses provided firm evidence of differences between subjects in how quickly they thought of responses unique to their type. Differences were particularly pronounced between the mutually exclusive Types II (who were the slowest to think of original responses) and Type III (who were the quickest).

8.2.6. Four-way classification of response characteristics.

Responses were further classified depending on whether their content referred to an *object, person, function* or *abstract*. Those responses classified as *objects* referred to physical components of the office or information environment; those as *person* to human components; *functions* to aspects of work carried out by people in that

environment; and those as *abstract* to concepts or to feelings.

A total of 259 responses could be classified as objects; 57 as abstract; 44 as functions and 67 responses as personal. Obviously, the majority of responses were concerned with the concrete or physical components of the office or information environment. Table 20 indicates the characteristic response style for each of the four cognitive orientation types, with reference to how many responses were 'object', 'abstract', 'function' or 'person'. The higher the mean response score (from one to 10 points), then the greater the tendency to use that class of response.

	No. of 'office' responses				*No. of 'information' responses*			
Classification:	Abst	Fun	Obj	Per	Abst	Fun	Obj	Per
Cognitive orientation type.								
Type I	10	2	39	18	4	5	35	1
Type II	4	3	32	11	6	2	26	1
Type III	15	7	30	17	5	11	30	4
Type IV	29	5	29	15	1	9	38	0
Cognitive orientation functions.								
Sensing	14	5	71	28	10	7	61	2
Intuition	28	14	59	32	5	18	68	3
Thinking	25	10	75	36	9	16	70	4
Feeling	17	9	55	24	6	9	59	1

Table 20. *Frequency distribution of responses, classified as abstract, function, object or person, for each of the four cognitive orientation types and for each of the four cognitive functions.*

One-way ANOVA was firstly computed to investigate whether subjects differed in their responses to the relatively concrete concept of *office*. *F* ratios in Table 21 indicate that there were no highly significant differences between the types. Style of evaluation was a source of differences between subjects in whether they classified *office* responses as objects ($p < .01$). Post hoc comparison of the means using Fishers test of least significant differences revealed that, not surprisingly, Sensing persons were more object-oriented than Intuitive persons (*LSD* .99, $p < .05$).

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Abstract	4.38	3	1.46	51.52	36	1.43	55.9	1.02	(p <.40)
Function	2.27	3	.76	19.71	36	.55	21.98	1.38	(p <.26)
Object	13.1	3	4.37	92.4	36	105.5	105.5	1.70	(p <.18)
Person	.32	3	.11	31.68	36	.88	32	.12	(p <.95)
Group B. Style of evaluation									
Abstract	2.43	1	2.43	53.47	38	1.41	55.9	1.72	(p <.20)
Function	1.27	1	1.27	20.7	38	.54	21.98	2.34	(p <.14)
Object	15.78	1	15.78	89.72	38	2.36	105.5	6.68	(p <.01)
Person	.10	1	.10	31.90	38	.84	32	.12	(p <.73)
Group C. Style of evaluation									
Abstract	.37	1	.37	55.54	38	1.46	55.9	.25	(p <.62)
Function	.02	1	.02	21.96	38	.58	21.98	.04	(p <.85)
Object	.63	1	.63	104.87	38	2.76	105.5	.23	(p <.64)
Person	.40	1	.40	31.60	38	.84	32	.49	(p <.49)

Table 21. *One-way ANOVA summary table for cognition as a source of differences between subjects in frequency of responses to 'office', with responses classified as referring to an abstract concept, a function, an object or a person. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Abstract	3.35	3	1.12	22.02	36	.61	25.38	1.83	(p <.16)
Function	3.34	3	1.11	44.04	36	1.22	47.38	.91	(p <.45)
Object	2.55	3	.85	74.42	36	2.07	76.98	.41	(p <.75)
Person	.43	3	.14	3.95	36	.11	4.38	1.31	(p <.29)
Group B. Style of evaluation									
Abstract	1.07	1	1.07	24.31	38	.64	25.64	1.67	(p <.20)
Function	1.82	1	1.82	45.55	38	1.12	47.38	1.52	(p <.23)
Object	.88	1	.88	76.10	38	2.00	76.98	.44	(p <.51)
Person	.01	1	.01	4.37	38	.12	4.38	.06	(p <.82)
Group C. Style of organization									
Abstract	.06	1	.06	25.32	38	.67	25.38	.09	(p <.77)
Function	.16	1	.16	47.22	38	1.24	47.38	.13	(p <.72)
Object	3.58	1	3.58	73.40	38	1.98	76.98	1.85	(p <.18)
Person	.16	1	.16	4.22	38	.11	4.38	1.42	(p<.24)

Table 22. *One-way ANOVA summary table for cognition as a source of differences between subjects in frequency of responses to 'information', with responses classified as referring to an abstract concept, a function, an object or a person. F ratios for cognitive orientation (Types I-IV) are in Group A, style of evaluation (Sensing or Intuition) in Group B and style of organization (Thinking or Feeling) in Group C.*

Intuitive subjects, on the other hand, had significantly more functional responses (S 6.68, $p < .05$). F ratios, in Tables 21 and 22, show that style of organization was not an important source of variance in the classification of *office* and *information* responses respectively. Analysis of the four-way classification of responses suggests that how information was evaluated determined response characteristics.

8.3. Discussion.

The four cognitive orientation types were found to differ in their word association response style. However, the four types were not independent of each other in their cognitive information processing, that is, in how they evaluated and organized information.

How subjects evaluated the stimuli and response was a more important source of differences in association style than how they organized (or judged) those same words. (People evaluate through the Sensing or Intuitive functions and organize through thinking or Feeling.) Sensing and Intuitive individuals were clearly differed in whether they preferred to process concrete or abstract environmental. Thus, it seems likely that the behaviour of Sensing persons is more stimulus-bound that that of Intuitive persons. Sensing subjects were object-oriented and preferred to process concrete information. Their MBTI scores indicated that they had developed one cognitive function but neglected the other and this had the effect of diminishing the flexibility of their cognitive processing. This was apparent in their difficulties in thinking of original words. People who evaluated through Intuition were more functionally-oriented and had more original responses than Sensing subjects. The information processing of Intuitive persons was the more flexible because they had the better developed functions. This flexibility of processing and greater openness to new information enabled them to respond with more original words.

Two types - Sensing-Feeling and Intuition-Thinking - who evaluated and organized independently of each other represented two extremes of behaviour on the word association task. People who evaluated through Sensing and organized through Feeling were verbally the most fluent in that they found the stimulus words the most meaningful. The particular sample of subjects belonging to this type emphasized evaluation through the Sensing function and were oriented to the processing of concrete and observable objects: their responses were also concrete and object-oriented. They were orientation-specific in the sense that they conceptualized stimuli as a physical entity with a specific context. Although Sensing-Feeling persons were the most verbally fluent on the word association task, they were also the slowest to think of original words. They organized the attributes of item content on the basis of their shared associations and responded with related items drawn from the same category. Consequently, they made many potential responses available to themselves but at the expense of fewer original responses.

In contrast, Intuitive-Thinking subjects thought of fewer words but responded more quickly with original words than any other type. This was because they retrieved independent items before items sharing membership of the same class. Their responses were functionally-oriented and they organized by stressing distinctive features of information. Consequently, they had fewer responses but those that they did think of were more likely to be unique.

It was clear from this that subjects response fluency was no indication of the relative worth, usefulness, or originality of their responses. The results of the word association task supported the exploratory hypothesis that the four cognitive orientation types behaved differently. This in turn was interpreted to support the hypothesis that differences exist between the four types in how they processed information.

8.4. Conclusions.

Cognitive orientation type biases a person to process some environmental stimuli more efficiently than others. The response style of people who evaluated through Sensing was concrete and object-oriented whereas that of Intuitive persons was more flexible, original and functionally-oriented. It can also be tentatively suggested that people who organized through Feeling retrieved classes of related responses whereas Thinking persons retrieved individual and independent items first. These were the characteristics of the cognitive information processing strategy associated with the four functions.

Combinations of functions define cognitive orientation type. Discernable differences were detected between the four types in their word association style. In particular, clear differences were found between the information processing strategy of the two mutually exclusive types of Sensing-Feeling and Intuition-Thinking in the fluency of their responses and in how quickly they thought of original words. Sensing-Feeling types had most responses and were more object-oriented whereas Intuitive-Thinking types had most original responses and were more functionally-oriented.

However, the word association task did not represent a real world situation but offered independent behavioural evidence of processing differences between the types. The following chapter describes the results of an experiment that investigated the strategy used by each of the four types when asked to sort, categorize and recall paper-based information.

Chapter 9. Results III: Sorting and recall performance.

9.1. Introduction.

The aim of the sorting and recall task was to identify behavioural correlates of information processing strategy and cognitive orientation type in order to test the hypothesis that patterns of organizing paper-based information bear some relation to type. The sorting and recall task was carried out immediately after the word association test. The forty subjects were the same as those who had participated in the previous study.

The design of the task materials was described in section 6.5.3.3. and the materials used are shown in Appendices C and D.

9.2. Results.

The results were interpreted for evidence of four discernable cognitive orientation types. Sorting strategy was described first, then the extent of categorization and then recall performance. In all cases, descriptive statistics for the subjects as a whole were presented first, and then the performance by the four types was described and analyzed. Differences between the dominant cognitive functions were included whenever they were an important source of differences in sorting and recall performance. The relationship between the extent of categorization and recall performance was investigated. Finally, sorting and recall scores were classified according to gender and area of academic interest of the subjects.

One of the requirements of the sorting task was for the subjects to sort 40 memos into as many categories as they thought necessary. The six representative kinds of component activity shown by subjects in completing the task were defined in section 6.5.3.3.2.

The sorting and recall performance characteristic of the sample as a whole is shown in Table 23.

'F' Sorting activities	*Frequency*	*Mean*	*S.D.*	*Range*
Read item in stack	124	3.1	7.31	40
Reread item in pile	239	5.98	7.34	40
Into new pile	357	8.68	2.61	13
Into existing pile	1225	30.63	2.72	12
From pile to pile	217	5.43	3.78	18
From pile to new pile	57	1.43	1.36	7
No. of categories	312	7.8	2.37	11
Memory				
No. of items remembered	763	19.08	4.55	18
No. of items located	618	15.45	5.15	23

Table 23. *Table showing descriptive statistics for sorting and recall for all subjects.*

Categorizing items, by sorting them into existing piles, was the most common of the six activities. Another feature of the sorting strategy was that the average subject was more likely to reread items *after* sorting than before. Additionally, subjects reorganized by rearranging the internal contents of already existing piles rather than by creating new categories.

All subjects created a total of 414 categories during the sorting task although they had, in sum, only 312 categories at the end of the task. This difference was accounted for by the reorganization of piles. Items were moved from pile to pile 217 times: in 115

cases, the internal structure of two piles was changed but in 102 cases, piles were amalgamated together.

It is clear from the final section of Table 23, that subjects did not successfully locate in the correct category all of the items whose content they remembered. It was concluded from this that memory for content was better than memory for location.

The remainder of the results section describes and compares the sorting and recall performance of the four cognitive orientation types. The classification of the 40 subjects into one of four types on the basis of responses to the Jungian-based inventory, the MBTI, was described in Chapter 7.

9.2.1. Sorting strategy by cognitive functions.

The characteristic sorting strategy of subjects when classified according to whether they evaluated through Sensing or Intuition and organized through Thinking or Feeling is shown in Table 24. The large standard deviations and ranges are due to the small number of subjects in each group.

	Cognitive functions			
	Sensing	Intuition	Thinking	Feeling
Frequency of sorting activities:				
Read item in stack:				
Mean score	4.22	2.18	2.32	4.06
Standard Deviation	9.23	5.32	2.89	10.51
Range	40	23	9	40
Reread item in pile:				
Mean score	4.72	7	6.68	5.11
Standard Deviation	4.69	8.93	5.44	9.25
Range	20	40	20	40
Put item into new pile:				
Mean score	8.28	9	8.27	9.17
Standard Deviation	2.11	2.96	2.16	3.05
Range	9	13	8	12
Put item into existing pile:				
Mean score	30.56	30.68	30.46	30.86
Standard Deviation	2.20	3.12	2.13	3.35
Range	9	12	8	12
Move item from pile to pile:				
Mean score	4.72	6	6.18	4.5
Standard Deviation	3.83	3.73	3.55	3.94
Range	18	15	16	15
Move item from pile to new pile:				
Mean score	1.56	1.32	1.86	.89
Standard Deviation	1.54	1.21	1.52	.9
Range	7	4	7	3

Table 24. *Descriptive statistics for the frequency of the six different sorting activities. Subjects classified according to cognitive functions. 18 subjects were Sensing, 22 were Intuitive; 22 were Thinking and 18 were Feeling.*

One-way analysis of variance was calculated for the cognitive functions as sources of differences between subjects in the frequency with which they carried out each of the six sorting activities. *F* ratios for the preferred ways of evaluating and organizing information are shown in Table 25.

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob.*
Group A. Style of evaluation									
Read in stack	41.22	1	41.22	2040.38	38	53.69	2081.60	.77	(p <.39)
Reread in pile	51.36	1	51.36	2049.61	38	53.94	2100.98	.95	(p <.34)
New pile	5.16	1	5.16	259.61	38	6.83	264.78	.76	(p <.39)
Existing pile	.16	1	.16	287.22	38	7.56	287.38	.02	(p <.89)
Pile to pile	16.16	1	16.16	541.61	38	14.25	557.78	1.13	(p <.29)
pile to new pile	.56	1	.56	71.22	38	1.87	71.78	.30	(p <.59)
Group B. Style of organization									
Read in stack	29.88	1	29.88	2051.72	38	53.99	2081.60	.55	(p <.46)
Reread in pile	34.42	1	24.24	2076.55	38	55.65	2100.98	.45	(p <.51)
New pile	7.91	1	7.91	256.86	38	6.76	264.78	1.17	(p <.29)
Existing pile	1.42	1	1.42	285.96	38	7.53	287.38	.19	(p <.67)
Pile to pile	28.00	1	28.00	529.77	38	13.94	557.78	2.01	(p <.16)
Pile to new pile	9.41	1	9.41	62.37	38	1.64	71.78	5.73	(p <.02)

Table 25. *One-way ANOVA summary table for the cognitive functions as a source of differences between subjects in the frequency with which they carried out the six sorting activities. F ratios for style of evaluation (Sensing or Intuition) in shown in Group A and for style of organization (Thinking or Feeling) in Group B.*

Style of evaluation was not an important source of variance for the frequency of sorting activities. However, style of organization was significant ($p < .02$) for how often subjects moved items from one pile to a new pile. This implied that subjects *judged* when to reorganize piles. Post hoc comparison of means using the Scheffé test indicated that Thinking persons moved items from pile to new pile more often than Feeling persons (S 5.73, $p < .05$).

The finding that Thinking persons reorganized by moving items from a pile to a new pile was an interesting one. Thinking persons are claimed in the Jungian literature to organize on the basis of differences and the evidence from the sorting task supports the suggestion that they are more discriminatory.

9.2.2. Sorting strategy by type.

Subjects were then classified according to their cognitive orientation type (based on combinations of functions). The frequency with which each of the four cognitive orientation types carried out each sorting activity is shown in Table 26.

Once again, there are large standard deviations and ranges for the frequency of sorting activities and once again, the means must be treated with caution. Not surprisingly, on the basis of mean frequency scores, sorting information into existing piles was the most common activity for all types. Moving items from pile to new pile was the one carried out least often.

	Cognitive orientation types			
	Type I	Type II	Type III	Type IV
Frequency of sorting activities				
Read item in stack:				
Mean score	3	6.14	1.64	2.73
Standard Deviation	2.45	14.97	3.20	2.10
Range	7	40	9	23
Reread item in pile:				
Mean score	6.64	1.29	6.73	7.55
Standard Deviation	5.10	1.11	6.00	11.32
Range	20	3	19	40
Put item into new pile:				
Mean score	8.64	9.57	7.91	8.91
Standard Deviation	1.50	4.12	2.70	2.34
Range	5	10	8	9
Put item into existing pile:				
Mean score	29.55	30.29	31.36	31.18
Standard Deviation	1.13	4.07	2.54	2.96
Range	3	10	8	10
Move item from pile to pile:				
Mean score	6.09	2.14	6.27	6.00
Standard Deviation	3.98	2.34	3.24	4.10
Range	14	6	11	15
Move item from pile to new pile:				
Mean score	2.09	.71	1.64	1
Standard Deviation	1.90	.76	1.10	1
Range	7	2	4	3

Table 26. *Descriptive statistics for the six different sorting activities. Subjects classified according to cognitive orientation type. There were 11 Type I subjects, 7 Type II subjects, 11 Type III and 11 Type IV subjects.*

One-way analysis of variance was computed where cognitive orientation type was the source of between group variance and sorting performance the source of within group variance.

F ratios are shown in Table 27. There were no results significant at the $p < .05$ level.

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Cognitive orientation type									
Read in stack	90.02	3	30.01	1991.58	36	55.43	2081.60	.54	(p <.66)
Reread in pile	192.09	3	64.03	1908.88	36	53.03	2100.98	1.21	(p <.32)
New pile	12.70	3	4.23	252.08	36	7.00	264.78	.60	(p <.62)
Existing pile	20.04	3	7.68	264.34	36	7.34	287.38	1.05	(p <.38)
Pile to pile	91.83	3	30.61	465.95	36	12.94	557.78	2.37	(p <.09)
Pile to new pile	10.89	3	3.63	60.88	36	1.69	71.78	2.15	(p <.11)

Table 27. *One-way ANOVA for cognitive orientation type (Types 1-IV) as source of differences between subjects in the frequency with which they carried out the six sorting activities.*

F ratios in Table 27 show that cognitive orientation type was the most important source of variance for the frequency with which items were moved from pile to pile ($p < .09$) and from pile to new pile ($p < .11$). Post hoc comparisons of means were significant for differences in the frequency with which the types reorganized. Using Fishers test of least significant difference, Type II subjects moved items from pile to pile less often than the other subjects in Type I, Type III and Type IV (*LSD* 3.53, $p < .05$; *LSD* 3.53, $p < .05$; *LSD* 3.53, $p < .05$ respectively). Type II were also the least likely to rearrange by creating new categories for difficult items and significantly less so than Type III (*LSD* 1.28, $p < .05$).

Subjects reorganized with two opposing aims: to amalgamate piles or to further discriminate between the contents of a pile. One consequence of reorganizing was that the number of categories left at the end of the task was not the same as the number of piles created during the sorting task. Type III subjects created fewer piles while sorting and that they reorganized to amalgamate piles; consequently, they were left with a few large categories at the end of the task (Table 28).

	Cognitive orientation types			
	Type I	Type II	Type III	Type IV
Mean frequency of sorting activities				
Categorizing				
Into new piles	8.64	9.57	7.91	8.91
From pile to new pile	2.09	.71	1.64	1.00
Total no. of piles created	*10.75*	*10.28*	*9.55*	*9.91*
Reorganizing				
No. of categories after sorting	9.36	8.00	5.73	8.18
No. of categories amalgamated	*1.39*	*2.28*	*3.82*	*1.73*
F. moved pile to pile	6.09	2.14	6.27	6.00

Table 28. *Categorization and the extent of reorganization during the sorting task. There were 11 Type I subjects, 7 Type II, 11 Type III and 11 Type IV subjects.*

The characteristic sorting strategy of each of the four types can now be summarized. Type I subjects checked on items after sorting into piles and, when reorganizing, they did so by moving items from pile to pile thereby rearranging the internal contents of piles. Type IV subjects were the most likely to check on items after sorting the latter into piles. The most interesting results were for the mutually exclusive Types II and III. Type II subjects were distinctive because they read items before sorting and created more new piles. They were significantly less likely to reorganize items than other subjects. Type III subjects, on the other hand, were the least likely to read items before sorting them. They created fewer categories and had fewer at the end of task, suggesting that they were comparatively tolerant of ambiguity.

In conclusion, cognitive orientation was most significant as a source of differences in how often subjects reorganized items. The reorganization of information was a judging process: Thinking persons (i.e., Types I and III) reorganized more than Feeling persons (i.e., Types II and IV). The sorting strategy of Type II subjects was made distinctive because they reorganized less. The lack of significant statistics may have been because of the comparatively small numbers of subjects or because the routine nature of the sorting task was not sufficiently sensitive to differences in cognition. Further analysis was carried out to find differences between the types in their recall performance and in extent of categorization that they preferred.

9.2.3. Number of categories.

The number of categories was defined as the number of piles left once subjects had completed the sorting task. The extent to which each type chose to impose structure on the items can be seen in Table 29.

	Cognitive orientation type			
	Type I	Type II	Type III	Type IV
No. of categories:				
Mean score	9.36	8.00	5.73	8.18
Standard Deviation	1.50	2.77	1.74	2.09
Range	5	8	6	8

Table 29. *Descriptive statistics for the number of categories left after completing the sorting task. Subjects were classified according to their cognitive orientation type. 11 subjects were Type I; 7 were Type II; 11 were Type III; and 11 were Type IV.*

One-way analysis of variance revealed significant differences ($p < .001$) between the four types in the extent of the categorization they imposed on items. One-way ANOVA was repeated for styles of evaluation and organization but any differences were unimportant (Table 30).

Type III subjects had created fewer piles during the sorting task (Table 29). Post hoc comparisons of means using Scheffé's test and Fisher's test of least significant differences confirmed that Type III subjects had fewer categories on completing the sorting task than Types, I, II and IV (S 6.13, $p < .01$; LSD 6.35, $p < .01$ and S 2.79, $p < .10$ respectively). Type III subjects clearly differed from the others in their tolerance for the loose classification of items.

After they had categorized the memos, subjects were asked to allocate titles of their own choosing to the piles that they had created. Those titles are shown in Appendix H. The relationship between categorization and recall performance is discussed as part of the following section.

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
No. of categories	76.04	3	25.35	142.36	36	3.95	218.40	6.41	(p <.001)
No. of items remembered	49.92	3	16.64	756.86	36	21.02	806.78	.79	(p <.38)
No. of items located	212.13	3	70.71	821.77	36	22.83	1033.90	3.10	(p <.05)
Group B. Style of evaluation									
No. of categories	4.40	1	4.40	214.00	38	5.63	218.40	.78	(p <.38)
No. of items remembered	77.22	1	77.22	729.55	38	19.20	806.78	4.02	(p <.05)
No. of items located	116.08	1	116.08	917.82	38	24.15	1033.90	4.81	(p <.04)
Group C. Style of organization									
No. of categories	3.17	1	3.17	215.23	38	5.66	218.40	.56	(p <.46)
No. of items remembered	3.22	1	3.22	803.55	38	21.15	806.78	.15	(p <.70)
No. of items located	6.63	1	62.63	971.27	38	25.56	1033.90	2.45	(p <.13)

Table 30. *One-way ANOVA for cognition as source of differences between subjects in how many categories they had at the end of the sorting task to be used as retrieval cues and in how many items that they remembered and located. F ratios for cognitive orientation (Types I-IV) are in Group A, for style of evaluation (Sensing or Intuitive) in Group B and for style of organization (Thinking or Feeling) in Group C.*

9.2.4. Recall.

After they had completed the sorting task, subjects were asked to recall as many items as possible and to locate the items using the category headings as cues. There were two different criteria for recall - the number remembered and the number located (section 6.3.2.). Memory for inventory information prompted recall of its spatial location. The number of memos recalled by each type was taken as an indication of the efficiency of that type's characteristic sorting strategy.

The percentage of subjects who successfully recalled each of the forty memos is shown in Appendix I. On average, subjects were more successful in remembering the content of items than in remembering to which category items belonged. They recalled 19.08 items and correctly located 15.45 of those same items (*t-test* 21.26, df 39, p<.00).

For the first part of the analysis, subjects were differentiated on the basis of their cognitive functions. The number of items recalled and correctly located by Sensing and Intuitive, Thinking and Feeling persons is shown in Table 31.

	Evaluation		**Organization**	
Functions:	Sensing	Intuition	Thinking	Feeling
Number remembered.				
Mean score	20.61	17.82	18.82	19.39
Standard Deviation	3.63	4.91	4.31	4.94
Range	12	18	18	17
Number located.				
Mean score	17.33	13.91	14.32	16.83
Standard Deviation	4.47	5.22	4.44	5.72
Range	13	20	19	18

Table 31. *Descriptive statistics for the number of items remembered and the number located. Subjects were classified according to their dominant cognitive functions. 18 subjects were Sensing, 22 were Intuition, 22 were Thinking and 18 were Feeling.*

One way ANOVA was carried out to investigate the cognitive functions (styles of evaluation and organization) as sources of differences between subjects in their recall performance. From the *F* ratios shown in Table 30, it was seen that style of evaluation was significant for recall performance for content ($p < .05$) and location ($p < .04$). Scheffé's test on the means indicated that Sensing types were more successful than Intuitive types in recalling content and location (*S* 4.02, $p < .05$; *S* 4.81, $p < .05$ respectively).

The next step was to compare the recall performance of the four cognitive orientation types. Their characteristic recall performance is shown in Table 32.

	Cognitive orientation type			
	Type I	Type II	Type III	Type IV
Number remembered.				
Mean score	19.82	20.86	17.82	18.46
Standard Deviation	2.89	4.98	5.33	4.91
Range	10	12	18	15
Number located.				
Mean score	15.36	20.14	13.26	14.73
Standard Deviation	2.66	4.91	5.66	5.35
Range	8	13	19	15

Table 32. *Descriptive statistics for the number of items remembered and the number located. Subjects were classified according to their cognitive orientation type. There were 11 Type I subjects, 7 Type II, 11 Type III and 11 Type IV subjects.*

The *F* ratios from one-way ANOVA on cognitive orientation type as a source of differences between subjects in their recall performance are shown in Table 30. There were significant differences ($p < .05$) between the types in the number of items they successfully located. Comparison of mean scores using Scheffé's test indicated that Type II subjects located more and Type III fewer items than the others and that the

difference between these two mutually exclusive types was significant (S 2.95, $p < .10$). Type III subjects had created fewer categories while sorting (as described in section 9.2.3.) so the finding that they located fewer items than the others was not a surprising one.

There were more significant post hoc comparisons of means between subjects on their recall performance than for their sorting strategy. If recall performance was taken as an indicator of the success of sorting strategy, then subjects who evaluated through Sensing sorted more efficiently than those who evaluated through Intuition. Type III subjects (who evaluated through Intuition) recalled the fewest items.

9.2.5. Extent of categorization and recall performance.

Good recall performance was taken as an indication of the efficiency of the different sorting strategies utilized by subjects on the grounds that the successful retrieval of items depended on there being a close enough match between the stimulus (in this case, the category headings) and the cognitive representation of the sorted items. The more categories that subjects created and titled, then the more retrieval cues they should make available to themselves. Type I subjects had the most categories but their recall performance was bettered by that of Type II subjects (Table 32). When sorting, the latter had reorganized items very little and this may have been a contributory factor to their successful recall performance.

Correlations between the number of categories created and the number of items recalled and accurately located are shown in Table 33.

	No. of cats correlated with:	
Cog orient type	No. items rem	No. of items loc
Type I	-.01	-.69*
Type II	-.68*	-.57*
Type III	.68*	.61*
Type IV	-.34*	-.22

Table 33. *Product-moment correlations between number of categories and number of items remembered (for content and location) for each of the four cognitive orientation types (*, $p < .05$). 11 subjects were Type I, 7 were Type II, 11 were Type III and 11 were Type IV.*

Contrary to the expectation that the more categories the types had, then the more items they would recall, the correlations in Table 33 show that there was a negative relationship between the number of categories and recall performance. The creation of more category titles proved significantly beneficial to recall for the group who had the fewest retrieval cues available - that is, Type III. Although correlation does not imply cause and effect, a tentative conclusion to be drawn from this was too much categorization was not particularly beneficial for recall performance.

9.2.6. Sorting and recall scores classified according to gender and area of academic interest.

Gender and area of academic interest was investigated as a source of differences in sorting and recall performance. There were 40 subjects of whom 20 were male and 20 female. Ten of those male subjects called themselves 'scientists' and the other ten were 'non-scientists'. The same division by area of academic interest applied to females.

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Gender									
Frequency: Read in stack	14.4	1	14.4	2067.2	38	54.4	2081.6	.26	(p <.61)
Reread in pile	164.03	1	164.03	1936.95	38	50.97	2100.98	3.22	(p <.08)
New pile	11.02	1	11.02	253.75	38	6.68	264.77	1.65	(p <.21)
Existing pile	2.02	1	2.02	285.35	38	7.51	287.38	.27	(p <.61)
Pile to pile	2.03	1	2.03	555.75	38	14.62	557.78	.14	(p <.71)
Pile to new pile	.62	1	.62	71.15	38	1.87	71.78	.33	(p <.57)
No. of categories	3.6	1	3.6	214.8	38	5.65	218.4	.64	(p <.43)
No. of items remembered	.62	1	.62	806.15	38	21.21	806.78	.03	(p <.87)
No. of items located	12.1	1	12.1	1021.8	38	26.89	1033.90	.45	(p <.51)
Area of intellectual interest									
Frequency: Read in stack	1.6	1.	1.6	2080	38	54.74	2081.6	.03	(p <.87)
Reread in pile	81.22	1	81.22	2019.75	38	53.15	2100.98	1.53	(p <.22)
New pile	1.22	1	1.22	263.55	38	6.94	264.77	.18	(p <.68)
Existing pile	1.23	1	1.23	286.15	38	7.53	287.38	.16	(p <.69)
Pile to pile	4.22	1	4.22	553.78	38	14.57	557.78	.29	(p <.59)
Pile to new pile	5.63	1	5.63	66.15	38	1.74	71.78	3.23	(p <.08)
No. of categories	2.5	1	2.5	215.9	38	5.68	218.4	.44	(p <.51)
No. of items remembered	.23	1	.23	806.55	38	21.22	806.78	.01	(p <.92)
No. of items located	10	1	10	1023.9	38	26.95	1033.9	.37	(p <.55)

Table 34. *One-way ANOVA for gender and area of academic interest as sources of differences between all subjects in the frequency with which they carried out each of the six sorting activities, the extent of categorization and their recall performance.*

Analysis of MBTI scores described in chapter 7 showed that males were more likely than females to judge through the Thinking function. The possibility that males and females use different cognitive strategies was of interest because of the unequal distribution of the sexes in office jobs. One-way ANOVA on gender and area of academic interest as sources of variance in sorting and recall performance found that the two variables were not important sources of differences between subjects in their sorting style and recall performance (Table 34).

Gender and area of academic interest were not important sources of variance in subjects sorting strategies and are not discussed further.

9.3. Discussion.

Analysis of the results for the sorting and recall task gave mixed support for the exploratory hypothesis that individual differences existed between the four types (identified on the basis of their MBTI scores) in how they processed paper-based information. The only significant differences on the sorting task were for the number of times that subjects reorganized items. The reorganization of paper-based items was found, not surprisingly, to be associated with the judging function. Subjects who organized through Thinking reorganized more than people characterized by the complementary Feeling function. The former reorganized by sharpening or stressing distinctive features. It was concluded that the similarities in paper-based sorting strategy, on this particular task, were greater than the differences. However, there were more differences between subjects in their categorization and recall performance, which suggested that short-term memory for spontaneously created categories was reconstructive rather than direct.

People who evaluated through Sensing recalled more than those who evaluated through the complementary Intuitive function. The former either had the most effective sorting strategy or simply found it easier to sort and recall the factual kind of

information inherent in the memos. MBTI scores described in Chapter 7 indicate that people who evaluated through Sensing had developed one particular preference only and emphasized evaluation *or* organization but at the expense of the other function. Sensing-Thinking subjects emphasized the organization of information (through Thinking) whereas Sensing-Feeling subjects stressed its evaluation (through Sensing). Although their neglect of one function limited their cognitive processing, they did not expend effort switching attention from one function to the other and thus left a greater attentional capacity for the storage of information in working memory.

Those who evaluated through Intuition, on the other hand, were more flexible processors because they had developed both cognitive processing functions (for evaluation and organization). They switched attention from one mode of orientation to the other to the other. Not only was this strategy more flexible, but it was also more effortful. Consequently, Intuitive persons had a poorer recall performance because switching from one mode of orientation to the other placed greater demands on a limited attentional capacity.

The above discussion has attempted to explain why people who evaluated through Sensing recalled more than those who evaluated through Intuition. One of the Sensing types - that is, Sensing-Feeling subjects - recalled and located significantly more than the other three types which was reminiscent of how they had found the stimulus words the most meaningful in the word association task. Evidence from the word association task can be drawn on to suggest that they remembered and located more items because their 'frame of reference' for the items was object-specific and content-oriented. In their case, paper-based information was coded in an orientation-specific manner. The experimental conditions suited this type in that they were able to retrieve using the same 'context-specific' cues as they used to categorize. Gittins (1965) described a more 'formal' cognitive style that classifies and notes spatial arrangement and corresponds to the characteristics of the Sensing-Feeling type. The latter's superior performance on the word association task was explained by their tendency to

retrieve classes of information where members of the same class share some common feature(s). They sorted the forty paper-based items by finding shared attributes between the items. By attending to associations or patterns between items as they categorized, they were able to build up a better representation of where items were in relation to each other, hence their superior recall performance. The Sensing-Feeling sorting strategy appeared to leave little room for ambiguity and these subjects changed the internal structure of the paper-based categories less frequently than the other types. This trend may arise because they are generally slower to change their cognitive representation. For this particular sample of Sensing-Feeling persons, an explanation can be found in their MBTI scores which indicated that they had neglected the development of the cognitive process (and in their case, this was the Feeling function) that was associated with the reorganization of paper-based information.

The cognitive orientation style of Intuitive-Thinking types tends to be mutually exclusive of that of Sensing-Feeling persons. The former had the poorest recall, due in part to their tolerance for ambiguity which had externalized itself in the creation of fewer categories than the other types at the end of the sorting task. Their recall performance would have been improved if they had created more paper-based categories because they would have made more retrieval cues available to themselves. The breadth of their categories meant that they included items that were connected to each other by comparatively tenuous links which thus inhibited recall. Furthermore, connecting a few category titles to many individual items makes it yet more difficult to retrieve those items. What motivated Intuitive-Thinking subjects to categorize items in the way they did? The need to stimulate thinking and openness to as much information as possible at any point in the information system was apparently more important to them than the need to retrieve efficiently. They sorted items into a few broad categories by differentiating items from each other (through Thinking) and then amalgamating them into a format where their contents could be easily scanned (because of the emphasis placed by subjects in this group on evaluation through

Intuition).

Because they created the broadest categories, Intuitive-Thinking persons were consequently more tolerant of ambiguity and more open to new information. In order to maintain the stability of cognitive processing, they integrated new information into the cognitive representation more quickly than people characterized by the complementary Sensing function. However, if the representation is updated too much, then it becomes increasingly difficult to remember what is where. This is the main disadvantage of the Intuitive-Thinking categorization style and is analogous to the situation in an office where, if the contents of a filing system are changed too quickly, it becomes difficult to keep track of what and where things are. The Intuitive-Thinking subjects suffered from the disadvantage of the Discrimination Net Approach to information retrieval (Barsalou and Bower, 1984) because they insufficiently tested a patterns shared properties before testing its unique ones and so often ended up retrieving the wrong items or not at all. This tendency to retrieve distinctive items first explains the greater originality of their word association responses. Instead of making it more easy to distinguish and retrieve, the very distinctiveness of these 'nodes' used as retrieval cues and the distinctiveness of the 'pathways' between them made the items they connected more difficult to retrieve. Distinctiveness did not confer memorability because of the problems of integrating information about the object with information about its location. Intuitive-Thinking persons would have retrieved more if, like Sensing-Feeling persons, they had processed the shared features first in order to retrieve classes of related information.

Two types of model have been proposed to account for retrieval cue combinations (Burrows and Okada, 1982). The independent model recognizes the possibility that retrieval cues function independently and corresponds to the Thinking function measured by the MBTI in the sense that Thinking orients a person to the distinctive features of information. Interactive models correspond to the Feeling function (complementary to Thinking) in the sense that Feeling orients people to organize around shared features where information derived from one item facilitates the

retrieval of other items. Burrows and Okada concluded that the interactive model was superior for recall. There is support for this view if, as seems likely, the Sensing-Feeling subjects used this model to organize around shared informational features.

The most discernable differences were found between Sensing-Feeling and Intuitive-Thinking persons whose cognitive orientation style tends to be mutually exclusive of each other. Both categorization styles were egocentric: that of the former was stimulus-bound and levelled differences between items; that of the latter was comparatively orientation-free and and sharpened or heightened the perceived differences.

9.4. Conclusions.

The similarities for processing paper-based information were greater than the differences between the types; this was to be expected because no one type had a cognitive information processing style that was theoretically independent of the others. There was evidence for two different types of memory storage, one for the content of paper-based information and one for its spatial location. Memory for the spatial-location information developed more slowly than memory for inventory information. Although there was limited evidence for sorting strategy as a cognitive manifestation of personality, there was significant evidence for differences between types of people in their recall performance. Discernable differences in recall performance were attributed to differences in how cognitive information was evaluated. People who evaluated through Sensing represented information in an orientation-specific context which facilitated the recall of more items than by Intuitive persons.

Recall performance was taken as an indicator of the success of sorting strategy. Two extremes of performance on the recall task were represented by the two types who evaluated and organized information independently: Sensing-Feeling (Type II) and

Intuition-Thinking (Type III). Sensing-Feeling subjects had the most successful sorting strategy in that they recalled and located more items than the most other three types. Their strategy was characterized by the hierarchical organization of facts or specific items of information and they recalled by retrieving classes of information. However, they were the least likely to reorganize categories so their greater efficiency may be achieved at the expense of flexibility. Intuition-Thinking (Type III) subjects had the least successful sorting strategy in that they recalled fewer items. This was because they retrieved independent items of information first

The perceptions that each type had of its own sorting strategy are described in Chapter 10.

Chapter 10. Results IV: Questionnaire on sorting strategy.

10.1. Introduction.

After participating in the sorting and recall task described in Chapter 9, subjects were asked to describe the cognitive strategy that they had used whilst sorting the forty memos. They did this by responding to questions on their sorting strategy that forced them to make broad categorizations about what they had done. The questions are shown in Appendix E. The rationale for each question is justified in section 6.7.3.4. Subjects cognitive orientation type was identified by using the Jungian-based personality inventory, the MBTI. The distribution of types was described in Chapter 7. The questions on sorting strategy were indicators of cognitive orientation because they investigated how subjects perceived (through Sensing or Intuition) and judged (through Thinking or Feeling) their behaviour. The primary aim of this study was therefore to validate the MBTI as a tool for identifying differences between types of people in how they perceived and judged their own information processing strategies.

10.2. Results.

The characteristic response style of subjects was compared for all subjects and then for each of the four cognitive orientation types. Preferred conditions of work and their influence on the sorting strategy were considered. The relationship between sorting strategy and responses was examined to see whether there was any correspondence between sorting 'as it really was' and as it was described. The primary interest of the results lay in finding discernable differences between the four cognitive orientation types but the analysis also focussed on differences between the four cognitive functions when helpful.

10.2.1. Questionnaire responses from all subjects.

The characteristic response style of all subjects is shown in Table 35.

	Number (n = 40)	Percentage of all subjects
Questions:		
Information was organized with:		
Past	2	5
Present	21	52.5
Future use in mind.	17	42.5
Information organization was based on:		
Content	29	72.5
Function	11	27.5
Incomplete information was:		
Piled as incomplete	2	5
Piled as appropriate to subject matter	35	87.5
Piled and mental note made of location	0	0
Other	3	7.5
Category inconsistent information was:		
Put in separate pile for inconsistent items	4	10
Placed in general pile	13	32.5
Put with most closely related information	23	57.5
Other action (or none)	0	0
Best description of final organization as perceived by subject:		
All information in a fixed place	5	12.5
Most information in a fixed place	15	37.5
Mostly loosely arranged	20	50
All loosely arranged	0	0

Table 35. *Frequency distribution of responses to questionnaire about strategies used to evaluate and organize information. Table shows the number of subjects (maximum of 40) who responded with each option and what percentage they were of all subjects.*

The majority of subjects reported organizing information for present use and on the basis of item content. Information that was difficult to categorize was put with other

items with the most closely related content. The arrangement of items and piles was seen as comparatively flexible.

Responses were then examined for evidence of discernable differences between the four types in how they perceived the sorting task. Responses by subjects characterized by different styles of evaluation and organization were also compared.

10.2.2. Individual differences in questionnaire responses.

The histograms in Figures 12-15 show responses to the questionnaire by subjects when classified according to cognitive orientation type. To recapitulate, there were four types: Type I (characterized by the Sensing and Thinking functions for evaluating and organizing information respectively); Type II (Sensing and Feeling); Type III (Intuition and Thinking) and Type IV (Intuition and Feeling).

The number of subjects claiming to categorize the experimental information on the basis of past, present or future use is shown in Figure 12.

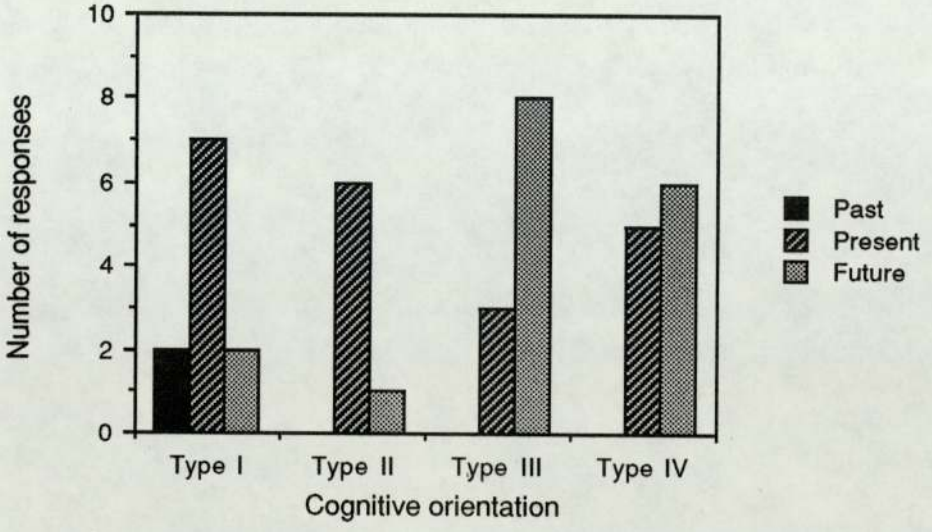


Figure 12. *Frequency distribution of responses to question about temporal characteristics of information by subjects who were classified according to their cognitive orientation type. (Type I = 11 subjects; Type II = 7; Type III = 11 and Type IV = 11 subjects.)*

The number of subjects in each type claiming to categorize the experimental information on the basis of content or function is shown in Figure 13.

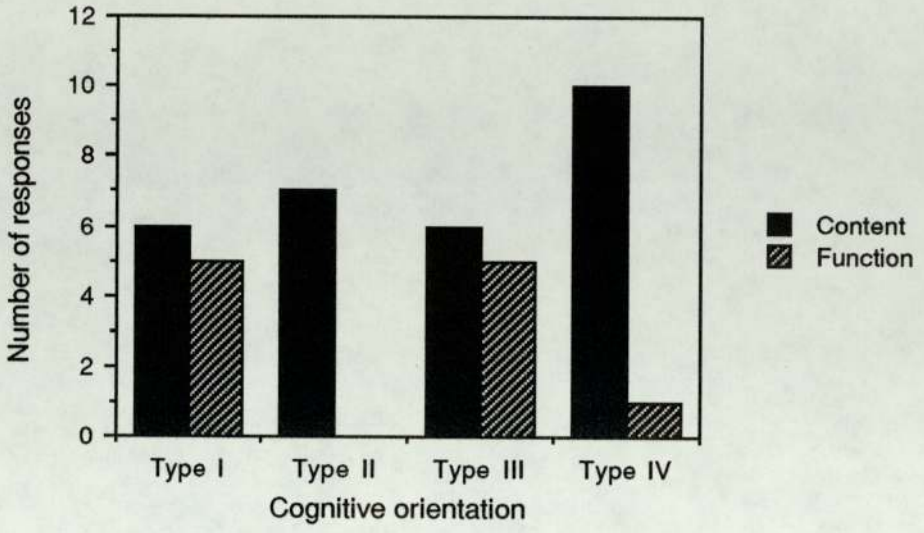


Figure 13. *Frequency distribution of responses to question about whether information was organized on the basis of content or function by subjects who were classified according to their cognitive orientation type. (Type I = 11 subjects; Type II = 7; Type III = 11 and Type IV = 11 subjects.)*

Strategies chosen by each of the four types for dealing with incomplete information are shown in Figure 14. Such items were piled as incomplete, piled as appropriate to their subject matter, their location noted or other action was taken (i.e., items were piled as 'miscellaneous').

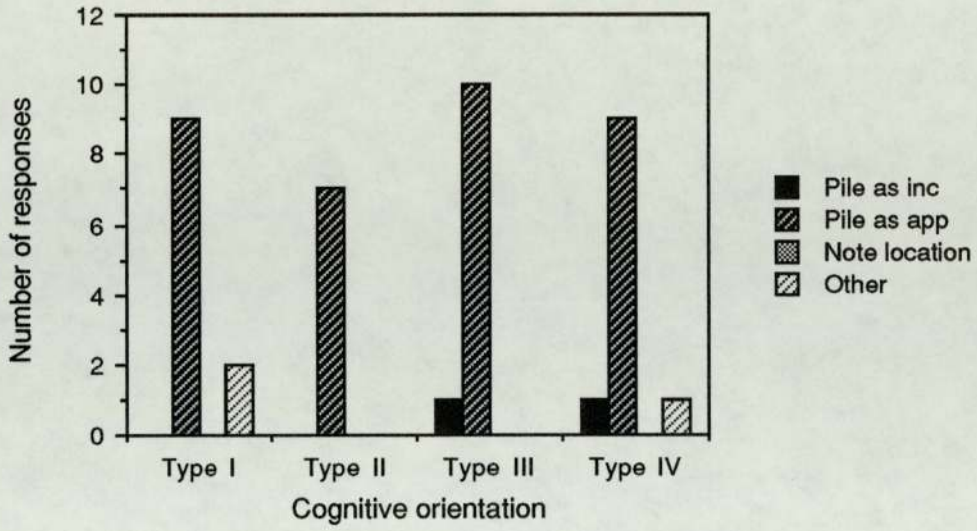


Figure 14. *Frequency distribution of responses to question about incomplete information by subjects who were classified according to cognitive orientation type. (Type I = 11 subjects; Type II = 7; Type III = 11 and Type IV = 11 subjects.)*

When it came to sorting category inconsistent items, the majority of subjects in all four groups put those items that they found difficult to sort with the most closely related information. The relative flexibility of categories as perceived by each of the four types is shown in Figure 15.

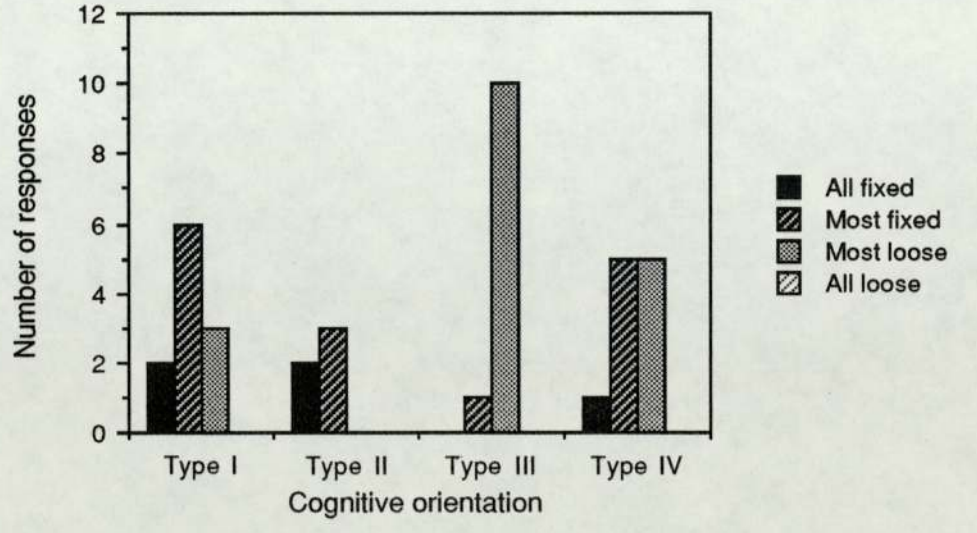


Figure 15. *Frequency distribution of responses to question about how fixed or flexible they perceived the final information arrangement by subjects who were classified according to cognitive orientation type. (Type I = 11 subjects; Type II = 7; Type III = 11 and Type IV = 11 subjects.)*

One-way analysis of variance was computed to investigate whether cognitive orientation was a source of differences in response style. The *F* ratios shown in Table 36 make it clear that the four types described their sorting strategy in distinctive ways. They differed in the time-span for which they categorized the items ($p < .009$), whether they organized for content or function ($p < .03$) and how they perceived the relative flexibility of the final arrangement ($p < .01$). Any differences between the types in what they did with category inconsistent information were due to chance but the majority put difficult items with the most closely related information.

F ratios for the cognitive functions associated with evaluating and organizing information as sources of differences in response style are also shown in Table 36. Style of evaluation is discussed first. Subjects clearly evaluated the time-span for which they were sorting ($p < .001$) and the flexibility of the final arrangement of categories ($p < .03$).

The differences between Sensing and Intuitive persons in the time-span for which they sorted can be observed from Figure 16.

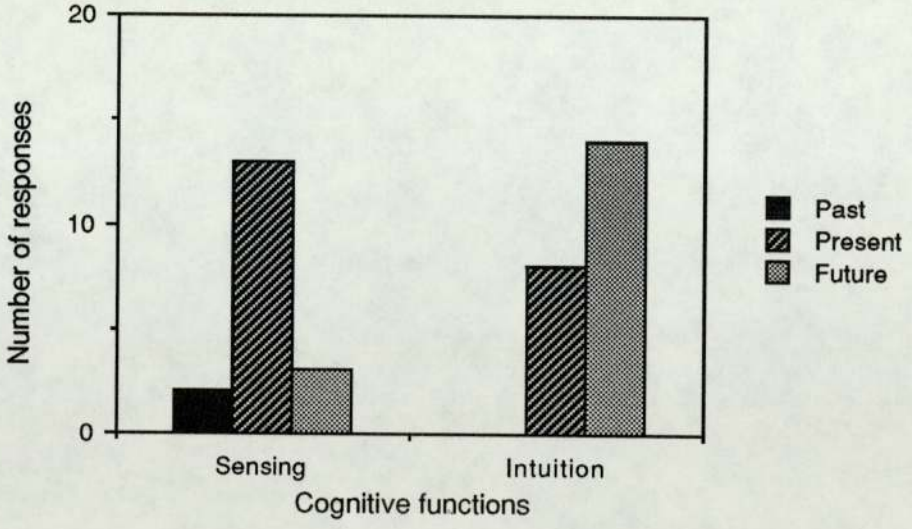


Figure 16. *Frequency distribution of responses to question about temporal characteristics of information by subjects who were classified according to their style of evaluation (18 subjects were Sensing and 22 were Intuitive).*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Temporal aspect	3.61	3	1.20	9.77	36	.27	13.38	4.43	(p <.009)
Characteristics of info	1.79	3	.60	6.18	36	.17	7.97	3.48	(p <.03)
Incomplete items	.43	3	.14	4.55	36	.13	4.98	1.13	(p <.35)
Category inconsistent items	.55	3	.18	17.43	36	.48	17.98	.38	(p <.77)
Final organization	5.01	3	1.67	14.36	36	.40	19.38	4.19	(p <.01)
Group B.Style of evaluation									
Temporal aspect	3.34	1	3.34	10.04	38	.26	13.38	12.65	(p <.001)
Characteristics of info	.09	1	.09	7.88	38	.21	7.97	.44	(p <.51)
Incomplete items	.24	1	.24	4.73	38	.12	4.98	1.95	(p <.18)
Category inconsistent items	1.20	1.	1.20	16.77	38	.44	17.98	2.72	(p <.11)
Final organization	2.28	1	2.28	17.10	38	.45	19.38	5.07	(p <.03)
Group C.Style of organization									
Temporal aspect	.51	1	.51	12.86	38	.34	13.38	1.51	(p <.23)
Characteristics of info	1.58	1	1.58	6.40	38	.17	7.98	9.36	(p <.004)
Incomplete items	.21	1	.21	4.76	38	.13	4.97	1.69	(p <.20)
Category inconsistent items	.21	1	.21	17.76	38	.47	17.97	.45	(p <.50)
Final organization	1.07	1	1.07	18.31	38	.48	19.38	2.21	(p <.15)

Table 36. *One-way ANOVA for cognition as a source of differences between subjects in their responses to the questions on their sorting strategy. F ratios for cognitive orientation (Types I-IV) are in Group A, for style of evaluation (Sensing or Intuitive) in Group B and for style of organization (Thinking or Feeling) in Group C.*

Post hoc comparisons of means using Scheffé's test revealed that Sensing types were predominantly oriented to past or present use, in contrast to Intuitive types who organized for future use (*S* 12.65, p <.01). In particular, Intuitive Type III subjects were more future-oriented than the Sensing Type II and Type IV (*LSD* .41, p <.05; *LSD* .36, p <.05 respectively).

Subjects characterized by the two styles of evaluation also differed in their perceptions of the final arrangement of categories. Intuitive persons were less likely than Sensing subjects to perceive the categories as comparatively flexible in time and space (*S* 5.07, p < .05). The representation of Sensing Type II persons was more 'fixed' than that of the Intuitive persons belonging to the Type III and IV groups (*S* 3.08, p < 0.10; *S* 2.95, p < .10 respectively). The differences between Sensing and Intuitive persons can be observed from Figure 17.

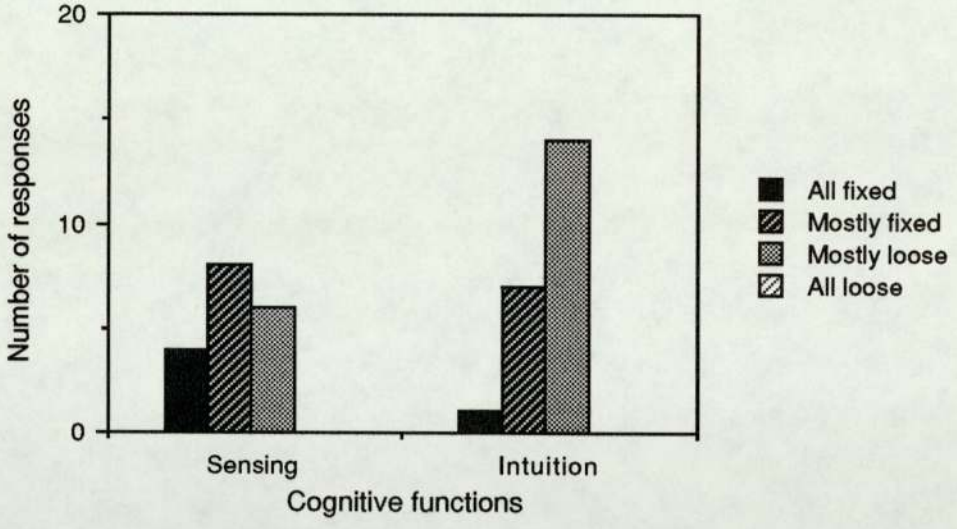


Figure 17. *Frequency distribution of responses to question about how fixed or flexible they perceived the final information arrangement by subjects who were classified according to their style of evaluation. (18 subjects were Sensing and 22 were Intuitive).*

Style of organization is now dealt with as a source of differences in how subjects perceived their sorting strategy. *F* ratios shown in Table 36 revealed that subjects differed in whether they organized items on the basis of content or function (p <.004). Scheffé's test on the mean difference indicated that Feeling persons were more likely

than Thinking subjects to say that they judged on the basis of content (S 9.36, p <.01). In particular, Type II subjects were more content-oriented than subjects belonging to the mutually exclusive Type III (S 2.47, p <.10). The different attitudes of Thinking and Feeling subjects can be clearly observed from Figure 18.

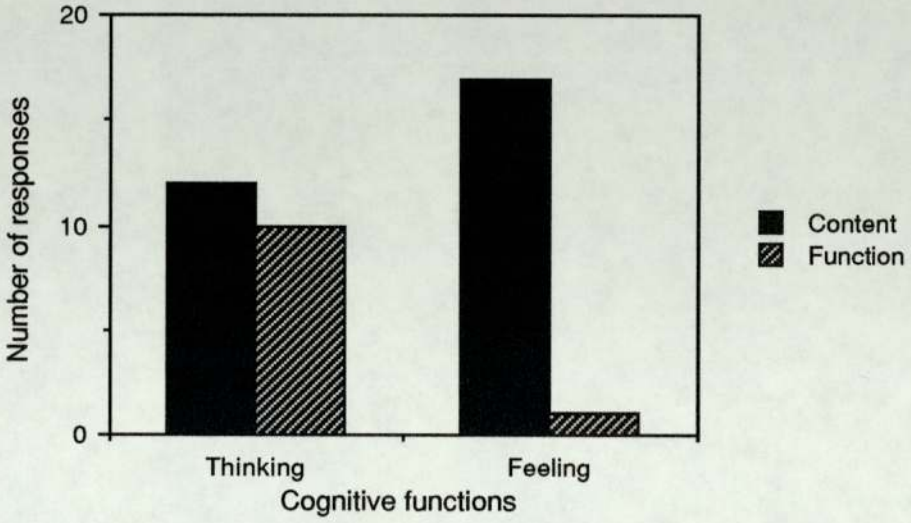


Figure 18. *Frequency distribution of responses to question about whether information was organized on the basis of content or function by subjects who were classified according to their style of organization (22 subjects were Thinking and 18 were Feeling).*

To summarize the findings so far, discernable differences were found between the four cognitive orientation types in how they perceived their sorting strategy. Rather surprisingly, no significant differences were found in how they processed category inconsistent information but this can be attributed to the nature of the sorting task, which required subjects to *categorize* all items. People were found to evaluate time and flexibility, but to judge for content or function. Types II and III who are, in theory, independent of each other, differed in how they judged the characteristics of information - the former organized for content; the latter for function. Type I were also found to be more future-oriented and more flexible than their mutually exclusive Type IV. The evidence is that there were more differences between people in how they *perceived* their sorting strategy than in how they actually sorted.

10.2.3. Preferred working conditions.

Subjects were further asked about the conditions they preferred when processing paper-based information in their working environment. The amount of space that a person likes to have to sort, pile and retrieve papers can influence his or her experimental sorting strategy. Likewise a persons attitudes to routine might determine their patience with the routine task of sorting paper-based information. The reported preferences of subjects, classified by type and dominant functions, are shown in Table 37.

Workspace:	Private		Shared		
Amount of routine:	Routine	Non-rout	Routine	Non-rout	Total subjs.
Cognitive types					
Type I	2	1	4	4	11
Type II	2	1	4	0	7
Type III	2	3	3	3	11
Type IV	1	5	2	3	11
Total no. of subjects	*7*	*10*	*13*	*10*	*40*
Style of evaluation					
Sensing	4	2	8	4	18
Intuition	3	8	5	6	22
Total no. of subjects	*7*	*10*	*13*	*10*	*40*
Style of organization					
Thinking	4	4	7	7	22
Feeling	3	6	6	3	18
Total no. of subjects	*7*	*10*	*13*	*10*	*40*

Table 37. *Work conditions, with reference to the preferred amount of space and of routine, for each of the four cognitive orientation types and for subjects characterized by each of the four cognitive functions.*

One-way analysis of variance was computed on cognitive orientation as a source of differences between subjects in their preferences for space and routine. From Table 38, it can be seen that there were differences between the types in how much routine

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Group A. Cognitive orientation type									
Amount of privacy	1.87	3	.62	8.13	36	.23	10.00	2.76	(p <.06)
Amount of routine	.24	3	.08	9.53	36	.26	9.78	.31	(p <.82)
Group B. Style of evaluation									
Amount of privacy	.91	1	.91	9.09	38	.24	10.00	3.80	(p <.06)
Amount of routine	.28	1	.28	9.50	38	.25	9.78	1.10	(p <.30)
Group C. Style of organization									
Amount of privacy	0.00	1	0.00	10.00	38	.26	10.00	0.00	
Amount of routine	.18	1	.18	9.59	38	.25	9.78	.73	(p <.40)

Table 38. *One-way ANOVA for cognition as a source of differences between subjects in their reported preferences for privacy and routine in the workplace. F ratios for cognitive orientation (Types I-IV) are in Group A, for style of evaluation (Sensing or Intuitive) in Group B and for style of organization (Thinking or Feeling) in Group C.*

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Temporal aspect	2.03	1	2.03	11.35	38	.30	13.78	6.78	(p <.01)
Characteristics of info	.23	1	2.3	7.75	38	.20	7.98	1.10	(p <.30)
Incomplete items	.03	1	.03	4.95	38	.13	4.98	.19	(p <.66)
Category inconsistent items	.03	1	.03	17.95	38	.47	17.98	.05	(p <.82)
Final organization	9.03	1	9.03	10.35	38	.27	19.38	33.14	(p <.0001)

Table 39. *One-way ANOVA for reported preferences for amount of routine whilst working as a source of differences between all subjects in their perceptions of their sorting strategy.*

they preferred ($p < .06$). *F* ratios on the cognitive functions as a source of differences provided further information by indicating that subjects evaluated their preferences for routine ($p < .06$). Sensing types had performed better on the sorting task described in Chapter 9 on the grounds that they had successfully recalled more items. Sorting is essentially routine in nature and, as expected, post hoc comparison of the means using Scheffé's test found that Sensing types were more routine-minded than Intuitive types (*S* 3.8, $p < .10$).

One-way ANOVA was again carried out, but this time on routine as a source of differences in perceptions of the sorting strategy itself. *F* ratios are shown in Table 39. The amount of routine that subjects liked was a source of differences in the time-span for which they sorted ($p < .01$) and the perceived flexibility of paper-based categories ($p < .0001$). Comparison of the means using the Scheffé method indicated that routine persons were more oriented to past or present use (*S* 6.78, $p < .05$) and perceived the final arrangement as more fixed (*S* 33.14, $p < .05$) than non-routine persons. The characteristics of routine persons correspond to those associated so far with Sensing persons. Sensing persons were accurate in describing themselves as more routine-minded than those who evaluated through Intuition: the former may have had more patience with the sorting task which might explain, in part, their more efficient sorting strategy.

10.2.4. Relation of questionnaire responses to sorting strategy.

More discernible differences were found between the four types in how they *perceived* their sorting strategy than had been found in the sorting task itself. The next step was to investigate whether subjects perceptions were an accurate reflection of their strategy. This was possible on the grounds that their responses to each

question are indicators of their cognitive orientation to the processing of paper-based information.

One-way ANOVA was calculated where questionnaire responses were a source of between-group variance and sorting strategy a source of within group variance. *F* ratios are shown in Table 40. What subjects did with incomplete information was a source of differences in the number of times they reorganized items from pile to pile ($p < .0004$). What they decided to do with category inconsistent items determined the number of new piles they created ($p < .02$) and the frequency with which they sorted into existing piles ($p < .002$) and moved items from pile to pile ($p < .02$). Post hoc comparison used Scheffé's test and Fishers test of least significant differences to compare options for sorting items that were difficult to categorize. Those who differentiated such items by putting them into separate piles not surprisingly created more categories than those who looked for shared characteristics and put 'odd' items with the most closely related information (*LSD* 3.54, $p < .01$). Subjects who sorted incomplete memos into a special category reorganized more often than those who found an association with an already existing pile (*S* 8.29, $p < .01$). Those who put items that were difficult to sort into a 'general' pile, where each item was distinctive from the others, reorganized more than those choosing the most closely related pile (*S* 2.59, $p < .10$). Therefore items that were difficult to sort were reorganized the most often.

Other significant mean differences were found. Subjects who reported organizing for future use reorganized more often than those who sorted for present use (*LSD* 2. 43, $p < .05$). Those who saw all items or categories as comparatively flexible in time and space reorganized the contents of piles more than subjects whose perceptions were more fixed (*LSD* 3.84, $p < .05$).

A question arose: did the distinctiveness of items that were difficult to categorize make them more memorable to the types of subjects who emphasized their very distinctiveness? One-way analysis of variance was computed again. This time, responses to the questions on what was done with incomplete and category

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
(1) Temporal aspect									
Read	195.91	2	97.96	1885.69	37	50.96	2081.60	1.92	(p < 16)
Reread	.96	2	.48	2100.01	37	56.76	2100.98	.01	(p <.99)
New pile	.08	2	.04	264.70	37	7.15	264.78	.01	(p <.99)
Existing pile	1.67	2	.83	285.71	37	7.73	287.38	.11	(p <.90)
Pile to pile	57.85	2	28.93	499.92	37	13.51	557.78	2.14	(p <.13)
Pile to new pile	5.00	2	2.50	66.78	37	1.81	71.78	1.38	(p < 26)
(2) Characteristics of information									
Read	55.83	1	55.83	2025.77	38	53.31	2081.60	1.05	(p <.31)
Reread	2.80	1	2.80	2098.18	38	55.22	2100.98	.05	(p <.82)
New pile	16.37	1	16.37	248.41	38	6.54	264.78	2.50	(p <.12)
Existing pile	8.28	1	8.28	279.10	38	7.35	287.38	1.13	(p <.30)
Pile to pile	5.59	1	5.59	552.19	38	14.53	557.78	.38	(p <.54)
Pile to new pile	.22	1	.22	71.56	38	1.88	71.78	.12	(p <.73)
(3) Incomplete items									
Read	5.69	2	2.85	2075.91	37	56.11	2081.60	.05	(p <.95)
Reread	113.41	2	56.70	1987.57	37	53.72	2100.98	1.06	(p <.36)
New pile	13.94	2	6.97	250.84	37	6.78	264.78	1.03	(p <.37)
Existing pile	29.83	2	14.92	257.54	37	6.96	287.38	2.14	(p <.13)
Pile to pile	191.57	2	95.78	366.21	37	9.90	557.78	9.68	(p<.0004)
Pile to new pile	5.07	2	2.53	66.71	37	1.80	71.78	1.41	(p <.26)

CONT....

Source:	Between variance			Within variance					
	SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
(4) Category inconsistent items									
Read	38.03	2	19.02	2043.57	37	55.23	2081.60	.34	(p <.71)
Reread	163.24	2	81.62	1937.74	37	52.37	2100.98	1.56	(p <.22)
New pile	50.86	2	25.43	213.92	37	5.78	264.78	4.40	(p <.02)
Existing pile	83.30	2	41.65	204.07	37	5.52	287.38	7.55	(p <.002)
Pile to pile	107.88	2	53.94	449.89	37	12.16	557.78	4.44	(p <.02)
Pile to new pile	1.22	2	.61	70.56	37	1.91	71.78	.23	(p <.73)
(5) Final organization									
Read	64.67	2	32.33	2016.93	37	54.51	2081.60	.59	(p <.56)
Reread	15.49	2	7.75	2085.48	37	56.36	2100.98	.14	(p <.87)
New pile	20.24	2	10.12	244.53	37	6.61	264.78	1.53	(p <.23)
Existing pile	30.03	2	15.01	257.35	37	6.96	287.38	2.16	(p <.13)
Pile to pile	59.09	2	29.55	498.68	37	13.48	557.78	2.19	(p <.13)
Pile to new pile	3.38	2	1.69	68.40	37	1.85	71.78	.91	(p <.41)

Table 40. *One-way ANOVA for perceptions of sorting strategy (questions 1-5) as a source of differences between subjects in the frequency with which they carried out the six sorting activities.*

Source:		Between variance			Within variance					
		SS	*df*	*MS*	*SS*	*df*	*MS*	*Total SS*	*F*	*Prob*
Incomplete items										
Type I	No. of items rem	8.44	1	8.44	68.46	9	7.61	76.91	1.11	(p <.32)
	No. of items loc.	29.92	1	29.92	45.71	9	5.08	75.64	5.59	(p <.04)
Type II	No. of items rem	17.36	1	17.36	131.5	5	26.3	148.86	.66	(p <.45)
	No. of items loc.	9.52	1	9.52	139.33	5	27.87	148.86	.34	(p <.58)
Type III	No. of items rem	75.97	2	37.98	210.21	8	26.28	286.18	1.45	(p <.29)
	No. of items loc.	24.01	2	12.01	312.71	8	39.09	336.73	.31	(p <.74)
Type IV	No. of items rem	104.39	2	52.2	136.33	8	17.04	240.73	3.06	(p <.10)
	No. of items loc.	100.3	2	50.15	181.33	8	22.67	281.64	2.21	(p <.17)
Category inconsistent items										
Type I	No. of items rem	40.91	1	40.91	36	9	4	76.91	10.23	(p <.01)
	No. of items loc.	45.58	1	45.58	30.06	9	3.34	75.64	13.65	(p <.005)
Type II	No. of items rem	-	-	-	-	-	-	-	-	-
	No. of items loc.	-	-	-	-	-	-	-	-	-
Type III	No. of items rem	98.18	2	49.09	188	8	23.5	286.18	2.09	(p <.19)
	No. of items loc.	69.51	2	34.25	268.22	8	33.53	336.73	1.02	(p <.40)
Type IV	No. of items rem	21.83	1	21.83	218.9	9	24.32	240.73	.9	(p <.37)
	No. of items loc.	8.74	1	8.74	272.9	9	30.32	281.64	.29	(p <.60)

Table 41. *One-way ANOVA for what was done with incomplete and category inconsistent items as a source of differences between subjects in their recall performance.*

inconsistent information were the source of within group variance and recall performance was the source of between groups variance. *F* scores were calculated for each of the four cognitive orientation types in turn (Table 41) but those for Type II subjects could not be calculated because of the uniformity of their responses to these questions. The most interesting *F* ratios were for Type I subjects. Firstly, what they did with category inconsistent items was a source of differences in their memory for location ($p < .04$). Those Type I subjects who put items in a 'general' pile located more than those who put the same items with the most closely related information. Scheffé's test indicated that the difference between the means was significant (S 5.89, $p < .05$). What Type I subjects did with incomplete information was important for memory for content ($p < .01$) and for location ($p < .005$). Those who piled such items as 'miscellaneous' recalled and located more than those who piled incomplete items as appropriate to their subject matter (S 10.23, $p < .05$ and S 13.65, $p < .01$ respectively).

Sorting paper-based items by emphasizing their distinctiveness made them more memorable to Type I subjects. However, this ability was not present in the other Thinking group of subjects (i.e., Type III).

10.3. Discussion.

The questionnaire investigated subjects cognitive strategy for sorting paper-based items of information into spontaneously created categories. If the attitudes externalized by the questionnaire can be generalized to the point where they reflect orientation to all such situations, then we can say that cognitive orientation determined several of the dimensions used to represent the processing of paper-based information. How subjects evaluated the nature of the sorting task was a more important source of variance in how they described it than how they judged and organized the same task.

Five sorting strategy dimensions were examined. Of these five, the temporal dimension and the relative flexibility of information were evaluated through Sensing or Intuition. Sensing persons (Types I and II) were oriented to processing information for past or present use and perceived the final categorization as comparatively fixed in time and space. Their admitted difficulty in anticipating the future uses to which information might be put means that their categories (whether cognitive or paper-based) can become out of date. They failed to update their cognitive categories quickly enough in order to integrate changing perceptions because their processing lacked the flexibility to quickly recognize and integrate change. Previous experimental research indicated that people who evaluated through the Sensing function were object-oriented and preferred to process concrete information. If they processed information in an orientation-specific manner, then this limited the number of potential applications to which information could be put and diminished the flexibility of information processing.

Previous research indicated that Intuitive types (Types III and IV), on the other hand, were more functionally oriented and more concerned about what was to be done with information. Their processing was more flexible and future-oriented and their categories more mobile than those of Sensing types. Their information processing was geared to recognize possibilities and to anticipate future expectancies, which means that their cognitive representation must be constantly reevaluated.

While the temporal dimension and flexibility of categories were evaluated, item characteristics were organized through Thinking or Feeling. Subjects who organized through Feeling (Types II and IV) found content-based associations between items. They judged items against some criteria, such as whether they agreed or disagreed that there were enough similarities to justify classing items together. Items that were difficult to sort were put with the most closely related information. This required Feeling subjects to find associations between items. In Chapter 9, it was suggested that Feeling persons organized by classing items on the basis of their shared attributes

whereas Thinking persons organized by emphasizing the distinctiveness of items. When uncertain about how to judge difficult items, they were unwilling to make ambiguous associations with items in other piles. What was interesting was that the strategy associated with Thinking persons facilitated retrieval in the case of Sensing-Thinking but not for Intuition-Thinking subjects. The difference between the two types lies in their different styles of evaluating information. The tolerance shown by Intuitive-Thinking persons for ambiguity within categories is not tolerated by hierarchical paper-based filing structures where items are categorized on the basis of 'all-or-none' inclusions. The word association task indicated that Intuitive-Thinking persons were functionally-oriented and they may have found it more difficult to process the sort of factual information inherent in the memos. Sensing-Thinking persons recalled more than Intuitive-Thinking subjects because the processing strategy of the former was more content-specific and the emphasis of distinctive items positively aided their memory for content and location. They put items that were difficult to sort (because these subjects were unable or unwilling to level distinctive features) into a general pile. The latter is a feature of many peoples office organization systems and is associated with the piling of miscellaneous or frequently used items. In the case of Sensing-Thinking types, the distinctiveness of items in a 'general pile' made them memorable. Another interesting feature of Sensing-Thinking responses was that these subjects regarded their categorizations as more inflexible than the other types. Their MBTI scores indicated that they emphasized organization (through Thinking) at the expense of evaluation (through Sensing). The implication of this for processing was that they distinguished between items by heightening the differences between them. Consequently, they were intolerant of ambiguity as they themselves reported.

To summarize, evidence was found for cognitive orientation as a source of differences between people in their perceptions of how they sorted. These differences in orientation suggest that subjects evaluated (through Sensing or Intuition) and, to a lesser extent, organized (through Thinking or Feeling) their cognitive representation of

how they sorted paper-based information. There were more differences between people in how they *perceived* their sorting strategy than in how they actually sorted.

10.4. Conclusions.

Questionnaire responses were examined to see whether the four cognitive orientation types differed in their perceptions of their sorting strategy. More differences were found between the types in how they perceived their sorting strategy than in how they had actually performed whilst categorizing paper-based information. Subjects evaluated (or perceived) the temporal aspect and flexibility of categorization but organized (or judged) item characteristics.

Jungian speculations about information processing characteristics were confirmed. With regards to the evaluation of information, Sensing persons were not as flexible as Intuitive types. Sensing-Thinking and Sensing-Feeling subjects (Types I and II) evaluated information for past or present use and perceived categories as more fixed whereas Intuitive-Thinking and Intuitive-Feeling (Types III and IV) were more likely to anticipate future uses and consequently their paper-based categories were regarded as more flexible in time and space. How subjects organized information was not such an important source of variance in their perceptions. Sensing-Thinking and Intuition-Thinking subjects (Types I and III) judged items on the basis of their differences whereas the Sensing-Feeling and Intuitive-Feeling types, (II and IV) judged on the basis of similarities in content.

It was concluded that the MBTI was a more successful tool for investigating differences in perceptions of sorting strategy than in how people physically sorted paper-based information. However, the discernable differences between the four types in their perceptions were evidence of personality differences in the organization of cognition.

Chapter 11. Discussion.

The Jungian-based personality inventory, the Myers Briggs Type Indicator (MBTI) identified four cognitive orientation types, each of which defined by a habitual style of evaluating and organizing information. The personality theory of Carl Jung has been claimed as one of the few that addresses the relationship between personality and cognition. 'Personality' pervades processing in the form of a distinct mode of cognitive orientation to information. Consequently, different 'personality' types have their own distinctive style of acquiring, evaluating and organizing concepts. People are consciously oriented to apprehend, store and retrieve certain kinds of environmental information more easily than others. The chief implication of the Jungian paradigm for cognitive information processing theory is that the strength of a cognitive function (reflected in whether it is habitually or rarely used) determines the relative ease with which that function processes the kind of information to which the function is oriented. Ideally, a person's information processing strategies should be congruent with the properties of the information they are required to process. In real terms, this means that people work best in the sorts of situation to which their 'personality' is best suited. 'Personality' can thus be defined as a cognitive structure altered by received information. In light of this definition, the Jungian personality traits of Sensing, Intuition, Thinking and Feeling correspond to cognitive functions modified by the processing of perceptual input. It is the direction of cognitive orientation which determines the kinds of environmental information that are evaluated and organized.

There is an interesting correspondence between the Jungian personality concepts operationalized by the MBTI and many aspects of cognitive style. People evaluate information through either Sensing or Intuition. These functions correspond in many

respects to field dependence and field independence respectively and to functional fixity and flexibility respectively. The processing strategy of the Sensing person is orientation-specific and stimulus-bound; that of the Intuitive person is orientation-free and stimulus-free. There is also some correspondence with Bruner et al's (1956) concepts of focusing and scanning. Although developed in the context of how people attend to concept acquisition, focusing and scanning are related to the Jungian concepts of Sensing and Intuition respectively in terms of openness to new information. At this point, the experimental findings concerning the characteristics of Sensing and Intuition should be introduced. People evaluate through Sensing or Intuition in order to represent the world as stable, controllable and predictable. They process to reinforce their self-attributions (for example, that they are in control of their environment). They use affective cues of which orientation to time, place or person are typical. Those subjects who evaluated through Sensing construed the environment in terms of concrete, object-specific information oriented to past or present use; those who evaluated through Intuition were oriented to the functions and future use of information. Sensing persons prefer to process factual and concrete information; Intuitive types are more flexible and more likely to process abstract information and to recognize the possibilities in a situation. Although both types selectively process information that reinforces their self-attributions, they differ in the extent to which they exclude contradictory evidence that disturbs their cognitive representation. They also differ in their tendency to construe the world in a multi-dimensional or discriminatory way. The more 'mobile' Intuitive person responds to a complex and changing environment by creating new constructs as needed and may be more likely to generalize and to recognize the regularities in a pattern: this ability is typically associated with greater creativity and insightful thinking. Sensing and Intuitive types clearly differed in their style of categorization. According to Myers and Myers (1980) Sensing persons are characterized by soundness of understanding, in contrast to Intuitive types who are said to be characterized by quickness of understanding.

Sensing types apparently have the more reflective categorization style whereas Intuitive types are more impulsive.

At the heart of this discussion is the idea that information processing is egocentric and that personal needs and values are the central attributes around which people evaluate and organize. In addition to a distinctive style of evaluating, all people are also characterized by a distinctive style of organization. Those who organized through Thinking processed and retrieved distinctive features of information and categorized on the basis of 'all-or-none' exclusions. In contrast, Feeling types organized informational content on the basis of its shared features. Consequently, they can be said to be more tolerant of ambiguity and to have the more flexible and less egocentric style of organizing. In real-life terms, they are more likely to take other people's perspectives and needs into account.

If information processing is egocentric, then the purpose of cognitive and affective cues for the retrieval of information from memory is analogous to the function of temporal, personal and physical cues used to locate paper-based information in the traditional office. The manual sorting and categorizing of paper-based information is typically based on subjective decisions about *where* to put what *what*. The argument so far is that people find it easier to recall and retrieve the kind of information whose properties are congruent with that person's dominant style of evaluation and organization.

Carlson (1980) pointed out the surprising lack of contact between, on the one hand, the Jungian view that man perceives and judges environmental information in order to understand meaning and, on the other, the Kellyian model which argues that we construe the world in order to anticipate events. Carlson equated the Jungian personality traits of Sensing and Intuition (that is, the cognitive functions for evaluation) with Kelly's personal constructs for eliciting and defining the meaning conveyed by environmental information. The Jungian model of personality is also suitable for investigating how types of people function in relation to the environment.

A particular situation might demand that a person uses information to learn, to create new information or to complete a task. They must be able to respond to a situation in the appropriate, intelligent or socially desirable way. People have social motivations for construing the world as stable and predictable and they judge environmental information according to their own needs and values or according to those of others. Thinking persons subjectively judge as true or false; Feeling persons, it is claimed, categorize on basis of whether they agree or disagree. All people judge and encode by emphasizing some features of information at the expense of others. It is by emphasizing the evaluation and organization of self-relevant information that Jung's personality theory is able to link cognition and affect.

Combinations of cognitive functions define the four cognitive orientation types. By definition, each type has a characteristic style of evaluating and of organizing information. Evidence for information processing differences between the four types was found in the performance of the forty subjects on the cognitive task indicators described in preceding chapters - a word association task, sorting and recall performance and perceptions of sorting strategy. For Sensing-Thinking persons, both their evaluative and organizing functions are characterized by functional fixity. For Intuitive-Feeling persons, both functions are characterized by functional flexibility. The most interesting experimental results were those obtained for the Sensing-Feeling and Intuition-Thinking types. Sensing-Feeling and Intuitive-Thinking types are 'cognitive hybrids' because of the apparently contradictory ways in which they evaluate and organize cognitive information. The two types stand at opposite ends of a continuum that represents flexibility/fixity of information processing. In the case of Sensing-Feeling, processing involves the systematic identification of concrete, orientation-specific objects which are thrown into focus by the comparatively inflexible Sensing function; items of information are then organized through the flexible Feeling function which finds shared associations between items and levels

differences. For Intuitive-Thinking persons, the flexible Intuition function is associated with scanning for abstract possibilities by the global search of the visual or cognitive field; the more inflexible Thinking function organizes on the basis of distinctiveness by zooming in and sharpening the differences between abstract features.

The greatest discernable differences were found between these two types. Neither type had the superior processing style for all situations. The Sensing-Feeling strategy was associated with greater response fluency and superior recall performance and the Intuitive-Thinking strategy with greater originality but poorer recall performance.

The MBTI has practical significance for the introduction of change into the workplace, by identifying differences between people in their information processing style. The advantage of identifying a cognitive orientation type lies in the type remaining basically the same across time and place. Reliability is achieved by a person using the same cognitive functions to process information. However, the introduction of change at work has made it important to assess the extent to which individual workers are able to modify their information processing strategy and adapt to changing demands at work and, in particular, how they reorient to processing computerized information when they are used to processing paper-based information. Personality tests have traditionally been used to predict behaviour at work. However, there is an underlying tension between, on the one hand, predicting people's habitual style of cognitive orientation to environmental stimuli and, on the other, the increasing importance of predicting their readiness to reorient to change.

One of the most important implications of Jungian personality theory for cognitive information processing is that the cognitive functions measured by the MBTI can be envisaged as a continuum. Although all people have a dominant style of processing, they also have the potential to be flexible and move along that continuum in response to environmental requirements; they prefer to process information through their

dominant functions but should also be able to process through the complementary functions if the situation changes. The more flexible a person's information processing, then the greater their ability to recognize change or the appearance of irregularities in the environmental pattern. Generally speaking, people find information processing easier when they are put in a situation where they are able to use their dominant cognitive functions.

There is a body of literature that people who evaluate through Intuition are quicker to understand than Sensing persons and generally have higher I.Q. scores. Whilst not investigating this particular hypothesis, evidence was found to support the view that Intuitive types had the more flexible information processing and were able to update their cognitive representation more easily than Sensing persons. They had strongly developed preferences for how they evaluated *and* organized information and, within limits, good development of both functions can substitute for intelligence (Myers and Myers, 1980). Sensing persons in contrast had a habitual preference for one function but had neglected the development of the other.

The question naturally arises of whether Sensing persons would be able to replicate their efficient sorting and recall performance when using computerized rather than paper-based information. The importance that these subjects attached to locating paper-based information in an orientation-specific context makes this seem unlikely. Paper has the advantages of being tangible and fixed but these properties also make paper-based information less amenable to modification. Most people, when sorting papers, do so at a conventional desk. The latter acts as an important orientation aid to knowing what information is present as well as for finding it. Information can also be arranged in such a way as to remind people of things that need to be done. The evidence from the cognitive task indicators leads to the tentative conclusion that attempts at the computerized simulation of the functions of the office desk may not be successful for the majority of office workers (who are Sensing-Feeling types) unless computer systems replicate adequately the physical, temporal and affective cues used

to orient to paper-based information.

Some vocational theories (e.g. Holland, 1973) argue that people self-select themselves into occupations which are particularly suited to their type. A selection of available MBTI norms are shown in Appendix J from which it can be seen that the Sensing function is the dominant mode of evaluation for a number of groups of office workers including secretaries, typists and managers. Discussion of the impact of technological change has tended to focus on managerial or professional staff, but the most interesting experimental results were found for Sensing-Feeling subjects whose type is the most common among lower-status office workers. In view of the small sample size, the cognitive information processing strategy of Sensing-Feeling subjects can only be related in very general terms to a discussion of how lower-status office workers process paper-based information. The sample subjects were characterized by the serial processing of information which may be suitable for comparatively small amounts of information but is unwieldy for information on a large scale. Their performance on the sorting task implied a disinclination to update or reevaluate the internal structure of categories which in turn can result in a long-term system of organizing information that is both inefficient and inappropriate. The conclusion drawn from this is that Sensing-Feeling subjects find it more difficult to integrate new information into their cognitive representation and hence to change their perceptions of the environment. Many Sensing office workers fail to evaluate the possibilities that are inherent in a new situation. An example of the sort of practical problems that result from a predominantly Sensing population in the office was observed after the introduction of the open plan office. Workers found spatial orientation in their redesigned office more difficult (Quinan et al, 1982) and consequently they failed to utilize new opportunities for physically rearranging the workspace to meet their changing requirements at work (Hedge, 1982). This phenomena, of not utilizing the potential of the open plan office, can be explained in terms of the personality of office workers. The preference shown by the majority for evaluating environmental

information through Sensing means that they are oriented to the concrete and observable features of their physical environment. They have neglected the complementary Intuitive function which is necessary for recognizing the abstract possibilities inherent in any situation. To sum up, style of cognitive orientation may offer one explanation of why many office workers have failed to recognize the latent capacity for change in the automated workplace. The experimental results have a second area of application for understanding why people differ in their responses to change. The most common justification for introducing office automation is to increase productivity (Kleim, 1985) and any problems associated with the introduction of new equipment are generally attributed to 'teething' difficulties. However, an alternative hypothesis, and one supported by the experimental evidence, is that many office workers are conservative Sensing types and thus find it difficult to recognize the flexibility for information processing that is allegedly offered by the computer. Sensing persons are more conservative because they are slower to integrate new information by updating the cognitive representation. Their resistance to change has implications for managing change in the workplace.

In contrast, the danger facing people who evaluate through Intuition is that the computer-driven generation of more and more new information will quickly overload their cognitive processing capacity. This raises the important question of how much change the cognitive information processing system should be expected to incorporate. The system becomes erratic with too much change; with too little change it becomes inert. The incorporation of new information must be balanced with the need to recognize the regularities in information that is so essential for stability of perception. These criteria are as applicable to the office filing system as they are to the cognitive processing system. The decision about what exactly is an efficient sorting strategy depends on what is ultimately done with the sorted information. The ability to retrieve items quickly and accurately is one indicator of how successfully items have been stored. To others, the advantages of having an efficient retrieval system do not compensate for

the way that the flow of information - conducive to stimulating new ideas - is hindered. This attitude was neatly summed up by an Intuitive-Thinking interviewee in the preliminary study: he said that he disliked filing because he felt that it restricted the flow of original thinking. The experimental evidence indicated that Intuitive-Thinking persons would find items more efficiently with a system that made them retrieve on the basis of shared features first

So to what extent is the MBTI suitable for predicting responses to different systems of organizing information? It is suggested that the ease with which people learn (or orient to change) depends on one or all of the following three conditions. Firstly, that they are able to use their dominant cognitive functions to process information. Each function is oriented to, or more prone to process certain properties of information. Secondly, people learn best if there is a match between the processing characteristics of their dominant functions and properties of the new information. Thirdly, they should be able to switch from one cognitive process to another so that they can evaluate and organize new information into the cognitive representation. This is more effortful and places greater demands on memory but processing is ultimately more flexible.

Processing is more difficult when people are put in a situation which requires them to use their auxiliary, or less preferred, functions. A real life example of this is when the factually-minded Sensing person has to use Intuition to master new theories or ideas. The implications for learning - whether in school situation or adapting to change at work - are that people who habitually evaluate through Intuition are quicker to process new information than Sensing persons because of the former's orientation to abstract ideas and new possibilities. Sensing persons are slower to grasp new ideas but may eventually have a sounder understanding of the same concepts. Experiences of success in learning certain kinds of knowledge will reinforce a person's preference for a certain information processing strategy.

Having generalized from the results of the experimental work, it is now necessary to point out any reservations concerning the materials and design of that experimental work. In particular, the MBTI must be discussed in terms of its suitability for identifying and distinguishing between types of people in terms of their information processing strategy. The research involved a two-tier evaluation of the Jungian-based personality inventory. No definitive answer can be given to the question of the extent to which the MBTI actually operationalized Jungian theory. However, the following ambiguity must be pointed out. The authors of the MBTI developed the inventory independently of Jung. When the latter's work was translated into English, they became aware of the correspondence between their own ideas and what the Swiss psychoanalyst had written. Thus the dimensions of the MBTI were developed on the basis of Briggs and Myers *own interpretation* of personality. They may have been selective in the use that they made of Jung's ideas. Although it is rarely, if ever, stated in the literature, the inventory was not originally designed to operationalize Jungian theory. Furthermore, it is not made clear whether the terminology used to describe the cognitive functions (Sensing, Intuition, Thinking and Feeling) accurately conveys the meaning of Jung's terms. Some of the precision of his concepts may have been lost in the translation from the original German.

The second issue to be considered was whether the inventory actually distinguishes between the four types in terms of certain information processing tasks. Experimental evidence indicated that there were four cognitive orientation types who differed in the way that they evaluated and organized information. The inventory was least satisfactory as a measure of individual differences in information processing on the sorting task but this may reflect the design of the task itself rather than any limitations of the theory. For example, there may not have been sufficient variety in the paper-based items to be sorted or the range of sorting activities that was examined was not wide enough. More individual differences might have been found with a content analysis of 'what' subjects sorted.

Two cognitive orientation functions were investigated - evaluation and organization. The results for all tasks indicated the greater importance of evaluation as a source of variance in cognitive processing style and that, in some situations, the role of organization (which was a judging function) was negligible. Organization and judgement probably become increasingly important for long-term memory. In the office, these cognitive functions are necessary for knowing what information is in archive storage and where it can be found. It seems likely that organization and judgement become increasingly important over a longer period of time. Consequently, the short time-span of the experimental tasks creates reservations about generalizing from the results of a task involving short-term recall for spontaneously created categories to long-term memory for much of the paper-based information found in the typical office. Another limitation on the extent to which the results can be generalized from was that the sample of subjects was a comparatively limited one. Testing of a larger number of subjects, including a variety of office workers, both male and female, of different educational levels, and working with a range of physical resources, would have allowed for greater generalization from the results.

The gradual accumulation of evidence regarding people's cognitive information processing strategy and their strategy for sorting paper-based information will enable us to predict how different types of people will respond to and adapt to changes in the workplace.

Chapter 12. Conclusions.

The Jungian personality traits of Sensing, Intuition, Thinking and Feeling correspond to dominant cognitive functions which are necessary for orientation to the environment. What we understand by 'personality' is a cognitive structure formed under the impact of received information and modified by changes in processing input. Each cognitive function (or personality trait) is associated with the processing of certain kinds of information. Therefore, people find it easier to process the kinds of information associated with their dominant cognitive functions but more difficult to process the kind of data that must be processed through the auxiliary functions. These processing preferences reinforce the structure of personality.

All people must evaluate information - through the Sensing or the Intuitive functions. People for whom Sensing is dominant are oriented to the processing of concrete, observable and stimuli-bound information. If the complementary Intuitive function is dominant, they are more likely to perceive abstract possibilities and their processing is more flexible.

The same people must also organize information - through the Thinking or Feeling functions. If Thinking is dominant, then people emphasize distinctive attributes of information; if Feeling is dominant, they organize around shared features.

Combinations of these functions define cognitive orientation type. This means that each Jungian-based type has a characteristic mode of evaluating and organizing information. The most discernable differences on the cognitive task indicators were found between the two types whose information processing tended to be mutually exclusive, that is, between Sensing-Feeling and Intuitive-Thinking subjects. The former processed with the 'fixed' mode of evaluation and the 'flexible' mode of organization. In contrast, Intuitive-Thinking persons processed with the 'flexible' style of evaluation and the 'fixed' style of organization. Sensing-Feeling types were

considered to have the most efficient paper-based sorting strategy in the sense that their recall performance was superior to that of the other types. They also responded most often in the word association task and their cognitive strategy was the most content- and object-oriented. They retrieved more items because they processed information on the basis of its shared features and thus retrieved whole classes of information. In contrast, the processing strategy of Intuitive-Thinking persons was the most functionally-oriented; they recalled the fewest items yet had the most original word association responses. They processed independent and distinctive features first.

The cognitive processing of people who evaluated through Intuition was more flexible than that of people who oriented through the complementary function of Sensing. This was because the Sensing persons in the sample had developed one cognitive function but neglected the other. Intuitive persons, on the other hand, had a greater range of available processes because they had developed both cognitive functions. It seems likely that the Sensing persons in the limited sample would be more resistant to the introduction of change in the workplace than the Intuitive persons in the sample.

Jungian personality theory, standardized by the MBTI, also offers a number of advantages that makes it suitable for research on information processing theory. In particular, it recognizes that information processing can be conceptualized as a continuum and that people have distinct preferences for processing with the dominant functions associated with one end of that continuum. The functions at either end of the continuum are associated with different kinds of environmental information. However, changes in the environmental situation can force people to move along that continuum and to process information with their auxiliary or less preferred function. When this happens, information processing is more difficult. Another implication of relating personality traits to cognitive processes is that information processing is egocentric. Cognition and affect are related through the way in which orient to

environmental stimuli.

There are a number of ambiguities inherent in using the Jungian perspective (standardized by the MBTI) to identify different processing styles. The relationship between the dominant and auxiliary functions is clear: these are the complementary functions at either end of a continuum. The continuums represent Sensing and Intuition, Thinking and Feeling. What is not clear is the nature of the relationship between the 'primary' and 'secondary' functions. A person may neglect the development of one function (as was the case for the Sensing-Thinking and Sensing-Feeling subjects in the sample). This does not mean that they never use the 'secondary' function but, in behavioural terms, this emphasis on one function at the expense of the other had the effect of diminishing the flexibility of processing. Further research needs to consider the relative importance of the two cognitive orientation functions and the effects on processing when an organizing persons is required to evaluate information and the evaluating person to organize.

To conclude, the MBTI offers a complex but informational-rich way of classifying people. The four cognitive orientation types are defined by their styles of evaluating and of organizing information. People evaluate by orienting through the cognitive functions of Sensing or Intuition and they organize by orienting through Thinking and Feeling. These functions have both cognitive and affective elements.

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Appendix A: The Myers Briggs Type Indicator (MBTI).

PART 1: Which Answer Comes Closer To Telling How You Usually Feel Or Act?

1. *When you go somewhere for the day, would you rather*
   (A) plan what you will do and when, or (B) just go?
2. *If you were a teacher, would you rather teach*
   (A) fact courses, or (B) courses involving theory?
3. *Are you usually*
   (A) a "good mixer", or (B) rather quite and reserved?
4. *Do you prefer to*
   (A) arrange dates, parties, etc, well in advance, or
   (B) be free to do whatever looks like fun when the time comes?
5. *Do you usually get along better with*
   (A) imaginative people, or (B) realistic people?
6. *Do you more often let*
   (A) your heart rule your head, or (B) your head rule your heart?
7. *When you are with a group of people, would you usually rather*
   (A) join in the talk of the group, or` (B) talk with one person at a time?
8. *Are you more successful*
   (A) at dealing with the unexpected and seeing quickly what should be done, or
   (B) at following a carefully worked out plan?
9. *Would you rather be considered*
   (A) a practical person, or (B) an ingenious person?
10. *In a large group, do you more often*
    (A) introduce others, or (B) get introduced.
11. *Do you admire more the people who are*
    (A) conventional enough never to make themselves conspicuous, or
    (B) too original and individual to care whether they are conspicuous or not?
12. *Does following a schedule*
    (A) appeal to you, or (B) cramp you?
13. *Do you tend to have*
    (A) deep friendships with a very few people, or
    (B) broad friendships with many different people?
14. *Does the idea of making a list of what you should get done over the weekend*
    (A) appeal to you, or (B) leave you cold, or (C) positively depress you?
15. *Is it a higher compliment to be called*
    (A) a person of real feeling or, (B) a consistently reasonable person?
16. *Among your friends are you*
    (A) one of the last to hear what is going on, or
    (B) full of news about everybody?

(On this next question only, if two answers are true, mark both)

17. *In your daily work, do you*

(A) rather enjoy an emergency that makes you work against time, or

(B) hate to work under pressure, or

(C) usually plan your work so that you won't *need* to work under pressure?

18. *Would you rather have as a friend*

(A) someone who is always coming up with new ideas, or

(B) someone who has both feet on the ground?

19. *Do you*

(A) talk easily to almost anyone for as long as you have to, or

(B) find a lot to say only to certain people or under certain conditions?

20. *When you have a special job to do, do you*

(A) organize it carefully before you start, or

(B) find out what is necessary as you go along?

21. *Do you usually*

(A) value sentiment more than logic, or (B) value logic more than sentiment?

22. *In reading for pleasure, do you*

(A) enjoy odd or original ways of saying things, or

(B) like writers to say exactly what they mean?

23. *Can the new people you meet tell what you are interested in*

(A) right away, or

(B) only after they really get to know you?

24. *When it is settled well in advance that you will do a certain thing at a certain time, do you find it*

(A) nice to be able to plan accordingly, or

(B) a little unpleasant to be tied down?

25. *In doing something that many other people do, does it appeal to you more to*

(A) do it in the accepted way, or (B) invent away of your own?

26. *Do you usually*

(A) show your feelings freely, or (B) keep your feelings to yourself?

PART II: Which Word In Each Pair Appeals To You More?

Think what the words mean, not how they look or how they sound.

27. (A) scheduled unplanned (B)
28. (A) gentle firm (B)
29. (A) facts ideas (B)
30. (A) thinking feeling (B)
31. (A) hearty quiet (B)
32. (A) convincing touching (B)
33. (A) statement concept (B)
34. (A) analyze sympathize (B)
35. (A) systematic spontaneous (B)
36. (A) justice mercy (B)
37. (A) reserved talkative (B)
38. (A) compassion foresight (B)
39. (A) systematic casual (B)
40. (A) calm lively (B)
41. (A) benefits blessings (B)
42. (A) theory certainty (B)
43. (A) determined devoted (B)
44. (A) literal figurative (B)
45. (A) firm-minded warm-hearted (B)
46. (A) imaginative matter-of-fact (B)
47. (A) peacemaker judge (B)
48. (A) make create (B)
49. (A) soft hard (B)
50. (A) sensible fascinating (B)
51. (A) forgive tolerate (B)
52. (A) production design (B)
53. (A) impulse decision (B)
54. (A) who what (B)
55. (A) speak write (B)
56. (A) uncritical critical (B)
57. (A) punctual leisurely (B)
58. (A) concrete abstract (B)
59. (A) changing permanent (B)
60. (A) wary trustful (B)
61. (A) build invent (B)
62. (A) orderly easygoing (B)
63. (A) foundation spire (B)
64. (A) quick careful (B)
65. (A) theory experience (B)
66. (A) sociable detached (B)
67. (A) sign symbol (B)
68. (A) party theater (B)
69. (A) accept change (B)
70. (A) agree discuss (B)
71. (A) known unknown (B)

PART III: Which Answer Comes Closer To Telling How You Usually Feel Or Act?

72. *Would you say you*
    (A) get more enthusiastic about things than the average person, or
    (B) get less excited about things than the average person?
73. *Do you feel it is a worse fault to be*
    (A) unsympathetic, or (B) unreasonable?
74. *Do you*
    (A) rather prefer to do things at the last minute, or
    (B) find doing things at the last minute hard on the nerves?
75. *At parties, do you*
    (A) sometimes get bored, or (B) always have fun?
76. *Do you think that having a daily routine is*
    (A) a comfortable way to get things done, or
    (B) painful even when necessary?
77. *When something new starts to be the fashion, are you usually*
    (A) one of the first to try it, or (B) not much interested?
78. *When you think of some little thing you should do or buy, do you*
    (A) often forget it until much later, or
    (B) usually get it down on paper to remind yourself, or
    (C) always carry through on it without reminders?
79. *Are you*
    (A) easy to get to know, or (B) hard to get to know?
80. *In your way of living, do you prefer to be*
    (A) original, or (B) conventional?
81. *When you are in an embarrassing spot, do you usually*
    (A) change the subject, or (B) turn it into a joke, or
    (C) days later, think of what you should have said?
82. *Is it harder for you to adapt to*
    (A) routine, or (B) constant change?
83. *Is it higher praise to say someone has*
    (A) vision, or (B) common sense?
84. *When you start a big project that is due in a week, do you*
    (A) take time to list the separate things in order to be done and the order of doing them, or
    (B) plunge in?
85. *Do you think it more important to be able*
    (A) to see the possibilities in a situation, or
    (B) to adjust to the facts as they are?

86. *Do you think the people close to you know how you feel*
(A) about most things, or
(B) only when you have had some special reason to tell them?
87. *Would you rather work under someone who is*
(A) always kind, or (B) always fair?
88. *In getting a job done, do you depend on*
(A) staring early, so as to finish with time to spare, or
(B) the extra speed you develop at the last minute?
89. *Do you feel it is a worse fault*
(A) to show too much warmth, or (B) not to have warmth enough?
90. *When you are at a party, do you like to*
(A) help get things going, or
(B) let the others have fun in their own way?
91. *Would you rather*
(A) support the established methods of doing good, or
(B) analyze what is wrong and attack unsolved problems?
92. *Are you more careful about*
(A) people's feelings, or (B) their rights?
93. *If you were asked on a Saturday morning what you were going to do that day, would you*
(A) be able to tell pretty well, or (B) list twice too many things, or
(C) have to wait and see?
94. *In deciding something important do you*
(A) find you can trust your feeling about what it is best to do, or
(B) think you should do the *logical* thing, no matter how you feel about it?
95. *Do you find the more routine parts of your day*
(A) restful, or (B) boring?
96. *Does the importance of doing well on a test make it generally*
(A) easier for you to concentrate and do your best, or
(B) harder for you to concentrate and do yourself justice?
97. *Are you*
(A) inclined to enjoy deciding things, or
(B) just as glad to have circumstances decide a matter for you?
98. *In listening to a new idea, are you more anxious to*
(A) find out all about it, or (B) judge whether it is right or wrong?
99. *in any of the ordinary emergencies of everyday life, would you rather*
(A) take orders and be helpful, or (B) give orders and be responsible?
100. *After being with superstitious people, have you*
(A) found yourself slightly affected by their superstitions, or
(B) remained entirely unaffected?
101. *Are you more likely to speak up in*
(A) praise, or (B) blame?

102. *When you have a decision to make, do you usually*

(A) make it right away, or

(B) wait as long as you reasonably can before deciding?

103. *At the time of your life when things piled up on you the worst, did you find*

(A) that you had gotten into an impossible situation, or

(B) that by doing only the necessary things you could work your way out?

104. *Out of all the good resolutions you have made, are there*

(A) some you have kept to do this day, or

(B) none that have really lasted?

105. *In solving a personal problem, do you*

(A) feel more confident about it if you have asked other people's advice, or

(B) feel that nobody else is in as good a position to judge as you are?

106. *When a new situation comes up which conflicts with your plans, do you try first to*

(A) change your plans to fit the situation, or

(B) change the situation to fit your plans?

107. *As are such emotional"ups and downs" as you may feel*

(A) very marked, or (B) rather moderate?

108. *In your personal beliefs, do you*

(A) cherish faith in things that cannot be proved, or

(B) believe only those things that can be proved?

109. *In your home life, when you come to the end of some undertaking, are you*

(A) clear as to what comes next and ready to tackle it, or

(B) glad to relax until the next inspiration hits you?

110. *When you have a chance to do something interesting, do you*

(A) decide about it fairly quickly, or

(B) sometimes miss out through taking too long to make up your mind?

111. *If a break up or mix-up halted a job on which you and a lot of others were working, would your impulse be to*

(A) enjoy the breathing spell, or

(B) look for some part of the work where you could still make progress, or

(C) join the "trouble-shooters" in wrestling with the difficulty?

112. *When you don't agree with what has just been said, do you usually*

(A) let it go, or (B) put up an argument?

113. On most matters, do you

(A) have a pretty definite opinion, or (B) like to keep an open mind?

114. *Would you rather have*

(A) an opportunity that may lead to bigger things, or

(B)an experience that you are sure to enjoy?

115. *In managing your life, do you tend to*

(A) undertake too much and get into a tight spot, or

116. *When playing cards, do you enjoy most*

(A) the sociability, or (B) the excitement of winning,or

(C) the problem of getting the most out of each hand, or

(D) you don't you enjoy playing cards?

117. *When the truth would not be polite, are you more likely to tell*

(A) a polite lie, or (B) the impolite truth?

118. *Would you be more willing to take on a heavy load of extra work for the sake of*

(A) extra comforts and luxuries, or

(B) a chance to achieve something important?

119. *When you don't approve of the way a friend is acting, do you*

(A) wait and see what happens, or (B) do or say something about it?

120. *Has it been your experience that you*

(A) often fall in love with a notion or project that turns out to be a disappointment, or

(B) use enough judgement on your enthusiasms so that they do not let you down?

121. *When you have a serious choice to make, do you*

(A) almost always come to a clearcut decision, or

(B) sometimes find it so hard that you do not wholeheartedly follow up either choice?

122. *Do you usually*

(A) enjoy the present moment and make the most of it, or

(B) feel that something just ahead is more important?

123. *When you are helping in a group undertaking, are you more often struck by*

(A) the cooperation, or (B) the inefficiency,

(C) or don't you get involved in group undertakings?

124. *When you run into an unexpected difficulty in something you re doing, do you feel it to be*

(A) a piece of bad luck, or (B) a nuisance, or

(C) all in the days work?

125. *Which mistake would be more natural for you?*

(A) to drift from one thing to another all your life, or

(B) to stay in a rut that didn't suit you?

126. *Would you have liked to argue the meaning of*

(A) a lot of these questions, or (B) only a few?

Appendix B: Word association task.

Word Association score sheet.

Please give a maximum of 10 words that you associate with the concepts of "office" and "information", in the order in which they occur to you.

(A) Words associated with the **OFFICE**

Responses listed in order in which they occur.	*Points (strength of association)*
1.	10
2.	9
3.	8
4.	7
5.	6
6.	5
7.	4
8.	3
9.	2
10.	1

(B) Words associated with **INFORMATION.**

Responses listed in order in which they occur.	*Points (strength of association)*
1.	10
2.	9
3.	8
4.	7
5.	6
6.	5
7.	4
8.	3
9.	2
10.	1

Appendix C: The forty memos used in the sorting and recall task.

Memo 1. A.V.S. Spring Conference: Note in Diary.

Please note in your diary that the Association of Vending Services will hold their annual Spring Conference in Birmingham on 16 April next year and that we shall be attending.

Memo 2. Request for Maternity Leave.

Mrs J. Lee in the Finance Department has requested maternity leave as from 1st September. Please note that we shall need to recruit someone to cover for 6 months as from that date.

Memo 3. Confirmation of Job Advertisement in Local Paper.

I have received confirmation of the receipt of the sum of £30-00 for the advertisement in the Friday 12th edition of of The Bilham Echo for the post of workshop engineer, starting as soon as possible, salary to be negotiated.

Memo 4. Appointment as Full-Time Sales Clerk.

To be typed and sent to Mrs R. Jones.

Following your successful interview last Tuesday, I am happy to inform you that we can offer you the post of full time sales clerk with the company, from the 1st of next month. I would be grateful if you could contact me as soon as possible with your NI number.

Memo 5. Notification of Lack of Success in Job Interview.

To be typed and sent to Mrs. R. Pearson.

Following your interview last Tuesday, I regret to have to have to inform you that you were not successful in your application for the post of full time sales clerk. We shall however keep your name on our files and contact you if a similar post comes up in the future.

Memo 6. Summer Holidays.

Will everyone please note that we shall take our annual Summer Holiday from 1st - 15th July inclusive, at the same time as the county's Industrial Fortnight.

Memo 7. Confirmation by A.V.S. of Date for Spring Conference.

I am glad to say that the AVS has accepted our application for 3 places at their Spring Conference in Birmingham. I shall send the details to you as soon as they arrive; please arrange payment of the conference fees.

Memo 8. Solicitors' Change of Address.

I have been sent details of the forthcoming change of our solicitors address. It is now:

Brown and Charnley
21, Latimer Row,
Bilham.

Please see that it is changed in the relevant files.

Memo 9. Hogg Robinson Insurance Confirmation.

Our insurance company has sent me confirmation of the insurance for the Managing Director's Mercedes. I am sending you the relevant documents.

Memo 10. Airflow Streamlines Company.

Airflow Streamlines have sent an invoice for the machine parts which were sent last month. Please see to the payment as this is the second invoice that they have sent us.

Memo 11. Industry and Commerce Exhibition Centre - Midland Exhibition Centre.

I have received details of the forthcoming Industry and Commerce Midland Exhibition, to be held at Nottingham on 1st - 3rd November. I am sending you a statement of account number N532H - can you please see to the payment for our stand.

Memo 12. Solicitors.

Brown and Charnley have just notified us that the proposed lease on the Parkland Industrial Estate has been successfully negotiated.

Memo 13. Hogg Robinson Insurance Confirmation.

Our agents have just sent us an insurance evaluation on the following Ford Escort van, registration number NAH 2165W.

Memo 14. Notification by A.V.S. of Annual Dinner and Dance.

I have received an invitation from the Association of Vending Services for the annual Dinner and Dance, to be held this year at the London Hilton on Saturday 1st October. Would you please make the necessary arrangements? There will be 6 of us to be booked into overnight hotels.

Memo 15. Application for Post of Service Engineer.
Please type up and send to Mr. A. English.

I have received your application for the post of service engineer as advertised in last weeks edition of the Bilham Echo.
I would be pleased if you would come for an interview, this Friday, at 2 pm. Someone will meet you at reception. Please phone if this is not convenient.

Memo 16. Datapost.
The AVS has sent out a questionnaire to all its members in order to evaluate how widely "Datapost" is used. I enclose the questionnaire and would be grateful if you could fill it in for me as it is really your area.

Memo 17. Undergraduate Research.
I have received a letter from a student at the college enquiring about the chances of doing a research project here from October to December. His research topic is the evaluation of personality tests as used in staff selection - I don't really think that we can help him, do you?

Memo 18. Job Application for Post of Service Engineer.
To be typed up and sent to Mr. T. Lloyd.

I have received your application for the post of service engineer as advertised in last weeks edition of the Bilham Echo.
I would be pleased if you would come for an interview, this Friday, at 3 pm. Someone will meet you at reception. Please phone if this is not convenient.

Memo 19. Industrial Estate Lease.
We are still waiting to hear from Brown and Charnley about the Parkwood Industrial Estate site.
Can you please give them a ring.

Memo 20. New Communicators.
I am delighted to say that our new communicators have finally arrived. Will the chief engineer please come and pick them me as soon as possible.

Memo 21. Proposed Y.T.S. Visit.
This morning, I spoke to Miss. Robinson who is in charge of the local YTS scheme. She will be visiting next Tuesday and is particularly interested in having a look around the workshop and in discussing the engineering opportunities available.

Memo 22. B.U.P.A.

I have had a letter from the AVS with details of the BUPA scheme which is open to all members. If we wish to join, we must fill in the enclosed forms and return them by the end of the month. Please let me know as soon as possible if you are interested.

Memo 23. New Contracts to Supply Vending.

There will be a fee of £35 for each member of staff who successfully informs management of the possibilities of obtaining further outside vending contracts.

Memo 24. Executive Meeting.

Will all departmental managers please note that executive meetings will, in future, be held on Fridays at 2 pm starting from next week.

Memo 25. Parking in Delivery areas.

Can everyone please remember not to park in front of delivery areas, as this is blocking access and causing extra work when loading and unloading.

Memo 26. Heating and Ventilation in the Cold Spell.

Please keep doors and windows shut whenever possible during the snap cold spell.

Memo 27. Job Reference for Miss. R. Jacobs.

Please type up and post.

Miss. Rachel Roberts worked at the above company from June 1984 to June 1987 as a receptionist. During that period, she proved to be helpful and conscientious employee. She is always immaculately turned out and has a calm and friendly manner.

Memo 28. Stationary Supplies.

Can all departments give me details of their stationary requirements as I shall be going to Blackwells on Friday.

Memo 29. Notification of Lack of Success at Interview.

To be typed and sent to Miss. Y. Mc Kenzie.

Following your interview on Wednesday, I regret to have to have to inform you that you were not successful in your application for the post of sales telephonist.
May I wish you every luck for the future.

Memo 30. Application for Post of Service Engineer.

We have received another application for the post of service engineer from Mr Terry Donald. I shall forward his application form to you.

Memo 31. Application for Post of Service Engineer.

We have received another application for the post of service engineer from Mr Eric Black. Please can you arrange to interview the prospective candidates as soon as possible as we need to fill this post quickly.

Memo 32. Office Cleaning.

I shall be away tomorrow. Please ask the cleaning lady to give my office a miss as I won't have have time to tidy a few things away.

Memo 33. Company Outing.

The company's summer outing has been arranged for 10th August. Due to popular demand, we shall be visiting the Rockyhills Amusement Park again. There will be coach seats for each employee and for two guests each.

Memo 34. Reply to A.V.S. concerning Datapost.

I enclose the completed questionnaire concerning our use of Datapost. May I add that we have been extremely satisfied with this service, particularly in emergencies, although we would use it more if it was cheaper.

Memo 35. A.V.S. Distribution Centre Addresses.

The AVS Midland Centre has changed its address, the new address is:

A.V.S. Midland Centre
Kilroy House,
13, Bookman Road,
Woodborough-on-Trent.

Memo 36. Termination of Employment.

Please type up and send to Mr. N. Blickley.

Following the incident in the workshop last Monday, I regret to inform you that we have no choice but to terminate your employment. Please call in to see me to arrange for payment of your outstanding wages.

Memo 37. Job offer for Post of Full-Time sales clerk.

Please type up and post to Miss. C. Samson

Following your interview I am delighted to be able to offer you the post of full time sales clerk. As I understand that you are able to start work as soon as possible, could you please give me a ring to arrange the details.

Memo 38. Industry and Commerce Exhibition - Midland Exhibition Centre.

To be held in Nottingham 1st - 3rd November.

Having booked and paid for our stand, can we now finalize our ideas about what we are going to present there.

Memo 39. Reply to Introductory Letter by Psychological Testing Firm.

Please type up and post.

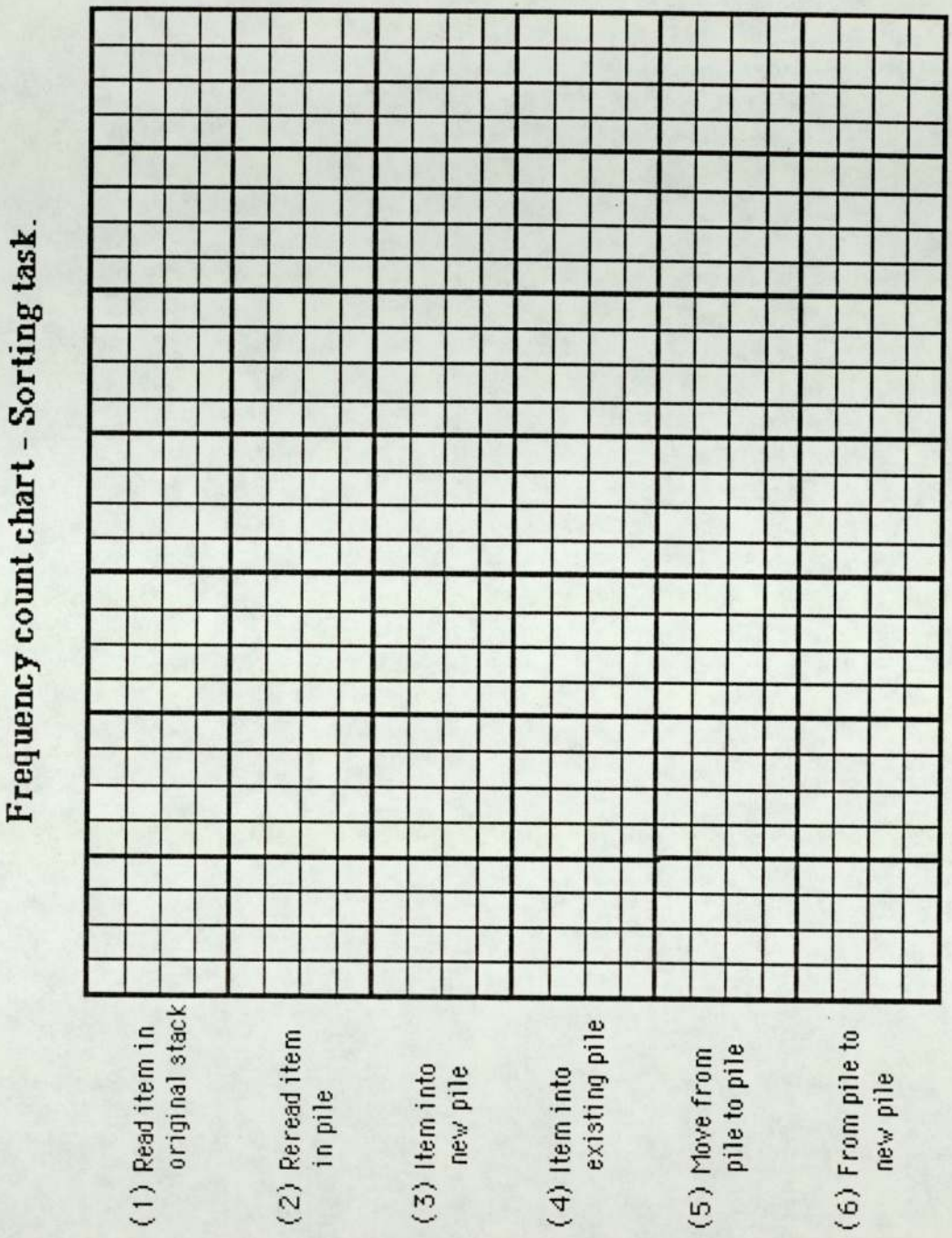
Thank you for your introductory letter.

At the moment, our staff requirements are not so great that we feel that we would benefit from the introduction of widespread psychological testing. I have your address and shall contact you in the future if necessary.

Memo 40. Aircall Communications - Enclosed Standing Order.

I am enclosing a standing order from Aircall Communications which somehow seems to have become mislaid on its way to Finance. Please note that it requires immediate attention.

Appendix D. Frequency count chart.



Appendix E.

Questionnaire on sorting strategy.

Subject No.

Col. no.	*Cat. code*	*Question No.*		*code*
			A. Biographical Data.	
1.	Gender	(1)	*Subject's gender:*	
			a) Male	01
			b) Female	02
2.	Area of interest	(2)	*Subject's area of interest:*	
			a) Science	01
			b) Non Science	02
3.	Work-space	(3)	*Subject's place of work is:*	
			a) shared	01
			b) private	02
4.	Degree of routine	(4)	*At work, subject prefers:*	
			a) Routine	01
			b) Non-routine	02

Col. no.	*Cat. code*	*Question No.*		*code*
			B. Sorting.	
5.	Temp chars of info	(5)	*Information was organized for:*	
			a) past use	01
			b) present use	02
			c) future use	03
6.	Chars of info	(6)	*Information organization was based on:*	
			a) content	01
			b) function	02
7.	Incomp info	(7)	*Incomplete information was:*	
			a) piled as incomplete information	01
			b) piled as appropriate to subject matter	02
			c) piled and mental note made of location	03
			d) other action	04
8.	Cat incon info	(8)	*Category inconsistent information was:*	
			a) put in separate pile for inconsistent information	01
			b) placed in a general pile	02
			c) put with the most closely related information	03
			d) other action	04
9	Final organiz.	(9)	*Best description of final information organization as perceived by subject:*	
			a) all information fixed in time and space	01
			b) most information fixed in time and space	02
			c) mostly loosely arranged in time and space	03
			d) all loosely arranged in time and space	04

Appendix F. Raw scores from the MBTI.

(see sections 4.4. and 6.5.3.1. for how to calculate scores.)

Type I subjects (Sensing and Thinking dominant).

	Indiv. function scores								*Strength of dominant function*			
	Extrav	Introv	Sens	Intuit	Think	Feel	Judg	Perc	E/I	S/N	T/F	J/P
1.	17	8	22	9	28	0	27	1	17	25	55	51
2.	23	4	20	5	14	4	7	21	37	29	19	29
3.	19	6	16	8	18	4	25	5	25	15	27	39
4.	13	16	27	6	25	1	0	28	5	25	47	57
5.	6	21	12	8	22	7	3	27	29	7	29	49
6.	8	21	18	3	25	0	18	6	27	29	49	23
7.	7	20	32	0	16	3	23	4	27	63	25	37
8.	6	18	12	2	25	5	25	5	25	19	39	39
9.	8	23	20	5	16	7	23	5	31	29	17	35
10.	21	11	21	7	2	16	11	16	19	27	29	11
11.	9	18	24	6	25	3	20	7	19	35	43	25

Type II (Sensing and Feeling dominant).

	Indiv. function scores								*Strength of dominant function*			
	Extrav	Introv	Sens	Intuit	Think	Feel	Judg	Perc	E/I	S/N	T/F	J/P
1.	1	26	20	5	10	13	21	9	51	29	7	23
2.	19	7	20	5	3	15	21	6	23	29	25	29
3.	9	18	15	13	9	11	4	24	19	3	5	41
4.	2	25	22	11	9	13	19	9	47	21	9	19
5.	6	19	18	8	8	12	19	9	27	19	9	19
6.	16	13	23	4	8	14	17	13	5	37	13	9
7.	10	13	14	8	6	11	18	9	7	11	11	17

Type III (Intuition and Thinking dominant).

	Indiv. trait scores								*Strength of dominant trait*			
	Extrav	Introv	Sens	Intuit	Think	Feel	Judg	Perc	E/I	S/N	T/F	J/P
1.	4	18	7	21	23	6	9	21	29	29	33	35
2.	17	5	7	13	9	10	8	17	23	13	3	17
3.	21	4	0	21	25	5	0	29	33	43	39	59
4.	11	12	15	18	12	10	11	16	3	7	3	11
5.	20	6	11	14	11	8	5	22	27	7	5	35
6.	15	12	1	22	8	7	0	28	5	43	1	57
7.	8	21	7	11	29	8	17	10	27	9	15	13
8.	22	5	11	16	13	9	11	17	33	11	7	13
9.	20	7	5	24	30	1	16	15	25	39	57	1
10.	22	6	11	15	17	5	25	4	31	9	23	41
11.	11	15	10	18	16	9	20	8	9	17	13	23

Type IV (Intuition and Feeling dominant).

	Indiv. trait scores								*Strength of dominant trait*			
	Extrav	Introv	Sens	Intuit	Think	Feel	Judg	Perc	E/I	S/N	T/F	J/P
1.	12	15	9	15	6	14	5	25	7	13	17	41
2.	14	6	0	23	3	19	3	27	5	47	33	49
3.	7	23	0	25	6	13	0	27	33	51	15	55
4.	9	18	8	13	8	11	10	20	19	11	7	21
5.	20	8	10	13	4	17	8	23	23	7	27	31
6.	3	25	15	18	10	15	10	20	45	7	11	21
7.	9	13	10	15	5	8	7	21	9	11	7	29
8.	21	5	0	23	6	15	6	22	31	47	19	33
9.	11	16	7	20	11	12	6	19	11	27	3	27
10.	8	19	6	18	6	12	5	24	23	25	13	39
11.	7	21	3	20	3	16	3	25	29	35	27	45

Appendix G: Word association task responses.

RESPONSES TO 'OFFICE'	*F. occ.*	*RESPONSES TO 'INFORMATION'*	*F. occ.*
Desk	25	Computer	19
Typewriter	20	Books	17
Secretary	19	Paper	15
Paper	17	Files	12
Manager	17	Library	11
Computer	15	Knowledge	8
Telephone	13	Telephone	8
People	8	Data	7
Boring	6	Conservation	7
Files	6	Letters	6
Invoices	5	Piles	4
Chair	5	Desk	4
Noise	5	Memos	4
Filing cabinets	4	Mess	3
Clerk	4	People	3
Hot	4	Writing	3
Mess	3	Filing cabinets	3
Photocopier	3	Disks	2
Information	3	Organization	2
Administration	3	Bin	2
Control	3	TV	2
Organization	2	Salesmen	2
Work	2	(to) print	2
Girls	2	Invoices	2
Women	2	Folders	2
Stationary	2	Help	1
Notebook	2	Notice boards	1
Pens	2	Tannoy	1
Books	2	Technology	1
Data	2	Spies	1
Tea	2	Interests	1
Piles	2	Conferences	1
Bin	2	Exhibitions	1
Talking	2	Sorting	1
Selling	2	Classifying	1

RESPONSES TO 'OFFICE'	*F. occ.*	*RESPONSES TO 'INFORMATION'*	*F. occ.*
Lifts	1	Recalling	1
Bookcase	1	Newspaper	1
Windows	1	Journals	1
Door	1	(to) give	1
Orders	1	Typewriter	1
Reception	1	Service	1
Intrays	1	Timetable	1
Pencils	1	(to) ask	1
Shredders	1	Office	1
Paper clips	1	(to) find out	1
Coloured stickers	1	Encyclopedia	1
Quiet	1	Index cards	1
Bustle	1	Radio	1
Headache	1	Announcements	1
Diary	1	In trays	1
Uncomfortable	1	Out trays	1
Word processing	1	Telesales	1
Coffee	1	Folders	1
Communication	1	Mail	1
Buying	1	(to) loose	1
Cramped	1		
Space	1		
Lunchbreaks	1		
Coats	1		
Worker	1		
Typing pool	1		
Plants	1		
Professional	1		
Dark	1		
Clutter	1		
Routine	1		

Appendix H: List of category titles for each of the four cognitive orientation types.

Type I (Sensing and Thinking)

(no. of subjects = 11; no. of category titles = 103).

General x 6
Training x2
Job advertisements x 3
Service engineers x 4
Sales clerk x 2
Personnel x 3
Job offers x 3
References x 4
Job refusals x 2
Termination of employment
Employees
To be sacked
Job interviews
Staff recruitment
Staff Leaving
Staff
AVS x 5
Holidays x 4
Industry and Commerce
Cars x 2
Visitors x 3
Conferences and Exhibitions x 3
Research and publicity
Miscellaneous x 3
Solicitors x 5
Insurance x 3
Solicitors and Insurance x 4
Legal matters
Standing orders x 2
Finance x 5
Payment of bills
To be paid
Expenses
Health x 4
BUPA x 2
For management
To be dealt with immediately
To be acted on
For discussion
For staff noticeboard
Information for execution
To be sorted
Internal memos x 2
Business meetings x 2
Questionnaires and Tests x 2
Addresses
Stationary x 2

Type II (Sensing and Feeling).

(no. of subjects = 7; no. of category titles = 56).

General x 2
Training
Employment
Engineers
Jobs - to type x 2
Jobs
Managerial x 2
Solicitors
Insurance
Exhibitions x 2
AVS x 2
Finance x 4
To ring
To all staff
Messages to be passed on
Stationary
Diary x 2
Datapost
Odd
Personnel x 3
Employees
Job adverts
Human resources
Jobs to be filled
Memos x 2
Research
Solicitors and Insurance x 3
AVS and Exhibitions
Conferences
To be paid x 2
To be typed
To note
BUPA x 3
Social events
Questionnaires
Addresses - to enter
For bin
Miscellaneous x 2

Type III (Intuition and Thinking)

(no. of subjects = 11; no. of category titles = 63).

General x 5
Personnel x 2
Employment - negative
Job applications
Personnel Manager
Internal memos x 2
Cleaning x 2
New communicators
'Air...'
Visitors and AVS
AVS
Solicitors and insurance
Receipts
Internal company reminders
Urgent
Delegated
To be acted on
Information to be changed
To be typed x 2
To be done by secretary
To be paid x 3
To be filed x 2
For action
Interviews x 2
Jobs and personnel x 2
Employment of new staff
Personal secretary
Information
Sales and marketing
Company business
Executive meetings x 2
Solicitors x 2
Visitors
Insurance x 2
Invoices and finance
Payments x 2
General - staff
Non-urgent
To be noted
To do
No action
To be typed and sent out
To be noted in diary
To inform
To be forwarded
For managements attention

Type IV (Intuition and Feeling).

(no. of subjects = 11; no. of category titles = 90).

General x 3
Maternity leave x 2
New employees x 2
Employment
Interviewing and job adverts
References x 2
Present employees
Psychological testing
Insurance x 3
Solicitors x 3
Invoices and finances
Conferences and Exhibitions x 3
Conference x 2
Correspondence
Industrial estate lease
Holidays x 2
Giving information
To remind x 2
Announcements x 2
For today
For information x 2
To ring
For managerial discussion
Notify staff
To be sorted again
To be forwarded
Forms to be filled in
Jobs x 2
Employees x 3
Staff - evaluation and feedback
To be interviewed
Write to failed interviewees
Personnel x 2
Write to AVS
Research x 3
Insurance and solicitors x 3
Invoices x 2
Finance x 4
Exhibitions
BUPA
Datapost
Company outing
YOPS
Urgent
To be notified
Enter in diary x 3
To be typed x 2
To be discussed x 3
To pay x 2
For staff noticeboard
Communications
To be filed away
Information in files to be changed x 2
Miscellaneous.

Appendix I: Percentage of memos recalled by subjects.

Memo number and title	*% of subjects who recalled memo*	*rank-order for recall*
1. A.V.S. Spring Conference: Note in Diary.	35	29
2. Request for Maternity Leave.	70	1
3. Confirmation of Job Advertisement in Local Paper.	60	4
4. Appointment as Full-Time Sales Clerk.	40	22
5. Notification of Lack of Success in Job Interview.	50	12
6. Summer Holidays.	40	23
7. Confirmation by A.V.S. of Date for Spring Conference.	55	8
8. Solicitors' Change of Address.	55	8
9. Hogg Robinson Insurance Confirmation.	70	9
10. Airflow Streamlines Company.	40	2
11. Industry and Commerce Exhibition Centre -Midland Exhibition Centre.	40	24
12. Solicitors.	45	18
13. Hogg Robinson Insurance Confirmation.	55	10
14. Notification by A.V.S. of Annual Dinner and Dance.	65	3
15. Application for Post of Service Engineer.	20	34
16. Datapost.	20	35
17. Undergraduate Research.	60	5
18. Job Application for Post of Service Engineer.	50	13
19. Industrial Estate Lease.	40	25
20. New Communicators.	45	26
21. Proposed Y.T.S. Visit.	50	14
22. B.U.P.A.	40	27
23. New Contracts to Supply Vending.	30	30
24. Executive Meeting.	50	15
25. Parking in Delivery areas.	60	6
26. Heating and Ventilation in the Cold Spell.	60	6
27. Job Reference for Miss. R. Jacobs.	45	19
28. Stationary Supplies.	25	33
29. Notification of Lack of Success at Interview.	55	11
30. Application for Post of Service Engineer.	40	28
31. Application for Post of Service Engineer.	20	36
32. Office Cleaning.	50	16
33. Company Outing.	45	19
34. Reply to A.V.S. concerning Datapost.	15	40
35. A.V.S. Distribution Centre Addresses.	45	20
36. Termination of Employment.	60	7

Memo number and title	*% of subjects who recalled memo*	*rank-order for recall*
37. Job offer for Post of Full-Time Sales Clerk.	30	31
38. Industry and Commerce Exhibition - Midland Exhibition Centre.	30	32
39. Reply to Introductory Letter by Psychological Testing Firm.	45	21
40. Aircall Communications - Enclosed Standing Order.	50	17

Appendix J:

MBTI norms for groups of office workers (from McCaulley, 1986) compared with subject norms.

	Extr...	Introv...	**Sens...**	**Intui...**	**Think...**	**Feel...**	Judg...	Perc...
Norms for office occupations (distribution of scores as a percentage).								
Office Managers	61	39	**55**	**45**	**39**	**61**	65	35
Managers	49	51	**67**	**33**	**75**	**25**	76	24
Administrators	56	44	**49**	**51**	**54**	**46**	70	30
Secretaries	49	51	**60**	**40**	**34**	**66**	69	31
Clerical workers	52	48	**61**	**39**	**32**	**68**	56	44
Clerical supervisors	52	48	**68**	**32**	**29**	**71**	57	43
Typists	53	47	**72**	**28**	**33**	**67**	60	40
Psychologists	66	34	**41**	**60**	**48**	**52**	56	44
Architects	30	70	**18**	**82**	**54**	**46**	59	41
Writers &Journalists	53	47	**26**	**74**	**43**	**57**	35	65
PR workers	66	34	**41**	**59**	**48**	**52**	56	44
Norms for subjects	37.5	62.5	**45**	**55**	**55**	**45**	42.5	57.5

Distribution of personality characteristics expressed as a percentage for different occupational groups of office workers, people in information handling jobs and for subjects. Cognitive orientation functions are in bold type. Norms for occupational groups taken from McCaulley, M.H. Myers-Briggs Type Indicator: Atlas of Type Tables. Gainesville, Flo.: Center for Application of Psychological Type. 1986.