Towards a Multimedia Computer Assisted Careers Guidance System for Adults with Dyslexia

(Volume 1)

by

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(Volume 1)

Summary

Dyslexic people face particular problems in employment. These problems, coupled with a lack of specialist support, create a critical need for specially tailored computer assisted careers guidance (CACG) systems. The primary objective of this thesis is to establish guidelines for the design of such a system.

Section one examines the possibility of providing training or guidance for dyslexic people via computer, and focuses on the use of symbolic information. The results of Study 1, using British road traffic signs, indicate that dyslexic people are deficient in implicit learning, even for symbolic information. Consequently, despite the advantage of symbol based systems for dyslexics, explicit training in system use is likely to be essential.

Section two examines the potential of such systems for delivering specially tailored CACG to dyslexic people. The literature on careers guidance for dyslexic people suggests that they particularly benefit from increased insight into the nature of their disability, and knowledge of its implications. Careers guidance for dyslexics would therefore be optimised by guidance in: the nature of their disabilities; likely effects of their disabilities; implications for careers decisions; and opportunities for overcoming dyslexia-related difficulties. It is argued that multimedia systems, encapsulating an open learning approach, are particularly appropriate for dyslexic people. Modern multimedia computer assisted careers guidance (CACG) systems have the potential to facilitate these beneficial processes, and to provide valuable information and support materials. However, presently available systems of this sort are far from suitable for dyslexics.

Unfortunately, little information on multimedia or CACG relates directly to dyslexia. To counter this, three studies were conducted; an interview study of selected dyslexia professionals, a questionnaire study of a wider range of dyslexia professionals, and a questionnaire study of dyslexic adults. Each was designed to establish: how careers guidance for dyslexic people can be improved; the feasibility and desirability of multimedia CACG for dyslexic people; and the design characteristics of such a CACG system. Not only was it generally agreed that such a system is feasible, and desirable, but also strong support was voiced for the central use of video resources. However, it was stressed that the system should not be allowed to replace human guidance. The results of these studies are combined with the conclusions from the literature, to construct a detailed design and description of a multimedia CACG system for dyslexic people.

Acknowledgements

Introduction

Being dyslexic myself, I am acutely aware of the problems dyslexia causes. Many dyslexics I have talked to have had grave difficulties gaining employment that they feel they can do well in, and gain satisfaction from. One, rather extreme, approach to this would be to suggest that their deficits in basic skills make them unsuitable for the vast majority of the more 'desirable' jobs. Thus, their failure to obtain such positions, though unfortunate, is inevitable. However, many of the dyslexics I have had the pleasure to meet, despite having such difficulties, have excelled in areas where one would least expect. I have met dyslexics who are lawyers, doctors and university lecturers, as well as a great many students with dyslexia reading the whole spectrum of subjects, from the arts to the sciences, to foreign languages. I have even come across one young man who was very successfully reading his way towards a degree in English literature. Then there is my own case. I was diagnosed at the age of 14, after having suffered years of typical difficulties, coupled with the insensitivity and lack of understanding that is unfortunately so common among institutions and individuals. However, I successfully negotiated academic 'O' levels, and 'A' levels, and obtained a more than satisfactory B.Sc. in psychology. Despite my dyslexia, I am capable of undertaking a task that requires the highest levels of literacy and organisation, i.e. a Ph.D..

Maybe the people discussed so far are exceptional. After all, most people do not do Ph.D.s, or degrees, or enter the more high status professions. However, this does not alter the fact that these exceptional individuals are dyslexic, and the problems this has caused have, and will persist throughout their lives. The stories of these people, as well as many others, some of which have achieved great fame and status (for example Richard Rodgers the architect, Michael Heseltine the politician, and, though this is somewhat more contentious and some authorities would display an entirely justifiable scepticism, Albert Einstein the pre-eminent physicist) emphasise that dyslexia need not be an insurmountable problem (West 1991). Thus, though there is no cure as such for dyslexia, and no prospect of anything like this in the foreseeable future, it is reasonable to suppose that ways and means can be developed to help many dyslexics achieve levels of employment success on par with, or even exceeding, those of most non-dyslexics. In our society one's judgement of oneself, as well as the judgements of us by others are greatly influenced by the work we do. Therefore, benefits of employment success

are often far deeper than the merely financial, contributing greatly to such concepts as self worth, and respect, and even going as far as things like confidence and happiness. One can further suggest that the benefits to society as a whole of having well adjusted people who live up to their greatest potential in employment, rather than the alternative, are self evident.

i.   Interest in Adults with Dyslexia

The number of dyslexics in this country has been estimated at approximately 5% (Jorm et al., 1986). This is probably a fairly typical estimate for English speaking countries (Nicolson, Fawcett and Miles 1993). In terms of numbers, this represents over two million British people, a significant amount of the population. Extrapolating this, it is likely that 5% of the adult population are dyslexic. The introduction of legislation in the United States (most recently the Americans with Disabilities Act, 1990), and in Britain (Disability Discrimination Act, 1995) has provided these adult dyslexics with statutory rights to appropriate support and accommodations. This move has fairly serious implications for employers and government departments, especially when one considers the raw numbers, and the possible costs of not fulfilling these legal obligations with any one individual. For example in 1997 Ms. Pamela Phelps (Electronic Telegraph 24/9/1997) was able to take Hillingdon Council to court for failing to recognise her dyslexia while at school, and thus failing to provide appropriate support and accommodations, placing her at a severe disadvantage in later life. The education authority in question was forced to pay substantial damages, £45,000 in total, including a sizeable amount for loss of earnings. It further serves to emphasise how high profile this case was that Ms. Phelps's council was Cherie Booth, the wife of the Prime Minister. This is only one of a number of cases. Thus, dyslexia in adults is something that cannot be simply ignored. That the then Department of Employment commissioned a feasibility study into the development and provision of large scale computerised screening of dyslexia (Nicolson, Fawcett and Miles 1993) strongly suggests that it is not being ignored. However, the fact that the conclusions of this study, which will be discussed in more detail below, have yet to be implemented suggests there is quite some way to go.

ii.   Employment and Adults with Dyslexia

Though studies have found lower employment rates amongst dyslexics (e.g. Scuccimarra and Speece 1990, Sitlington and Frank 1990), a more consistent finding is that they tend to be in occupations of a significantly lower status than non-dyslexics, and were significantly more dissatisfied with their jobs (Newbert, Danehey and Taymans 1990, White et al 1980, Scuccimarra and Speece 1990). This may well be because dyslexics tend to avoid jobs that require any academic skills or achievements, or stretch their abilities (Fourqurean et al 1991, Goodman 1987, Newbert, Tilson and Ianacone 1989, Gottfredson, Finucci and Childs 1984). What is more, dyslexics seem to have more problems in choosing appropriate occupations, and actually acquiring, maintaining and succeeding in jobs (Humes 1986, Hasazi, Gordon and Roe 1985). In short, what emerges is a pattern of poorly paid, unstimulating work with little prospect for advancement, and problems in finding any way out of this position. The major alternative to this is unemployment.

From the above it seems fairly obvious that dyslexics as a whole could benefit from some well thought out effort to help them attain higher educational standards, so they are not so disadvantaged in the market place. However, they could also benefit from some additional assistance with choosing, locating, obtaining and maintaining suitable jobs that make the best of their skills. In other words, they would gain special benefit from some sort of additional careers advice that specifically takes into account the difficulties caused by their dyslexia.

iii.   The Possibility of Computerised Screening for Dyslexia

As mentioned above in Section i., the Department of Employment, now the Department of Education and Employment, has shown specific interest in implementing some sort of screening for dyslexia, to the point of commissioning a report on the feasibility of such (Nicolson, Fawcett and Miles 1993). The main point of this was to identify likely targets for employment accommodations and further specifically designed support. The decision to investigate computerised screening derives from the fact that obtaining staff with suitable backgrounds and properly training them to administer the screening procedure is potentially

significantly more expensive, difficult and slower to get off the ground than implementing a well designed computer system. The study itself consisted of a number of in-depth structured interviews with professionals involved with diagnosis of dyslexia, followed by a questionnaire study of more professionals to confirm and elaborate upon the findings of the interviews. The overall results were very favourable to some sort of computerised screening. Not only was it considered feasible, but also a good idea, with the proviso that it should not be left entirely to a computer, i.e. it should be two stage, including a substantial human component. However, interviewees and questionnaire respondents agreed strongly that there was little point in diagnosing someone if one did not offer further help and support with dealing with that diagnosis. Specifically they stressed that some sort of specialised careers guidance would be necessary.

iv.   The Possibility of Computer Assisted Careers Guidance for Dyslexic Adults

To a great extent this thesis represents a follow up to the above study, specifically examining the last suggestion. If computers play a major role in the screening process, it seems appropriate that one should consider designing a computer system that plays a major role in subsequent careers guidance. The advantages of using computers for screening would also apply to using computers for careers guidance, in some cases even more so. Screening tests for dyslexia have been developed that require the tester to have no special qualifications and only a small amount of training (DAST, Fawcett and Nicolson 1998). However, in careers guidance there is a considerably stronger emphasis on counselling, and the possible processes and outcomes are far more varied. As a consequence an effective careers advisor must be familiar with a wide range of issues and approaches. It is not for nothing that most professional careers advisers spend three years gaining their diploma. Thus, implementing a programme of specialist careers guidance is all the more likely to require a costly and time consuming training programme.

This is not to say that careers guidance for dyslexics should be left entirely to a computer. A similar two stage process to that proposed for screening is likely to be more appropriate. However, there are far more general careers advisers than specialist careers advisers for dyslexics. So, at the very least, this system could

assume the important role of providing the client with the special information and guidance that the human advisor can not, as well as taking over some of the more mundane tasks of careers advisers (e.g. formal testing, and locating sources of information), giving advisers more time to deal with issues that only another person can deal with.

Advances in computer interface design mean that the user does not need any particularly specialised knowledge or extensive training to use computer systems. Furthermore, advances in digitisation allow modern computer systems to deliver information in a wide variety of formats, including graphics, photographic stills, sound, speech and video, as well as text that itself can be graphically manipulated. This has also been made possible by the general increase in speed and memory capacity of machines. As a consequence, modern computer systems can potentially provide the user with a very wide range of easy to use facilities and deliver an enormous amount of very varied information, with considerably less emphasis on using text than on more conventional approaches (e.g. searching careers libraries). All of this can be exploited by an individual with minimal experience of computing. Such systems may be particularly appropriate both for delivering specialist careers guidance, and for use by dyslexics. Whether this is actually the case is one of the major issues that will be confronted in the main body of this thesis.

v. Structure of the Thesis

The thesis is divided into two sections. Section 1 is an examination of learning among dyslexics, geared to establishing the appropriateness for them of training via the multimedia systems mentioned immediately above. Consequently, this section contains a discussion of theories of dyslexia (Chapter 1) to familiarise the reader with the present state of our understanding, and define as well as possible the major characteristics and possible causes of the condition, followed by an account of an experimental study (Chapter 2). This study investigates the capacities of dyslexics regarding stimuli other than text or speech, specifically graphic symbols (traffic signs). This, along with the ideas presented in Chapter 1, contributes to our understanding of the most effective ways to teach or train dyslexics, which is essential to a discussion of whether multimedia systems are an

appropriate medium for teaching, training or guidance, and if so, why? And how? This is all covered in the last chapter of Section 1 (Chapter 3).

Section 2 deals with the development of a specialised computer assisted careers guidance system for dyslexics. This section opens with a discussion of the issues and processes involved in delivering effective careers guidance to dyslexics, in an effort to generate some guidelines (Chapter 4). These guidelines are then applied to the design of computer assisted career guidance systems in general. Thus, in Chapter 5 there is an examination of the structure and workings of such systems, and the way these could best be implemented via multimedia and otherwise tailored to dyslexic users. This information, along with information from the previous chapter, is used as the primary basis for three studies (Chapters 6, 7 and 8). Together these have been designed to establish whether a multimedia careers guidance system for dyslexics would be helpful, feasible and desirable, as well as of what it should consist. The first (Chapter 6) is an in depth structured interview study of professionals in the fields of dyslexia in adults, careers guidance and computing. The second (Chapter 7) is a questionnaire study of a larger number of the same type of people, intended to clarify, confirm and elaborate upon the results of the interview study. The final study (Chapter 8) is another questionnaire study based on the previous two, but this time the participants are adult dyslexics themselves. This is essential for gaining the opinions of the end users, as well as finding out about some of their relevant experiences and characteristics. Overall, this approach, i.e. interviews of professionals followed by questionnaire studies, as well as the interview schedule and questionnaires themselves, are modelled on the computerised screening for dyslexia study mentioned above (Nicolson, Fawcett and Miles 1993). This is to provide some continuity between these two bodies of work, and facilitate a comparison of the results. Thus, the first study leads naturally to the second, and the second can be used to elaborate upon and refine the conclusions of the first.

The last chapter (Chapter 9) of Section 2, not including the 'Conclusion', presents the culmination of all the work in previous chapters. The conclusions of the three previous studies are brought together and discussed in the context of the findings of other chapters. This, along with information from previous chapters, is used to generate a detailed design and description of the proposed multimedia computer assisted careers guidance system for adults with dyslexia.

v.i.   *A note on terminology*

A general problem when writing about people with disabilities is the choice of an appropriate reference term. Ideally one does not want to define these people purely in terms of their disability. In the case of dyslexia this admirable sentiment leads to the suggestion that terms such as 'dyslexic people' or 'people with dyslexia' would be most appropriate. However, the problem with this is that when used repeatedly, as they must be in a work of this type, these terms become clumsy and tiresome. Personally, in this type of context I have never objected to being called 'a dyslexic', and in my experience dyslexics do not find the term belittling or derogatory in any way. It should also be said that throughout the literature in the UK referring to people as 'dyslexics' is standard. Indeed McLoughlin, Fitzgibbon and Young (1994, work that will be discussed in some detail), authors who are particularly sensitive to such issues, explicitly agree with the use of the term 'dyslexics' in this sort of context. Consequently, throughout this thesis people with dyslexia are referred to as 'dyslexics'. The only exception to this is in titles, where the use of the more longwinded terms causes minimal irritation.

Another difficulty is the difference in terminology used by researchers working in different countries. Specifically, American researchers tend to use the terms 'learning disabled' or 'learning disability', often shortening these to the acronym 'LD'. In many cases this is equivalent to what other researchers, mostly British in this case, would call 'dyslexia'. However, the equivalence of these terms is not always clear in specific pieces of literature. Thus, erring on the side of caution, when discussing specific pieces of research the terms 'learning disabled' or 'learning disability' will be retained if it is not absolutely clear that the people under discussion are purely dyslexic. Otherwise, the terms 'dyslexic' and 'dyslexia' will be used to reduce any potential confusion.

SECTION 1

Dyslexics, Learning And Multimedia

This section begins with a discussion of some basic theories of dyslexia, after which is an outline of an experiment that elaborates on this discussion. Subsequently, there is an examination of methods that can facilitate more efficient learning, and how these methods can be applied. It will be suggested that a multimedia computer system, in combination with informed human support could be a very feasible way of implementing these methods.

1. Theories of Dyslexia

A good strategy for designing a computer system specifically for adult dyslexics, is to approach the problem from two directions. Firstly, one must consider the findings of research into dyslexia, and the theories to which these have given rise. The resulting conclusions as to the nature of the deficits in dyslexics must then be applied to computer assisted guidance in general. This is the task undertaken in 'Section 1'. Secondly, one must apply one's understanding of dyslexia to the specific area covered by the suggested system, in this case careers guidance, and generate some guidelines for the suggested system. One is then in the position to gain the opinions of potential users and others that have practical experience of the situations where the computer system will be used. In this case adult dyslexics, and professionals in the fields of careers and computing for adult dyslexics were consulted. The final aim is to pull these threads together and from this generate a design for the suggested system. These tasks are undertaken in 'Section 2'. This approach gives us the best chance of designing a system that accommodates for the deficits of dyslexics, while fully taking into account their sensitivities, experiences and goals.

The most commonly considered problems of dyslexics are connected with literacy. Literacy relies upon fairly high level skills, proficiency in which is dependent on a number of more primitive skills. It is reasonable to assume that dyslexia is the result of deficits in one or more of these primitive skills. A large amount of research has been done to establish the nature of these deficits and has resulted in the discovery of a sometimes bewildering variety of difficulties. This in turn has given rise to a number of fairly widely differing theories, each of which emphasises different problems as primary. A number of these theories will be outlined in the subsections below, before going on to an experimental study (Chapter 2) designed to test them.

The phonological deficit hypothesis has been the most influential theory of dyslexia over the last two decades. This approach has generated a great deal of research from a number of different perspectives, and contributed greatly to our understanding of dyslexia. Consequently, a large portion of this chapter will be devoted to the examination of the phonological deficit hypothesis from several perspectives.

In recent years a number of alternative theories challenging the supremacy of the phonological deficit hypothesis have begun to gain momentum. Two of these are the transient visual system deficit hypothesis (see Section 1.7), and the automatisation deficit hypothesis (see Section 1.8). Though one must be very cautious in questioning a theory as productive as the phonological deficit hypothesis, compelling evidence for these alternative theories is growing. Thus, a section will be devoted to each of these theories. Finally, there will be a brief discussion of the implications of the findings discussed for adult dyslexics.

1.1.   General Language Deficits

Work by Vellutino (1979) provided support for a generalised language deficit in dyslexic children. The cause of this could be a variety of things, for example problems with articulatory motor programmes, or with perceiving speech sounds. However, early problems with language in general are not an accurate predictor of later dyslexia, which strongly suggests that this explanation is not sufficient (Bishop, 1985). Furthermore, little information is provided on how the generalised language deficit comes about, or how it can have such a specific effect on written language skills, while there may be no deficit detectable in auditory comprehension tasks.

1.2.   A Deficit in Phonological Awareness

Despite the above, the idea that dyslexia is the result of some more specific problem with the processing of speech sounds has become very popular, indeed such ideas have been firmly in the fore of dyslexia research for a number of years. This approach has come to concentrate on the possibility of a deficit in phonological awareness, i.e. the ability to analyse and process words in terms of their component sounds. Spoken language is composed of a flow of words which can be comprehended and learnt at the single word level, but in order to learn to write one must be able to break down the word into its component phonemes (the smallest single units of speech sounds) and convert them into their written equivalent. Conversely, in order to learn to read one must be able to convert written representations into phonemes and then blend these appropriately to form words. This mapping of written to spoken words underpins literacy, leading to

the development of complex generalised mapping rules that allow for the comprehension of novel words. The most prevalent version of this hypothesis is the phonemic segmentation hypothesis (e.g. Morais et al, 1987). This suggests that the primary disability is in breaking spoken words down into their basic phonic components. As phonemic segmentation is not absolutely essential to learning to speak and comprehend spoken language (Liberman et al 1974, Gough and Hillinger 1980) this hypothesis has none of the problems of the general language deficit hypothesis when it comes to specificity to written language. It also provides a definite mechanism linking the proposed core deficit to the manifestation of the disorder. Briefly, some anomaly in the brain leads to a phonological impairment, possibly in segmentation, this in turn leads to poor conversion of graphemes to phonemes. Poor reading and, in combination with the original phonological impairment, poor phonological awareness are natural consequences (Frith, 1997).

Over the years a large amount of evidence has been amassed connecting poor literacy skills and dyslexia with impaired phonological awareness. Various studies have found impaired phonological awareness to be the most accurate predictor of later poor reading (Share et al, 1984, Tunmer and Nesdale, 1985). However, there could still be a deeper problem that independently leads to poor phonological awareness and poor reading. Work by Bradley and Bryant (1983) has gone some way to establishing the existence of a causal relationship. This longitudinal study of initially preliterate six year olds used two contrasting methods, test, training and later retest, to build the strongest possible case. The ability to categorise words by sound, a phonological task, was strongly correlated with later reading ability, even when differences in educational achievement between poor and good readers were taken into account. Those trained in sound categorisation skills over the four year duration of the study showed a very marked improvement in reading and spelling ability, independent of educational achievement, compared to those that received no such training, or training in a similar but non phonological task. Thus, improvement was specific to the task and not the result of some general effect. Taken together these results provide strong evidence for a causal connection between initial poor phonological awareness and later impaired literacy. This is not the only study to find that training in phonological skills has definite positive effects on literacy for slow readers (e.g. Uhry and Shepherd, 1993), and for dyslexics (e.g. Morais et al, 1987).

Working from a slightly different angle Gallagher and colleagues (Gallagher, Frith and Snowling (submitted), cited in Frith 1997) tested 3 year olds with a familial risk of dyslexia, who were obviously pre-literate, and detected the presence of phonological impairments. This and the other research outlined above forms only a small selection of studies that establish a link between dyslexia and phonological skills, there are many others (e.g. Gallagher et al 1996, Kamhi and Catts 1986, Snowling 1981).

Thus, there are strong indicators that poor phonological awareness gives rise to literacy problems in dyslexic children. Likewise there is evidence that this phonological problem persists into adulthood, an area of particular relevance to this thesis. A recent study by Fawcett and Nicolson (1995) compared the performance of three different age groups of dyslexics, the oldest 17, against age and IQ matched control participants on a range of phonological tasks. As well as making possible the detection of differences between age groups, that could strongly suggest changes over time, using a number of age groups provides a comparison with reading age matched controls. Thus, one can estimate if any impairment found is the result of a developmental lag in reading ability, or is independent from reading ability, and therefore constitutes an underlying core deficit. In both a test of sound categorisation similar to that used by Bradley and Bryant (1983), and a more difficult and complex phoneme deletion task, all dyslexic participants performed worse than the chronological age, and reading aged matched control participants. Performance on the phoneme deletion task tended to be better for all older and high reading age groups of participants. However, for the simpler sound categorisation task dyslexics who were older or had high reading ages did not perform significantly better than other dyslexic participants. Similar results were obtained by Bruck (1992), using a group of older adult dyslexics and controls matched for reading and chronological age. These studies strongly suggest that a deficit at a very basic level in phonological awareness persists into adulthood, and is not alleviated through general improvement in reading, further suggesting this could constitute a core deficit.

1.3. Phonological Working Memory Deficits

Research into dyslexics' ability to retain, recall, and manipulate word sounds (e.g. Gathercole and Baddeley, 1990) has added another facet to this phonological deficit hypothesis. Specifically, it shows that dyslexics have problems in the way they handle word sounds in working memory. One manifestation of this would be an impairment in phonological awareness. The process of mapping speech sounds to utterances becomes gradually more refined as children grow older, and leads to improvement in access to phonological representations in long term memory resulting in increases in speech rate, and improved performance of verbal short term memory (Snowling and Hulme, 1994). Emphasised here is the vital role of memory systems. In Baddeley's (1986) very successful model of human memory short term memory is re-conceptualised as working memory, in order to emphasise its role as a system for active manipulation and processing of information received through the senses, and from the long term memory store. Working memory also acts as an interface between the senses and the long term memory store. Thus, production of stable and accurate representations in working memory are essential for producing a good trace in the long term store (Gathercole and Baddeley 1990). Thus, in Snowling and Hulme's (1994) description of literacy development when they talk of improvement in access to phonological representations in long term memory, some function of working memory is strongly implied. In Baddeley's model there are three main subsystems in the working memory, the central executive which monitors and co-ordinates the whole system, the visual/spatial sketch pad which deals with visual and spatial coding, and the articulatory loop which is a temporary store and processing site for sounds especially speech sounds. Researchers have consequently focused on the articulatory loop as a possible site for the deficit leading to poor phonological awareness.

One task commonly used to test the capacity and accuracy of the phonological store is the digit span task. In this a series of digits is presented and the testee must repeat them back to the tester immediately. The longest sequence of digits they are capable of accurately repeating is taken as an index of the capacity of their phonological store. Dyslexics have been shown to have significantly lower scores on the digit span test (Byrne and Arnold, 1981). Indeed the digit span test is a subtest of one of the major tools for diagnosis of dyslexia, the WISC test

(Wechsler, 1976). Low scores on this in comparison to the other subtests are taken to be indicative of dyslexia (Thomson, 1990).

Torgeson and Houch (1980) have conducted a series of experiments to establish the working memory characteristics of learning disabled readers with poor digit span (LD-S), a group of people closely resembling dyslexics. The problems of LD-S participants proved not to be due to attention problems (i.e. distractibility), lack of motivation or inefficient use of any mnemonic strategies. The LD-S group had equivalent scores to the other groups on a task similar to digit span but using non words and nonsense syllables, which possess no ready made code in long term memory. They also had significantly higher latencies in naming items. This suggests that the problem in the LD-S group lies in the poor representation of phonological information from long term memory, or the retrieval of that information. Any poor long term memory representation may itself be due to initial poor encoding in working memory. Only a fraction of the variance between LD-S participants and other groups could be accounted for by differences in the efficient use of conscious strategies. Overall, the results suggest that there is a fundamental problem in working memory.

A similar working memory deficit has also been shown to exist for familiar written items, i.e. words and letters (Hulme, 1981, Shankweiler et al, 1974). Dyslexics show significantly less confusion between phonetically similar items than non-dyslexics when those items are presented visually (Shankweiler et al, 1974), suggesting that dyslexics make less use of phonetic representations during the task. Indeed when sub vocal articulation (talking in your head) is prevented, the performance of dyslexics in a paired associate learning task for letters matches that of non-dyslexics (Jorm, 1983). Working from the opposite angle, there are indicators that dyslexics are more biased than non-dyslexics towards using semantic rather than phonetic cues to access long term memory (e.g. Papagno, Valentine and Baddeley, 1991, Lefly and Pennington, 1991).

To summarise, there is a case for a deficit in phonological working memory being partly responsible for the literacy problems of dyslexics. From a more practical angle this working memory deficit can interfere with anything that puts a heavy load on working memory, such as remembering instructions, names or facts. This in turn could give rise to problems in organisational tasks (McLoughlin et al, 1994).

1.4. Deficits in Speed and Ease of Phonological Recall

Studies using rapid automatised naming, where the participant is presented with visual stimuli and must name them as quickly and accurately as possible, have also provided evidence for inefficient access to phonological codes in dyslexics over a wide range of different types of stimuli, including pictures, verbal descriptions, colours, digits and letters (Denckla and Rudel, 1976, Torgeson and Houch, 1980, Snowling, 1981, Wolf, 1986, Van Wagtendonk and Stafford, 1988, Nicolson and Fawcett, 1994).

More precisely it has been suggested that the actual deficiency in working memory may be due to lower automatisation in the retrieval of phonological codes (e.g. LaBerge and Samuels, 1974, Perfetti, 1983, Gough and Hillinger, 1980), i.e. for dyslexics the process of retrieving phonological codes requires more conscious effort and is less smooth and efficient than for non-dyslexics. As the capacity of working memory has an upper limit, this increased burden will cause a major reduction in available capacity, giving rise to reduced memory span and inefficiencies in the manipulation of phonemic items in working memory (Perfetti, 1983). This could also have the effect of interfering with integration of text into larger chunks of meaning, as the sense of previously read text must be held in memory (Gough and Hillinger, 1980).

A recent example of evidence supporting this view comes from research by Yap and van der Leij (Yap and van der Leij, 1995). In this case the authors were influenced by the Automatisation Deficit Hypothesis mentioned below (Section 1.8). However, as this study deals exclusively with automatisation in phonological recall and its relationship to reading, it is directly relevant to the earlier research mentioned previously in this section. They compared the ability of dyslexic children against that of reading age and chronological age matched controls on the naming of visually presented words and pseudowords. Dyslexics were particularly impaired under conditions that allowed only for an automatized response. Using a test/retest design they discovered the dyslexic participants' rate of development under these conditions was only half the rate of controls, whereas it was the same under conditions that did not rely on automaticity. Regression analysis of the results revealed that as time goes on the dyslexic participants must rely increasingly on skills other than those used for single word reading. Training dyslexics to improve automaticity lead to definite improvements in all conditions as well as in continuous reading (reading sentences rather than single words).

However, there was little improvement in automaticity for lower level items, i.e. clusters of letters and their phonemic equivalents, rather than whole words. Thus, in terms of automaticity and single word reading it is suggested that dyslexics are not simply experiencing a lag, but show a qualitatively different and idiosyncratic development, suggesting these problems are strongly related to the core deficit. In short, the authors provide strong support for the conjecture that dyslexics suffer an impairment in automatisation of phonological processes, and that this is a fundamental problem not merely a peripheral one.

1.5. A Neurological Substrate for Phonological Deficits?

All the above forms a convincing argument for a deficit in phonological awareness being fundamental to dyslexia, even providing convincing mechanisms by which this can work. However, underlying all of this work is the assumption that there is some biological substrate. The discovery of the location and nature of a neural anomaly, assuming a causal connection can be found between that and phonological awareness problems, would place the final piece in this jigsaw.

The search for this has begun to bear fruit. Post-mortem studies by Galaburda (Galaburda and Kemper, 1979, Galaburda et al, 1985, Galaburda, 1989) have discovered anomalies in the perisylvian area of the brains of a number of dyslexics, along with a number of other smaller cortical anomalies. The perisylvian area on the left side of the brain contains Broca's area and Wernicke's area, both areas linked to language function and dysfunction. However, the number of brains used in this study was fairly small, and as yet these have not been widely available for independent replication of the above findings. There is also the question of how many of the brains were acquired from genuinely dyslexic people, as the criteria used for diagnosis are in most cases unknown. In addition to this, case histories reveal that some of the people providing the brains suffered from conditions other than dyslexia that could be connected to neural anomalies (e.g. epilepsy).

Galaburda (1989) proposes that in order for dyslexia to develop both the perisylvian anomalies and smaller cortical anomalies must be present. However, these characteristics have also been found to occur together in some people without dyslexia. So, at best these problems could be said to provide vulnerability

to dyslexia. Thus, the causal connection between these anomalies and dyslexia is not as simple as one might have hoped. This in combination with the previous criticisms suggests it would be wise to reserve judgement on the above findings until there is more supporting evidence.

To some extent work using magnetic resonance imaging has provided further support for these findings (Larson et al, 1990, Hynd et al, 1990), but only those connected to the perisylvian area. Very recent research by Morgan and colleges (Morgan et al, 1996, cited in Hynd and Hiemenz, 1997) has established a correlation between neural structures in this area, and linguistic measures in normal readers and dyslexics. However, the resolution of these machines is not sufficiently fine to detect any of the small neural anomalies predicted by Galaburda above. Thus, though all the above findings do appear broadly consistent with phonological problems there is by no means total agreement as to the significance of the above results, and the exact mechanism by which these neural characteristics contribute to dyslexia is not yet clear.

1.6.   Secondary Effects of Phonological Impairment

One persisting problem with the phonological deficit hypothesis is that a large number of impairments have been found in tasks not directly related to phonological awareness (Stanovich, 1986). However, one must bear in mind the wider implications of poor literacy, and phonological memory. Essentially, the assumption is that language, both written and spoken, has such an influence in our lives that any deficit will have enormously pervasive effects extending well beyond what would classically be considered linguistic tasks. This bears close similarities to what has come to be called the Matthew effect (Stanovich, 1986), named after a biblical reference to the idea that the 'rich get richer' and the 'poor get poorer'.

At its simplest, lack of reading experience combined with a deficiency in decoding skills, and difficult material (often the case due to the difference in ability between the dyslexic person and his peers), leads to an unrewarding reading experience, demotivation to read and thus less practice. This is clearly a downward spiral, and has a knock on effect on general and semantic knowledge, both essential in many areas of schooling and life, including social interactions. Further, the

demotivating effect can extend to the teaching environment and teachers, even authority figures in general.

All too commonly the results include a general lowering of self confidence and self esteem. Indeed, there is evidence (Paris and Oka, 1986) that children with low reading ability tend to underestimate their reading competence, and report lower self-perceptions of social-competence, and require more motivation from external sources, rather than being self motivated (more extrinsic motivational orientations). Others (McLoughlin et al, 1994) have noted that in their experience dyslexics tend to have unrealistically high judgements of others' level of abilities or skills. These correlations only appear as children get older, i.e. presumably well after their problems with reading have manifested. It should be noted that whether the deficit is phonological or not, processes analogous to the Matthew effect are likely to occur, as it is due predominantly to the manifest performance of dyslexics, and not so much the specific low level deficits responsible for dyslexia.

One can see how a great many problems experienced by dyslexics can be explained as a result of secondary effects outlined above. After all, it's not all that easy to find tasks or tests that do not have any at least implicit phonological content, or rely upon something that does. However, such tasks have been found, administered to dyslexics, and uncovered a number of deficits that are not easily explained by the phonological deficit hypothesis, even considering secondary effects.

1.7.   A Transient Visual System Deficit

Over the last decade or so a number of convincing challenges have been made to the phonological theory. One of these has come from a renewed interest in the visual system of dyslexics. Various researchers have identified problems in the transient visual system of dyslexics (e.g. Slaghuis and Lovegrove, 1985, Livingstone et al, 1991). This system is used for perceiving low detail (equivalent to lower spatial frequency) visual input, and is also especially sensitive to changes over time, i.e. moving stimuli. This contrasts with the sustained system, which is used for perceiving high detail (higher spatial frequency) and is more attuned to static stimuli (Breitmeyer, 1988). In the focus of ones visual field the sustained system is dominant, and as one moves in to the periphery the transient system becomes more dominant. This explains why it is often easier to catch brief

movements through 'the corner of your eye' despite not being able to clearly perceive what is moving.

Sustaining an effective interaction between these systems is vital to the proper development of literacy. During the saccade (eye movement from one fixation point to another) the transient system becomes dominant, as the text is moving relative to the eye. Dominance of the transient system inhibits activity within the sustained system. This is necessary as activity within the sustained system lasts longer than the physical duration of the fixation, and can even carry over into the next fixation. This can cause interference, by overlapping the images from each fixation. Thus, it has been suggested (Lovegrove 1994) that dyslexics suffer from a deficit in the transient system, leading to visual interference and inefficiencies in controlling saccades, and this is a major factor in impairing the development of literacy.

Studies by Martin and Lovegrove (Martin and Lovegrove 1984, 1988) have uncovered deficiencies in detection of flicker in dyslexics at lower spatial frequencies, and thus a deficit in the transient visual system of dyslexics. Researchers have also found that dyslexics are far more capable in reading tasks that do not require integration of text from the right of the fixation point (Lovegrove and MacFarlane 1990 cited in Lovegrove 1994), thus establishing a causal connection between reading impairment in dyslexics and the transient system. One interesting point is that with blue light the relative contribution of the temporal system to the process is increased, and vice versa with red light, which suggests that dyslexics should do far better with blue masking of text than any other colour. Studies using dyslexics (Williams, LeCluyse and Bologna 1990, Williams et al 1990) have suggested that this may be the case. However, it is yet far from clear that this applies to all dyslexics.

Thus, this interest in visual impairments has been a fairly productive line of research. As the work which has led to the theory of visual deficits in dyslexics has mostly used tasks testing very primitive features of the visual system, with low linguistic content, the results do not appear to be open to any interpretation generated from the phonological deficit hypothesis. Having said this, it would be extremely rash to discard the huge mass of evidence for the phonological deficit hypothesis on the strength of this, much of which cannot be explained by the above visual theory. Indeed, Tallal (Tallal 1980) has also suggested the existence of temporal problems in audition that are analogous to those found in vision, and

research suggesting that visual problems derive from anomalies within the magnocellular pathway within the thalamus (Livingstone et al 1991) has uncovered similar anomalies in magnocellular nuclei associated with audition. There is nothing to say that such problems may not be more general.

1.8.   A General Deficit in Automatisation

Though there is good evidence to support the visual or phonological theories above, neither of these theories can account for all the characteristics of dyslexia. This suggests that dyslexia is a far more pervasive condition than either of the two allow for, and that what is required is a higher level theory which allows for the integration of the two. One recent theory with adequate breadth and depth is Nicolson and Fawcett's cerebellar deficit hypothesis (CDH) (Nicolson, Fawcett and Dean 1996), which itself is a development of their earlier hypothesis of a general automatization deficit in dyslexics (the dyslexic automatisation deficit hypothesis, DAD) (Nicolson and Fawcett 1990). As one can see from above (see Section 1.4), the idea that automatisation problems are implicated in dyslexia is not a new one. However, the idea that these problems in automatisation extend well beyond the realm of phonological processing certainly is.

Following a series of experimental studies on dyslexic and control participants Nicolson and Fawcett concluded that dyslexics suffered from a general impairment in their abilities to automatise skills (Nicolson and Fawcett 1990, Fawcett and Nicolson 1992), i.e. development to a point where a skill becomes smooth and automatic, and requires no conscious effort. In these studies the child or adult is asked to perform a simple task, for example a balance or simple reaction time task. Then child is then asked to perform the task again but this time in conjunction with a distracter task designed to exert cognitive load, i.e. calling for conscious effort. The distracter task would effect the performance of a skill only if that skill required some conscious effort itself, due to the fact that the total amount of conscious capacity an individual has is limited. Only the dyslexic participants' performance was impaired by the distracter tasks, suggesting that the initial primitive task required them to use some conscious effort. As a fully automatised skill requires no conscious effort the dyslexic children were seen as having a deficit in automatisation, even in the most primitive tasks.

An example of the type of task used is the balance beam task (Fawcett and Nicolson, 1992). Participants were simply asked to balance on a beam for a short period of time. They were then asked to balance again but this time while performing a backwards counting task, the difficulty of which had been standardised over all the participants. Despite this dyslexic participants' performance was far worse under the distracter condition than the controls', even those matched for reading age. Without the distracter there was no difference between the groups. As the backwards counting task required use of language the experiment was repeated using a simple tone discrimination task as distracter. Even though this distracter has no phonological component the results confirmed that of the previous study.

Another study worth noting compared the performance of dyslexic participants against controls on a choice reaction time task and simple reaction time task (Nicolson and Fawcett, 1994). The dyslexic participants' performance was the same as controls on the simple reaction time task, i.e. pressing a button as fast as one can in response to a tone. However, their performance was significantly lower than controls' when the task involved two tones and the participant was required to press one of two buttons, one in the left hand and one in the right, in response to one of two tones. These results were further confirmed when the requirement for a left/right decision was removed by using an omission choice reaction time method, ensuring that the results were not due to a poor phonological mediation of left and right. Thus, the requirement of having to discriminate the tones and make a choice interfered with the simple reaction time, suggesting that their simple reaction time skills were not fully automatised.

As these tasks require only very primitive skills which one would expect to be fully automatic and contain no phonological component, they provide strong evidence for a general automatisation deficit. This can account for the phonological problems via the concept of impairment of automatisation in the accessing of phonological codes outlined above in Section 1.4.

However, Nicolson and Fawcett at the time were unable to offer a full explanation in terms of the DAD hypothesis, as they could not identify the root cause of the deficit. This was not the first time someone had identified a deficit in motor based skills among dyslexics. For example, a large scale study by Haslum (Haslum 1989) discovered deficits in one leg balance, walking backwards, match sorting speed, and a graphaesthetic test, i.e. identifying shapes traced on the skin.

Further deficits have been found in toe tapping and successive opposition of fingers and thumbs (Rudel 1985). This has led to speculation that the problem may lie in some area of the brain connected to learning and movement. One such area is the cerebellum. This large hind brain structure appears to be strongly implicated in the acquisition of motor skills (e.g. Ito 1993, Jenkins et al 1994), in that it compares signals that initiate movements with sensory feedback from the muscles generated during that movement, and then uses that comparison to fine tune the movement in question, rendering it smooth and effortless, i.e. automatic.

Many of the impaired skills mentioned immediately above rely heavily on the cerebellum. However, it was not until relatively recently that the cerebellum has been implicated in cognitive functions (e.g. Paulesu et al 1993, Silveri et al 1994), or acquisition of language (Leiner et al 1993). This led Nicolson and Fawcett to speculate that an abnormality in the cerebellum of dyslexics was what led to their pattern of difficulties. Thus, they conducted a study of dyslexic children and young adults, age matched controls, and reading aged matched controls, using classic neurological tests for cerebellar abnormalities (Fawcett, Nicolson and Dean 1996). Dyslexic participants proved to be impaired in the vast majority of the tests applied, in some cases this impairment was greater than that for reading. Nicolson and colleagues speculate that poor timing and co-ordination of muscles lead to less fluent articulation, and thus more use of conscious resources leaving fewer for sensory feedback. This leads to incomplete processing of auditory and phonemic structure, and thus, the impairments identified by the exponents of the PDH. The following diagram taken from Frith (1997) illustrates the mechanism outlined above, demonstrating its progression through biological, cognitive and behavioural levels.
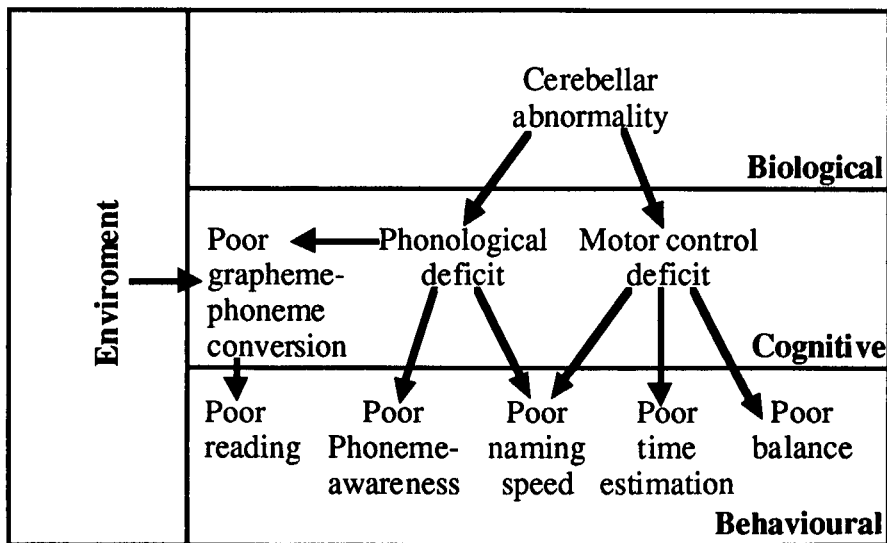
fig 1.   'Example of causal modelling of dyslexia as a cerebellar abnormality based on the proposal by Nicolson and Fawcett (1995)' from Frith 1997

In the same way handwriting and spelling may be affected by the simultaneous use of phonological skill and motor output. Thus the CDH and indeed the DAD hypothesis on its own, appear to have a great deal of potential for bringing together the large number, and broad range of deficits suffered by dyslexics under one theoretical roof, as well as predicting deficits that are not predicted by other theories, e.g. problems with muscle tone, disturbance of posture, gait or the movements of extremities. However, more work is required, as the authors point out the evidence they have found is still '...indirect and non-specific' (Fawcett, Nicolson and Dean 1996, p 275). Ideal support would come from neuroanatomical studies of the cerebellum, and studies of cerebellar activation.

One implication that is of particular importance to us is that if the automatisation deficit is the result of problems in the cerebellum, it is very unlikely that this deficit will be overcome with age. Thus, problems with learning and perfecting skills will be there for life. One would expect such a deficit to have very wide ranging effects, impairing skill learning in all modalities, and impairing performance under all circumstances when two or more skills must be used simultaneously, or any situation where skills must be used while there is already a high load on working memory.

However, there is still the question of why dyslexics are not far more severely impaired than they are. This is explained by use of the conscious compensation hypothesis (Nicolson and Fawcett, 1990). Dyslexics compensate for their lack of automatisation by investing more conscious effort. This explains the fatigue and

vulnerability to distractions that may dyslexics suffer during complex tasks such as reading. All of the above suggests that for dyslexics the best strategy in learning is to render all material as accessible to conscious manipulation as possible (e.g. by encouraging the learner to actively participate in the learning process, rendering all information and instruction as explicit as possible), reducing distractions to a minimum, and ensuring that skills are not required to be used simultaneously (e.g. by breaking tasks down into their component parts which can be then completed in sequence).

1.9. Conclusion: What can we say about dyslexia in adults?

Most of the research noted above deals with dyslexia in children. However, there is an assumption that core deficits persist throughout life, which is supported by discoveries of anomalies in neurological development, as such anomalies cannot be rectified over time. There is evidence that adult dyslexics still have problems with basic phonological awareness (see Section 1.2), and with working memory for phonological items (see Section 1.3), which could adversely affect competence on a wide variety of skills, e.g. organisational skills. Dyslexic adults may have problems in the transient visual system. Furthermore, it would appear that dyslexic adults still have problems with learning and performing complex skills due to inefficient automatisation (see Section 1.8). In all cases, one would expect the dyslexic person to develop compensation strategies as they get older. The exact nature of these strategies would vary from person to person depending on the individual's strengths, weaknesses and experience. Indeed, various researchers have noted that dyslexic adults have an unusual balance of skills (e.g. McLoughlin et al, 1994, Gilroy and Miles, 1995), which can often lead to unconventional styles of performance and interaction. Thus, as a result, dyslexics can exhibit greater variance in learning styles and preferences. Likewise, as the dyslexic person gets older the influence of secondary effects (see Section 1.6) is liable to become more significant, e.g. the gap between the dyslexic person and others in general knowledge can increase, and general demotivation and poor self-esteem can become progressively more engrained as failures are perceived to accumulate. This could all occur despite improvements in literacy skills that place the dyslexic person within an acceptable range for their general intelligence.

In order to examine further how wide the deficits in adult dyslexics are, and provide evidence upon which one of the above theories is most appropriate, an experimental study of dyslexics' ability to recognise British road traffic signs has been conducted. This may seem an unusual choice of stimuli to use. However, as will be explained in the beginning of the next chapter, these stimuli, in conjunction with the procedure used, is particularly well suited to the purpose.

The following chapter outlines the results, method and conclusions of this study as well as some more specific background information.

2. Impaired Recognition Of Traffic Signs In Adults With Dyslexia

The study described in this Chapter was also described in a paper published in the Journal of Learning Disabilities (Brachacki, Fawcett and Nicolson 1995).

Three competing hypotheses regarding the nature of the core deficit responsible for dyslexia were discussed in the previous chapter; a phonological deficit of some sort (Sections 1.2, 1.3, 1.4 and 1.5), a deficit in the transient visual system (Section 1.7), and a general deficit in automatisation (Section 1.8). A major objective of this study is to determine which of these hypotheses is the most appropriate, and uncover some implications of this for learning amongst dyslexics.

One of the difficulties in distinguishing between the three hypotheses is that early failure in reading, the centrepiece of early schooling, results in the loss of a potent method for information acquisition, together with pervasive generalised effects such as negative expectations and emotional problems (see Section 1.6). Consequently, a relatively specific deficit which leads to reading problems may have much more widespread ramifications throughout the life span.

A further issue is that of developmental delay versus developmental disorder. Many skills in children with dyslexia are impaired at 8 years but appear relatively normal in the more mature, to the extent that the deficits are reduced by late adolescence (Fawcett & Nicolson, 1993). One would expect that if there were a fundamental cause of the deficit, then that skill should show a longer lasting, more severe, impairment than other skills which were secondary. In particular, it should be possible to identify deficits in the skill in adulthood. A problem with this approach is that, in order to avoid the potential confound with secondary motivational effects, it is difficult to find a suitable skill on which to test dyslexic adults. Ideally, it should have negligible verbal content, not be in any way associated with schoolwork, and be generally acquired relatively late in adolescence.

In this paper we examine knowledge of traffic signs. These are generally non-verbal and symbolic, and have little overlap with school work. All one must do on seeing a traffic sign when driving is to understand it and drive appropriately. In the case of a traffic sign that contains no writing, conversion of its meaning into any

verbal form, even implicitly, would be quite unnecessary. Indeed, in circumstances where a rapid immediate response is required this last activity could be a hindrance. The general meanings of traffic signs are normally learned at first by situated instruction from parent, friend, or instructor while driving, though further learning occurs from written sources such as the "Highway Code." However, learning meanings from written sources and actual use when driving present the symbol in two vastly differing contexts, with very different priorities, and very different responses.

Another reason for selecting these stimuli is because they are everyday. This is a very important feature. The manner, and extent which the above mentioned theories of dyslexia influence performance with a multimedia computer system, is of particular interest to us. The computer system will be used by dyslexics in the real world. Thus, it is vital to discover whether deficits have any influence when using stimuli dyslexics encounter in the course of regular activities.

The use of symbols and graphic metaphors is a key feature of multimedia systems and graphic user interfaces. As with traffic signs, these tend to be learned more through experience than through explicit training. System developers have tended to rely upon constructing a repertoire of symbols based around a small set of simple components that can be combined to form more complex and specific symbols. The user need only know the meanings and be able to identify the components within a specific symbol to understand it, thus reducing the overall amount of learning necessary. For example, the symbol for 'file' is standard in the Macintosh Operating System as is the symbol for 'extension' (basically an optional add-on to the system) by superimposing the 'extension' symbol on the 'file' one generates a new symbol for 'extension file'. In essence they have tended to construct languages of symbols independent of written and spoken language. An analogous approach is used in the construction of traffic signs.

It may be argued that it would be appropriate to test participants' abilities with symbols used in multimedia systems and graphic user interfaces. That computers are strongly text based, increases the chance that an experiment using symbols from this source as stimuli will be confounded by problems associated with written language. Experience of these symbols throughout the population is also less universal, and the symbols themselves are less standard. As a result these symbols would not make appropriate stimuli for this experiment. However, as mentioned above, in terms of basic construction and primary method of learning, i.e. through

experience and use, there are strong similarities between traffic signs, and symbols used in multimedia systems and graphic user interfaces. Due to these similarities, it is reasonable to attempt to extrapolate the results of an experiment on the recognition of traffic signs to the recognition of symbols in multimedia systems and graphic user interfaces.

To return to the purely theoretical issues outlined at the beginning of this chapter, what predictions can we make in light of the three hypotheses? If the deficit were purely phonological, we would expect to see little or no difference between dyslexic and control participants in accuracy or learning rate, as the task and stimuli possess negligible linguistic or phonological content. If the primary deficit was purely in rapid visual processing, we would again expect the dyslexic adults to show little impairment. Indeed, if there were such a general visual deficit that an impairment would be predicted, it seems that one would also have to predict problems in general visual acuity, which is in fact known to be unimpaired. If the primary deficit was in terms of skill acquisition, one might again expect little or no deficit, since knowledge of traffic symbols is declarative knowledge rather than skill. However, the skill acquisition hypothesis (Nicolson & Fawcett, 1990) explicitly notes that reduced skill levels show up as less well automatised skill, essentially leaving less spare resources for acquiring incidental knowledge (such as meanings of traffic signs whilst driving). Indeed, the proponents of the theory use the analogy of driving in a foreign country (one can do it, but the costs in attention and effort are high, and the incidental details taken in are low) to elucidate the everyday difficulties faced by dyslexics. Consequently the skill deficit hypothesis predicts that the participants with dyslexia will be considerably less accurate and show impaired learning rate with experience compared to control participants.

2.1. Method

2.1.1. Participants

There is no standard test for dyslexia in adults, and current testing procedures vary widely (Nicolson, Fawcett, & Miles, 1993). Consequently a composite test was adopted, using a battery of three tests already used individually for diagnosis of dyslexia in adults, namely Wechsler Adult Intelligence Scale - Revised (WAIS-R, Wechsler, 1986) discrepancy, British Ability Scales (BAS) spelling (Elliott, 1992)

and nonsense passage reading (Finucci et al., 1976), plus previous diagnosis of dyslexia. For each test a criterion was determined such that a positive dyslexia indication gave a score of 1, and the sum of these scores was determined. The composite criterion for dyslexia (and inclusion within this study as dyslexic) was a score of at least 3 (out of a maximum 4). The criterion for inclusion in the study as non-dyslexic was a score of no greater than 1, together with no familial dyslexia or history of reading or writing difficulties.

All participants were tested with the WAIS-R. Children with dyslexia are particularly weak on ACID (Arithmetic, Coding, Information and Digit span) subtests of the Wechsler Intelligence Scale for Children - Revised (WISC-R, Wechsler, 1976), although not all children with dyslexia show deficits in all four subtests (Thomson, 1984). On the WAIS-R the analogous tests are the Arithmetic, Digit Symbol, Information, and Digit Span subtests. In a student population, shortfalls on the Arithmetic and Information subtests are less common than in the general population. Therefore, a shortfall of greater than 3 points in any of these four subtests (as compared to the mean of the remaining non-ACID subtests) was considered an indication of poor performance, and sufficient to generate a dyslexia score of 0.5, whilst deficits in 2 or more generated a score of 1. This ensured that undiagnosed adults with remediated dyslexia were not inadvertently included in the normally achieving group.

The BAS spelling scale has a top age limit of 15 years, far younger than any of the participants. However, no adequate adult spelling scale was available. The hardest short form of the test (test C) seemed sufficiently hard to provide the required index of spelling ability, as well as being conveniently brief.

The reciting of a nonsense word passage has proved a valuable task in diagnosing adult dyslexia (Finucci et al., 1976). The total number of errors made and the total time taken was recorded. One error mark was awarded for each nonsense or meaningful word mispronounced. The explicit criteria used are summarised in the table below.

Criterion Measure	Dyslexia Points
Previous diagnosis of dyslexia	1
Low score on the BAS spelling scale (maximum score 20)	0.5 for 16-17 1 for <16
High error score on the nonsense passage	0.5 for >7 errors
Long time on the nonsense passage	0.5 for >59 seconds
Poor scores on one or more of the ACID subtests of the WAIS-R	0.5 for a shortfall in one of the ACID subtests 1 for two or more shortfalls
Selection Criterion	≥3 points—dyslexic ≤1 point —non-dyslexic

table 1. **Criteria for inclusion of participants in the dyslexic and non-dyslexic groups.**

A total of 21 adults fulfilled the criteria. The table below provides information on the characteristics of both control and dyslexic groups. In addition to age, sex and IQ data, information on the levels of driving experience has been provided (see Appendix Ib, table i. for data on individuals). Each participant was asked how long it had been since passing their driving tests. Further, they were contacted after the experiment and asked to provide an estimate of the number of miles they drive per year, along with information on vocalisation mentioned below. Some participants proved unavailable. (Appendix Ib).

	controls	dyslexic adults
males	6	6
females	4	5
mean age in years	26.8	20.5
range for age	19-43	18-29
WAIS-R IQ	119.2	117.7
range for WAIS-R IQ	102-126	101-128
mean of driving experience in years	5.2	1.5
range for driving experience	0-20	0-4
mean of estimated annual mileage	4867	1767
range for estimated annual mileage	0-17000	0-7000

table 2. **Characteristics of participants.**

The large discrepancies in levels of driving experience and annual mileage between the two groups were caused entirely by inclusion of two mature students with dyslexia, they also account for the difference in age. Analyses will be presented with and without these two older participants.

2.1.2. Stimuli

Twenty conventional traffic signs were copied from the "Highway Code" to an Apple Macintosh micro using 'MacDraw Pro', a colour drawing program. These were drawn in equal numbers from the three main categories of British traffic signs that bear no writing: prohibitive signs (see Figure 2a), warning signs (see Figure 2b), and instructive signs (see Figure 2c), each being identified by the shape and colour of the background. These signs are simple, extremely common, and are not readily expressed in verbal form. The issue of whether stimuli were verbally labelled is addressed in the results section. Twenty false signs were then constructed by adapting each true sign in one of three ways: a genuine central

feature was placed on a genuine but inappropriate background, and altered to the colour appropriate to that background (see Figure 2d); an irrelevant component, (e.g., an arrow head), was added to the central feature or a component was deleted (see Figure 2e); or a completely new and inappropriate central feature was made and placed in a genuine background in the appropriate colours (see Figure 2f). The above techniques are simple and quick, and when it comes to distinguishing the results from real signs, provide false stimuli covering the whole range of difficulty, reducing the chance of ceiling and floor effects. Colour facsimiles of all the road traffic signs and false signs used can be found in Appendix Ia (Figures i. and ii. respectively).

fig. 2a.
'no U turn'

fig. 2b.
'warning, roundabout'

fig. 2c.
'keep left'

fig. 2d

fig. 2e

fig. 2f
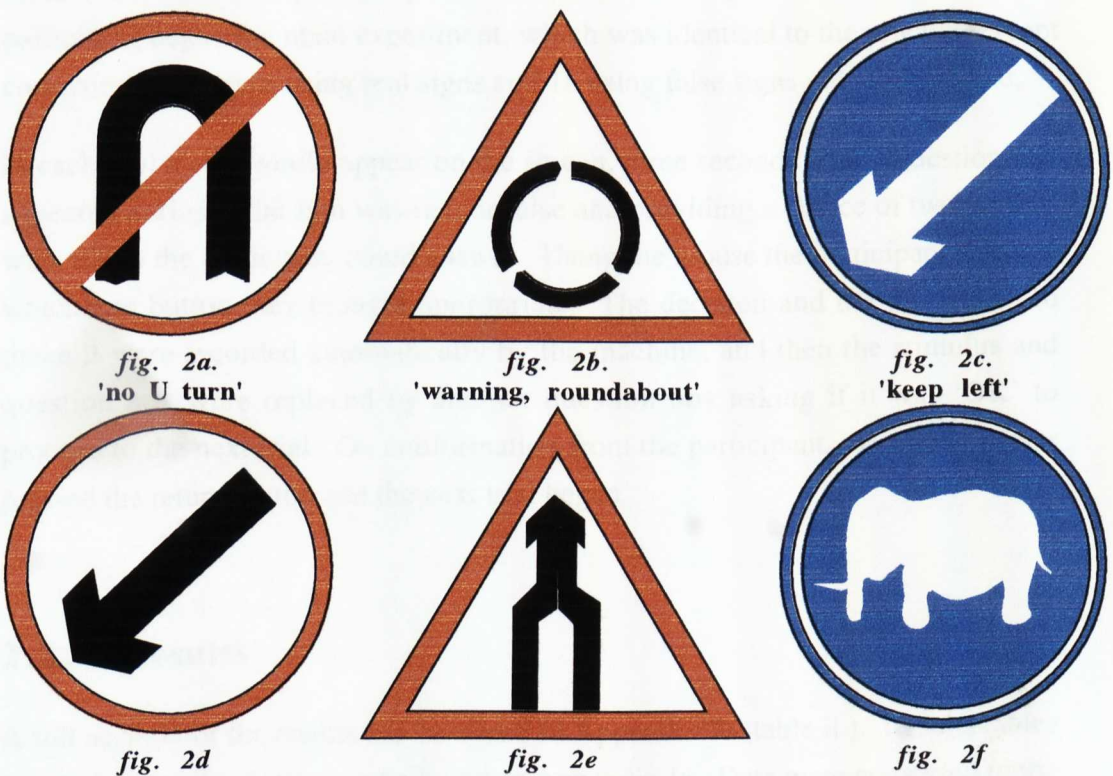
fig. 2. Examples of real (figs. 2a, 2b and 2c) and false (2d, 2e and 2f) traffic signs used as stimuli. Note: These images are 50% of the original size used in the experiment. Due to minor incompatibilities between 'MacDraw Pro' and 'Microsoft Word 5' there is some minor distortion of colours and lines. This is only a problem printing and did not occur with the original stimuli used in the experiment.

2.1.3. Procedure

The participants were seated before the computer and asked if they were familiar with the use of a mouse. All of them were, so it was never necessary to use a mouse training program. The experimenter pressed the start button and entered the participant's name. A brief explanation of the nature of the task and what was required of the participant then appeared written on the screen, and was simultaneously recited by the machine using synthesised speech. The participant then began a practice session where he or she was exposed to 2 real signs and 2 false signs mixed at random. The experimenter ensured during this practice session that the participant fully understood the task requirements. After this the participant began the main experiment, which was identical to the practice except consisting of 18 trials using real signs and 18 using false signs randomly mixed.

In each trial a sign would appear on the screen, three seconds later a question box appeared asking if the sign was real or false and providing a choice of two buttons with which the participant could answer. Using the mouse the participant selected whichever button they thought appropriate. The decision and the time taken to make it were recorded automatically by the machine, and then the stimulus and question box were replaced by another question box asking if it was 'OK' to proceed to the next trial. On conformation from the participant, the experimenter pressed the return button and the next trial began.

2.2. Results

A full account of the results can be found in Appendix Ib (table ii.). Results tables for all the statistical tests can be found in Appendix Ic. Data were converted to the signal detection indices (MacNicol, 1972). Since d' (d-prime) is not a common statistic, a further description is included here. In a forced choice paradigm, where decisions must be made based on equivocal evidence, it is necessary to separate two aspects of the decision. Sensitivity (d') describes how well the participant is able to make correct judgements, and avoid incorrect ones. The other, bias (b) refers to the extent to which participants favour one hypothesis rather than another, independent of the evidence he/she has been given. The most common response bias is to continually say "yes", which generates a large number of "false alarm" errors. The mean values of d' were 0.91 and 1.55 for the dyslexics and controls,

respectively, and the mean values of b were -0.16 and -0.28, respectively. One factor ANOVA tests were performed on the data using the computer application CLR ANOVA. There was a significant difference between the groups in d' [$F(1,19)$ =5.92, $p<.05$] , but not in b [$F(1,19)=0.65$; NS]. In order to assess whether the lower accuracy might at least be in part due to a speed-accuracy trade-off, the latency data were also analysed. A one factor ANOVA test revealed no significant difference between the groups [$F(1,19)=0.13$; NS]. Consequently, the reduced accuracy of the dyslexic group does appear to reflect an inferior knowledge of road traffic signs, rather than any strategic factor. A significant correlation (generated through Microsoft Excel 5) between d' and length of driving experience was found for the controls (Pearson's $r=0.655$; $p<.05$), but not the dyslexic adults (Pearson's $r= 0.205$).

The data were then re-analysed excluding the two older dyslexic participants. Re-analysis of the data had no effect on the general shape of the results. Only d' showed a significant difference between the groups [$F(1,17)=5.23$, $p<.05$] . The Pearson's correlation for the dyslexics between d' and driving experience still proved non-significant (Pearson's $r=0.349$).

In order to investigate further the relationship between sensitivity to the signs and driving experience a linear regression was conducted independently for the dyslexic and control participants data (see figure 3. below), via the computer application Cricket Graph III. For both groups the linear regression accounted for a low to medium proportion of the variance ($r^2 = 0.122$ and 0.429, for dyslexics and controls respectively). The slope of the regression lines, which give an index of the rate of improvement with experience, was 0.007 for the dyslexic adults and 0.022 for the controls. The intercepts, which provide an index of pre-driving experience, were 0.708 for dyslexic adults and 1.137 for controls respectively.
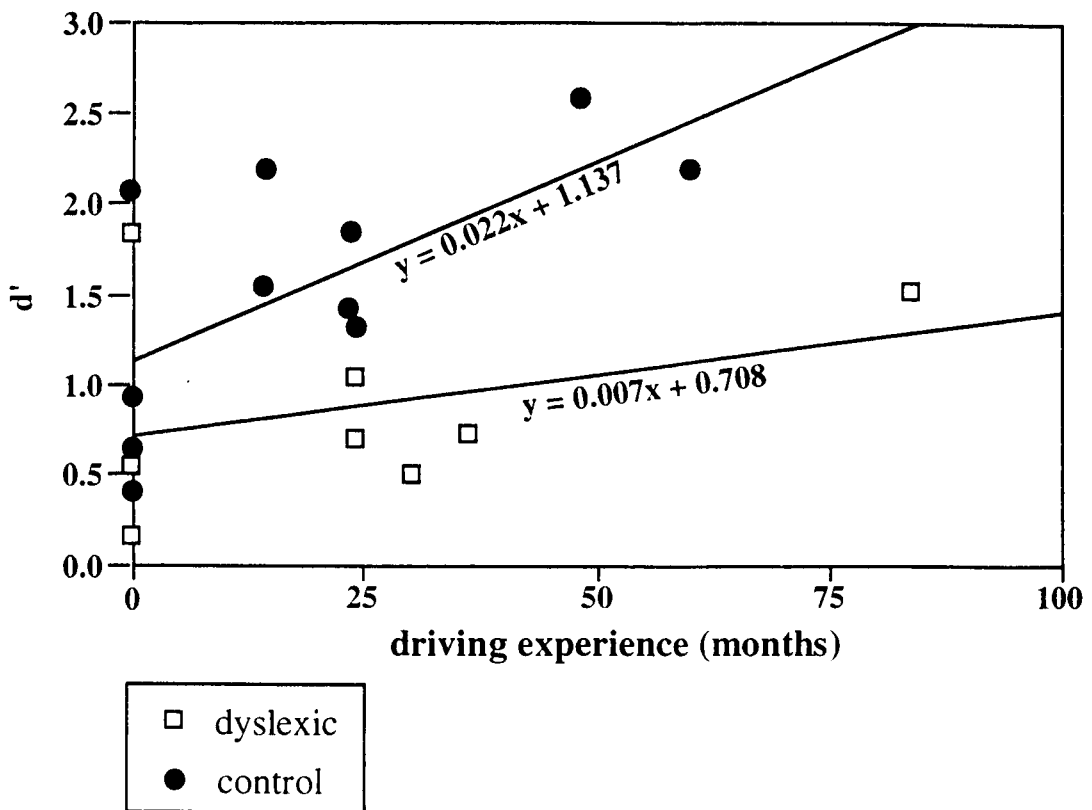
fig 3.   Scatter diagram with regression lines comparing driving experience against d' of stimuli detection for dyslexic and non-dyslexic participants.

Correlations between d' and estimated life time mileage (generated from driving experience and estimated miles per year) followed the same pattern as for driving experience (r=0.171 and 0.522 for the dyslexic and control groups respectively).

Finally, in order to assess the possibility that the normally achieving adults might gain their advantage in d' by a strategy of attempting to name the signs before deciding whether or not they were valid, participants were later questioned to this effect. Of those responding, 44% (4) of the controls and 17% (1) of the dyslexics used a naming strategy. However, correlations between use of naming strategy and d' were in fact non significant for both groups, (r =-0.460, -0.265 for dyslexic and control groups respectively). This leads to the conclusion that use of the strategy was not the key to successful performance.

2.3. Discussion

The results show a clear deficit for knowledge of traffic signs amongst the participants with dyslexia. A second important finding was the apparently much lower rate of improvement of knowledge for the group with dyslexia as a function of driving experience. The initial deficit in knowledge, that is at the time when the driver might be explicitly learning the traffic signs, was relatively small. By contrast the mean rate of improvement with experience for the group with dyslexia was only one third that of the controls. These two findings are as predicted by the skill acquisition deficit hypothesis, but contradict the predictions of the phonological deficit hypothesis and the rapid visual processing hypothesis. Both of these hypotheses predict no effect. It appears therefore, that the fundamental deficit, or deficits, must lie deeper within the cognitive system than suggested by thse two hypotheses. Of course, alternative hypotheses for the cause of this deficit may be posited. The least specific hypothesis consistent with the results is that the dyslexic adults showed a deficit in symbolic, non-verbal learning.

It is important to state that the results of this study do not inevitably mean that dyslexic adults will drive any less well, or that their ability to interpret correct road traffic signs is impaired. The primary concern in this study is not the practical issue of the driving abilities of dyslexic adults, but the theoretical issue of symbol use and learning in dyslexic adults. However, the task of driving, or learning to drive does conform to the characteristics of a task that the DAD hypothesis would predict dyslexics would have difficulty in. It is a dual task that places heavy emphasis on speed and accuracy of responses. Thus, it is possible that the deficit detected in this experiment is one part of a wider deficit in driving, or learning to drive.

Given the complex aetiology and developmental nature of dyslexia, together with the diversity of the symptoms shown by dyslexics, it is difficult to envisage a single test or set of tests which could identify the underlying cause(s). Thus, it would be unwise to entirely dismiss interpretations of any results in terms of the phonological deficit hypothesis and the temporal visual hypothesis, especially if we take into account the secondary effects which each could cause. It is also dangerous to generalise too strongly from the results for a small set of high achieving subjects. Consequently, these results are best interpreted in the light of existing findings on dyslexia. Our preferred hypothesis, following Nicolson and

Fawcett (1990), is that the performance of the dyslexic adults is less automatic than that of the controls, with this greater cognitive load leading to less spare capacity for noticing road signs. This difficulty leads to an apparent deficit in implicit learning, accounting for the slower acquisition of traffic sign knowledge.

2.3.1. Implications for a Career Guidance System

The results may also have implications for the design of career support materials, with a particular concern being the implication that dyslexic adults are not likely to be served well by externally paced tasks where information is removed and inaccessible following each response. Furthermore, the results suggest that such materials should be geared towards explicit learning. To use somewhat more natural phrasing, it would be unwise to expect understanding and skills to simply 'rub off' on a dyslexic person. The implications will be discussed further in the next chapter.

The results of this study have further, very significant, implications for multimedia CACG systems. There is a natural assumption (based on the phonological deficit hypothesis) that icon-based interaction will empower dyslexics, completely eliminating their text-based problems. The results demonstrate that this is simply not so. Dyslexics are liable to have greater difficulties, even with icon-based interaction. Recognition is a key stage in comprehending the meaning and function of a symbol. Thus, problems with recognition could well contribute to problems in symbol use. The implication is that dyslexics may have more difficulties than non-dyslexics in learning the meanings of symbols, and thus, more difficulties in learning to effectively use multimedia systems and graphic user interfaces. Consequently, in a system designed for dyslexics it may be wise to pay special attention to ensuring that the symbols used are as transparent and memorable as possible. In addition, designers could consider providing some explicit training in symbol meanings and functions, supported by easy to use help facilities that can explicitly outline those meanings and functions during system use. It could also be a good idea to reduce the number of symbols necessary to a minimum, possibly by making a special effort to standardise formats and processes throughout the system. These suggestions are particularly apt when considering the dyslexic user. However, they would also be beneficial in any system.

3. Effective Learning in Adults with Dyslexia, and the Application of Multimedia.

As discussed in Chapter 1, there is extensive evidence suggesting that dyslexics have problems in working memory for phonological items. Furthermore, the experiment described in the previous chapter strongly suggests that adults with dyslexia are impaired in memory tasks that use everyday stimuli and have only a minimal phonological or linguistic component. The deficit detected may be the result of an inefficiency in implicit learning. Most likely this is due to the limitation of working memory resources resulting from a need to compensate consciously for lower speed, smoothness and efficiency (i.e. lower automatisation) of tasks performed simultaneously with the exposure to the stimuli. In addition, research (see Section 1.6) has suggested that the interaction of these primary effects with social and educational environments will give rise to a number of more global symptoms, extending into areas such as motivation and self-esteem.

This chapter will examine what measures can be implemented to counter the above mentioned deficits, in an educational, counselling or guidance setting. This is essential in order to be able to offer a later critique of presently available computer systems, and produce preliminary suggestions as to the proposed computer-based careers guidance system. Thus, the remainder of this chapter will cover various concepts around the subjects of open learning, multimedia learning, and countering secondary effects.

3.1. Open Learning

Open learning is an educational philosophy developed in the 1980's specifically to facilitate adult learning. Though definitions vary, a number of factors are typically emphasised (discussed below), and have a direct relevance to the problems faced by adult dyslexics in learning situations.

Kline (1991) lays out three basic principles to setting up a learning programme for adult dyslexics. Firstly, the programme must be completely relevant to the individual's needs and goals. Secondly, it should give students immediate experience of success. Finally, students should participate in and eventually take over their own learning. These principles imply a philosophy very similar to that

of open learning. More specifically the concepts of active, learner-centred learning fit easily in to these principles, along with some contribution from the concept of mastery.

Drawing from the description provided by Nicolson (Nicolson, 1997), outlined below are some of the aspects of open learning, and how they affect dyslexics.

3.1.1. Flexibility

This refers to the requirement to remove barriers to learning, specifically in terms of physical factors, such as timing and location. Flexibility is likely to be of considerable significance for dyslexic adults.

The automatisation deficit hypothesis, and Brachacki, Fawcett and Nicolson (1995, see Chapter 2) both support the idea that dyslexics are more affected by distraction than others; as they are required to invest more conscious effort, and conscious processes are more vulnerable to interference (see Section 1.8). This danger has been stressed by a number of other authors (e.g. McLoughlin et al, 1994). Many dyslexics consequently have problems working in environments with any level of noise, or indeed working in the presence of other people. For example, one fairly successful dyslexic person recently came to see me for assistance as his company was changing premises. It transpired that his primary worry was that he was to be moved into an open plan office, and did not believe he would be capable of properly fulfilling his duties in such an environment, which included a lot of paper work. I have no doubt that he would experience difficulties. In addition the mere anxiety the prospect of such a working environment caused was enough to induce serious doubts and stress. Clearly, David would have problems working under circumstances akin to normal classroom conditions. Equally, the prospect of working in such an environment would be likely to dissuade him from participating. Some flexibility in the learning environment so that the individual learner's sensitivities can be taken into account would be extremely useful.

For the dyslexic person reading and learning require far more effort. Drawing from her years of experience working with dyslexics, Augur (1985) notes that dyslexics tend to become fatigued far more easily than non-dyslexics as a result of this greater effort. This is also a problem often mentioned by dyslexics

themselves. In addition, various authors (e.g. Fawcett 1995, McLoughlin et al, 1994) have noted that, in their experience, dyslexics seem to have 'good days and bad days' or 'good times and bad times'. Though everybody has times when they feel unable to cope with the pressures of work, it is commonly believed that for dyslexics these are more frequent, and tend to hamper their progress more. So, not only is there more fatigue, but there is also more variation from day to day.

Allowing the dyslexic learner some ongoing flexibility in the duration and timing of the learning session is very useful in compensating for the effects of this fatigue. Within limitations, the dyslexic learner need only do as much as they feel able, when they feel able. This principle can also be extended to the length and timing of breaks within the session. As dyslexics tend to be very wary of teaching situations anything that makes it easier to attend and removes pressure, will be very helpful in encouraging their participation.

3.1.2. Learner-Centred

The learner should be given as much control as possible over the style and content of the learning.

The results of the experiment in Chapter 2 (Brachacki, Fawcett and Nicolson, 1995) suggest that dyslexics are likely to be served less well by externally paced tasks. Handing control of learning over to the dyslexic, allows them to set their own pace, i.e. the task becomes internally paced.

Dyslexics also tend to have more unusual styles of performance and interaction (McLoughlin et al., 1994, Gilroy and Miles, 1995, Fawcett and Nicolson, 1997), probably due to a combination of memory and automatisation deficits, along with the strategies developed to overcome them. This could easily lead to the development of unusual learning styles. This is not always a bad thing:

> 'One of the compensations of teaching dyslexics is being amongst people who continually present you with unusual ideas and perceptions on a diverse range of subjects. These pupils can have lively, divergent and rather revolutionary minds which scatter challenging thoughts and unusual questions.' (Edwards, 1994, page 124)

However, it does mean that dyslexics may respond better to more unusual presentation styles and teaching methods. The quote above suggests that they

could perform exceptionally under such circumstances. The strategies a dyslexic person uses are individual to them, as are the extent and exact manifestations of their dyslexia. Consequently, needs and preferences can vary widely between individuals.

We must also take into account the connected factor of the dyslexic individual's understanding of their own disability. Different levels of understanding require different levels and types of general support (McLoughlin et al., 1994, Gerber et al, 1996, see Chapter 5).

Considering all the above, it is clear that the most efficient method of presentation as well as the exact content and style of that presentation could vary widely from that appropriate for non-dyslexics, and from dyslexic to dyslexic. Allowing the user influence over these factors, and tailoring the programme to the individual, is therefore essential.

Giving users greater control over style and content of presentation also helps ensure that information presented to users has more chance of being understood and being explicitly relevant to them. Obviously this is very helpful in the learning process, but also helps to reinforce the motivation to learn, something that is often badly deteriorated in dyslexics (see Section 1.6).

3.1.3. Active learning

The idea of active learning is to teach by relating information to existing knowledge, allowing the learner to discover ways of evaluating and organising it. Thus the learner is encouraged to have an active role in the learning process and find their personal best method of understanding information, rather than being presented with the facts, the interpretation and evaluation, and being asked to absorb passively all of this.

One inference from the experiment in Chapter 2, and from other work by Nicolson and Fawcett (see Section 1.8), is that learning will be more efficient when the dyslexic person is encouraged to examine consciously, and manipulate learning material. This is primarily because, it encourages the dyslexic learner to consciously attend to the material, and gain a more explicit understanding of it. Increasing their control over the material also helps increase the chance that what is

being learned is relevant to the learner, thus, making it easier for them to assimilate.

Studies have confirmed that encouraging the adoption of such an active learning style leads to more successful learning (e.g. Rotter, 1975). The perception of repeated failure, seen so regularly amongst adult dyslexics, often leads to the adoption of passive learning styles (Holt, 1984). This could explain the often seen withdrawal of the dyslexic pupil to silence and introspection at the back of the classroom, hopefully out of the range of the teacher's attention (e.g. Edwards, 1994, for some illuminating case studies).

The suggestion that active learning is disrupted by excessive speed of presentation, confusing presentation and fatigue (Nicolson, 1997), serves to emphasis the necessity of making learning learner-centred and flexible. In order for effective active learning to occur the learner must have control over presentation style and timing. The special vulnerability of dyslexics to these disruptive factors, due to the need for greater effort and inefficient working memory, makes this a particularly important issue for them. Indeed the concepts of active learning and learner-centred learning are hard to view in isolation from each other.

That in active learning information is rendered more directly relevant to the individual, and that the individual is more instrumental in the whole process, tends to make the whole process more motivating. As has been said all through this chapter, anything that is more motivating is especially useful in teaching dyslexics.

3.1.4. Mastery

Despite the emphasis of the needs of the individual, care should be taken that the user reaches a sufficient level of performance in the part of programme they are working in before they are allowed to continue. This level is called mastery. This is particularly important, as the relaxation of constraints implied in open learning makes it inappropriate to assume any specific level of mastery on the part of the individual. To facilitate this the programme should give precise specifications of objectives, and provide intermittent tests of mastery to establish the extent of progress towards those objectives.

This is particularly important for dyslexics as the wide variation in learning styles and level of proficiency make it less easy to predict how they will progress. Well designed tests of mastery will make it possible for the dyslexic learner, as well as members of staff, to discover where they have done well and not so well in the programme. This helps in establishing where they should look again, and how the programme can be adapted to suit best their personal needs and preferences.

Providing mastery tests at significant points in the programme gives the perfect opportunity to render explicit the nature of the process. If dyslexics have an implicit learning deficit, as suggested by Brachacki, Fawcett and Nicolson (1995, see Chapter 2), they are unlikely to simply absorb information on how the learning programme works from just watching its progress. Thus, they will find it harder to gain a full understanding of the type of learning process they are participating in. In order for learning to be active and learner-centred it is essential that the learner possesses such knowledge.

In addition, problems of distractibility and associated difficulties in organisation and attention problems, can cause the dyslexic learner to wander off course. The risk of this happening is significantly increased by the flexibility and learner-centred nature of the programme. Clear goals and mastery tests provide an effective way of countering this by maintaining the goal at the forefront of the learner's mind, and indicating what else is required to achieve that goal. This can also be seen as the laying down of clear criteria for success, and clear routes by which this can be achieved, providing a good chance for the dyslexic learners to experience success throughout the programme. This helps to fulfil the criteria for success laid out by Kline (1991) above, and could well increase the motivation to see the programme through to the end.

3.1.5. Support Environment

Some amount of social contact is extremely useful. This could come from a sympathetic tutor or guidance officer, or from people who are in a similar situation, with similar problems to the user. It allows an opportunity to provide human feedback, clarify and confront any unforeseen problems with the program, and give encouragement. No less important, it provides a far better context for the exploration of human and emotional issues.

All of these factors can be very useful for dyslexics. The risk that individuals will have problems with the program that the designers did not, or could not, fully account for is higher, due to the wide variation in the difficulties suffered by adults with dyslexia. This could include problems resulting directly from cognitive deficits. However, the emotional issues are possibly more relevant in this case. Many adult dyslexics suffer from such things as lack of confidence, hopelessness, and a sense of isolation. These can be very intense, in some cases producing behavioural problems, or interfering with general coping with life as well as progress in learning (e.g. see Edwards, 1994, and Hampshire, 1990, for some informative case studies). This was the major reason why those questioned in the feasibility study of computerised screening for dyslexic adults mentioned in Section iii of the 'Introduction' (Nicolson, Fawcett and Miles, 1993) greatly favoured a two stage process of computer and then human screening over total computerisation.

Sessions with a sympathetic counsellor or guidance specialist, or discussions with other adult dyslexics could be very useful in resolving these problems, from the point of view of information and motivation. It would allow the user to explore these issues in a sensitive and constructive environment, and provide reassurance that their problems are being taken seriously, and that they do not have to deal with them alone. It is also the case, that developing learning strategies directly through discussion is often liable to be more effective than developing them through formal exercises. The learning has a better chance of being explicitly relevant to the individual as discussion happens on an individual level, and naturally leads to organisation and evaluation of the information by the individual (as long as the discussion is not one sided, of course!). In short it can be an excellent context for active learning.

One point worth remembering is that the support environment provided should avoid any resemblance to school, as that is unlikely to provide the dyslexic learner with the sense of security necessary.

3.1.6. New Technology

Open learning programmes generally emphasis the use of new technology where appropriate. Obviously in the case of an interactive computerised careers advice package the use of new technology is far more than implied.

A well designed computer system can provide an excellent platform for an open learning programme. A computer has the advantage of being completely systematic, and if the system is designed well, predictable and with transparent processes. The same cannot be said for the majority of humans. This gives the user a better chance of understanding the nature and method of the learning programme, as well as making it easier to tell exactly where they are in the programme. Such information is essential to allow for learner-centred learning, and facilitate active learning, partially by providing a broader context for any particular component or task in the programme. Active learning is further facilitated by the fact that computers are for the most part interactive. Systems can be designed simply to reel off information, like a video or tape recording, but what computers excel at is being responsive to the user. Choices of what task to undertake or information to see can be presented, but it is the user who makes the final decision. The learner must be active to progress through the programme.

Not only can machines be very flexible as far as speed, style and content of presentation is concerned, but they can also afford to be more flexible than a human in the timing and duration of learning sessions, i.e. a computer never gets bored or tired, and has no other obligations but to serve. Thus, the user can easily be allowed to set their own pace, which could be especially beneficial for dyslexics (Brachacki, Fawcett and Nicolson, 1995, see Chapter 2). Likewise, computers are unable to express exasperation, impatience or any other negative emotion. Due to bad experiences with teachers and education dyslexics are often particularly sensitive to these things, and thus can feel very daunted by human teachers, and very wary. Of course the computer is also unable to provide the emotional support a concerned human can.

One final advantage to the user is that a computer system can hold a great deal of readily available raw information, with less risk of that information becoming corrupted or distorted than with a human being. Of course one problem is that the computer's capacity to retrieve, filter and sort that information appropriately may

not be as good as a human's. However, if one were to take a rather optimistic view, leaving some of this to the user could be seen as a good opportunity for active learning, as it involves the user evaluating and organising for themselves.

Computer mediated learning offers a number of more practical advantages over a human mediated programme. Placing the learning programme on one system allows for complete and coherent record keeping. This is not only useful to the user in terms of rendering explicit the nature and results of their progress, but also to support staff who likewise can keep track of users. This information also allows for ongoing evaluation of the programme itself, leading to progressive improvement.

Another advantage to staff and institutions providing the program is that it leads to the freeing up of staff, giving them more time to deal with issues that can only be resolved by human beings, such as advocating for the user, providing social support, and counselling. Done correctly, this would mean more efficient use of staff time.

Thus, a computer system could be a very appropriate and efficient way of delivering an open learning programme. However, it is also vital to remember that such a system cannot be expected fully to replace well trained and sympathetic staff.

One issue not covered in this section is the ability of modern computer systems to deliver information via a number of different media, i.e. multimedia capacity. Quite a bit of work has been done on the advantages to dyslexics of multisensory learning and multimedia, and, as the title of this thesis suggests, the concept of multimedia is particularly important to us. Thus, it is worth devoting a separate subsection to this.

3.2.   Multimedia and Dyslexic People

Besides text, modern computers can efficiently deliver and manipulate high quality graphics and sound, as well as synthesised or digitised speech, and digitised video or animation. Systems that make use of two or more of these media can be termed multimedia. However, this does not fully express what most people would think of when considering a multimedia program. In such systems the separate media

are used in an integrated fashion to support each other, and can be connected, allowing the user to move relatively freely through this rich data environment. As a consequence, some people have preferred to use the word hypermedia when talking of such programs. Michael Liebhold (1990) of the Apple Multimedia Lab. defines hypermedia as 'a linked, non-linear knowledge structure with multiple data types- text, graphics, sound, animation, video'. Any specific piece of data in a variety of media types can contain within itself user activated links to related pieces of data in any of the media types stated above.

Thus, multimedia can be used to augment a program in two connected ways, both of which are of potential benefit to dyslexics. Firstly, multimedia can be used to provide the user with an easy and relatively natural interface for carrying out functions in the system and retrieving data, most commonly through icons, menus, internal links and a mouse. The use of icons and menus to control computer systems is now extremely widespread in the form of graphic user interfaces, for example the Macintosh Operating System Desktop environment and the Microsoft Windows environment. The use of links between data has also become very familiar to many people via the use of the internet and internet navigator programs such as Netscape from the Netscape Communication Corporation. Closer to home, the help system in the application I am using to write this thesis, Microsoft Word, uses this method. In these cases, links form the primary method of data retrieval. Mostly these are hypertext links, where selecting specified terms or words from the body of the text with the mouse will retrieve other information resources relevant to those terms. These could be more text, pictures, sound or video clips. Likewise links can be embedded into pictures or videos.

Secondly, multimedia can be used to enhance the delivery of information to the user, by presenting data in a rich variety of media formats. An example of this would be any one of the range of CD-ROM encyclopaedias available, for instance Microsoft's Encarta. Microsoft claim that besides over 21,000 text articles, Encarta contains 7 hours of sound with animations and movie clips, as well as 7000 photographs and graphics.

According to Cawkell (1996) in a recent review of multimedia, despite the massive interest in computerised training and education there is still a noticeable lack of consistent theories of computer assisted learning to support design. In short, developers and educators have had to rely, to a great extent, on acts of faith. Attempting to review the literature on the subject one cannot help sympathising

with this point of view. There are plenty of books and articles on multimedia in general, for teaching and training, and describing and evaluating specific systems. There is little in the way of detailed analyses of how multimedia is so useful, and the specific functions of different types of media. A similar point is made by Mayer (1997), to quote:

> "Instructional development is too often based on what computers can do rather than on a research-based theory of how students learn with technology. In particular, the visual-based power of computer technology represents a grossly under-utilised source of potential educational innovation." Mayer, 1997, page 17.

Thus, in this subsection will be outlined the various ways in which graphic user interfaces, and graphically manipulated text, diagrams and stills, speech and digitised video can be used to assist dyslexic users, and help increase the effectiveness of a computer based open learning program. Examples will be provided where possible. In some cases the sections below will overlap. Considering the potentially vast diversity and complexity of multimedia programs, this is inevitable.

In the following analysis, two key features of multimedia will be returned to repeatedly. Firstly, multimedia can simplify and increase user control over learning. Secondly, the flexibility and sensory richness of the multimedia environment have great potential for increasing general understanding of the learning process, and data delivered by the system. The key themes implied in these two statements can also be seen in some of the key points to come out of Apple's multimedia project (Ambron, 1990). Firstly, if multimedia is to reach its potential, hardware and software for end users must be made easy to use. Secondly, learning with interactive multimedia gives users additional options on how to learn the material they choose, and if used rightly this could provide motivating and effective learning, tuned to the individual.

3.2.1. The Graphic User Interface

The use of icons and mouse, or even more exotic systems like touch screen, can be enormously beneficial to dyslexics. Reducing the need to read and type text to use the system has obvious benefits. Older systems often required the user to remember a fairly unnatural and idiosyncratic set of commands and prompts, which were extremely sensitive to errors in syntax, and far from immediately

transparent as to their function. This is a major hindrance to dyslexics, for whom memory and organisational problems could make it exceptionally hard to produce the correct format for a command, as well as remember exactly where they are, and what they are trying to do. As a consequence the machine can become very intimidating.

I can't help remembering my own experience as an adolescent, being given a then state of the art Commodore 64 computer by my parents, to assist me in school work. These machines, along with those produced by Sinclair were fairly common amongst my friends, who seemed to delight in using them for a whole range of complex functions. However, I never managed to get past an onslaught of error messages, and as a result avoided using it at any cost, despite the protests of my mother. The machine was sold on after just six months or so. Perhaps I should have studied the manual more carefully, but as a dyslexic person the very thought of reading such a complex, and quite frankly poorly written document was enough to set me running. Though purely anecdotal, in my experience this is also a fairly common problem among dyslexics. They simply do not like learning from manuals.

If I had been presented with a system that provided a graphic overview of its contents, required a minimal amount of writing or remembering commands, and could be mastered without studying complex instructions, I would have done far better. Indeed today I find machines with such systems indispensable. I would go as far as to say that I would not be capable of pursuing a doctorate without them.

Having an overview of the arrangement of the system, with each component and each class of component immediately and clearly identifiable, facilitates active learning. By emphasising how those components relate to each other, and the system as a whole, the chance of the user gaining a deeper understanding of the functions and working of the program is increased. This in turn is liable to increase the user's sense of involvement in the learning process (see section 3.2.4. for more details and examples). If they understand the system better, they are also in a better position to adapt its use to their own needs.

The presentation of an overview, through which one can access components of the program, makes the system considerably less linear. Potentially, the components can be accessed in any order. This makes it possible for the user to take a more exploratory approach to the program, and exploration is by nature active. The user

can also skip sections that they feel they are not ready for, or they do not perceive as relevant. Clearly such flexibility allows the user to take more control over the learning process, making the system more capable of catering for unusual learning styles.

In many programs, including the one that is the subject of this thesis, some tasks will have to be completed before others. However, in this case, at least the learner can be more aware of how the program proceeds towards the goal, and exactly how the section they happen to be in relates to subsequent sections. A graphic representation of exactly where they are in the context of the whole program, how far the user has progressed, and what remains to be done, could be provided to help (see section 3.2.4. for more details and examples). This is especially useful to dyslexics, as they are more likely to lose track of where they are and what they are actually doing, leading to lower achievement (Gray, 1996, De Brulijn, 1995). This is most likely due to the additional working memory load produced by the need to navigate through the system (Oren, 1990).

One other useful feature of graphic user interfaces is that they can be relatively easily adapted by the user to suit best their tastes in presentation. For example, screen and text colours, and icons can be manipulated by the user. Some dyslexics find that their reading improves when the text or the background is a particular colour, or when they use a particular font, or size of font. The capacity to personalise the system allows the user to make the graphic representation more relevant to them, and more memorable. This could increase the user's involvement in the learning process by making the system more immediately transparent, less intimidating and more fun. Fun is always a plus. Being able to increase the transparency and memorability of graphic representations could be especially helpful to dyslexics; due to the difficulties they have with implicit learning (Brachacki, Fawcett and Nicolson, 1995, see Section 2.3).

3.2.2. Graphically Manipulated Text

Various graphical manipulations can be applied to text to make it easier to read, and clarify the meaning. This is by no means unique to computers of course. Authors and publishers have always used such techniques as highlighting key words and phrases, separating points into bullets, containing certain sections of text within

borders, etc.. These are usually used to break up text into more manageable chunks, itself helpful to dyslexics, and visually separate information on different concepts, or with different levels of importance. Under such conditions it is easier for the reader to gain a general overview of the themes and structure of the text, and place any details within the general context. This helps counter any tendency to lose one's way while reading, a problem that is likely to be associated with the memory problems, distractibility and fatigue that many dyslexics experience (see Sections 1.3, 1.8, 3.1.1). It also makes it easier for the user to read more selectively. Dyslexics in particular seem to lack a sensitivity to textual organisation and the relative importance of main ideas and details (Englert and Thomas 1987, Wong and Wilson, 1984).

Though the above is nothing new, the use of computers does make it easier to manipulate text in these ways than with old fashioned printing techniques. It just takes the flick of a few buttons. In addition, the number of variables a computer can easily manipulate is greater. One consequence is that the computer can be used, with relative ease, to make text visually richer and more interesting, which helps counter any demotivation to read. MacArthur and Haynes (1995) found that the use of clear headings, key terms and highlighting proved very popular with users, and increased comprehension of the text. Students using their Student Assistant For Learning From Text (SALT), a system that allows one to create multimedia versions of text books, commented that these adaptations streamlined the text preventing overreading and confusion. It was also considered a big plus that these adaptations were attention getting, and thus assisting the student to focus on the material. Indeed this proved to be one of the most popular features of the adapted text books. Another useful feature of the SALT system is the ability to link terms to a glossary. Thus, the definitions of all the key terms in the text are readily available to the user. This is particularly helpful for dyslexics, who often have low vocabularies (see Section 1.6).

Another feature of modern computers that has been exploited extensively by designers is the capacity to treat sections of text as objects. Text can be selected and copied into other areas of the document or between documents. This is of great value to dyslexics as it significantly lowers the amount of typing required when taking notes. Again, the SALT system provides an on-line note book that is used by the student for answering questions posed by the teacher or taking general notes. The majority of the students made use of the ability to copy text into the

note book rather than type it themselves, and considered it a particularly useful aspect of the system. Another system using this is described by Thomas (1994). The Picture Book Professional careers guidance system developed by Humberside FE/IT unit offers the user a link to a word processor that supports copying and pasting. This has the advantage that notes can be viewed, adapted and printed without having to enter the original multimedia program. Taking this idea one step further, StoryMaker from the National Council for Educational Technology (again described by Thomas, 1994) facilitates the improvement in ordering and sequencing skills of children by allowing them to construct their own electronic book through copying and pasting text and pictures in to pages.

3.2.3. Speech

Speech can make a very useful addition to a computer based learning program, especially for people who have problems dealing with text. Its primary uses are in delivering and emphasising information, assisting users in processing text, and along with alert sounds (sounds used by the machine to indicate the initiation or completion of processes, or the occurrence of errors), can be used to clarify what actions the machine is undertaking, and further enrich the interface. For example, upon selecting an icon the machine could inform the user of what the icon does with a phrase.

Dyslexics are very likely to prefer speech to text. However, it would be unwise to present all information in speech, as there are a number of important limitations. Firstly, speech is fundamentally linear in nature, making it very hard to skim as one can with text, and has very strict limitations as to its pace. Thus, presentation through speech is more time consuming for the user. Dyslexics' problems with externally paced tasks (see Chapter 2) may cause further difficulties. In addition, the user cannot request two pieces of information simultaneously, making it far more difficult to compare one piece of information against another. Secondly, speech is very passive in nature as the user can just sit back and listen. Not being forced to attend fully to information, it easier for them to let it pass by. This could lead to negligible learning, as well as encourage an unhelpful passive learning style. Thirdly, synthesised speech requires effort to understand, as even the best examples do not sound natural. It is important to reduce the need for such

incidental effort, as it is liable to interfere with the dyslexic user's attention to content.

One can use digitised speech. However, this requires someone to dictate all that is included in the program, which is not only expensive and time consuming, but also takes up a lot of computer memory. Clearly, digitised speech would not be an appropriate means of providing speech back up for all the information in the program, as this would make the production of the program more difficult, and require either a more expensive system or sacrifices in other areas. Thus, digitised speech is best used sparingly.

As opposed to presenting all the information as speech, it would be far better to have it as an option for the user, and to use it to enhance presentations, rather than as the primary medium of delivery. SALT (MacArthur and Haynes 1995) mentioned above, which is specifically designed for people with low reading abilities, allows the user to select sections of text with the mouse, and have these spoken using synthesised speech. Though students found this useful, it was not rated as highly as other features. Users' comments suggest that this was due to the synthesised speech being time consuming and difficult to understand, a problem outlined above. However, this technique has been used successfully in other programs, for example Arthur's Teacher Trouble by Broderbund Software (described by Singleton, 1994).

A number of other programs have made extensive use of digitised speech, and synthesised speech, specifically to help develop reading skills in people with low literacy; for example 'Say that again, please' (described by Hartas, 1994), the Somerset Talking Computer Project (described by Miles, 1994), and Selfspell (Nicolson and Fawcett, 1993). That these systems have proved effective suggests that those with low literacy, such as dyslexics, can cope with digitised and synthesised speech, and benefit from them.

Text is a primarily visual medium. In combining text and images one creates a situation where these two media must compete for limited visual working memory resources. This can be particularly detrimental to learning among dyslexics, who commonly have problems with working memory. Work by Mayer (1997) suggests that when using images or animated diagrams, users gain a greater understanding of the topic if a commentary in digitised speech is provided, rather than just text. He also emphasises that speech must be properly co-ordinated and

integrated with images to be most effective, especially for groups with low prior knowledge of the topic. Thus, providing short segments of digitised speech to emphasise important points and instructions can be very effective. A practical example of this sort of use of speech and graphics can be found in Apple Multimedia Lab's Living Constitution program (described in Florin, 1990). In one section the user is provided with conceptual map of the differing opinions of the major players in the American civil rights movement. By selecting an individual the user can hear digitised recordings of segments of speeches that exemplify that individuals point of view, while still viewing the conceptual map.

Finally, this example above emphasises another fairly obvious feature of digitised speech, that it can be a motivating and far more 'human' way of delivering information. Florin (1990) emphasises that still pictures and text can often be perceived as lifeless unless combined with sound or motion footage. One use of this aspect has been in help or guidance systems in multimedia applications. For example the DTP Graphic Design Mentor from the Computer Graphics Workshop (described in Cotton and Oliver, 1993), uses a 'talking head' mentor, i.e. a screen consisting of a picture of a person (the mentor) along with guidance and advice in text and digitised speech. The result is said to be more 'human', and less intimidating.

3.2.4. Diagrams and Photographic Stills

Integration of graphics such as diagrams or photographic stills into text can make the whole experience of learning more interesting, as well as providing the dyslexic user with a well-needed respite from reading.

Diagrams are also very useful for showing the relationships between pieces of information, making the context of any piece of information clearer, and consequently aiding general understanding. One example would be that provided above in section 3.2.3 from Apple Multimedia Lab's Living Constitution program (described in Florin, 1990) which includes a conceptual diagram displaying the relationships between the views of various key players connected to the American civil rights movement. Of course in this case the diagram also contained links to auditory data, which brings us to the concept of embedding links in diagrams. The

difference between an explanatory diagram and a graphic user interface begins to break down as soon as this is done.

A graphic user interface is usually conceptualised as a graphic representation of the system and its workings, whereas, a linked diagram can be seen as a graphic representation of the structure of knowledge contained within the system. Thus, linked diagrams not only contain an intrinsic knowledge value, but also render explicit the relationships between the pieces of data, in whatever medium, that can be accessed through them. This has become an almost universal feature of multimedia programs, and as a result one can find a huge wealth of examples.

Another component of the Living Constitution program mentioned above is the Time Gallery. This is based around a particular user manipulable diagram/interface called by the authors the 'data cube'. The user is presented with a cube representing the history of the American Constitution, with a chronological sequence of events represented along one axis, a breakdown of events in terms of themes along another, and an alphabetical listing along the remaining axis. The user can manipulate the cube in pseudo-three dimensional space, so that they can see any face. They can then extract a slice, through which they can access further pieces of data. So, if one were to extract a slice perpendicular to the theme axis, one would obtain access to all the data on a single theme, arranged both chronologically and alphabetically. They can also move along any axis from any particular point within the cube. This allows the user to keep track of exactly where they are as they browse through the knowledge structure, helping counter the problem of the user becoming lost in an overwhelming mass of data.

A somewhat more straight forward example, Apple Multimedia Labs Visual Almanac (described by Hooper, 1990) allows the user to access a map at any time via a 'super button' providing them with information as to their orientation within the knowledge structure. This last point is of particular importance to dyslexics, as they may be more likely to lose track, and get bogged down. The additional cognitive load produced by navigating, and keeping track could also interfere with the user's assimilation of data (Oren, 1990). Work by Nicolson and Fawcett (1990, 1992, 1994 see Section 1.8) suggests that dyslexics are particularly vulnerable to the effects of additional cognitive load. Another example of a system that makes use of graphical techniques to counter this is the Electronic Whole Earth Catalogue (described by Oren, 1990). Like the Visual Almanac, this program can provide the user at any time with a higher level map to show them exactly where

they are in the knowledge structure. As the Electronic Whole Earth Catalogue is essentially an atlas the use of the term map is quite literal. However, in addition to this the Electronic Whole Earth Catalogue makes extensive use of graphics that form backgrounds to any data, to provide the user with cues as to their orientation. So, for example if one were examining the architectural heritage of a particular city the user could examine a series of photographs of important buildings in foreground of the computer screen, while the background would remain the same and contain graphics representing famous or memorable characteristics of the city and/or country.

It goes without saying that these techniques can not only be used to orientate the user within a knowledge structure, but also within the broader context of a whole system, containing other components besides information sources.

Some have suggested that dyslexics may have a particular talent for learning from visual representations. For example West (1991) believes that dyslexics have a great talent for visual thinking, and will benefit enormously from wide spread use of multimedia systems. To quote West, referring directly to dyslexics:

> Indeed, in some cases, these machines may come to be used as extensions and amplifiers of the imagination, permitting gifted visual-thinkers to work in a visual-spatial language on fast and powerful graphics-oriented computers, developing and communicating their ideas in novel ways.

When it comes to West's opinions on the visual talents on dyslexics the jury is still very much out. Brachacki, Fawcett and Nicolson (1995, see Chapter 2) and Lovegrove and colleagues (see Section 1.7) suggest that dyslexics may have some problems in the processing of visual information, and in the end there is little clear evidence for some special gift. However, it is fairly clear that dyslexics are considerably less impaired in learning from visual representations than from text (McLoughlin et al, 1994). Several researchers have found that use of graphics is an effective, and motivating, way to teach those with specifically low reading abilities (e.g. Peterson et al, 1989, MacArthur and Haynes, 1995). Unfortunately, there has been little work on the effectiveness of the use of graphics in teaching those suffering specifically from dyslexia.

Modern computer systems are very effective at displaying high quality photographic stills. As with diagrams these can be used to relate together and access other resources, via the designation of objects in the still as hyperlinks that

can be activated with the mouse. For example, in Dorling Kindersley and Microsoft's Musical Instruments (described in Bowen, 1994) clicking on any part of particular pictures of instruments retrieves text on the purpose of that part. Incidentally, further manipulations enable the user to investigate the variety of sounds the instrument makes. 'Brain Dissection' (described in Neild 1997) displays pictures of brain scans, to assist medical students learning about neurology. Textual labels for parts of the brain are only available when the relevant area of the picture is clicked on. The author reports that students found this particularly motivating as it was more active, and allowed for self testing.

One final key advantage of stills is that rather than just providing a description one can show the user the thing, or an environment. By doing so one can increase the connection between the learning programme and the real world, and hopefully increase the relevance of the learning programme to the user. In short they can make information more personally salient to the user. This power of pictures has not been lost on the mass media over this century. Who could deny the enormous impact of images of the extermination camps that appeared just after World War II, and the great power, and salience, they gave to the accounts of survivors and witnesses.

This idea of increasing the personal relevance of information by using images extracted from the real world is implicit in all the systems using stills that have been mentioned above, including Encarta and the Visual Almanac as well as a great many other multimedia systems over the whole range of uses. For example Picture Book Professional from the FE/IT Unit in Humberside (Thomas, 1994) uses pictures to demonstrate jobs and working conditions in jobs, providing colour and a human element to otherwise bland accounts of different careers.

3.2.5. Digitised Video

More and more people have come to rely on television as their major source of information as time has gone on. This is likely to be even more so for dyslexics. I remember being silently entranced by David Attenborough's series 'Life on Earth'. The only time I kept quiet, so I am told. The idea of reading anything out of interest or pleasure, let alone natural history, never occurred to me at the time. However, I was then bought the book of the series (Attenborough 1979, if you can

get it, it's a wonderful read, and the pictures are stunning). It was the first thing I ever read for pleasure. I can safely say that my interest in science and biology that eventually led me in a somewhat round about manner to psychology, crystallised at that point. Even now I can clearly remember the images and ideas. Combining images, movement and sound can produce something very rich and enthralling, which, for a dyslexic person, has none of the stigma of text. Thus, video can provide a very comfortable, familiar and intrinsically motivating way to learn.

The capacity to integrate real time video into multimedia systems is one of the most recent advances in the field. As a consequence, considerably less systems have become widely available that make use of this medium compared to the other mediums above. It is much harder to find clear cut examples of its advantages and disadvantages. Thus, much of what is said in this section is derived from the conclusions arrived at in the sections on other mediums above, particularly the sections on speech (Section 3.2.3) and graphics (Section 3.2.4).

Integrating segments of video in to the learning program has advantages similar to those of using still photographs. As with stills, it can make the learning experience more interesting, and show the user how information applies in the broader context of the real world through practical demonstration, increasing its personal relevance. As a result of this, and the general richness of video with sound, this medium can be far more memorable than others, especially text. A training program developed by Futuremedia for Hydro Aluminium (described in Bowen, 1994) demonstrates this aspect fairly well. The trainee is presented with a simulation of machinery, and must manipulate parameters such as speed and temperature. They are then given the opportunity to see the results of their labour. This consists of a video clip of the product, in this case metal, that would have been produced if they had used a real machine. If the user performs badly the resulting metal will show the appropriate anomalies. Thus, the trainee is given something as close to hands on experience as possible. Without taking up a real machine or wasting resources they have a graphic, real life example of the results of their decisions. Incidentally, the Hydro Aluminium claims that this training package has increased its productivity by 25%.

Likewise video shares some of the problems of speech that have been outlined above. For single chunks of video it is hard to give the user practical control over the rate of information presentation, and hard to skim for the gist or specific details. One cannot effectively attend to other sources of information

simultaneously with attending to video as it requires all the relevant senses. Thus, immediate comparison with other information is difficult. Due to the effects of the automatisation deficit (see Section 1.8) this is likely to be more of a problem for dyslexics.

Though video is absorbing it is also fairly passive, placing little burden on the watcher to extract information. The flip side to the motivating effect of the medium's richness, is that it can distract the user from the content. I'm sure the experience of watching a TV programme without really attending to, or absorbing the content is something we have all done at times. Such effects are generally exacerbated by mental fatigue and high distractibility, both of which dyslexics seem particularly vulnerable to (see Section 3.1.1).

What is needed is an attempt to make the use of video more interactive, and emphasise the content. This can be done by keeping video segments as short and to the point as possible, and providing an immediate summary of the content in some other media. Interactivity can be increased by making these segments only available at the specific request of the user to fulfil a specific, explicitly stated purpose. The user should also be given the option to stop, wind, and play segments at will.

Life Story (described in Florin, 1990) made by the Apple Multimedia lab, Smithsonian Institution, and Lucasfilm Ltd. is an excellent example of a multimedia system, heavily reliant on video, that has had to confront these problems. This is essentially a dramatisation of the discovery of DNA produced by the BBC that has been placed in a multimedia framework. After viewing the entire film, the user can then view small segments of the film in any order, retrieving them via a graphical representation of the story line shaped like a double helix. This serves to indicate explicitly the theme and content of the segment he is watching, and keep track of exactly where it is in relation to other segments. The user is also given simple controls allowing them to stop, revue and skim while watching segments. Interactivity is also increased by assigning hot spots to important features in the video, e.g. characters; to activation labels, and even short segments of spoken information are provided. This is used to identify features, provide some of their background, and even suggest new pathways of enquiry. Each key scene is documented in a 'pamphlet'. Contained in this is a summary of the scene, as well as questions with links to the segment where the answer can be found, and links to other relevant 'exhibits', such as recorded interviews with the

real people depicted in the drama, and photographs. Thus, the user is provided with the information and means to take control over their viewing. Active interaction is encouraged, and information contained in the video is fully explained and elaborated on to help the user to a fuller understanding.

Of course, Life Story is a fairly specialised program that cannot be implemented on most regular computer systems. Such large amounts of video cannot be held on appropriate modern recording media, for example CD, and places an even greater burden on the machine's memory than digitised speech. Thus, at present it is not practical to have a large amount of long, high quality video segments included in a system. To do so would incur the risk of placing the system outside the means of smaller, less wealthy organisations.

One problem with a program that relies heavily on the unsupervised use of a computer is that it limits the opportunities to provide social support (see section 4.1.5 above). As mentioned previously, dyslexics often suffer from such problems as lack of confidence, hopelessness, isolation, and demotivation. Unless these issues are dealt with, the dyslexic person is unlikely to gain any real long term benefit from what they are learning. This is particularly relevant to careers guidance (McLoughlin et al 1994, and Gerber, Ginsberg and Rieff 1992). If someone feels beaten down, useless and alone, they are in no position to satisfy fully their true potential, and gain the associated benefits. The vicious circle this creates must be broken for there to be a chance of real success.

Computers are still very limited in the extent to which they can handle open ended questions. They can only deal with a pre-specified range of answers and questions. This lack of flexibility and insight means that it is extremely hard, if not impossible, to program a computer to deal effectively with complex human and emotional issues. For such things, social support from other people is essential. However, interactive video does have some potential for assisting in this process. Seeing real life dyslexics describing or demonstrating the problems they have had, both practical and emotional, could help relieve isolation, and assist the user in gaining a greater or clearer understanding of their own problems. Having this person describe or demonstrate how they have countered these difficulties and achieved a satisfactory level of success despite them, could help build the user's confidence and motivation, as well as providing practical advice. In addition, all of this could provide a very useful basis and stimulus for later discussion.

To try and pull together the above ideas on video, it would be helpful to finish this subsection by constructing a hypothetical situation from a multimedia computer assisted careers guidance system for adult dyslexics. The user is examining the possibility of some form of office work, but is worried about how their dyslexia may effect their competence.

1. The computer will provide the option of viewing an interview and other footage of a successful dyslexic office worker, talking about and demonstrating the problems their dyslexia causes, and how they have countered these. This could be via a linked still of the person performing some typical duty.

2. On agreeing the user would be presented with the option to view any of a number of video segments on specific difficulties, for example organisation, literacy, or memory. The user need only pick those that seem relevant to them.

3. On selecting, they view a very short segment on the problems the specific difficulty has caused containing explanatory links, followed immediately by a text summary that can be retained for later viewing. They will also be presented with the option to view a segment covering strategies for overcoming these problems.

4. If they agree, once this footage is finished and a summary provided, the user is allowed to move back though the system, and examine another difficulty if they wish.

3.2.6. Final Thoughts on Multimedia

To summarise, multimedia computer systems could be a very effective way of delivering an open learning programme to adult dyslexics, though certainly some level of human support will still be essential. Graphical user interfaces can make a system flexible, intuitive to control, transparent, and reduce the reliance on text. Graphic manipulation of text and the use of speech can greatly increase the ease of text processing. Graphics and videos can provide a rich, motivating and informative learning environment, that has more direct personal relevance to the

user. The interlinking of information resources allows for an exiting non linear environment perfect for exploitation.

In addition to this, it has been suggested that dyslexics have a talent for manipulating visual imagery. The increasing power and use of multimedia systems could unleash the potential of the millions of dyslexics world wide, so that their performance not only matches that of non-dyslexics, but exceeds it. This is an extremely optimistic view (only for dyslexics, I might add), and has yet to receive anything like a sufficient level of support from research to be generally accepted. However, the idea that dyslexics seem to show less impairment in learning via visual and multimedia resources has received such support. By teaching dyslexics through multimedia computer systems one is likely to be providing an environment that, if constructed properly, is better suited to their learning than the conventional classroom with conventional media, and thus gives them a better chance at success, or even excellence. However, in designing such a system one should be careful to pay close attention to the conclusions presented in Chapter 2. In particular, designers should bear in mind dyslexics problems with externally paced tasks, and use of symbols, as well as ensure that all learning is rendered as explicit as possible. More generally, dyslexics problems with working memory, and memory load should be considered at every step.

SECTION 2

Dyslexic Adults, Careers Guidance and a Multimedia Computer Assisted Careers Guidance System

In this section will be discussed the particular problems dyslexics face in finding and maintaining successful employment, and the implications this has for specialist careers advice for adult dyslexics. This leads to a discussion of computer assisted careers guidance (CACG), applying the ideas on specialist careers advice and multimedia for dyslexics presented earlier. The guidelines for a multimedia CACG system for dyslexic adults thus generated, along with ideas presented earlier in the thesis, form the basis for three subsequent studies. These are designed to establish the opinions of professionals in the fields of adult dyslexia, computing and employment, and dyslexics themselves as to the proposed system. The results of these three studies will be compared and discussed. The conclusions generated from this, in conjunction with ideas presented throughout the thesis, will be used to construct a detailed design and description of a multimedia CACG system for adult dyslexics.

4. Adults with Dyslexia and Careers Guidance

4.1. General Models of Careers Guidance

For the most part, dyslexics have the same requirements as anyone else in careers guidance: Someone to help them understand the decision making process and related issues, so they can locate and obtain a job in which they can gain satisfaction and success. There have been quite a few theories on how this can best be done. However, various people have attempted to construct models of the career guidance process that bring together the common factors within these theories, or are compatible with the majority of them. The general idea is to rationalise the process and break it down into small manageable chunks.

Gati, Shenhav and Givon, (1993) outline a series of stages for careers guidance designed to be compatible with most theories.

a. Defining or structuring the decision problem (e.g. selecting a career).

b. Selecting a set of aspects or criteria relevant to the decision (e.g. income or prestige).

c. Ranking or rating by importance the various aspects identified as relevant to the specific decision.

d. Explicating the individual's preferences regarding the various levels of those aspects identified as the more important .

e. Identifying occupational alternatives, the characteristics of which are compatible with the career decision maker' preferences.

f. Testing the feasibility of these alternatives.

g. Collecting relevant information on the few alternatives identified not only as compatible with preferences, but also as feasible.

h. Ranking alternatives from most to least preferred based on all the information.

i. Implementing the most preferred alternative.

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3. There is a need for skills specific to job selection, acquisition and retention to be assessed or taught.

4. There are personal, social and environmental factors which need to be explored as these can be a barrier to deciding on or pursuing a particular career.

From these common factors they construct a decision making model.

1. *Initial assessment.* Gather personal and employment information to arrive at career counselling goal that is motivating to the client.

2. *Self understanding.* Exploration of values, interests, experience and abilities that relate to the clients present goal, as well as personal and environmental barriers. This includes assessment of psychological issues that may affect career counselling.

3. *Making sense of self-understanding data.* Data from the self understanding stage is made into a coherent set of statements which indicate the clients desired outcomes for career choice. These will be used as reference points in later stages.

4. *Generating alternatives.* A list of possible alternatives is generated using the pervious data. At this stage no judgement as to the value of the options is made.

5. *Obtaining occupational information.* Enough information on each option must be examined to make an informed choice, which narrows the list of options.

6. *Making the choice.* The client chooses from the remaining options.

7. *Making plans to reach the career choice goal.* This also includes contingency plans for setbacks.

8. *Implementing plans.*

As with Gati's model above, the process is clarified and broken down into more manageable stages. However, especially when one takes into consideration the central factors outlined previously, it is clear that this model places far more

emphasis on the client's understanding. For example, even barriers to the actual guidance process are taken into account. Thus, for those suffering some confusion about their own strengths and weaknesses, or from affective difficulties such as low self esteem, this model is liable to be more appropriate, which is one of the reasons why McLoughlin, Fitzgibbon and Young (1994) use it as the basis of their suggestions on how to deliver careers advice to dyslexics. However, this will be discussed later in this chapter.

4.2. Gerber, Ginsberg and Reiff's Model of Alterable Factors in Employment Success and Adults with Dyslexia

Before going any deeper in to the matter of careers advice for dyslexics it is necessary to examine what characteristics predispose a dyslexic person to success in their chosen field. In the context of this thesis, the primary interest is in those factors that can genuinely be influenced by the dyslexic person or a careers guidance specialist, as opposed to things such as IQ. These factors have been termed alterable factors in employment success by Gerber, Ginsberg and Reiff (1992), in what is fast becoming a classic study in the field.

The authors conducted a large number of interviews with moderately successful, and highly successful people with learning disabilities, the vast majority of who would be classified as dyslexic in this country. They identified a number of alterable factors that tended to differentiate moderately and highly successful interviewees, from which they constructed a model (Gerber, Ginsberg and Reiff, 1992). They then went on to speculate on what can be done for dyslexics to improve their chances of success (Reiff, Gerber and Ginsberg, 1994, Gerber, Reiff and Ginsberg, 1996).

The central theme of this model is that the successful dyslexic person seeks and achieves greater control over their life, especially their working life. Taking control is defined as making conscious decisions to take charge of one's life, termed 'internal decisions', and consciously adapting and shaping oneself in order to move ahead, termed 'external manifestations'. The successful dyslexic has a

will to succeed, and the necessary understanding to take effective action to achieve that goal. In the words of the authors:

> 'The adult with learning disabilities must want to succeed, must set achievable goals, and must confront the learning disability so that appropriate measures may be taken to heighten the likelihood of success.' Gerber, Ginsberg and Reiff. 1992, p 478

In contrast to this, the moderate success group often only sought control to cover up their disabilities rather than to succeed. They were more likely to ascribe success to luck or fate, and were less certain of their future prospects, suggesting that they felt and asserted less control over their working lives.

All the factors within the two categories of internal decisions and external manifestations interact a great deal to increase the extent of control, as will become clear in the following analysis. However, it is internal decisions that form the first stage in the process.

4.2.1. *Internal Decisions*

- *Desire.* Put simply this is the desire to succeed or excel. The authors suggest that this is facilitated by a secure and safe environment, i.e. where there is 'goodness of fit' (see Section 4.2.2 below), and the individual has a favourable 'social ecology' (see Section 4.2.2 below). Good 'goal orientation' (see Section 4.2.2 below) also facilitates 'desire' by providing the dyslexic with a well defined and achievable rout to success They emphasise here that the client should be given as much encouragement as possible.

- *Goal orientation.* Successful dyslexics have a plan for success. Goal setting allows adults with learning disabilities to have realistic, achievable aspirations. Achieving goals is itself motivating and, thus tends to lead to achieving greater goals. The moderate success group tended to set more short term goals, and were more easily diverted from goals. The highly successful group tended to proceed by realistic, successive steps. 'Reframing' is necessary for this, as they are unlikely to identify appropriate goals if they do not have a full awareness of their abilities.

• *Reframing.* This involves the recognition, acceptance, and understanding of the disability by the dyslexic person, and the commitment to take action based upon this. This implies gaining knowledge of one's strengths and weaknesses, and identification by the dyslexic person of their personal learning style. The core idea is that the dyslexic person reconceptualises their disability from a negative interpretation to something more positive that they can actually work with to improve their position. As the authors say:

> 'A lack of reframing in the developmental process can keep individuals from deriving productive meaning and experience from their learning disabilities in adulthood.' Gerber, Reiff, and Ginsberg, 1996, p 98

Of all the factors leading to success the authors put the most emphasis on this one. They see it as the link mechanism between internal decisions and external manifestations, and as a trigger to the adaptation process (Gerber, Reiff, and Ginsberg, 1996). It is also the only variable that is absolutely specific to disabilities in the model. Action obviously requires the 'desire' to overcome the condition and good 'goal orientation'. As implied above the authors break this process down into four stages:

1. *Recognition.* People at this stage recognise they have a handicap, i.e. that there is a difference between them and others. To some extent this means seeing one's strengths and weaknesses. However, as yet they have failed to assimilate this information into their view of themselves, and are thus not in a position to do anything to improve their situation.

2. *Acceptance.* This is closely linked to recognition. The dyslexic person must learn to accept the negative and positive aspects of their disability. They must also accept that they have something to offer despite their disability.

3. *Understanding.* After accepting that they have a disability and have no choice but to work with it, the dyslexic person must gain as full a possible understanding of their own personal limitations and strengths, and how they can compensate for the former and build on the latter. They must discover their own best formula.

4. *Action.* The dyslexic person must then make the conscious decision to take action towards goals, putting that understanding to practice.

The moderate success group did not progress through all four stages to the same extent as the members of the high success group. They tended to have especial problems with acceptance, leaving understanding less than complete, and interfering with the undertaking of the decisive action. As a further consequence of lack of acceptance they also engaged in more blaming, avoidance and holding back than the highly successful group.

4.2.2. External Manifestations

- *Persistence.* This is 'desire' turned into action. The highly successful group were more driven, took many more risks, and appeared more resilient and less easily distracted from goals. The dyslexic person must be willing and able to do what is necessary for success, to work harder and longer than their non-dyslexic peers. In order to do this they must have an awareness of their condition, i.e. be well 'reframed'. If this is not the case their efforts are liable to be misdirected, leading to demotivating failure and an increased sense of lack of control. Appropriate 'goal orientation', 'goodness of fit' and favourable 'social ecologies' also facilitate the development of 'persistence'.

- *Goodness of fit.* To be successful the dyslexic must find working environments that are responsive to their learning styles, that maximise their strengths and minimise their weaknesses. Often the highly successful dyslexics chose to be their own boss for this reason. 'Goodness of fit' implies finding work they enjoy doing and gain satisfying rewards from. Thus, the dyslexic person must be sufficiently 'reframed' so that they understand their abilities and preferences, and have good 'goal orientation'.

- *Learned creativity.* The dyslexic person must develop a full personal repertoire of compensation strategies that make the best use of their abilities. This again relies on being sufficiently 'reframed'.

- *Social ecologies.* The dyslexic person must develop a network of supportive people who can facilitate their ability to achieve. This encompasses emotional support and support of self esteem, as well as more practical support. Often dyslexics receive the support of family members or a spouse, then again such support can be provided by work mates, superiors or even a counsellor. The highly successful dyslexics tended actively and pre-

emptively to seek out such support, whereas the moderately successful dyslexics were more likely to gain support only as a result of it being offered, and only when things had already gone awry. Having a good 'social ecology' does not imply a high degree of dependency, which would actively work against the individual gaining more personal control over their lives. Clearly successful 'reframing' is essential for a good 'social ecology'. The individual must have a clear idea of what sort of support they will need, and when, to identify who are the best people to approach, and explain to those people what they need.

4.2.3. The Interaction of Internal Decisions and External Manifestations

Figure 4 below succinctly outlines the complex interaction between the factors outlined above. Internal decisions are placed on a circle to represent the idea that there is no clear beginning point for the process, e.g. the setting of appropriate goals necessitates 'reframing' and could lead to an increased 'desire' to succeed by making it clear that success is possible, or successful 'reframing' could stimulate the 'desire' to succeed, and as a result facilitate better 'goal orientation'. The boundaries between these factors are far from sharp, indeed they overlap and interact to a great extent.

'External manifestations' arise from 'internal decisions'. However, development of effective 'external manifestations', i.e. effective adaptation, facilitates the whole internal decision process. Thus arrows connect these two boxes in both directions. 'External manifestations' themselves are all separate facets of adaptability, and are thus presented as a list with no particular order.

Engaging in the 'internal decision' process increases the individual's control over their disabilities and life in general. Implementation of 'external manifestations' also serves to increase this control. Likewise increased control is liable to lead to a greater level of successful adaptation.

Successful adaptation also leads directly to a higher degree of success, which in turn feeds back, positively reinforcing the 'external manifestations' and their further development, as well as strengthening 'internal decisions'. Thus, success is seen as cyclic, i.e. success breeds further success.

DEGREE OF SUCCESS

low   high

control

low   high

ADAPTABILITY

persistence
goodness of fit
learned creativity
social ecologies

desire

goal oriented   reframing

internal decisions   external manifestations
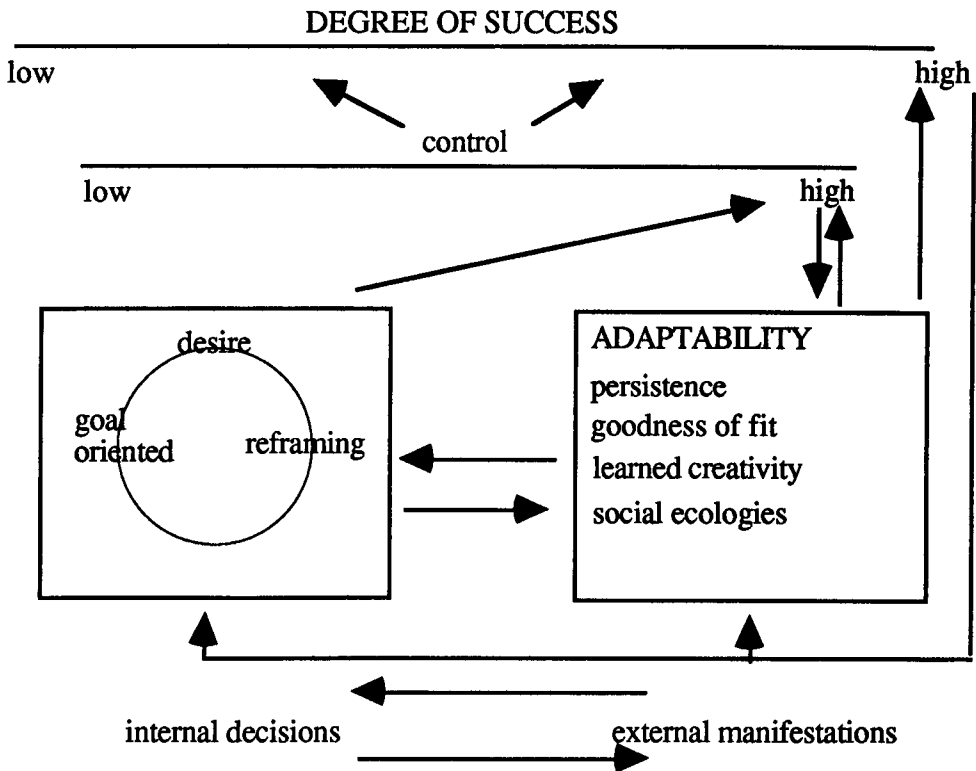
fig 4.   **A model of vocational success for adults with learning disabilities (from Gerber, Ginsberg and Reiff 1992)**

However, it is important to remember that none of this can guarantee success; at best it can only provide the best possible conditions for success. Chance events, bad luck, can intervene.

By making explicit the complex interaction between the individual, with their understanding and desires, and their environment, this model provides an excellent basis for guidance explicitly geared to the specific individual. By emphasising the vital importance of control in achieving employment success, Gerber, Ginsberg and Reiff (1992) provide strong support for the handing over of control of the guidance process to the client, along with the responsibility for accompanying decisions. Finally, from my own personal view as an adult with dyslexia I must say that the model presented above rings true.

4.2.4. Some Supporting Research for Gerber, Ginsberg and Reiff's (1992) model

Spekman, Goldberg and Herman (1992) have also looked into factors relating to success for young adults with learning disabilities. Their findings bear many points of correspondence with those of Gerber, Ginsberg and Reiff. This study makes an especially interesting comparison as much of the data, and the vast majority that will be outlined here, was obtained via interviews as with Gerber, Ginsberg and Reiff (1992). However, many of Spekman et al's findings received additional support from other sources, such as case records, a parent rating scale, and cognitive and academic screening.

Basic common themes across all Spekman et al's (1992) participants provide support for conclusions that have been arrived at in previous chapters.

1. *Learning disability is an ongoing condition.* A dyslexic person does not recover from their disability with treatment or time. Some manage to compensate for their disability to the extent that it no longer appears to have any overt influence. However, the dyslexic person can never expect to perform specific tasks with the same efficiency, or in the same manner as a non-dyslexic person. It is likely that they will never be entirely free of any secondary effects of their condition, as these make a profound contribution to the development of the individual's self-image.

2. *Learning disabled individuals face additional life stressors.* Along with the stress caused by dyslexia, dyslexics suffer from all the other stressors that effect people. Many of the young adults in this study had experienced dysfunctional families, divorce, or the incarceration or death of a parent. Clearly, along with the stress of dyslexia these contribute to an overall greater level of stress for dyslexics.

3. *Learning disabled individuals tend to be late-bloomers.* Prolonged periods in school, low paying jobs or unemployment tended to prolong dependency on the family. In addition, few of the young adult dyslexics questioned were in steady relationships or married. This delayed maturation may also be caused by secondary factors, such as low self confidence or low belief in one's capacity to control and deal with life events. They may attempt to distance themselves from others to avoid being identified as dyslexic, or to reduce

their chance of being exposed to potential social failure. As a result they may miss out on the opportunity to develop valuable social skills.

Three themes differentiate successful members of the learning disabled group from the unsuccessful members. For successful young adult dyslexics the three worked together to keep them going and allow them to reach their full potential. This is reminiscent of one of the major features of Gerber et al's model; the complex and intimate interaction of its components. As is the idea that successful young adult dyslexics tend to take more control of events and their disability, which appears throughout the following themes. An ongoing comparison with Gerber et al's model will be provided as Spekman et al's findings are outlined

1. *Successful young adults exhibited a realistic adaptation to life events.* This can be broken down into four components.

   a. *They had a high level of self-awareness and acceptance of their learning disability.* Though appreciating that they had a disability, they considered it as only one aspect of their identity. They had a good understanding of their capacities and used this understanding to help construct a more manageable environment and set appropriate goals. This closely resembles high levels of 'reframing' in Gerber et al's model. Successful dyslexics take action based upon a well developed acceptance and understanding of their condition. Using Gerber et al's terminology, this action manifests as 'learned creativity' that helps to ensure 'goodness of fit'. Effective 'goal orientation' is also inferred. Unsuccessful young adults were more likely to deny the influence of their difficulties. Consequently they often failed to see that solutions to their problems were possible. Denial was often at such a level that these young adults actively avoided any specialist help or association with anyone else with learning disabilities. Skinner and Schenck (1992) also support this finding. In other words they had failed to 'reframe' effectively, and this interfered with the development of a helpful 'social ecology'.

   b. *They were proactive.* Successful young adults took an active part in the world around them, and believed that they had power to establish control over their own destiny. Again this infers that the successful young adults had progressed well into the action stage of 'reframing',

leading to a higher sense of personal control. Unsuccessful young adults tended merely to respond to events, having little confidence in their ability to control and guide events themselves.

c. *They had high levels of perseverance.* Successful young adults accepted difficult situations, and were willing to work to alleviate them. 'Persistence' in Gerber et al's model expresses almost exactly the same idea. Unsuccessful young adults tended to be overpowered by problems and thus give up more easily. They also tended to blame their failure on sources other than themselves. Again this suggests a belief in their lack of control over their own lives.

d. *They demonstrated considerable emotional stability and the ability to reduce stress.* They were socially active, positive and had developed good coping strategies. This has less correspondence with Gerber et al's model than previous points. However, it does suggest good 'reframing' and high levels of 'learned creativity'. Many unsuccessful young adults were unable to reduce stress and as a result experienced high levels of anxiety. This may be connected to low self-esteem as, according to Salomone (1993), self-esteem protects individuals from unmanageable anxiety.

2. *Successful young adults were characterised by appropriate goal setting and self-directedness.* They recognised the importance of planning and understood the importance of a rational step by step approach to achieving goals. The goals they set were reasonable, attainable, and motivating. Clearly this closely resembles Gerber et al's idea of effective 'goal orientation'. Unsuccessful young adults tended to have few goals and lacked a sense of direction. Where they did have goals these tended to be poorly examined and unrealistic.

3. *Successful young adults tended to have access to effective support systems and use them.* Support, encouragement and guidance often came from families, but in cases where this was not available they had often gained it through 'mentoring' relationships with significant others such as teachers, therapist, tutors, friends or employers. They also actively sought this support. This seems to resemble closely Gerber et al's concept of good 'social ecologies'.

Thus, the issues emphasised by Spekman et al (1992) and Gerber, Ginsberg and Reiff (1992) are very similar. Both theories complement and support each other excellently, though Gerber et al's model seems more detailed and complete.

Work by Wehmeyer (1993, 1992) also lends support to the above theories. He suggests that taking control over one's destiny is vital for success for people with learning disabilities. Internal locus of control is associated with greater achievement, better judgement and greater sensitivity to environmental cues (Wehmeyer, 1993). However, people with learning disabilities tended not to display the characteristics associated with taking control. They wanted other jobs, and knew what they required, but were waiting for someone else to find the job for them (Wehmeyer 1992). They also tended to make others make decisions for them, avoid responsibility for the results, and often relied on luck to provide solutions and make decisions rather than their own reasoning and understanding. This is not an irreversible situation, as it can be alleviated through training and guidance, in Wehmeyer's (1993) own words:

> 'Students are not allowed the opportunities to learn the skills and abilities necessary to take control in choices and decisions which impact their lives.' p137

4.3. Career Guidance for Adult dyslexics

All that remains is for us to pull together the threads presented above, to arrive at some understanding of the best practices for careers advisers when working with dyslexics. It is vital to remember that we must include ideas from personal counselling, as this cannot be separated from careers counselling (see section 4.1). As personal counselling issues are implicit in the ideas on success, the above is also necessitated by integrating these.

4.3.1. Suggestions based on Gerber, Ginsberg and Reiff (1992)

Reiff, Gerber and Ginsberg (1994) outlined a number of instructional strategies for long term success based on the model developed by Gerber, Ginsberg and Reiff (1992). The authors provide suggestions associated with each of their alterable

factors in success. These suggestions are mostly geared towards trainers. However, they can be applied to the counselling process.

- *Desire.* Higher level motives develop only after more basic needs have been met. This applies to life circumstances in general. However, for the most part these are outside the realm of the adviser or trainer. Thus, the authors concentrate on the training or counselling environment. They emphasise that attention must be paid to basic psychological needs and dealing with psychological difficulties, i.e. one must create an environment where the client can feel safe. Care must be taken not to demotivate the client, but encourage them to move forward despite their difficulties. Thus, mistakes and misconceptions should not be punished but reconceptualised as opportunities to learn. They suggest that in dealing with such circumstances the trainer or adviser should always begin with encouragement and positive support, then give constructive help, and end with positive optimistic statements. The client is not left with a sense of failure, but hopefully a desire to move forward and clear up difficulties. To this effect the authors also suggest that rewards should be given for effort rather than results.

They further suggest that exposure to role models may help develop a passion in the client to be successful. In Reiff et al's (1994) own words:

> 'Teachers should consider inviting successful adults with learning disabilities and dyslexia in the community. They can help students develop a realistic appreciation of what it takes to succeed, and of where the possibilities of success lie' p 276

- *Goal Orientation.* The authors suggest that clients should be encouraged to progress with small realistic steps, and specific objectives, that can be attained and mastered. The positive motivational results of attaining goals and mastering tasks could well encourage the client towards further achievement. Exploration and risk taking should be encouraged, as the client is unlikely to improve their circumstances if they cannot break out of the constraints of their familiar and safe patterns of behaviour, or decision making. Under these circumstances the client can be expected to make errors or inappropriate judgements. The authors advise that these should be tolerated as much as possible so as not to demotivate the client more than necessary.

- *Reframing.* As with 'desire' this is facilitated by the construction of an environment that meets basic psychological needs. The teacher or adviser should then find ways of fostering a constructive dialogue with the client to facilitate self understanding, especially understanding of the client's disability. The authors again stress the value of support groups, and contact with other dyslexics. Hearing about other people's experiences may provide the individual with insight into their own capacities, and how to make the best of these. In Reiff et al's (1994) own words:

  > 'Support groups for students with learning disabilities provide an excellent forum to facilitate the reframing process. Younger students listen to older ones explain how they have learned about their strengths and weaknesses and the consequent plans they have developed. Students also share the emotional side of competing- the frustration, the anger, the fear- and they realise that they are not alone. This is sometimes the discovery that sparks recognition and acceptance'. p278-279

- *Persistence.* The authors point out that people who set goals that focus on personal improvement, rather than favourable external judgements of performance, tend to be more persistent in the pursuit of those goals. The client should thus be encouraged to do this. Complete records of past work should be maintained so that there is evidence of progress, and evidence that persistence pays off. Persistence itself should be rewarded, regardless of outcome.

- *Goodness of fit.* In many ways ensuring goodness of fit is the main goal of the careers adviser, as this involves helping the client find an occupation that will provide the best opportunity for them to excel and gain satisfaction. This process is clearly deeply related to 'reframing'.

  > '...it is vital for students to build an awareness of career avenues that maximise their strengths and minimise their weaknesses. Equally important, students must discover their likes and dislikes, for one of the crucial elements of goodness of fit for the successful adults in the study was that they liked or even loved their work.' Reiff et al, 1994, p 281

Thus, anything that facilitates the 'reframing' process, and allows for the opening of a constructive dialogue, will assist in the achievement of 'goodness of fit'. It is also important for the adviser or teacher to modify their methods and the environment to suit the client's personal style.

- *Learned Creativity.* Once again, facilitating reframing is vital for this. 'Learned creativity' can also be encouraged by giving the client room to experiment and discover their own best strategies, and by creating an environment where the client feels safe enough to take risks and explore. One may even want to encourage novel and unusual ways of responding. As with 'reframing'. support groups and contact with other dyslexics may be very helpful, allowing the client to find out what works for other people in a similar position to them.

- *Social ecologies.* Being an adviser or teacher gives one the perfect opportunity to provide the sort of social support that is inferred here. The adviser or teacher should be prepared to do this. The authors stress that the ability and desire on the part of the client to avoid becoming psychologically overly dependent is vital. The client should be encouraged to develop self responsibility and self advocacy. Thus, it is advisable to hand as much control of learning or advisory process over to the client as possible.

  Another way in which the adviser or teacher can assist in the development of 'social ecologies' is by providing the client with 'ammunition' against the negative words and attitudes, and misconceptions that dyslexics often encounter. This involves the ability to reinterpret negative messages into positive ones, and familiarisation with the type of negative messages one is likely to confront.

  Of course, positive 'social ecologies' are also afforded by support groups, and other contact with dyslexics.

Taken together, the above form a set of suggestions on how an adviser or teacher can facilitate the understanding, use, and internalisation of control. The authors point out that control in a great part evolves from the ability to predict and anticipate events, and that dyslexics tend to be deficient at tasks involving these skills. Thus, it is a good idea for the adviser or teacher to use methods that stimulate the development of these skills, for example, 'what if?' role playing or simulations, or training in planning. Indeed, anything that increases understanding of cause and effect relationship could be useful in this.

Finally, it should be noted that Reiff et al (1994) seem to emphasise three ideas over and over again in their suggestions. Firstly, the client should be provided

with a safe and motivating environment, i.e. it should be positive and encouraging, concentrating on what people can do rather than what they cannot, it should stimulate experimentation and exploration, be tolerant of errors and failures, and tuned specifically to the client's needs and capacities. The implication from Brachacki, Fawcett and Nicolson (1995, see Section 2.3) that dyslexics would benefit from being allowed to set their own pace, and retrieve information that has been removed, also goes some way to supporting this idea. Secondly, maximum effort should be made to facilitate the reframing process, i.e. to increase the client's recognition, acceptance and understanding of their own difficulties and strengths, as well as their wants and needs. Thirdly, great benefits can be gained from contact with other dyslexics, or even exposure to suggestions and accounts of experiences provided by other dyslexics, for example, through text or even video resources.

4.3.2. Suggestions from McLoughlin, Fitzgibbon and Young (1994)

'Adult Dyslexia: Assessment, Counselling and Training' by McLoughlin, Fitzgibbon and Young (1994) is one of the few substantial works that is specifically dedicated to the practical implications of dyslexia in adults and employment. What's more, all three of the authors are well regarded practitioners that work every day with adult dyslexics, providing careers guidance, counselling, assessment, advocacy, training and employment support. Thus, these authors are not only well acquainted with the theoretical issues and concepts, but have an extensive first hand knowledge of the practical business of providing support. For the purposes of this thesis, and the purposes of others dealing with dyslexia in adults and employment, this seems a perfect combination. Much of what McLoughlin et al (1994) have to say sits well with the ideas of Gerber et al (1992) and Reiff et al (1994), though they are approaching the subject from different angles. Thus, where it is helpful, the correspondences will be indicated, even using the ideas of the latter authors to enlarge upon those of the former.

Though McLoughlin et al (1994) point out that for the most part adult dyslexics are the same as their non-disabled peers, they do stress that a number of additional issues should be borne in mind when offering them careers guidance and counselling.

- Affective problems such as low self esteem and lack of confidence are more common and more significant for dyslexics. The authors are at pains to stress the great effect such secondary factors have on performance and satisfaction. Regularly these are given equal status to primary difficulties such as literacy, often greater status.

- Dyslexics typically suffer from problems with working memory that can affect their performance on certain aspects of work, for instance general organisation, following instructions, and maintaining sustained attention despite distractions. Though strategies can be used to compensate for this, more often than not, it cannot be fully remediated.

- Dyslexics often avoid, or focus on, certain occupations as a result of an incomplete or unrealistic appraisal of their own capabilities, and the influence their dyslexia will have in particular jobs. In these cases the adviser must assist the client to develop the skills and understanding necessary for a realistic and full appraisal. Clearly, facilitating the 'reframing' process is deeply implicated in this.

- Following on from the last point, the authors suggest that the counsellor should take a positive approach, and avoid reinforcing the idea that there are a great many jobs that the client automatically should, or should not, consider. Instead the adviser should concentrate on the development of strategies that make the best of the clients abilitie's, and thus widen the number of occupations they will be able to cope with. This is reminiscent of Reiff et al's (1994) idea that the client should be provided with a motivating environment that concentrates on what they can do rather than what they cannot, and the facilitation of 'learned creativity'.

- Often the client with dyslexia would benefit from retraining, remediation, or some other form of additional education. When considering this it is vital to bear in mind that the client expectations and impressions are likely to be highly coloured by negative educational experience. Thus, great care should be taken in assessing the appropriateness of courses to the client's personal style and prejudices, as well as in preparing and encouraging the client.

The above represent some general points to be borne in mind by the adviser or counsellor when helping a person with dyslexia find an appropriate career.

McLoughlin et al (1994) go on to apply Yost and Corbichley's model of careers advice (1987, cited in McLoughlin, Fitzgibbon and Young, 1994, see section 4.1) to dyslexics, providing a more systematic set of suggestions.

1. *Initial assessment.* Gathering personal and employment information. This can be very helpful in facilitating the process of self-understanding, or as Gerber et al (1992) might say 'reframing', and should be geared towards the formation of an appropriate counselling goal. A positive and constructive approach should be taken towards the client and the problems they have, i.e. emphasising what they can do rather than what they can't.

    The authors point out that special care should be taken in selecting any test or assessment instrument to be used. There is little point in using instruments that rely heavily on skills that the person is liable to be deficient in, for example instruments that require extensive written responses, or strictly timed responses. Such ability or aptitude tests are only liable to emphasise the disability, rather than provide reliable and helpful information about the client. The dyslexia will also tend to distort the results. A similar point is made by Hursh (1989), to quote:

    > 'Many tests rely heavily on academic skills, have inappropriate norm groups, and administration procedures that fail to consider the individual/s cognitive, perceptual, or motor deficits.' p 206

    As the client is likely to have already undergone a formal diagnostic procedure, there is little point in administering instruments that restate the diagnosis, especially when those instruments are not suited to this purpose. During this stage the adviser should consider how the client's disabilities have effected their confidence and self esteem. These factors will effect the results of both informal and formal assessments.

2. *Self understanding.* Efforts should be made to assist the client in gaining a greater understanding of their condition, how it affects them, and how it relates to employment goals. Though McLoughlin et al (1994) do not use the word 'reframing' here themselves, what they do say corresponds very well with Gerber et al's (1992) concept. Without this the client is unlikely to form a realistic understanding of what it will take to achieve their goal, or gain the strategies and confidence necessary to pursue it.

3. *Making sense of self-understanding data.* All the information is used to generate a number of statements or goals that can be used as reference points in later stages. In other words, the data is used to facilitate effective 'goal orientation'. In further reference to Gerber et al's (1992) model, this may also stimulate 'desire' and 'persistence' by rendering explicit what the client wants and what they can do. Thus, listing possible difficulties, along with what the client must do to overcome these, is particularly helpful.

4. *Generating alternatives.* All the data acquired so far is used to generate a list of possible occupational alternatives. Barring any differences in the data or goals, there is no difference in this stage between people with and without dyslexia. Following on from Reiff et al (1994), this can provide a good opportunity to encourage the client to generate imaginative, or even risky, alternatives, as this list is meant to be compiled without making any judgements as to the value of the options. That stage comes next.

5. *Obtaining occupational information.* Enough information is acquired on each occupational alternative for the client to apply the information they have obtained at previous stages of the counselling process. Through this they narrow the list of alternatives down to those that are achievable and desirable. Again this process is mostly the same for those with dyslexia and those without. The authors do suggest here that special consideration should be taken of the nature of any qualifications and training the client must gain. They emphasise the value of courses that set a series of short term goals. These are generally more manageable, and allow the client a more immediate experience of success. Kline (1991, see Section 3.1) also emphasises the importance of immediate experience of success for dyslexics; and as Gerber et al (1992) point out, success tends to breed success.

6. *Making the choice.* The client chooses from the remaining options. If the stages above have been properly completed all the remaining options will be viable. Thus, this choice need not be arrived at through any clear formal or rational processes. However, it is probably wise to encourage this. There is no real difference in this stage between a client with dyslexia and one without.

7. *Making plans to reach the career choice goal.* Plans should be as realistic and detailed as possible, as having a clear and achievable route to success is liable to increase the client's 'persistence', according to Gerber et al (1992). This effect can also be stimulated by breaking the plan down into small manageable chunks or sub goals. As suggested above, this prevents the client from becoming daunted by the task ahead, and allows for a more immediate experience of success and a sense of achievement. In addition to the above the whole process of planning and setting sub goals could help teach the client how to establish effective 'goal orientation'.

One important consideration is what happens if the client fails at one particular stage. For a person with dyslexia failure can be a particularly difficult experience, especially after such efforts have been made to avoid it. It is liable to reinforce the belief, inherent in many dyslexics, that they have very little control over their lives. Probably as a consequence of this they have a tendency to give up more easily when confronted with failure (see Spekman et al 1992 above). Thus, special care must be taken to make contingency plans for situations where a chance of failure can be anticipated, or where failure could completely disrupt the plan, for example examination results. Consideration should also be given to alternative routes to the final career goal. It may also be wise for the counsellor to reassure the client that if problems do arise they will be available for ongoing support and advice, assisting the client to develop some sort of 'social ecology'.

8. *Implementing plans.* McLoughlin et al (1994) make a number of suggestions as to what this could involve.

- *Further education or training.* As mentioned above, proper consideration should be given to the structure of any course to be taken. Preferably it should have clear sub goals, and as many dyslexics have problems with exam conditions, it may be better to select a course that emphasises continuous assessment. They may need to develop their learning skills, literacy and compensation strategies, so basic skills courses should be considered.

- *Starting a job search.* The client may need some training and guidance on the basic skills involved. These include how to gain access to, and

use the relevant resources, such as newspapers and jobcentres, as well as making telephone calls and exploratory enquires.

- *Learning to deal with interviews.* Many dyslexics have special difficulties with job interviews, they can find it very difficult to deal with the stress, relate to the interviewer, and put their point across (due to problems with social interaction, see Section 1.6). Teaching relaxation techniques, and using role plays may be useful for this. One should also consider whether it is better for the client to tell potential employers about their dyslexia or not. If the client decides to tell they must be able to put across a clear explanation of their condition, to dispel any misunderstandings, and learn to frame their explanation in as positive terms as possible.

- *Preparing application letters and CVs.* Clearly this could involve some training in how to express oneself effectively on paper. Again simulations could be helpful, as well as discussion and analysis of common questions.

- *Developing complementary skills.* For example the ability to use a work processor and touch type would be very helpful to many dyslexics.

- *Confidence Building.* The authors suggest providing positive feedback on strengths, as well as the use of role playing techniques to familiarise the client with situations that could potentially damage their confidence. However, from Reiff et al (1994) above, one could suggest contact with people suffering from similar difficulties who have nevertheless obtained success may be helpful in reassuring the client that they are capable.

Almost all the above would be good practice when administering careers advice to anyone. Apart from the fact that one must investigate the implications of dyslexia with the client, the majority of the practices specially included for dyslexics consist of putting additional emphasis on particular components. Thus, there seems to be a greater emphasis on increasing the self understanding of the client and dealing with affective problems, as well as on careful planning and goal setting, and the possibility and nature of further education. This is not too surprising, after all

Gerber et al (1992) similarly maintain that the only component of their model that is absolutely specific to dyslexics is the understanding the person has of their condition and its implications, i.e. 'reframing'.

McLoughlin et al (1994) also examine the issue of more general counselling for dyslexics. As said above, personal counselling should not be separated from careers counselling. They emphasis that unconditional positive regard (Rogers, 1951) should underlie all counselling, i.e. the counsellor should show "....complete and unqualified acceptance for the client's feelings and actions" (McLoughlin et al, 1994, p47). However, they also suggest that it may be particularly appropriate to encourage the client to clarify, and question their thinking and beliefs, with a view to discovering any distortions that may have arisen. Through this the client can gain a more realistic view of their circumstances, and accordingly make more appropriate and effective changes.

The authors further suggest two primary factors affecting the way dyslexics come to terms with their difficulties. The first factor is the level of conscious awareness the individual has of their difficulties. This is an essential precursor to the second factor, the level of development of conscious compensation strategies. These allow one to assert conscious control over difficulties. Dyslexics that show low levels of both can live in an 'ignorance is bliss' state. However, they are considerably more vulnerable to unforeseen changes in their circumstances, as they have no effective way of examining, adapting, and fine tuning their compensation strategies to cater for this. Such individuals are also less able to pre-empt problems. Consequently, they may be unable to establish an effective level of control in novel situations. These ideas are highly reminiscent of what Gerber et al (1992) have to say on the subject of 'reframing', and 'external manifestations' or 'adaptation', and the relation between the two.

Combining the factors of awareness and compensation McLoughlin et al (1994) develop a four level typology of dyslexics, and provide suggestions as to what skills the counsellor will require for people at each of the levels. It is well worth bearing in mind Gerber et al's (1994) four levels of 'reframing', i.e. 'recognition', 'acceptance', 'understanding', and 'action' (see Section 4.2.1 above).

- *Level 1.* Such people are unaware they have any special difficulties compared to others, and learned to live with their problems. They have made no effort at conscious compensation. In other words they have made little or

no progress into the first, 'recognition', level of 'reframing'. They often have hidden and undeveloped talents, that have remained so because the person has never been intellectually or academically stretched. For instance, many have been restricted to inappropriate low intelligence classes in school. Thus, their performance may not represent their true potential. People at level 1 will not usually seek help. However, changes in life circumstances can bring the condition to the fore, and lead them to do so, often at the suggestion of others. For people at this level, counsellors require skills in general counselling, and a more specific knowledge of dyslexia and its implications, so they can help the client clear up misconceptions, understand their condition, and deal with any ongoing affective problems. Thus, they facilitate the client's 'recognition' and 'acceptance'. Clearly, a formal assessment may be necessary and helpful here, and training should be considered.

- *Level 2*. These people realise they have a specific weakness but have not developed any conscious compensation strategies. Some are not aware that their problems are caused by dyslexia. They have learned to live with their limitations, often with bad feeling. Many people at this level have been recently diagnosed. They are liable to feel a great deal of relief and happiness at eventually having an explanation for their difficulties other than stupidity and laziness. However, this is often accompanied by strong feelings of anger and frustration, as a result of the conception that they have not allowed to develop to their full potential due to the misjudgement and misunderstanding of others. Thus, people at level 2 have gone through the 'recognition' stage of 'reframing', but need help in achieving full 'acceptance' and sufficient 'understanding' to compensate for their symptoms, which they often find very distressing. They will generally be more inward looking than those at level 1, full of doubts and questions. The counsellor must be able to help the client express and deal with all the negative emotional responses, and achieve a more positive and constructive approach to their situation. Investigating the nature and implications of the symptoms is clearly very useful in this.

- *Level 3*. Such people understand they have a specific weakness, but have as yet only developed unconscious compensation strategies. Thus, so far they have not achieved a sufficient level of control. In terms of Gerber et al

(1992) these people have been through the 'recognition' and 'acceptance' stages but have yet to progress sufficiently into the 'understanding' stage to take effective conscious action. Many have developed competence in a range of tasks. However, because of this people can tend to expect them to be competent at other less familiar tasks that they have not developed a strategy for. As they are not conscious of their compensation strategies they are unable to generalise them to new tasks, and accordingly fail to perform well under these circumstances. They often fear change due to this, and as a result avoid novel situations and greater responsibility. Clearly, this can hold them back. As people at this stage are not aware of their compensation strategies, these can often become misdirected towards merely covering up their dyslexia, rather than maximising their potential. Again general counselling skills will be required by the counsellor. A knowledge of dyslexia, with the skills to use this to assist the client to increase their awareness and understanding of their own symptoms is also required. However, more specific to this level, the counsellor must be able to help the client to learn to deal with other peoples perceptions and expectations of them, and the negative emotional effects these may have.

- *Level 4.* These people have developed full awareness of their condition and full compensation strategies. Thus, they have successfully completed the 'understanding' stage and are now progressing through the 'action' stage. They are in the process of taking effective conscious control. As one might expect from this description these people are generally getting by satisfactorily. The counsellor may have to help them deal with residual secondary symptoms. People at this stage may also need help in fine tuning strategies, and fully clarifying their understanding of their cognitive functions to facilitate generalisation of strategies.

Despite the differences in approach advised for people in different stages, two themes remain consistent throughout the levels. Firstly, the counsellor must be able to help the client cope with a full range of negative affective problems that develop as secondary symptoms of dyslexia. Secondly, the counsellor must be able to help the client to understand the exact nature and implications of their symptoms, as well as facilitate the development of conscious compensation strategies from this understanding.

Finally, one general point that McLoughlin et al (1994) make very strongly several times is that if one is going to diagnose someone as a person with dyslexia it is completely unacceptable to offer no assistance in helping them come to terms with this information, and no support in dealing with the implications. In the authors' own words:

> 'A diagnosis of dyslexia without further support, or given out of the context of the client's awareness and understanding so that they do not realise that they can move to a stage of greater competence, is as serious as giving someone a medical diagnosis without offering treatment.' p56

It is very encouraging to see that McLoughlin et al (1994) agree so whole heartedly with the opinion that underlies this thesis.

5. Computer Assisted Careers Guidance Systems and Adults With Dyslexia

The previous chapter examined the work of several authors who have studied the application of careers guidance to dyslexics, as well as what factors dispose dyslexics to success. In this chapter this information, as well as information from Section 1 of this thesis, will be applied to computer assisted careers guidance (CACG) systems. The objective is to arrive at a number of suggestions on how best to construct such a system specifically for dyslexics, and examine the implications to dyslexics of the design of such systems. In order to provide some context for this discussion, the history and development of CACG up to the present day will first be outlined.

5.1. History and Development of Computer Assisted Careers Guidance systems

Developed in the mid 1960's, the first CACG systems ran on large mainframe time sharing computers. These were the only machines available at the time with sufficient speed and memory capacity to handle the large amount of data processing and storage necessary. Initially systems were designed to take the load off careers advisers by performing the more mundane tasks such as administering self assessments, and subsequent generation of potential occupational alternatives. This was particularly helpful in America as the demand for careers guidance far outstripped availability (Sampson, 1996a).

However, before long a number of theorists began to see the potential of CACG as a method of operationalising theories of career guidance, and actively altering the way careers guidance was delivered. Watts (1986) stresses how integration of a computer assisted careers guidance system makes it necessary for approaches to careers guidance and assumptions of careers counsellors to be rendered explicit, allowing for a true evaluation of approaches. Thus, the system can act as an 'agent for change' in organisations offering guidance. Along with improvements in software and hardware, this resulted in the development of comprehensive systems using on-line dialogue to interact with the user directly, rather than batch processing of optically scanned forms that had been used in many previous

systems. This had the great disadvantage of separating the user from the careers guidance process, and delaying the delivery of results. The new systems developed in the late 60's and early 70's also tended to incorporate a wider range of components, such as a greater variety of assessments, or even parts to assist in decision making. These systems form the basis for the modern CACG.

The next stage came with the development of the microcomputer in the early 80's. These machines, though at the time of fairly limited capacity, had the advantage of being relatively cheap, fast and simple to use. Thus, systems could now be more widely disseminated, and the counsellor could to take far greater control over operation and administration. As the decade went on the capacity of microcomputers increased, to the extent that it was no longer necessary to size down programs converted from mainframe machines. Another result of this has been a general increase in the amount and richness of information systems can offer. Almost all modern CACG systems now run on microcomputers.

Improvements in technology have also made it feasible to construct computer assisted careers guidance systems that incorporate multimedia techniques. Though these are far from widely available a number of researchers have developed such systems (e.g. 'ACT College Search' Harris-Bowlsbey, 1992 and 'Knowledge for Youth About Careers', Bradshaw 1991). As Sampson (1994) points out these could be especially helpful to people with low literacy, a conclusion that is strongly supported above in this thesis (see Section 3.2). He emphasises such systems capacity to enhance learning and understanding, and neatly sums this up with a quote from Bloch, McKinlay and Thomas (1989)

> Technology properly utilised optimises multi-sensory input, fosters affective projection, stimulates creative visualization, and enhances the development of the decision making process (p4)

In Britain there has been considerably less development and use of CACG than in the USA. Work by Watts (1986) concludes that the most common systems in use in this country are CASCAID and JIIG-CAL for schools, and DOORS for the general public. None of these systems is as advanced or comprehensive as those widely available in the USA. Watts and Ballantine (1983) suggests several probable reasons for this. Firstly, there has been far less willingness to fund the development of systems, indeed the DOORS system was scaled down during development due to cuts in spending, and the considerably more adventurous ICGS has seen virtually no development or use since its inception in 1974.

Secondly, much of the development in this country has been done on a part time basis by people with other commitments, which sharply contrasts with the dedicated development teams in the USA. Finally, Watts suggests that there has generally been some scepticism in this country as to the value of these systems, especially in terms of their general validity. Though this work is over ten years old little appears to have changed in the intervening time.

To conclude, computer assisted careers guidance systems have been steadily developing for over thirty years, and in that time have established themselves as useful tools in the careers guidance process. New technologies hold the promise of further enhancing their capabilities and usefulness, so there is plenty of room for more development. However, in Britain the potential of computer assisted careers guidance systems has not been fully realised. If one were to be optimistic one could say that there is a great deal of potential for improvement, a potential that the system proposed in this thesis could fulfil.

5.2. Construction

Harris-Bowlsbey (1990) defines modern CACG systems as:

> on-line systems whose purpose is to engage the user in interactive material that either teaches and monitors a career planning process, or at least provides data to be used by the individual in educational and vocational decision making (p 11)

Similarly Sampson (1996a) defines CACG as:

> a system of interrelated assessment, generation of alternatives, and information dissemination subsystems, often coupled with counselling interventions and various print and media-based support resources, that are used within an organisation to assist individuals in making current career decisions, as well as improving their capacity to make effective career decisions in the future (p 4)

This second definition emphasises the importance of other components, such as other resources, and counsellors, in the careers guidance process. CACG systems form only one part of the careers advice process, and will be used to their full potential only if properly integrated into the whole process. As is clear from the above definitions, CACG systems must contain some common core elements. However, there is considerable variation in their methods of operation, as well as

in what additional elements are included in the system. Sampson (1996a) outlines the core elements as:

1. self assessment related to psychological constructs, and/or labour market information constructs.

2. generation of occupational alternatives based on self assessment results.

3. dissemination of occupational and/or educational alternatives.

Each of these core elements will be discussed in later sections. For much of this it makes little difference whether the user has dyslexia or not. However, where appropriate the following will include observations and suggestions, and draw conclusions based on previous chapters.

5.2.1. A Simple Approach Verses a More Complex, Adaptive Approach

In the following discussion of the above mentioned core elements, simple and more complex approaches to CACG will be contrasted. There will also be an examination of the appropriateness of the resulting systems to dyslexic users.

CACG systems display wide variation in terms of their complexity. Simple systems have the advantages of being small, cheap and generally simple and quick to use. However, due to the very limited ways they can process information, such systems are liable to be inflexible and prescriptive, giving the user little influence over the basic processes. This is likely to encourage the user to adopt an unhelpful, passive learning style. Fairly low input from the user also means that simpler systems must also rely more heavily on the validity of the judgements of experts used in the construction of the system. This can create problems, especially for dyslexics. However, the full discussion of why this is the case will be left until Section 5.2.3.1., where it is more pertinent.

More complex systems can be made more flexible and adaptive, allowing the user more freedom and influence. Thus, such systems tend to be far more learner centred, operating more in line with the principles of 'open learning'. This could be particularly beneficial to dyslexics (see Section 3.1) Greater user control of

processes reduces the reliance on expert judgements implicit in the system, by making it easier for the user to examine and question these.

Whereas the simpler systems mentioned above just provide the user with suggestions, more complex, learner centred systems have a potential to teach the life long skills necessary for coming to a careers decision. Thus, net benefits can be far greater. However, complexity tends to breed more complexity. Such systems tend to be large, and difficult and expensive to produce, as well as more complex and time consuming to use. Thus, to some extent there is a trade off between complexity and simplicity.

Finally, another issue that crops up throughout the discussion below is that in the field of CACG there are many basic points where there is no clear agreement between experts (Katz and Shatkin 1983, Sampson 1996b). This can cause great difficulties as there are no clear guidelines as to best practice, or even what information is important and how exactly it should be processed. As a result the validity of any particular system or approach is far from clear. In many cases this uncertainty is due to a lack of research. In the words of Lenz, Reardon and Sampson (1993):

> '....the popularity of this technology and its rapid spread have outpaced research evidence that might serve as a guide for practitioners seeking to improve their use of these systems with clients.'(p 246)

5.2.2. Assessments

The starting point in constructing any assessment element must be deciding upon what construct the system will examine, and how. Labour market information constructs tend to be fairly standard over systems. These often include aptitudes/skills, past accomplishments, disabilities and acceptable pay scales. However, different systems have used a number of different psychological constructs in the assessment phase (e.g. attitudes, values, interests and temperaments). For example SIGI, a system widely used in America, emphasises values over all others, whereas GIS allows the user to emphasise one of a number of factors, including aptitudes, and lifestyles. Even amongst assessments of the same construct there is a considerable amount of confusion as to what dimensions of the construct should be used. For example the construct of 'interests' can be

assessed in terms of occupational clusters, types of activities, objects of activities, purpose of activities or settings of activities (Katz and Shatkin 1983). As yet there is no overall agreement as to the definition of any of the constructs measured.

5.2.2.1. A Simple Approach to Assessments

The system can provide a standard battery of assessments that the user is obliged to go through, such as QUEST in Career Information System. This leads to a fairly simple assessment process, with low computer processing power requirements, and a minimal requirement of effort and time from the user. In addition, each user is guaranteed a full and thorough assessment. However, this type of assessment process does rely very heavily on good expert judgements of what is appropriate (the exact nature and function of these expert judgements will be examined in Section 5.2.3.1.). Unfortunately, there is little clear agreement amongst experts on this (Katz and Shatkin 1983, Sampson 1996b). Such assessment processes also force the user to accept the priorities of the experts involved in designing the system, when these may not coincide with the user's priorities. Thus, the user is expected to conform to some sort of model that may not be appropriate to them. One is reminded of Hursh's (1989) cautions on the use of tests with dyslexics, quoted in Section 4.3.2. All of this leads to the system being fairly insensitive to the individual, a particular problem for dyslexic users whose personal styles and abilities are more likely to form unusual patterns (see Section 3.1.2.). As this method is prescriptive the user has little real control over the process. As a result they are liable to adopt a passive learning style, which is far from ideal for dyslexics (see Section 3.1.3.). The locus of control is deleteriously shifted from the user to the machine (Wehmeyer, 1993). Following on from the work of Gerber et al (1992), this failure to encourage the user to assert control is especially counterproductive for dyslexics.

5.2.2.2. A More Complex and Adaptive Approach to Assessments

An alternative to this prescriptive technique is to use a more complex adaptive approach. One can provide a wide range of different assessments and allow the user the opportunity to select those that they feel are most appropriate, such as in the DISCOVER system. This allows for more active interaction and encourages

the user to take more control over the process, and take more responsibility for their responses. This responsibility increases the chance that their responses are well thought out and truthful. Following from the comments at the end of the last section and ideas presented throughout Chapter 4; all of this could be particularly appropriate for the dyslexic user. On the other hand, allowing the user to control which assessments are taken may lead to important factors being missed out. It also increases the time spent on the machine by the user, and the amount of effort they must exert. Thus, the chances of boredom and fatigue setting in are increased. These could be particularly disruptive for dyslexic users (see Sections 3.1.3 and 1.8). The increased complexity of the process may also require the use of machines with greater processing power, more time and effort in programming, and thus increased cost.

A number of systems have used even more complex approaches, which allow the user to initially prioritise assessments, and alter their responses and priorities in response to the occupational alternatives generated by the system from the assessment results. SIGI PLUS and Making Better Career Decisions (Gati 1990, cited in Gati 1996) are good examples of such systems. In the latter case, users are provided with ten aspects of work (for example pay), and are not only asked to rate the importance of these on a seven point scale, but also to rank them in terms of personal relevance. Only then are they asked for their ratings within these aspects, (e.g. rate of pay). Thus, data is collected that allows the users' preferences and priorities to be taken into account without any important information being missed out. The ranking is used by the system in identifying which occupations would be appropriate (a process that will be discussed later, in Section 5.2.3.3). After the occupational alternatives have been generated and provided, the user is given the option to adapt their ratings of aspects, and responses within aspects, to see what effect this will have on the occupational alternatives (a 'What if?' facility).

Thus, the user is encouraged to take a high level of control, and many decisions they make are ultimately reversible. As well as the previously mentioned advantages of handing over control of the process to the dyslexic user, this is liable to: lead to final results that are more relevant and meaningful to the user; increase user's sense of responsibility for their responses; and consequently increase their acceptance of any data generated from these. Reversibility of decisions provides an environment where the user can safely speculate, engage in an exploratory approach, and make errors of judgement. The latter characteristics are particularly

beneficial for dyslexics receiving careers guidance (see the work of Reiff et al, 1996, and McLoughlin et al, 1994 in Chapter 4), and form a central feature of the 'open learning' approach (see Section 3.1).

Finally, the active and reflective nature of the process described above, along with the increased sense of personal responsibility, could help users gain a deeper understanding of themselves, in the context of the world of work, assisting the 'reframing' process. Offering the dyslexic user the capacity to examine and test their priorities could also generally assist them in forming appropriate goals, facilitating 'goal orientation'. Thus, the system will not only benefit the user with career decisions, but also help develop the skills to make future career decisions. The empowerment this brings could be very helpful in facilitating the long term development of the sense of control and independence so important to dyslexics (see Chapter 4).

Such elaborate systems do have a number of drawbacks. As said previously, greater complexity leads to greater development, implementation, and maintenance costs. It is also necessary for the user to spend more time at the machine. Clearly this means that less people can use the system, but also makes it more important to construct the system in such a way that the user can run through it over a number of sessions. Further knock on effects on the complexity and size of the system arise from including such a facility.

Using more complex systems places a greater cognitive load on the user. As well as increasing the effects of fatigue, this is liable simply to overload the dyslexic user, leading to confusion and demotivation. If this is not countered by including a well designed interface (i.e. one that is simple, transparent and motivating, see Section 3.2.1) and user orientation components (i.e. clear explanation or demonstration of the structure, function and use of the system), the dyslexic user is likely to get tired or lost, and either give up, or not use the system appropriately. Not only will the system have failed to provide any useful insight, but it will have also increased the dyslexic's sense of failure and helplessness, which is probably their greatest barrier to success (see Chapter 4).

Thus, one can see how increasing the complexity of the system can, in principal, lead to significant advantages for dyslexic users, but in practice may lead to exactly the opposite effect. Of course this not only applies to the assessment component of the system, but also to all the other components.

5.2.3. Generation of Occupational Alternatives

The next core element of computer assisted careers guidance systems is the processe by which the results of the assessments are used to generate a number of potential occupations for the user.

To outline the process in general terms, results of each assessment are compared with ratings for that construct ascribed to each occupation. Occupations that do not fall within the parameters determined by the user's assessment responses, are rejected. When the results from all the assessments have been applied in this way the occupations remaining are then presented to the user as potential occupational alternatives. In order to be effective the resulting alternatives must be appropriate to the user, and should be presented so that the user can gain some understanding of how they are appropriate.

5.2.3.1. Some General Problems With the Generation Process and the Use of Expert Judgements

How appropriate the suggestions are depends very much on the validity of the original assessments, the validity of the characteristics assessed as indices of the appropriateness of occupations, and the validity of the ratings for each construct ascribed to each occupation. All of these factors are derived from expert judgements and/or research. However, as said before, there is not a great deal of agreement between experts. Over the labour market as a whole, there is a lack of sufficient research. This should come as no surprise, as fully describing the relevant characteristics of an occupation, and an individual, is an enormously complex task.

Most systems use some form of what Katz and Shatkin (1983) call 'trait-matching for success or membership' to generate occupation alternatives from assessment results. Under ideal circumstances the same assessments provided to the user are given to members of occupations, preferably those who are doing well. The results are then used to derive ratings for the occupations. In less than ideal (i.e. more common) circumstances these ratings can be derived from other sources. Clearly, the validity of the ratings relies heavily on the thoroughness of the

research. Those ratings are compared with the user's assessment results, to generate a selection of best matched occupational suggestions. The nature of this approach, i.e. that it really consists of finding simple correlations between two sets of data, makes it very suitable for implementation on a computer. Computers can perform such tasks quickly, and with little fuss. This method is also attractive to researchers and developers searching for a simple, valid and consistent approach to the problem, as it is based on fairly straightforward logical manipulation of standardised, empirically collected data.

However, the fact that this approach works on a 'birds of a feather' basis gives rise to problems. The system defines suitability via the norm of suitable people, ignoring those who have proved suitable but do not fit that norm. Thus, the system is biased against people who do not readily fall in to occupational norms (Gati 1996). This is often the case with dyslexics due to unusual patterns of characteristics. One is reminded of McLoughlin et al's (1994) and Hursh's (1989) warnings about the selection of tests for dyslexics (see Section 4.3.2.). This difficulty is further increased by the fact that variation between different subsections of occupations cannot be usually taken into account. One can see that the above could lead to the rejection of occupational alternatives that are in fact very suitable for the user, as well as decrease the total number of appropriate occupational alternatives provided. Following from McLoughlin et al (1994), this will only serve to reinforce the belief held by many dyslexics that there are a great many jobs they should be automatically barred from, and thus could easily lend support to inaccurate and unhelpful opinions on their own capacities. This would be highly counterproductive, interfering with the motivation to succeed and the development of accurate self knowledge, i.e. 'desire', and the 'reframing' process.

All the above is particularly worrying when one considers that the relationship between the characteristics measured and the level of suitability is not necessarily a strong one. Ratings for occupations only correlate with success, and are not necessarily directly causally connected with it. They could be a useful guide, but cannot be taken as characteristics that actually lead to success. To use a simplified explanatory example, the willingness to wear leopard skin may be virtually universal amongst circus strong men. However, possessing this characteristic has very little do with being suited to this occupation. This further calls into question the validity of any occupational alternatives generated through this method.

5.2.3.2. A Simple Approach to Generation of Occupational Alternatives

In the end a lot relies on how adaptive, and 'open' (see Section 3.1), the system is. A simple system may just provide the user with a standard set of assessments, and churn out a list of occupational alternatives using a standard comparison process. The individual is taken less into account, as the user is given comparatively little influence or control over the process, and it is implicitly assumed that the machine knows best. Consequently, there is a higher chance that the alternatives offered may not appeal to the client; however technically appropriate they may be. If this is the case they are likely not to act upon the suggestions. The system will have failed, and the dyslexic user will end up even more confused and demotivated.

Such an approach would also further encourage passivity on the part of the user, and a shift in locus of control from the user to the machine. This is particularly bad practice when assisting dyslexics (Wehmeyer 1993, Gerber, Ginsberg and Reiff, 1992, See Chapter 4). Fairly clearly, this simple prescriptive approach does little to increase the clients' understanding of themselves and the labour market. Thus, the long term benefits to the user are minimal.

5.2.3.3. A More Complex and Adaptive Approach to Generation of Occupational Alternatives

Less prescriptive systems must include a lot more room for user influence and control over the generation process. Internal processes, which in simple, prescriptive systems are standard and automatic, must be variable and open to manipulation by the user. Thus, they offer greater potential for the application of 'open learning' techniques (see Section 3.1). In order for this actually to work such a system must provide an effective and usable interface, and a comparatively large amount of instruction and help for the user on how to get the best out of the system. Clearly, such systems must be considerably more complex, with all the drawbacks that produces.

However, the advantage of using this approach is that one can focus on increasing the client's understanding. Rather than simply providing appropriate occupational alternatives, the emphasis is given to teaching users to maximise their own satisfaction. This requires them to increase their competence at career decision making, and thus their understanding of the decision making process and the

labour market. These are some of the primary goals of careers guidance outlined in Section 4.1. Rather than dictating to the user, a system encapsulating this approach facilitates the user's own decision making. They must be given the freedom to explore and analyse themselves, and their relation to the world of work. To do this, the system must allow the user maximum freedom to manipulate how the assessments are used to generate occupational alternatives. In addition it must give the user a clear understanding of how the decisions they have made, and the results of the assessments, are related to the occupational alternatives generated. The limitations of the assessments and processes generating occupational alternatives should be made clear to the user. Thus, the user is encouraged to view the occupational alternatives as a basis for further thought and development and system use, rather than as an absolute answer. This should help reduce the deleterious effects of inappropriate and/or unappealing suggestions. All the above is facilitated by including as wide a possible selection of facilities for the client to explore how their decisions effect the alternatives offered.

A good example of the latter approach would be the reflective processes available through the 'What If?' facility in the Making Better Career Decisions system (Gati 1990, cited in Gati 1996, see section 5.2.2.3), where the user is allowed to observe the effect of altering their assessment parameters on the occupational alternatives generated. A 'Why Not?' facility also helps the user explore the relationship between themselves and the world of work, as expressed in the machine, by allowing them to examine exactly why any particular occupation was rejected. Thus, they are encouraged to engage in a user centred, exploratory or experimental approach to the system.

The ranking of aspects of work by the user in this system (mentioned in Section 5.2.2.3 above) also helps to make it far more sensitive to the individual, by providing some freedom to manipulate how the assessments are used. The system applies this user generated ranking to determine the sequence in which the results of individual assessments are compared to potential occupations. GIS (described in Sampson 1996a) also uses a similar system. The user is further assisted in understanding the process by being given feedback on the number of occupations rejected at each stage. As mentioned in section 5.2.2.3., the effects of changing the ranking, and thus the user's priorities, can also be explored through the 'What If?' facility.

The user is further encouraged to examine the effects of making compromises, a vital aspect of career decision making, by specifying and applying not only an optimal level within each aspect of occupations, but also an acceptable level. The system can apply this acceptable level data to prevent the rejection of occupational alternatives that comply to the vast majority, but not all, of the optimal levels, and thus could be very appropriate. This could also help reduce the negative effects of unreliable matches between occupations and the aspects measured (see Section 5.2.2.1. above), as the influence of any one aspect is reduced.

From the above we can again see that the active, adaptive, and user centred nature of such systems along with their greater flexibility, is potentially very advantageous, especially to the user with dyslexia. The influence of the system can extend well beyond the immediate issues by providing the user with the necessary skills to make appropriate career decisions in the future. Such systems are the most appropriate to the aim of this thesis, despite the penalties incurred by greater complexity and the subsequent greater burden on the user (see Section 5.2.1 and the end of Section 5.2.2.3.). This sort of system conforms most closely to Sampson's definition of computer assisted careers guidance systems provided above (see Section 5.2.), and the ideas as to best practice in careers guidance for dyslexics presented in Section 4.3., for example, handing the decision processes over to the client and facilitating the client's understanding. As the technology necessary has become more affordable and available, developers have tended to adopt this approach.

5.2.4. Dissemination of Occupational Alternatives

After generating a list of potential occupational alternatives, the machine must present the user with the results. This is not as simple as it sounds. One could say that this final function is what the whole system has been working towards. If it is not fulfilled in a manner that is clear, helpful and encouraging for the user, so that they are willing and able to follow up the suggestions offered, the whole process has come to very little.

5.2.4.1. How Many Occupational Alternatives Should Be Offered?

Almost all systems are capable of arriving at a large number of occupational alternatives of varying applicability. However, how many is it wise to present to the user? On the one hand too few may not provide the user with wide enough variety of alternatives, increasing the chance that none of the suggestions are acceptable to them. In this case the system is liable to have only added to the user's confusion and disenchantment. Too small a number of suggestions could also reduce the variety and range of occupations the user is encouraged to consider and explore to too low a level. This could lead them to a skewed and inaccurate image of their own occupational potential.

On the other hand, too many suggestions could be overpowering, making it far more difficult for the user to arrive at an effective strategy for searching out further information on the basis of the selection provided. The resulting increase in confusion and cognitive load is liable to be especially disruptive for the dyslexic user. Another factor is that with a large number of alternatives the proportion of those which the user finds completely unacceptable will be increased. As the assessment profiles of users with dyslexia stand a higher chance of being out of the ordinary, the this is more likely to occur with them (see Section 5.2.3.1.). This could reduce the user's confidence in the system and add to any demotivation they may have.

Clearly it is important to find a happy medium. However, as yet there appears to be no clear consensus as to what this is. Gati (1996) suggests that about seven items is appropriate, following on from early work into human memory (e.g. Miller 1956). However, the question of whether this is, and always will be an appropriate number requires a greater amount of applied research using a number of differing systems in order to be resolved.

5.2.4.2. Presentation of the Occupational Alternatives

Due to the statistical nature of the process that generates the selection of occupational alternatives, virtually all systems are capable of presenting a rating for each alternative or, more likely, the alternatives in a ranked order. The question is whether this is a good idea. Ranking gives special emphasis to top rated jobs. If

none of these are to the liking of the user, as is likely to occur in many cases, the user could end up feeling very disheartened. On the other hand the user may be more willing to unquestioningly accept highly ranked occupations as very appropriate to them when they are not, and be led astray. This increased chance of unquestioning acceptance goes hand in hand with a decreased chance that the user will take personal responsibility for decisions regarding what to pursue. It also reduces the possibility of the user engaging in exploratory or creative searching. The reduction of activity and responsibility on the part of the user makes it less likely that they will learn any occupational decision making skills (Gati 1996).

In the end this ranking is only really necessary if the system delivers a large selection of alternatives, as it may be wise in this case to prioritise the list in order to prevent the client getting bogged down by a vast number of potential options. If the list is shorter, for example about seven items, the client is unlikely to be overwhelmed.

Of course, one could present the selection in alphabetical order, as in, for example, SIGI PLUS. This is neat and easily searchable, but almost totally arbitrary, and does not provide any useful information about the alternatives offered (Sampson 1996a). Another option is to make the display theory based as with the World of Work map used in DISCOVER for Colleges and Adults. This has the advantage of providing some information on individual options, and allowing the user to see if options cluster on any variable. The latter would be useful as a representation of what general area of the world of work they may be suited to, which could lead them to investigating other job options, and an increased understanding of the structure of the labour market. Such a map lends itself to a rich graphical representation using multimedia techniques, with all the benefits that has (see Section 3.2.4.). It could also be used as an effective graphic interface for a database containing further information on specific jobs and the more general areas of employment, as well as the labour market. Of course, this would increase the cost of the system and require more time and effort in development, as great care must be taken to ensure that the representation is clear and unambiguous.

5.2.4.3. Presenting Multiple Selections of Occupational Alternatives, an Option for More Complex Systems

In more complex systems that provide the user with a number of ways as to how they can generate suggestions, or allow the user the option of altering their preferences, it may be feasible to offer more than one selection of occupational alternatives. Additional selections can provide additional suggestions of appropriate occupational alternatives, and increase the variety and range of potential occupations. If the option to display additional selections is left to the user's discretion, one can avoid the drawbacks of presenting small selections of alternatives, without incurring any of the problems of cognitive overload and confusion produced by presenting large selections of alternatives (Gati 1996). In addition, it introduces a useful active element to the dissemination process.

Clients can also compare lists to gain further information, e.g. if an alternative appears on more than one list it could be taken as an indicator of higher overall appropriateness. In some respects this is similar to ranking, in that it rates some alternatives over others. However, as opposed to ranking, assessing this information requires judgement (e.g. on the relevance to the user of the criteria used to construct each selection), and activity. This type of prioritising could appear less definitive than ranking to the user, encouraging a more critical approach on their part. Multiple selections could also increase clients understanding of the occupational decision making process, by demonstrating in a practical manner how changing priorities or adopting different criteria can influence the range of appropriate occupations.

One drawback to this approach is that presenting the user with a number of lists could be confusing. This can be countered by increasing the amount of explanations and instructional dialogue, which would place an additional cognitive load on the user. Because of working memory problems this could cause particular difficulties to dyslexics (see Sections 1.3 and 1.8). A better solution may be to replace as much as possible of the additional dialogue with some graphical representation and cues, showing the relationship between different selections, and the different factors underlying their generation. The chance of confusing or overloading the user would also be reduced by having the generation and display of secondary selections as optional. The user would request only as much information as they can handle.

5.2.5. *Other common elements*

Sampson (1996a) also outlines a number of other common elements in CACG systems. By no means all systems have these, but most modern systems have at least some of them.

1 . *Printing of individual screens or entire files of information.* Almost all systems process this element in some form. However, beyond the selection of occupational alternatives, there is little consensus on what exactly should be included in the printout. If the user subsequently sees a human careers adviser, it may be very useful for that adviser to see a complete record of the users interaction with the system; including such things as a complete record of answers provided to assessments, and which modules were used in what order. The adviser can then assess if the user has used the system effectively, and rapidly gain an outline of their client's preferences, abilities, strategies and plans. This could provide an excellent basis for initial discussions. It could also be particularly useful to dyslexics if the adviser has little or no experience of dyslexia, as is likely to be the case. However, the user may not require such a detailed print out, and indeed find such a large mass of complex information intimidating and demotivating, especially if they have dyslexia. In this case the user may never examine the print out, and any influence the system has had on them may be lost as soon as they walk away from the machine. Thus, for the dyslexic user it may be better to have as simple and concise a printout as possible, containing only information that can directly assist them in finding an occupation. For some information, such as additional selections of occupational alternatives, it may be worth allowing the user to choose whether they are included in the printout. This does run the risk of the user not having a record of information that only later they may see the value of, or that a human adviser may find very useful. However, the need to make a decision as to whether it is included could encourage the user to attend more fully to information presented, and encourage them to accept more responsibility for the information on the print out. One thing is clear, the print out must be well organised, to the point and unambiguous. If not, the user or an adviser is liable to find it more trouble than it is worth, and simply put it to one side.

This should be the case throughout the system, but it is wise to remember that a printout can offer no on-line help or assistance.

One final point worth remembering is Reiff et al's (1996) suggestion that a record of progress serves as evidence to the user of their own 'perseverance', and that this can lead to a positive outcome. As a result the users willingness to 'persevere' could be encouraged.

2. *User record keeping of data input and output as well as modules/section completed.* Clearly this could be useful in the same way as a detailed print out to any later adviser. However, it also allows those that administer the system to check that it is being used in the way it is intended, and further examine its usage with a view to adapting and improving the system. Such a record, in conjunction with the results of follow ups with users, can also be used to assess the overall effectiveness of the system as a whole, or its individual components. Obviously, this element is essential if the user is provided with the option of using the computer over several sessions. For large, complex systems this may be essential, especially when considering dyslexic users.

The above suggestion from Reiff et al (1996) on encouraging 'perseverance', could also apply here.

3. *An option for direct access to information files.* Some systems can provide the user with files of information on occupations (e.g. MICRODOORS). What these could contain will be discussed in more detail in Section 5.2.5 below. In most cases these will be accessed via the selection of occupational alternatives. However, by providing the user with the capacity to access these files directly the guidance system doubles as a rapid and convenient reference system. The use of a computer for this has the distinct advantage that it is possible to search the occupational data base using a wide range of occupational characteristics, rather than just alphabetically as is most common in written material. This is particularly the case in these systems as the occupational characteristics must be available for searching in order to generate a selection of occupational alternatives. Computer mediated information delivery may be more acceptable to many dyslexics than the common paper alternatives, especially if one uses multimedia techniques.

4. *Localised information dissemination.* The system can deliver information on actual companies, or even vacancies in the local area. This requires that the database can be readily altered by the system administrators, and also could produce a significant increase in their work load, as it is essential that the information in question is accurate and up to date. The benefit to the user is clear, not only can they get general information on an occupation but specific and very apt information on who they could work for, and where.

5. *On-line user evaluation of system performance.* Again, information from this could be very useful to administrators and developers in evaluating the performance and effectiveness of the system with a view to making improvements. This could also serve to increase the user's sense of involvement and trust in the system, by emphasising that users have influence over the system's construction.

6. *A variety of support materials for users.* These could include a number of things, such as special information and advice for people with disabilities (e.g. support services and organisations, legal requirements and services, and general suggestions on possible accommodations), and material covering CV and letter writing, job searching, or interview technique. One could also suggest from McLoughlin et al's (1994) ideas (see Section 4.3.2) on 'implementing plans' that it would be advisable to also include sections on issues involved in further education and training, and information related to developing complementary skills. The general function of these is to actually help the user with the implementation of any career decision they have made. A number of these could benefit from a multimedia or interactive approach. For example, the system could provide interactive tutoring on CV writing, eventually generating a preliminary CV, or tutoring in interview technique using segments of video footage to demonstrate good and bad practice. Such materials may not be useful to every user, and so are best left as optional modules.

5.2.6. Dissemination of occupational information

Sampson (1996a) does include an option for direct access to information files as a common element. However, on examination he should probably have also included the actual dissemination of occupational information. A great many systems simply provide occupational titles and leave it to the user to locate the information, usually from written sources. This would be a very demotivating prospect to a dyslexic person. However, the prospect of computer mediated dissemination of occupational information could be a particularly attractive one for dyslexics. Thus, some space will be devoted to this here.

5.2.6.1. What Information Could be Offered?

One general question is what specific information should be provided on each occupation? As each occupation is rated for the assessment constructs anyway, information derived from each of the constructs measured in the assessment phase would be an obvious choice. As well as maintaining consistency through the system, providing this information could help users understand how an occupation relates to their assessment results. This could further help the user gain insight into the world of work and the career decision making process as encapsulated in the system. In this case it may be a good idea to provide the option to view assessment results and the information simultaneously and in similar formats, so as to facilitate a comparison.

Whatever is included in the assessments, some information would appear common sense to include, for example common wages, hours and duties, as well as qualifications and experience necessary. Care would be needed as some of these are liable to change over time. Fortunately, modern data storage facilities provide sufficient capacity to keep almost any amount of factual data one could desire on each occupation, as long as one is satisfied with pure text. However, too much information at one time could easily overload and confuse the user, causing them to lose interest, especially if that user has dyslexia. Thus, good presentation and organisation are of paramount importance. The judicious use of such things as menus, hyperlinks and/or icons throughout the information delivery module could be very appropriate (see Section 3.2.1.). They can provide an easy, intuitive and motivating way for the user to control the rate and extent of their exposure to

information, as well as facilitating a more exploratory and learner centred approach to data searching. Other multimedia techniques, such as the provision of appropriate graphics or graphic backgrounds, possibly with integral hyperlinks, could be used to further enhance the presentation, and give the user helpful cues on the context of information and its connections to other pieces of data. The reader is referred to Chapter 3 for a full discussion of the use and potentials of this sort of multimedia approach. When all is said, the shear quantity and complex interrelatedness of information which could potentially be included in an occupational database makes it a fairly good candidate for a multimedia approach.

Another question is, on top of that mentioned above what information would be particularly helpful to dyslexics? On the whole dyslexics require the same information as anyone else to make a career decision. One can make a number of obvious suggestions based upon common weaknesses, for instance information on the literacy levels required, or any area that might rely heavily on working memory or efficient automatisation, such as the requirement to learn rapidly and accurately novel complex procedures, or the need for high levels of organisational ability. Unfortunately, common strengths are far more variable, if they can be said to exist at all, so it may not practical to provide any specific items of information related to these.

A number of other suggestions can be drawn from the work of Gerber et al (1992) and McLoughlin et al (1994) quoted in the previous chapter. McLoughlin et al (1994) point out that as dyslexics tend to lack qualifications, they are often less equipped to take conventional paths into employment. Thus, providing some information on alternative routes into occupations could be particularly helpful. It may also be sensible to provide information not only on the standard requirements but also the minimum requirements, and the context under which they are acceptable. Both Gerber et al (1992) and McLoughlin et al (1994) stress the importance of conscious compensation strategies, or in the former case 'learned creativity'. One could offer suggestions on simple compensation strategies for overcoming difficulties that could arise in specific occupations. Gerber et al (1992) further stress the importance of 'goodness of fit', which can be simply defined as how much an occupation suits the person. Of course, included in this are all the factors measured in the assessments. However, other less tangible factors are equally important, such as the prevalent culture in the occupation (e.g. is it co-operative and supportive, or highly competitive), or the level of formality or

informality in the organisational structure or hierarchy one can expect in the occupation, or even simply the general social climate prevalent.

5.2.6.2. The Possible Use of Video Resources

Complex or less tangible information, such as that relating to 'learned creativity' and 'goodness of fit', is very difficult to effectively explain and justify in the form of brief text. A more suitable format may be digitised video footage. One could, for instance, have a dyslexic person describing and demonstrating a strategy or the social climate in their place of work. There is a full outline of the use, and advantages and disadvantages of digitised video footage in Section 3.2.5., as well as a brief scenario describing how it could be used in the context of a CACG system. The advantages are mostly that it can convey complex and subtle information, in an easy to process and motivating form, that places that information automatically in the context of the real world, thus making it easier for the user to incorporate into their ideas and lives. The key disadvantages of digitised video are that it can be time consuming and difficult to produce, and commonly available storage systems do not at present have sufficient capacity to hold that much of it. As it takes time to view and cannot be effectively skimmed for relevant information, digitised video is also liable to increase the time the user must spend at the machine. Thus, it is probably not presently feasible to provide video presentations on each occupation. A good compromise would be to provide video presentations each covering a category of occupations that share common working practices or environments. These could be available through direct access, access from information files on relevant occupations, and from the user's selection of occupational alternatives. In addition, depending on the content of the presentations, access could be provided through some of the additional elements outlined below.

As suggested above, video presentations can serve a number of more subtle functions. Reiff et al (1996) emphasise at a number of points the value to dyslexics of contact with other dyslexics. They suggest that role models, i.e. successful dyslexics, could stimulate 'desire'. Contact could also facilitate the 'reframing' process, and help develop 'learned creativity'. Face to face contact is preferable, however if it is not available video presentations would be the most effective alternative, especially if they make use of interactive techniques.

There are five broad categories of information that could be covered in these video presentations of dyslexics in their places of work. These are personal history, general information, problems and solutions, how did the person succeed, and the results of success. A common effect over all of these is that in some way each assists the 'reframing' process, which Gerber et al (1992) see as the key starting point for success, and the only part of their model that is specific to dyslexics. The fact that the ideas behind McLoughlin et al's (1994) typology of dyslexics in counselling also bear close comparison to this process of 'reframing' further emphasises the central role credited to it. In more down to earth terms, video presentations can be used to emphasise that dyslexia need not be a barrier to success or something to be ashamed of. Thus, they can increase the chance of the user fully accepting, and working with their condition. Seeing an unashamed and successful dyslexic may also help reduce any isolation the user may feel, which would further assist the process. In the outlines of the categories below attempts have been made to suggest how the features of each could relate to components of Gerber et al's (1992) model.

1. *History*. The subject of the video gives a brief history and description of themselves, concentrating on academic achievement and employment. These histories are likely to contain characteristics the client will recognise from their own life, allowing them to identify with the subject on video. This could help instil the idea in the user that they to are capable of successful employment, and thus stimulate 'desire'. In other words the person acts as a positive role model. As has been said, this could also help reduce any sense of isolation, along with the negative emotions and perceptions associated with this. Confronting the user with the issues of dyslexia in such a positive manner could be very helpful for 'reframing'.

2. *General Information*. The person in the presentation outlines and demonstrates such features as the duties of the job, working environment, social environment, etc.. This information is vitally important for ensuring 'goodness of fit'. In addition it provides the perfect opportunity for raising issues associated with good 'social ecologies' in the workplace, e.g.. how much support can the person expect to receive from within their organisation? who can, and do they ask? what can they ask for? and how do they ask for it?.

3. *Problems and solutions.* Here the subject of the video graphically points out the problems they have had to face, or continue to face, and demonstrates how they have overcome these. This could help the user in the development of 'learned creativity', in that it graphically demonstrates the use of various compensation strategies, which the user may be able to adapt to their own purposes. Furthermore, it could increase their conscious awareness, and thus control, of their own compensation strategies. According to the suggestions of McLoughlin et al (1994) on counselling, these strategies are particularly helpful. Emphasising that problems can be overcome could help stimulate 'persistence', countering the tendency to give up when confronted with hurdles noted by Spekman et al (1992).

4. *How did the person succeed?* Here the successful dyslexic outlines the things which they believe have led to their success. This serves to counter any negative effect caused by the 'Problems and solutions' information, to which it is similar in function. It could be used to provide some more general hints to the user, without emphasising a negative context of difficulties. Obviously, this could help develop 'learned creativity', but depending on the exact content it also could help with other 'external manifestations', i.e. finding 'goodness of fit', being 'persistent', and developing an effective 'social ecology'. Emphasising the various stages they went through to get to where they are could even stimulate the user's appreciation of the subgoals necessary, thus facilitating 'goal orientation'. Again the potential effects of a positive role model on 'desire' and 'reframing' could apply here as well. Thus, this category of information can serve a very general function in terms of Gerber et al's (1992) model, potentially helping with all the basic factors. This should come as no surprise as both Gerber et al's (1992) model and this category of information have employment success in general as their central theme.

5. *Results of success.* The subject of the video discusses and shows the positive effects of employment success. This could provide a strong incentive for the user to 'persevere', and powerfully enhance their 'desire'.

Though the above are outlined as discrete categories of information, it is clear that they can exhibit a high degree of overlap. In the practical task of making interactive video presentations for a CACG system it may not be feasible or

appropriate to divide up the presentations in this manner. What has been presented is an analysis of what is possible, rather than what will always be expedient.

It should be noted that the subjects of the video presentations must be comparable with the user. If they are particularly exceptional individuals the user is liable not to accept them as appropriate role models. In other words, the Albert Einsteins of this world would not make good subjects for such presentations. Exposure to such role models may only emphasise to the user their own deficiencies. What is required are regular dyslexics who have found an occupation that they are good at, and happy in.

5.2.7. Additional elements

The core processes form the backbone of CACG systems. In that they are so basic to systems, they offer only limited opportunities to make accommodations specifically for dyslexics. Best practice regarding these processes are much the same for people with and without dyslexia, as should be the range of job options available. It would be very unwise to restrict what occupational alternatives the system can offer due to preconceptions of what dyslexics in general can and cannot do (see Section 4.3.2., McLoughlin et al 1994). At best one can pay special attention to assessment constructs that have a special relevance to dyslexics, such as literacy levels, or organisational skills. However, great caution is advisable, as this inherently contains the risk of over restricting the user, and negatively emphasising their difficulties over their abilities.

On top of the core elements and common elements, Sampson (1996a) also outlines a number of additional elements. No available system includes all of these, and many include none of them. As the additional elements are more flexible and variable, they provide more room for special features for dyslexics.

Most of the additional elements outlined below are designed to enhance the user's capacity to make, and implement, a decision. This could be particularly apt for dyslexics. As suggested throughout the previous chapter, dyslexics tend to have more problems understanding their own capacities as they relate to occupations, and the processes involved in obtaining successful employment. They may also have shied away from making decisions and taking actions on their own behalf (Wehmeyer, 1992, see Section 4.2.4). The presence of secondary symptoms,

such as low self esteem and low self confidence would further aggravate the situation. Thus, there is a good chance that a dyslexic user will find the task of deciding upon an occupation and obtaining employment a particularly daunting prospect, and have a less than accurate understanding of the processes involved.

Other additional elements have to do with providing information on fields related to employment (e.g. education), and tuning the system to the individual. These are particularly valuable to dyslexics, as they are liable to exhibit fairly high levels of variation in personal style and competence. McLoughlin et al (1994) emphasise the value of additional training, rehabilitation or education for dyslexics. In addition, dyslexics would especially benefit from information on specialist support services.

Where appropriate suggestions will be given as to how the following additional elements can be made so as to provide the best service to the dyslexic user, drawing on the suggestions arrived at in previous chapters. Sampson's (1996a) additional elements are as follows:

1 . *Orientation to the nature of effective career decision making.* This consists of an introduction and explanation of the process of career decision making, and the benefits of effective career decision making. Clearly, this information could be very useful to the user by providing them with some framework through which they can come to a rational well considered decision. It could also help dispel any apprehensions the user may have about engaging in the decision process, by breaking it down into manageable and reasonable subgoals. Both of these are helpful in general, but would be of particular use for dyslexics (see Chapter 4 generally). Outlining the benefits of effective career decision making could also increase the user's 'persistence' when engaging in the process.

2 *Assessment of users needs and a subsequent recommendation for the selection and sequencing of module/section use.* Obviously this is only of any use in systems with a number of optional modules that can be accessed in a variety of different orders. Considering the wide variation amongst dyslexics in level of competence, and awareness of that level, their condition and its implications (see Chapters 4 generally), this may be particularly apt in a system designed for dyslexics. In other words, this can be used to pitch the system at the right level for the individual, and suggest to the user which of the systems facilities would be of most use to them, even when the user

themself is unclear on what either of these could be. However, making these recommendations may impede the user's free exploration of the system.

3 . *Orientation to the world of work.* This consists of a general introduction to and explanation of the world of work, outlining its structure and what general areas of work are available. As dyslexics are more likely to have poor experience of the world of work, and damaging misconceptions about it (McLoughlin et al 1994), this could be of great help to them. Also, exposing them to a clear outline of what is available, and how those options are related, could broaden the range of occupations they are willing to consider.

4 . *Generation of educational alternatives based on user supplied search criteria.* Following from the ideas of McLoughlin et al (1994), many dyslexics could benefit from additional education, and many dyslexics feel that they have missed out on education, and would like the opportunity to make up the loss. However, due to bad experience of education, this is often a frightening prospect, and their knowledge of what is available and appropriate is liable to have become negatively distorted. Thus, the dyslexic user is more likely to have difficulties coming to an appropriate decision on what course to pursue, and any system that can help them do this would be very helpful. This is even more the case when one considers that for the dyslexic person, with typically low traditional academic skills, there are a higher percentage of courses that are unsuitable. In order to ensure the suitability of alternatives generated it would be sensible to use aspects of courses that have special influence on dyslexics, suggested by McLoughlin et al (1994), in the search criteria; these include, length of course, course structure, method of assessment, and required literacy level.

5 . *Dissemination of educational information.* The same arguments and suggestions apply here as those made in the section on dissemination of occupational information. Following on from suggestions made in point four above, it may be advisable to ensure that information of special relevance to dyslexics is included for each type of course. As above, this could include length of course, structure, assessment and literacy requirement. However, as with occupational information, it may also be advisable to include information on alternative routes into types of course. In many cases the dyslexic user will not possess the standard basic qualifications or experience, and is far from ideally suited to attaining them.

6. *Instruction in, or modelling of, the decision making process.* This is related to the orientation element outlined in point one. However, in this case the user is lead step by step through the decision making process. This could be merely a set of instructions, guidelines or questions, but may be far more effective if designed as an interactive tutoring system. The primary function is to assist the user to organise and assess the information provided by the system, and make judgements. For many people this doesn't come naturally. For dyslexics, who are liable to have relied more on fate and other people for decisions (Wehmeyer 1992), and may have problems organising and assessing data due to working memory difficulties, the processes may be especially hard. It is important that the system does not make the decision for the user, as the user doing it for themselves is a vital step towards assuming control and responsibility. The primary importance of this in achieving employment success was stressed throughout the previous chapter, most notably in the ideas of Gerber et al (1992). In addition, showing how the process can be broken down into realistic and manageable steps could stimulate the user to engage in more effective 'goal orientation'. The great hope is that the user will eventually walk away from the system with not only a well thought out occupational decision, but also a better understanding of the decision making process. When it comes to having to make another later decision they will be better equipped to take charge of the whole process themself.

7. *Clarification of issues and dissemination of information related to dealing effectively with barriers to career choice.* This is clearly relevant to a CACG system for dyslexics. There are three barriers particular to dyslexics, primary symptoms, secondary symptoms, and a lack of sufficient qualifications and experience resulting from these. Information could be offered on dyslexia and its influence on work, including what accommodations could be helpful and are likely to be available. The user could be provided with, or referred to information on developing effective compensation strategies. Helping with secondary symptoms is more difficult. One could provide contacts to organisations offering support. In the last two cases it would be a good idea to provide links to video presentations suggested in Section 5.2.6.2 if available, as these are basically designed to fulfil these functions. Information and advice on gaining qualifications, and issues associated with types of courses would be appropriate, along with contacts to organisations

offering specific information or assistance, and links to other elements in the system associated with education if available. It is important to bear in mind that the actual barriers should not be overstressed. In the end emphasis should be given instead to the idea that these barriers can be overcome, and ways in which this can be done. In other words, one should be careful to take the positive, constructive view advised by McLoughlin et al (1994).

8. *Development of strategies for implementing a career choice.* Once the user has decided on a career, this element is designed to assist them in planning exactly how they are going to achieve their goal. The suggestions made regarding 'instruction in, or modelling of, the decision making process' also apply in general to this element. However, it provides an excellent opportunity for teaching the user about effective planning, prioritising and goal setting, and thus improving their 'goal orientation'.

5.3. The role of the Counsellor with Computer Assisted Career Guidance Systems

CACG systems are not used in a vacuum. At the very least someone must maintain the system. Preferably, human advisers should be made available to the user as well, as computer plus counsellor intervention is more successful than lone computer intervention (Marin and Splete 1991). One is also remedied of the importance attributed to social contact in 'open learning' (see Section 3.1.5.). The human adviser can vet potential users to ensure that they will benefit from using the system, and make sure users are aware of the capacities of the system, and especially of its limitations. After a client has used the system, the adviser can ensure that they have used it effectively and gained the most possible from it, as well as help them make sense of the outcomes. More to the point, it would be foolhardy to assume that a computer can entirely replace a human being. No matter how elaborate the system it will never be as flexible, intuitive, or capable of empathy or human understanding as a human adviser. Drawing on this last point Sampson (1996b, 1997) suggests a number of characteristics that reduce the client's suitability to using a computer assisted career guidance system.

1. Limited verbal ability. Lower intellectual development.

2. Goal instability and dependence.

3. Social and enterprising interests.

4. Limited self knowledge and occupational knowledge, confidence, and motivation.

5. Negative career thinking.

6. Anxiety and depression.

7. Barriers to career choice.

8. Intuitive decision making style.

9. Misconceptions about computer assisted careers guidance, e.g. that it can provide some 'magic answer'.

Dyslexics can have many of the above characteristics, depending on the individual. Clearly dyslexia can be a difficult and complicated barrier to career choices. By no means all dyslexics have intellectual or verbal problems. However, problems in the development of specific intellectual capacities, and some deficiencies in verbal ability are more common amongst dyslexics (See Chapter 1 generally, and Sections 1.2 to 1.5 specifically). As a consequence of secondary symptoms (see Section 1.6), many dyslexics suffer from limitations in self and occupational knowledge, as well as conditions resulting from a combination of this with negative affect, i.e. lack of self confidence and motivation, negative career thinking, anxiety and depression. Computer assisted career guidance systems encapsulate the idea that career decisions should be made using a rational decision making style, the particulars of that style being dependent on the theoretical assumptions of the developers. Due to an interaction of deficits and compensation strategies, dyslexics may have unusual styles that cannot be catered for by these theoretical assumptions. Moreover, secondary effects of dyslexia, along with low self and occupational knowledge, may lead to a less than rational decision making style.

Thus, in some cases it may be inadvisable for the individual to be exposed to the system without extensive prior work with a human adviser. However, as implied throughout this chapter, many of the barriers to effective system use could be countered by a system adopting a positive learner-centred, and adaptive approach, which makes judicious use of multimedia techniques, and has additional and common elements designed specifically with dyslexics in mind. Sampson (1996b)

also supports the idea that multimedia can be very valuable, as such an approach has the advantage of moving the emphasis away from writing and towards a more visually based, and intuitive style of interaction and information delivery. Sampson (1994) further suggests that individuals with low reading ability form a major strategically important group that could especially benefit from greater development of such systems.

A well designed system orientation session, provided via print or video resources, could also go a long way to ensuring the best outcome from system use (Sampson, 1997). In the case of a multimedia system these can be delivered by the system itself. For example, the system can provide video demonstrations of system use and outcomes to clear up misconceptions about the system. Any anxiety the client has over using the system could also be relieved by demonstrating its efficiency and user friendliness. Such orientation can be provided at various points throughout the system as well as in an introduction, e.g. at the beginning of each section, or as a component of the help systems. This would allow the information to be more targeted and relevant to what the user is doing, reduce the amount of information the user must process at any one time, countering information overload and boredom, and provide the user with ongoing support.

One only has to look back at the ideas of McLoughlin et al (1994) provided in the previous Chapter (Section 4.3.2.), to appreciate how important the human element is in the counselling process. Throughout their analysis there are points where only a competent careers adviser, with knowledge and experience of dyslexics will be able to help with all eventualities. However, such people are few and far between, nor are they likely to become significantly more common in the foreseeable future. Thus, if a CACG system specially designed for dyslexics were available, when a dyslexic person goes to a careers advisory service at least they can receive some information and assistance that takes their disability fully into account. There is also a hope that integrating such a device into a careers service could increase awareness of dyslexia amongst the advisers in that service. It would become an issue explicitly worth considering. Even a little more of this consideration would be good news to dyslexics.

5.4. Summary and Conclusion

This has been a long and fairly difficult chapter, especially as few people are familiar with the subject. Thus, it would be particularly helpful to summarise some of the main points and conclusions given above.

5.4.1. A simple approach to CACG

All CACG systems possess a common core of elements. The user is obliged to go through an assessment, or a number of assessments. The machine compares these with the characteristics of occupations, rejecting occupations that do not match. The remainder are presented to the user. A simple, and thus cheap and easy, approach would be to do the above, and only the above. However, this leads to systems that are insensitive to individuals, and encouraging a passive learning style, and increased dependency. This is all particularly inappropriate for dyslexics.

Being rigid these systems are forced to rely very heavily on expert judgements in the assessment and generation processes. However, these expert judgements are not always accurate or appropriate. This is likely to be particularly the case for dyslexics. We would expect to see higher numbers of inappropriate suggestions, or less suggestions overall. For a person with dyslexia this is likely to be especially demotivating, and reinforce the unhelpful misconception that they are automatically barred from entering a great many fields of employment.

5.4.2. A more complex and adaptive approach to CACG, and its implications for dyslexic people

A more complex system could allow the user to assert a far greater influence over the whole process. It would, therefore, be better able to adapt to the individual user, giving rise to more appropriate occupational suggestions, as well as encouraging them to adopt an active learning style, and accept greater control and responsibility.

Users must be kept fully informed if they are to effectively assert their influence. This would encourage a fuller and more realistic understanding of not only the system's capacities, but also the world of work, and the careers decision process as it applies to the user. Thus, such a system could facilitate the development of valuable knowledge and life long skills that dyslexics are typically deficient in.

The requirement for the user to process far more information, instructions and explanations, could cause significant problems for dyslexics. Well designed orientations to system use, and on-line help facilities would be essential. In addition, a simple and intuitive graphic user interface would be invaluable. Where possible, information should be presented graphically, with, or instead of text.

5.4.3. Some suggestions for the core elements of a more complex adaptive CACG system for dyslexic people

Various methods have been discussed for allowing the user greater influence and involvement, and making the system generally more adaptive to individuals.

- The user could be given the capacity to select or rank assessment results for use in the generation process, something that would otherwise be left to expert judgements. This would allow the user's priorities to be taken into account.

- The user could be asked for acceptable levels in addition to optimal levels for some of the assessments. These could be used to automatically prevent the rejection of occupations that conform to all but a few optimal levels, and prevent the generation of an unacceptably low number and variety of suggestions. Both are likely effects of relying on expert judgements.

- The user could be allowed to generate a number of different sets of occupational suggestions on top of the primary set, such as:

  - new sets generated from using acceptable levels.

  - new sets generated from altering the assessment selection or ranking.

  - similar occupations to a specified occupation.

These allow for the generation of larger number and variation of suggestions, and a more exploratory approach to career decision making, facilitating a better understanding of the process. The last factor could also be encouraged by making it easy for the user to make active comparisons between sets.

- An exploratory approach and better understanding of career decision making could also be facilitated by providing the user with a capacity to compare their assessment profile against the profile for any particular occupation.

5.4.4. Some other suggested features of a more complex CACG system for dyslexic people

There are a number of possibilities as to what else the system could deliver. One major option is that it allows the user access to files of information on specific occupations. This would be generally useful for dyslexics, and also could be used to provide information of special to value them, e.g. the literacy levels required. However, some very helpful information is particularly difficult to putt across effectively through text alone. In many cases using digitised video and sound may be far better. In addition to being somewhat more stimulating, it could be used to provide a much needed human component.

A printed reference document containing all the information the user has found out would be especially useful for helping them put that information to work, and in subsequent sessions with human advisers. It would be particularly important to keep the text as concise as possible, and ensure that it is well organised, accessible and unambiguous. The majority of the contents could be selected by the user, thus helping ensure all the information is personally relevant, as well as reducing overall length.

The system could also offer such things as general information for dyslexics, information on local vacancies, guidance on CV and letter writing and on job searching, information on educational alternatives, and a number of other additional components. Many of these could be of particular value to the dyslexic user, who is liable to be less familiar with the processes involved in finding and securing a job, and unsure about the implications of their condition.

5.4.5. *Some final thoughts*

A CACG system for dyslexics is likely to be a feasible and desirable prospect. However, in order to make it genuinely so, and get the best from it, it would be advisable to make it a more complex adaptive system, using a learner centred approach with all the flexibility that implies, and facilitating an active learning style on the part of the user. To do this effectively one would be advised to make extensive use of multimedia techniques. These are particularly helpful for dyslexics. A system such as this could prove to be an effective means to help dyslexics over come many of the barriers to successful employment, both internal and external, that were identified in Chapter 4.

6. Interview Study of Professionals in the Fields of Adult Dyslexia, Computing and Employment

In the previous chapters it was argued that well designed multimedia computer systems may be very useful tools for providing teaching and guidance to dyslexics. Furthermore, dyslexics appear to have particular problems in finding and maintaining satisfactory employment, and as a result would benefit from specialist guidance where those difficulties are taken fully into account during the guidance process, and explicitly explored. Computer assisted careers guidance (CACG) systems have been developed to a fairly sophisticated level, but could benefit from the application of a multimedia approach. CACG systems also have the potential to offer specialist guidance for dyslexics, and this potential also is likely to be greatly facilitated by the use of multimedia techniques. Thus, there is good reason to suggest that a multimedia CACG system specifically for dyslexics is desirable.

The primary objective of this interview study and the subsequent questionnaire studies (Chapters 7 and 8) is to establish the opinions of those in the best positions to know (i.e. professionals in the fields of adult dyslexia, computing and employment, and dyslexics themselves) as to the suggestions mentioned immediately above. More specifically we need to enquire into:

- the current state of careers guidance for dyslexics, and best practice for delivering such guidance.

- the feasibility and desirability of constructing and implementing a multimedia CACG system for dyslexics.

- the design criteria and specifications for that CACG system.

The conclusions of these three studies will form a solid and confirmed foundation from which a detailed design for a practical system of the type proposed (see Chapter 9) can be constructed.

6.1. Rationale and Description of Interviews

6.1.1. Why an interview?

- it allows for more depth of information than alternative methods, e.g. a questionnaire.

- it follows on from the Adult Dyslexia Screening Feasibility Study (Nicolson and Fawcett and Miles 1993), i.e. the methodology is consistent allowing for a truer comparison between these two related studies.

- professionals in the field of dyslexia, computing and employment are individually more likely to have broader understanding of problems experienced by adult dyslexics than alternative groups, for example the dyslexics themselves.

- professionals in the field of dyslexia and employment are more familiar with the issues which we must focus on, and the concepts we must use.

6.1.2. What was in the interview?

All the interviews followed an interview schedule, which was pre-circulated to the interviewees along with background information and an account of the 'Careers Advice System Scenario'. This consisted of an account of how the system could be constructed and used. What follows is a brief summary of the 'Careers Advice System Scenario' (see Appendix IIa for full scenario). Note that the view of the system expressed in the scenario has been simplified by only including information on the major possible options discussed in Chapter 5 above. Providing a more detailed account would require a great deal of additional descriptions and explanations, many of a fairly technical nature. This would be inappropriate as it would tend to cloud the key issues, and make the interviews and questionnaires unreasonably difficult and time consuming for the participants, very few of whom are likely to have had more than a passing experience of CACG systems.

Context

user	unsupervised adult dyslexic person
location	Jobcentre or careers centre
additional specifications	will not have to be completed in one sitting
	must be flexible enough to cater for a wide range of wants, styles and levels of proficiency.

Introduction

explain generally the workings and aims of the system. Could offer videoed accounts from famous successful adult dyslexics

Main section

range of options presented as icons, including assessments, and browsing information on jobs

assessment	self assessment on a number of characteristics (e.g. likes and dislikes, or skills), used to generate a list of appropriate jobs.
written information	The user will be given the option to view any text relevant to any job in the list of appropriate jobs.
video footage	interviews with successful dyslexics in their place of work, and a general demonstration of the characteristics of the job by the same individual. Each one will have to be a good example of a whole employment area.

Print out

summary of session. Must be designed to be helpful to the user in searching for further information, and to any careers adviser they might consult.

The issues and questions covered in the interview schedule were determined following brain storming sessions with Rod Nicolson and Angela Fawcett, and after close examination of interview schedule used by Nicolson, Fawcett and Miles (1993).

The questions came in 6 sections. What follows is an outline of the sections, with a brief description of what each of covers.-

Section 1.   *Background and experience-* this is self explanatory

Section 2.   *Dyslexics in employment-* how do adult dyslexics perform in employment and why do they perform this way?

Section 3.   *Dyslexics and careers advice-* What is the current state of specialist careers advice? how can it be improved? what are the most effective techniques?

Section 4.   *Feasibility of careers system-* how useful would the system be? can it be done?

Section 5.   *Specifications-* what information should it offer? and how?

Section 6.   *Conclusion-* any further points or contacts.

All interviews were undertaken over August and September 1995. Interviewees were given the opportunity to provide a written or spoken response. All opted to be interviewed. Each was taped and later transcribed (see Appendix IIb). The transcriptions were then sent to the interviewees for final checking, but no major alterations were made. Many thanks to David Fawcett, who, through a practice session, assisted in refining the interview.

6.2.   Professionals Interviewed

Names were initially collected from Nicolson, Fawcett and Miles (1993), these people then provided further contacts. Various interested organisations, such as the Adult Dyslexia Organisation, were also consulted. Final selections were made on the basis of the need for a wide range of relevant experience in the sample, and simple availability. The final list contained 11 names, which was considered sufficient as each interview was likely to be rather long and give rise to a very large amount of information. Unfortunately two interviews, with Harry Chasty and Gary Fitzgibbon, were affected by faulty recording equipment. Consequently

some of the interview was lost in both cases, this was more severe for the latter case. As with all the other interviews, both of these interviewees were given the chance to check, revise and make additions to their interview transcripts. However, in these two cases the option of a more extensive comment, or repeating sections of the interview over the telephone, was offered. In both cases this offer was declined due to the pressure of other commitments.

Interviewees were asked a number of questions to assess their level of experience in a number of areas. In each area 2 points were allotted for extensive experience, 1 for some or informal experience, and 0 for no experience. The means are provided in the graph below.
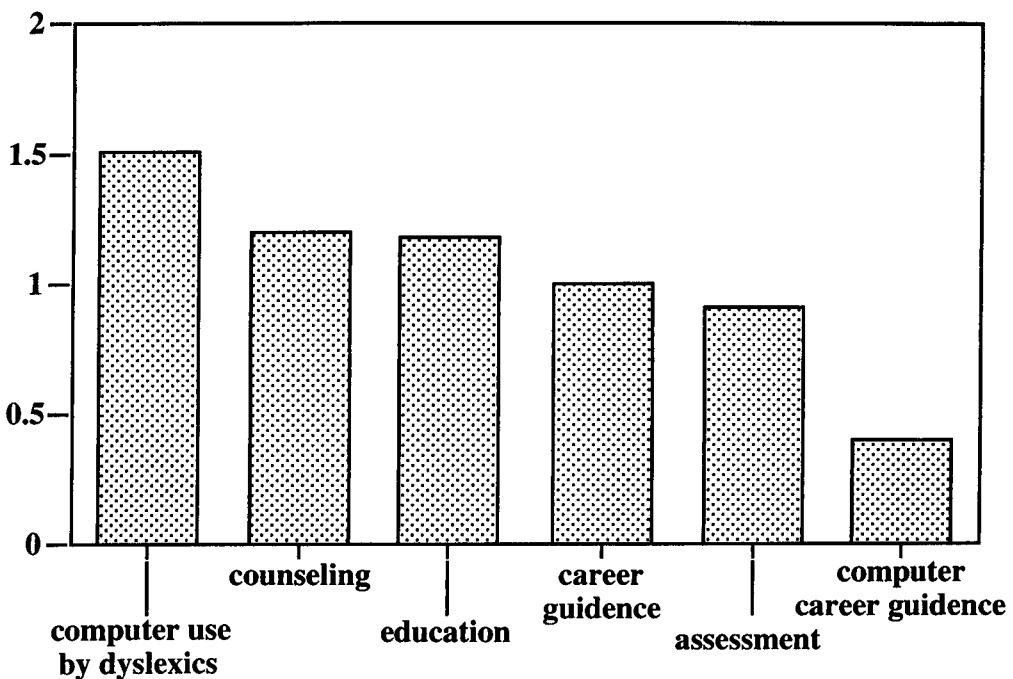
fig. 5. **Professional experience of interviewees**

Below is provided a list of the interviewees with a brief outline of relevant experience drawn from the interviews.

Interview 1. Dr. Dorota Zdzinski, Kingston University, London

Worked within the dyslexic field for about fourteen years, she has run evening classes, and held individual tuition and counselling sessions with adult dyslexics for a number of years. She has also given out careers advice to dyslexic adults

who are looking for work, or having problems within their jobs, and is familiar with some tests designed to help those looking for a career. Over the last couple of years she has been involved in helping students to get equipment, usually computers, to help them with their studies. Finally, she has been working on putting together an assessment procedure for dyslexic students at university.

Interview 2. Dr. David McLoughlin, Adult Dyslexia and Skills Development Ctr., London

Has specialised as an educational, occupational psychologist working with dyslexics for approximately 14 years. Roughly 50% of his clients are adults. He spends about 50% of his time doing assessments and counselling adult dyslexics, and also offers careers counselling. He has some experience of computerised careers guidance systems, though has never used them as part of his work, and extensive experience of computer use by dyslexics. He is also co-author of 'Adult Dyslexia: Assessment Counselling and Training' (1994).

Interview 3. Donald Schloss, Adult Dyslexia Organisation, London

A dyslexic adult himself and Chairman of the Adult Dyslexia Organisation (ADO), which offers support, advice, including careers advice, and information to adult dyslexics, on a charitable basis. From its beginning as a local organisation in London the ADO has expanded to include local organisations throughout the country. As well as offering individual help they have also conducted extensive public awareness campaigns, and regular conferences, the latter being directed towards both practitioners and adult dyslexics. The ADO have also undertaken training and awareness courses for a number of organisations including commercial companies, and had extensive collaboration with other dyslexia organisation. Many thanks must be given to Donald Schloss for providing many of the contacts for this interview study and the subsequent questionnaire study, as well as circulating the final questionnaire to members of his organisation.

Interview 4. Julian Hobbs, Dyslexic Educational Resources, London

Dyslexic Educational Resources provide software and hardware to adult dyslexics, and also advise on appropriate systems. One aspect of his job is advising on computer equipment to be used by adult dyslexics in their working environments. His organisation receives both private referrals and referrals from various dyslexic organisations as well as PACT teams. Consequently he has great practical experience of computer use by adult dyslexics.

Interview 5. Sava Savich-Lee, University of Kingston, London

As well as being married to an adult dyslexic person, she is a Ph.D. student working with Dorota Zdzinski. The main body of her experience derives from interviewing dyslexic adults on their experiences of past employment and present employment. However, she is also a very active member of the ADO, working on help lines, and assisting in the arrangement of awareness campaigns, courses and events.

Interview 6. Joan Gibson, Harrogate, N Yorks

Over the last five years she has worked with the Dyslexia Institute, and liaised with careers officers in Harrogate and York. Her work has involved explaining the jobs market to dyslexic adults looking for a change in employment, as well as doing lectures for careers officers about the needs of dyslexics. In addition to this she has worked with the Training and Employment Service on awareness of possible difficulties with employees, with the Post Office and the Army Education Officer. Before this she was a full time careers guidance counsellor. She has some experience of computerised career guidance systems.

Interview 7. Marion Walker, Solihull, West Midlands

Has been teaching adult dyslexics for over five years. She also does work for the Dyslexia Institute, and with unemployed adult dyslexics through the PACT

service. She is responsible for setting up six evening classes in the Midlands specifically for adult dyslexics. Though she has little formal experience in careers guidance, through her teaching she has had the opportunity to offer counselling and careers guidance to her students. All of her students are taught to use a word processor, and she is a great supporter of the use of computers by dyslexics.

Interview 8. Dr. Sylvia Moody, London

For approximately ten years she has been working as a psychologist specialising in assessing dyslexics. In recent years she has specialised in adults. She has had referrals from various large firms, local authorities and other Government organisations. At present her particular area of interest is in dyslexia in the work place and amongst students. She is well known and respected in the dyslexia community, and has a host of publications to her name.

Interview 9. Gary Fitzgibbon, Fitzgibbon and Associates, London

Unfortunately some of this interview was lost due to recording equipment failure (see the interview transcript in Appendix IIb for a full account of what was missed). Much of the section on experience was missed. Most of his work over the previous three years has been in assessing dyslexic adults, and training people who have been assessed by other occupational psychologists to improve their performance at work. At present his company holds a contract from the Employment Service in London to provide specialist careers help to adult dyslexics. Among other publications he is co-author, along with David McLoughlin, of the book 'Adult Dyslexia: Assessment Counselling and Training' (1994).

Interview 10. Dr. Harry Chasty, Dyslexia Institute, Reading

Engaged in work with 16 plus dyslexics in schools and further education colleges, as well as with more mature adults who '.....have experienced fairly catastrophic failure in a working adult life'. Having been Director of the Dyslexia Institute, and responsible for setting up their assessment programme, he has very extensive

experience of academic higher education and vocational education. Through helping adult dyslexics he has gained great experience in the computer use of adult dyslexics, and is a great supporter of it. Unfortunately due to faulty recording equipment approximately 10 minutes of this interview were lost. See the interview transcript in Appendix IIb for a full account of what was missed.

Interview 11. Philip Alexander, Bromley, Kent

Designer and co-ordinator of the CompuCampus touch typing course, which has expanded over the last few years to various sites around the country from its beginnings in London. This course is designed to teach computer typing skills to students, mostly in the younger teenage years. He has an ongoing interest in dyslexia, and has sponsored older dyslexics for his course as a result. As well as teaching the very useful skill of touch typing the CompuCampus also serves to reinforce spelling and reading skills, from a very basic level upwards. He reports dramatic increases in co-ordination and ability in his younger students, as well as increases in self esteem and confidence.

6.3. Analysis of Interviews

As each interview lasted between forty and ninety minutes the transcripts make up an impressive volume. Clearly it is impossible to fully appreciate the depth of information without reading the transcripts themselves. However, in order to ease the burden of the reader, a summary for each interview (Appendix IIc), as well as an overall summary for all interviews (Appendix IId), has been provided.

Individual summaries were derived by generating from each interview, short phrases that capture the central gist of the answers provided by the interviewee within each section of the interview schedule to which they clearly responded. In many cases these are direct quotes. From these was constructed a list of common answers to questions. Transcripts were then marked on whether those common answers were present. Each response was allotted 2 if it was explicitly positive to the point raised, 1 for a mixed response or if the point was only supported implicitly, and 0 if it was explicitly negative to the point raised. The only exceptions to this were in three questions (indicated below) where the schedule

provided a number of suggestions. In these cases an index of agreement was calculated by allotting 1 point for each suggestion supported, subtracting 1 point for each rejected, then adding half a point for each suggestion not mentioned. Marks were only allotted if the interviewee explicitly mentioned the suggestions. All the scores were then standardised into a 1 to -1 format, with 1 meaning explicitly positive, 0 neutral, and -1 explicitly negative.

Throughout this chapter, and in the two subsequent chapters, I will present results primarily in the form of bar charts expressing means. It may be objected that the questionnaire data are only ordinal (typically 1 to 5), and hence that a measure such as the median or the mode should be used. Use of the mean is appropriate if the scale is equal interval, so that 1.5 does sensibly represent the average of scale points 1 and 2. It is implicit in the use of a 1 to 5 scale that intervals are roughly equal, and so, following Nicolson, Fawcett and Miles (1993), I consider that the clarity provided by use of the mean justifies its use here.

If the reader wishes to engage in a more detailed examination of the results, or indeed wishes to reinterpret or re-analyse them, it is suggested that they turn to the relevant appendices. These contain a complete breakdown of the data by respondent and question. A clear reference to the appropriate appendix is provided before all the relevant sections in the following chapters.

Below is provided a summarised account of the results, where possible these have been presented these as graphs. Numbers above each column represent the number of responses upon which the means are based. No attempt has been made to summarise the results on a question by question basis, as the interview schedule was only meant as a starting point. Thus, it was very common for interviewees to skip over questions, allow their statements to diverge from the subject of the question, or provide responses in the discussion of one question that were well suited to another. Such flexibility and freedom is one of the great strengths of the interview study over alternative methods, that it allows the interviewees to present their opinions in the way they prefer, reducing the influence of the interviewer's preconceptions, and broadening the discussion.

Thus, in the summarised account of results given below, and in Appendices IIc and IId, a broad section by section account has been provided, having in many cases reduced the responses from a number of questions in to one set of results.

6.3.1. Dyslexic People in Employment

Important factors in employment success for adults with dyslexia- the most common suggestions here were drive/confidence, self knowledge, and the level of support throughout their lives and during the job.
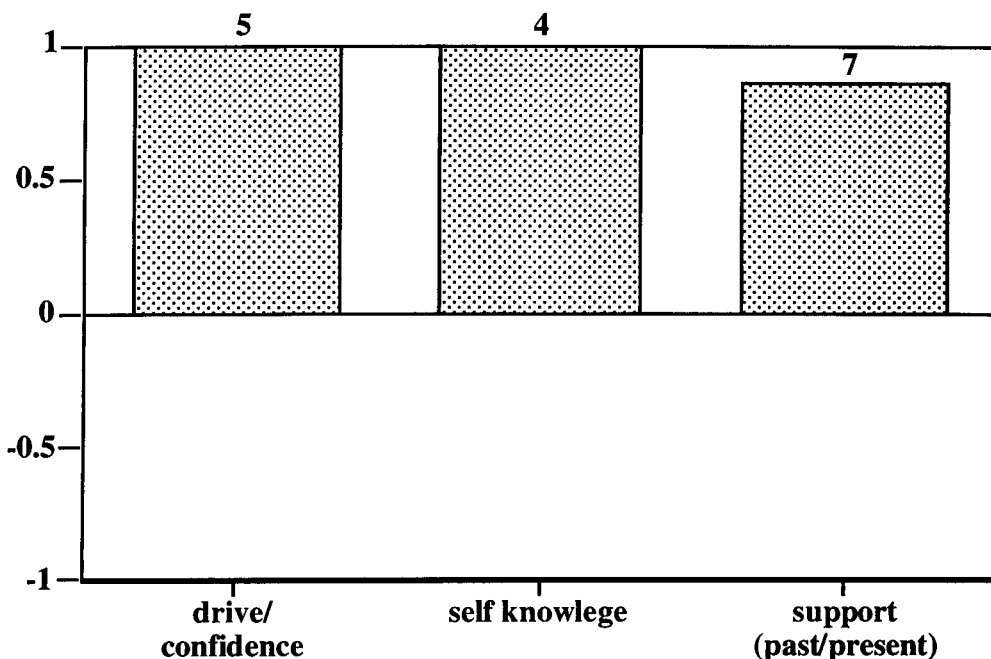
fig 6. **Bar chart showing important factors in employment success for dyslexic adults.**

4 interviewees made other suggestions. These were

- 'finding the right niche'

- 'prejudice, not making too many mistakes'

- 'severity of difficulties'

- 'realism'

Strengths of adult dyslexics in employment- the most common suggestions here were determination, creativity and communication skill.
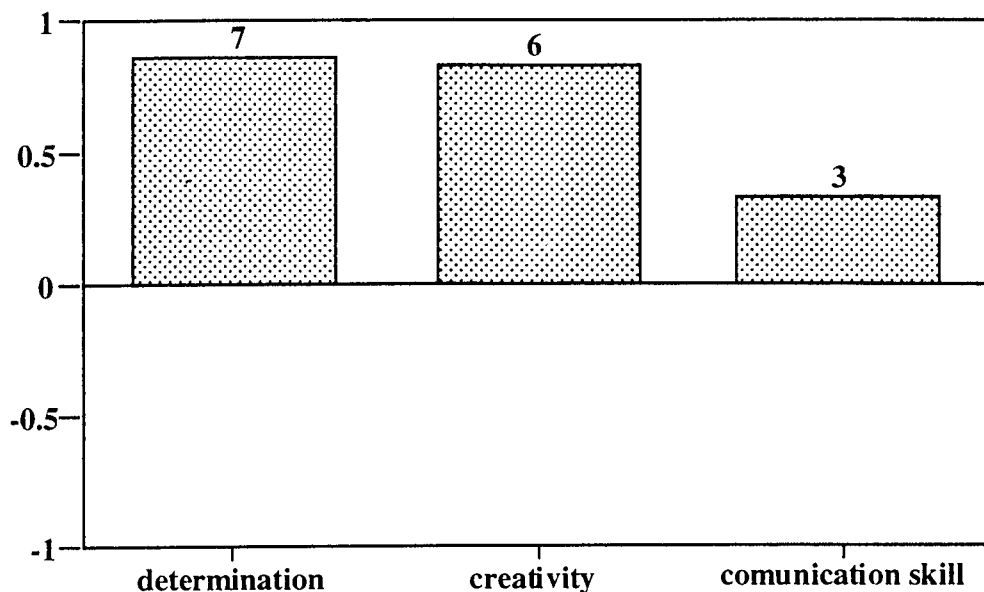
fig. 7. **Bar chart showing strengths of adult dyslexics in employment.**

The only other suggestion was that they may have 'affinity with people in the caring field', though one interviewee warned that 'strengths and weaknesses can be a movable goal post', a sentiment which was suggested by others.

Weaknesses of adult dyslexics in employment- the most common suggestions here were lack of confidence, memory, literacy, and organisational skill.
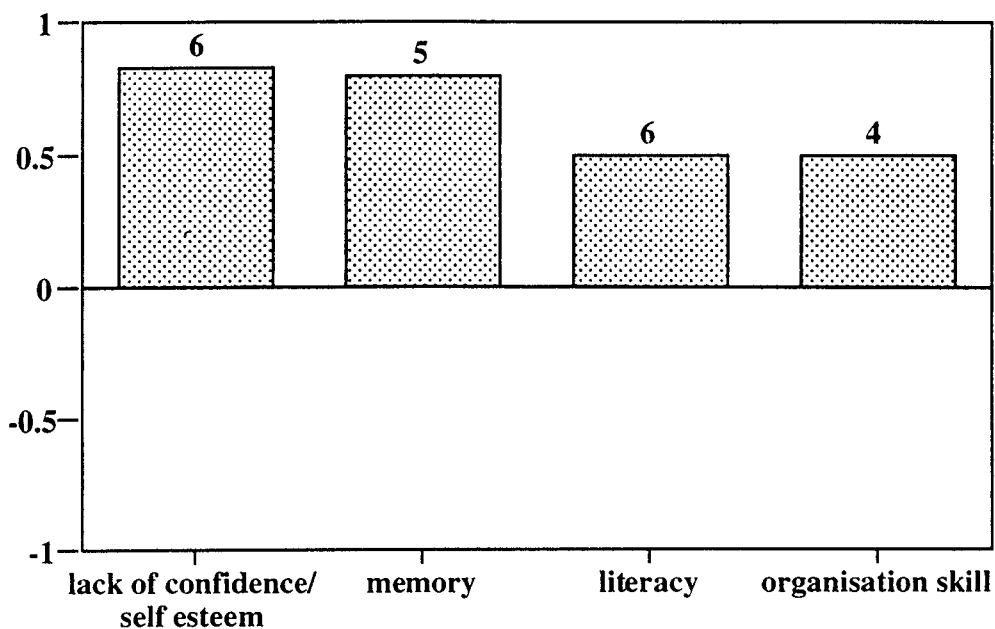
fig. 8. **Bar chart showing weaknesses of adult dyslexics in employment.**

4 interviewees gave other definite suggestions as to weaknesses. These were

- 'inappropriate goals'

- 'tests, interviews. The stigma'

- 'not prepared for other peoples reactions to them'

- 'much at a disadvantage in social awareness. Distractibility'.

6.3.2. Dyslexic People and Careers Advice

Interviewees were asked about the availability of specialist careers advice and appropriate careers advice material. Not all of them felt they had sufficient experience of formal careers advice to provide a meaningful answer. The results are provided in the table below. The mean response is an index of how supportive the interviewees were to the statements that there was a lack of availability or appropriate material.

	number of responses	mean response
lack of availability	7	0.57
lack of appropriate material	7	0.57

table 3. **Opinions of current specialist careers advice.**

What factors should a careers adviser consider to achieve the best results- the most common suggestions for this were to address the question of disclosure of one's dyslexia to a potential employer, be sensitive to the emotional issues implicated in dyslexia, and to facilitate self knowledge.
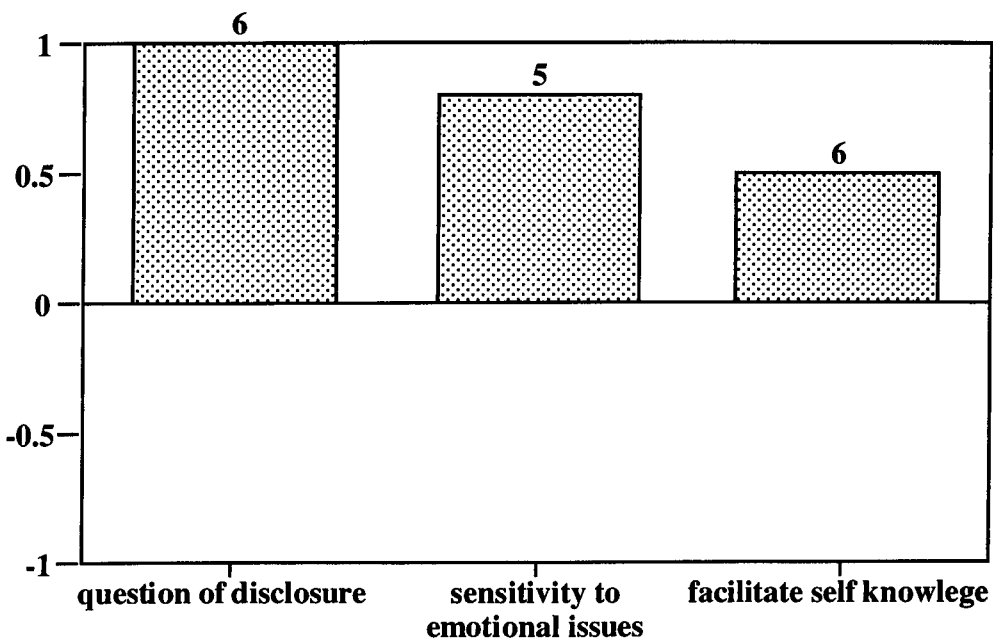
fig. 9. **Bar chart showing what factors should a careers adviser consider to achieve the best results.**

7 interviewees gave other suggestions. These were

- 'no door closing on potential choices of employment'

- 'find out what dyslexia is before you embark on giving advice to them'

- 'have practical experience of dyslexics'

- 'make available lists of helpful people they can talk to'

- 'emphasise strengths. adviser needs practical insight into dyslexia'

- 'address presentation to future employer. Have thorough knowledge of individual'

- 'facilitate realism. Plan to the nth degree. Don't be restricted to traditional employment types'.

6.3.3. Feasibility of Careers System

Interviewees were asked a number of questions about various characteristics of the use of the system and how much these would effect staff and users. These have been reduced to 6 statements on these characteristics and indicated the level of support for each. These statements are-

a. time reduction for staff will be useful, i.e. potential reduction in time taken up with advisery sessions.

b. data the system can deliver will be helpful

c. reduction of time restrictions on the user will be useful

d. some human contact is still needed

e. a broad range of information on jobs with the limited depth this necessitates will be sufficient.

f. systematic assessment of clients' characteristics is a good and useful idea.
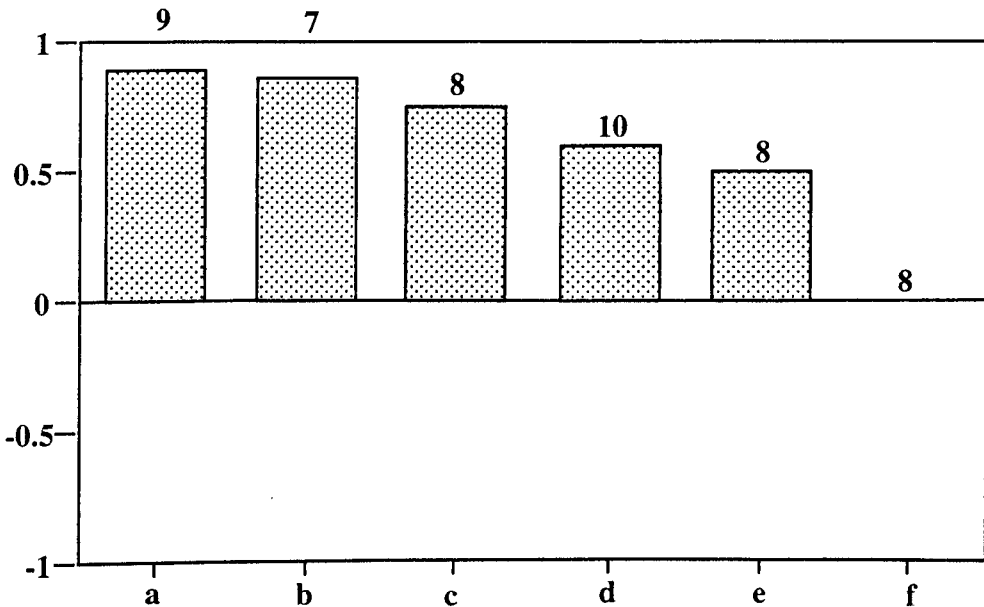
fig. 10. **Bar chart showing opinions on characteristics of the system.**

Some worried that assessments may be too insensitive and inflexible.

Interviewees were asked to assess how appropriate to dyslexic adults were the use of computers, use of digitised video footage and sound in the system, and the interactive structure of the system, in an effort to find the level of support for the general characteristics of the system.
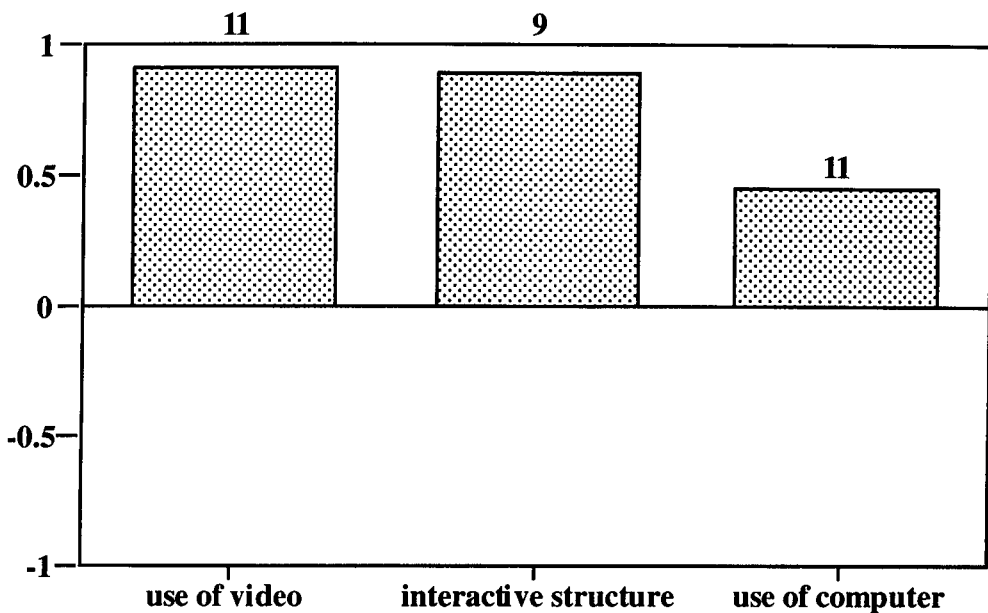
fig. 11. **Bar chart showing opinions on more general characteristics of the system.**

Interviewees were also asked to assess the general feasibility of the system, whether it could be properly implemented. The only problem which was consistently raised was the cost of the system, both initial and ongoing. One interviewee did suggest that people may be tempted to use the system to replace counsellors, when it cannot do the job.

	number of responses	mean response
cost	5	-0.4
general feasibility	10	0.6

table 4. **Opinions on the feasibility of the system.**

A number of suggestions were made as to what follow up services should be offered to the user. These were

- 'immediate, to clear up anomalies. Long term, to find if they followed through'

- 'Record data for research. Link to business'

- 'counselling, job shadowing'

6.3.4. Specifications

One idea was to use video clips of famous dyslexic adults in the introduction. Interviewees were asked to comment on the idea. Responses were mixed.

	number of responses	mean response
use of famous dyslexics	10	0.1

table 5. Opinion of the use of famous dyslexics.

Overall interviewees were sceptical about the use of famous dyslexics, but liked the idea of introducing the system with clips of simply successful dyslexics. Other comment include

- the need to spell out strengths and weaknesses in the introduction

- the use of humour

- the need for the introduction to be brief and well made

- could also include courses and help lines

Three questions were asked on what information should be offered at various points when using the system (questions 5.2, 5.3, and 5.5), specifically general information on jobs, information to be emphasised in the video clips, and information to be included in the hard output. With each of these questions a number of suggestions were given to provide a basis for discussion. Many of the interviewees commented directly on the suggestions. The graph below indicates

the level of agreement with those suggestions, standardised into a 1 to -1 format, and calculated using the procedure outlined at the beginning of this sub section.

The suggestions were:

a. *general info.*	information on minimum qualifications an outline of duties an outline of skills required, an outline of working conditions (e.g. working environment, flexibility of hours and duties, deadlines) information on the social environment, special factors for dyslexics (e.g. reliance on literacy skills, organisational skills, or general willingness to make accommodations) promotion prospects wages
b. *hard copy*	job lists compiled from individual assessments as well as the final list which is a combination of the these ratings on characteristics measured in the assessments general information about dyslexia including contacts an account of how the client has searched the system any information on jobs the client has requested summaries of information contained in the video segments which the client has watched a list of further appropriate resources the client can consult a list and description of parts of the system the client did not explore

c. *video info.*	a brief personal history their strengths and weaknesses in general an account of problems they have faced in finding and holding down an appropriate job ways they have overcome those problems (successful strategies) the results of success some account of their priorities in life in general) demonstration of general duties a demonstration of what skills are required or most useful a demonstration of working conditions (e.g. working environment, flexibility of hours and duties, deadlines) an impression of the social environment an account of the prospects for advancement and demonstration of what this requires an account of what accommodations can be made for dyslexics

fig. 12. **Showing opinions on information offered by the system.**

The interviewees made a number of further suggestions for information to be included in the general job information and the video information.

In the general job information there could be information on-

- companies' equal opportunities policies

- holidays

- tips on what to do when things go wrong

- information on required literacy levels

- level of flexibility over qualifications (suggested by three interviewees)

- legal factors

- required courses

- hours

- the difficulties of getting the job

- highest potential of job

In the video segments there could be information on-

- who has helped and supported the person interviewed

- the daily routine

- who is the boss

- 'what's good, and what's bad in their work, and how they have dealt with it'

- 'where they got good advice'

- 'what they think their prospects are'

- 'interview technique'

Interviewees were also provided with sample outputs from two currently used computerised careers guidance systems, Prospect HE, and Gradscope, and asked to comment. Opinions were uniformly negative. Common opinions were that they were too long, too complex, and too difficult to read.

	number of responses	mean response
satisfaction with examples	8	-0.63

table 6. Level of satisfaction with example print outs.

6.4. Conclusion

The interviewees provided a good range of experience, and though some of them felt that they did not have sufficient experience to give fully qualified answers to some sections or questions, almost all were willing to give some response. The spread of experience ensures that all the results possess a high level of authority.

On the whole the interviewees suggest that many of the major issues for the adult dyslexic person looking for work are to do with the emotional factors, such as self esteem, rather than simply cognitive deficits. However, they constantly emphasised the need to see dyslexics as individuals, with as wide a variety of abilities and wants as non-dyslexics. As a result many interviewees warned against closing doors on areas of employment due to somone's dyslexia. Because of the importance of emotional factors almost all stressed the need for continuing human support, as they can only be effectively overcome through counselling. As one interviewee said 'I see a lot of people in tears, I see a lot of anger, I see a lot of frustration, and I would never want the humanness to go out of the whole business'.

Careers services for adult dyslexics were seen as insufficient, and there was a general consensus that the system proposed in the scenario would be useful to both adult dyslexics and staff at careers or job centres. Furthermore there was a general consensus that the scenario was feasible, the only real drawbacks being the potential cost, and some concern that some dyslexics may not be comfortable with computers.

Virtually all the suggestions that were made as to the construction of the system and what information it should deliver were excepted, with only a few reservations. The only exception to this was the use of video clips of famous dyslexics to introduce the system. Many thought it would be better to use video clips of 'everyday' successful dyslexics.

On the whole those interviewed were very supportive of the proposed system, and the results outlined above provide a solid basis for the construction of subsequent questionnaires for further professionals, and dyslexic adults themselves.

7. Questionnaire Study of Professionals in the Field of Adults with Dyslexia, Computing and Careers

The overall objectives for this questionnaire study are identical to those for the previous interviews. Due to the more restrictive nature of the questionnaire approach, as opposed to the openness of interviews, the accent is more on the derivation of quantitative data, and less on generating new ideas.

7.1. Rationale and Description of Questionnaire

7.1.1. Why a questionnaire?

- it allows for input from a far wider range of people than the interview study could, i.e. people who are unwilling to submit to an interview, for example adult dyslexics themselves, and those who are less sympathetic to the position of adult dyslexics.

- as the questionnaire will go to a comparatively large number of people it allows for the assessment of the extent of general support for the conclusions arising from the interview study.

- it allows for a sharper focus on the issues that were raised in the interviews.

- it follows on neatly from the Adult Dyslexia Screening Feasibility Study (Nicolson, Fawcett and Miles 1993), i.e. the methodology is consistent allowing for a truer comparison between these two related studies.

7.1.2. What was in the questionnaire?

The questionnaire (see Appendix IIIa) was closely based on the interview schedule and designed in the light of the results of the interview study. The Introduction and the 'Careers Advice System Scenario' closely resemble the sections of the same name presented in the interview schedule, and are identical in substance. The questionnaire itself consisted of 7 sections, covering broadly the same areas as

those covered in the interview schedule and roughly in the same order. As many questions as possible made use of a 5 point scale for responses, in order to minimise effort for the participants, and ease the final processing of the data. However, a large number of questions requiring free comments were also included. The last two sections consist of a SWOT analysis, where the respondent was asked to assess strengths, weaknesses, opportunities and threats for the system, and specimen statements. In the latter the respondent was provided with a number of specimen statements drawn from the interviews. They were asked to indicate whether they agreed or disagreed with each statement, or leave it untouched. Both of these sections were modelled on sections included in Nicolson, Fawcett and Miles (1993).

What follows is an outline of the sections, with a brief description of what each of covers.

Section 1.1: *Background and experience-* this is self explanatory

Section 1.2: *Dyslexics in employment-* what is important for success, strengths and weaknesses.

Section 1.3: *Specialist careers advice-* What is the current state of specialist careers advice? And what are the most effective techniques?

Section 2.1: *Feasibility of the system* - how useful would the system be? can it be done?

Section 2.2: *Specifications of the system-* what information should it offer? and how?

Section 2.3: *Conclusion-* any further points or contacts. The SWOT analysis.

Appendix- *sample comments*

7.2. The Respondents

Names were initially collected from Nicolson, Fawcett and Miles (1993), and these people then provided further contacts. Various interested organisations, such as the Adult Dyslexia Organisation, were consulted. These provided yet more

contacts. A list of potential respondents was assembled, on the basis of the need for the widest range possible of relevant experience in the sample. Individuals who have sufficient relevant expertise are relatively rare, so all suitable potential respondents who could be contacted were sent a questionnaire. The final list of potential respondents came to 77.

To maximise returns, potential respondents who had not returned the questionnaire after approximately one month were sent a second copy along with a reminder letter. If the questionnaire was not received after a further month they were sent a further reminder.

A list of the respondents is provided in Appendix IIIb. Out of 77 questionnaires originally sent out, 24 were returned. Not all of these had a completed sample comments section and less the SWOT analysis.

total of questionnaires sent out	total questionnaires returned	total SWOT completed	total sample comments completed
77	24 (31.17%)	6	16

table 7. **Number of questionnaire returns.**

The respondents were asked a number of general questions on experience, of dyslexics the results are shown in table 8 below. Unsurprisingly all the respondents had extensive experience with dyslexia.

Type of experience	mean	S D
dyslexia in general (1=0-1 years, 5=more than 7 years)	4.79	0.72
proportion of time with adults (1=0-9%, 5=more than 40%)	3.42	1.67
computer use by dyslexics (1=no experience, 5=very extensive)	2.83	1.27
computer careers guidance (1=no experience, 5=very extensive)	1.71	0.81

table 8. **Respondents professional experience.**

A more specific question was also asked on what proportion of their general experience was in remediation/education, assessment, counselling, career guidance, and research. Figure 13. shows the number of people who responded to each question, all the respondents had experience of at least two areas, the majority

had more. Figure 14. shows the percentage of those people's time which has been spent engaged in the activity in question.
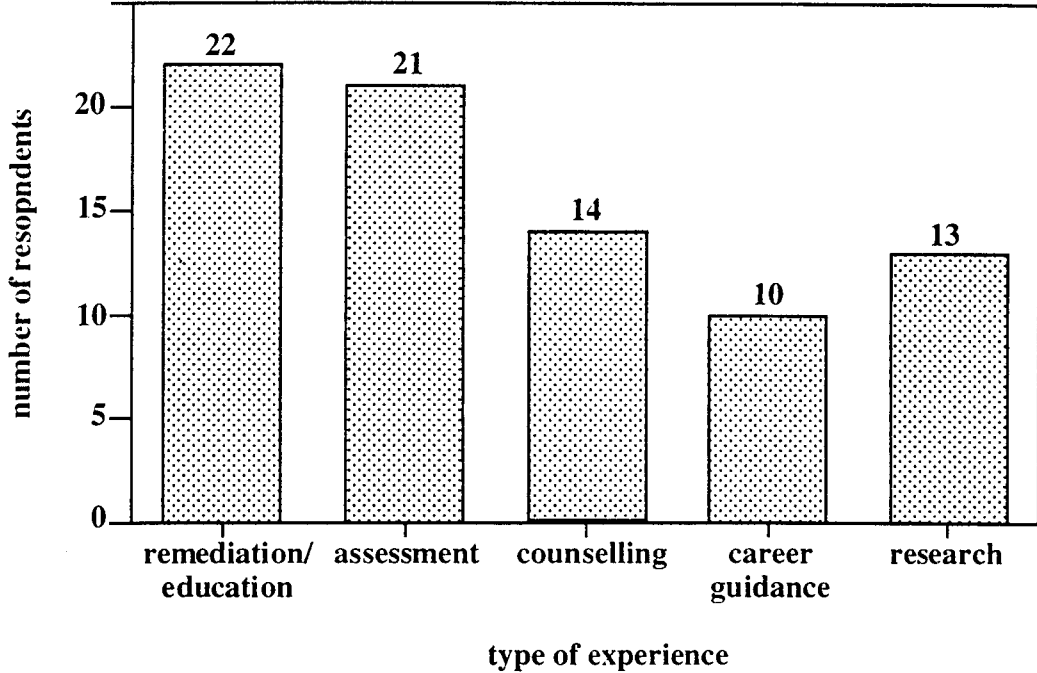
fig. 13. Bar chart showing the number of respondents with specific types of experience.
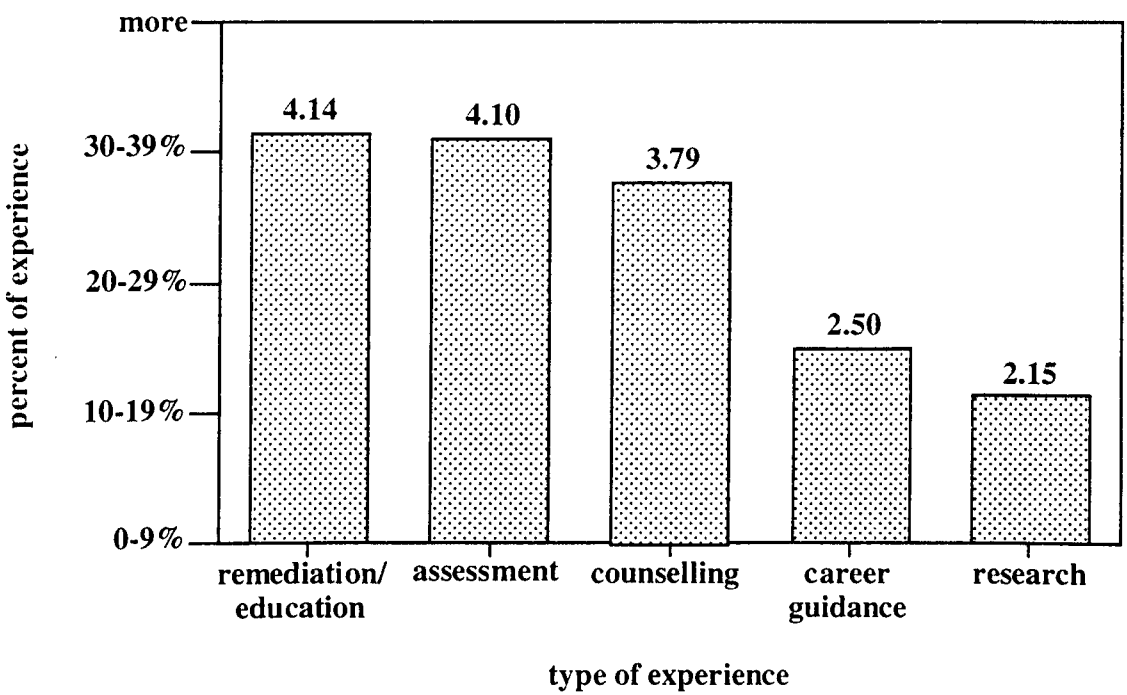
fig. 14. Bar chart showing extent of specific types of experience.

The data above tell a similar story. Most respondents spent the largest amount of their time involved in remediation/education, and assessment, whereas considerably fewer respondents had any experience of careers guidance and research, and of those the mean amount of time spent in these activities was low.

In addition to the quantitative questions above respondents were asked to give a free response to the question '1.1.6 Do you have any other experience which you think would be relevant to this study?'. A full list of responses to this is provided below.

'21 year old dyslexic daughter'

'25 ye general careers guidance, 10 ye training specialist teachers'

'Research into workplace success for LD'

'Teaching dyslexic prisoners'

'Secondary education, and careers advice'

'Regional trainer for employment service. won regional award; 93 for AD course'

'Teacher training in dyslexia therapy'

'Ph.D. in computer assisted reading'

'Trains teachers, careers advisers and counsellors. co-author 'Demystifying Dyslexia"

The most prevalent type of additional experience seems to be in training specialists in providing services or teaching dyslexics.

7.3. Analyses Of Quantitative Questions

A results table with number of respondents, means, and standard deviations for the questions requiring quantitative responses is available in Appendix IIIc. Below is a summary by section of these results. Many of the questions are divided into subsections, where appropriate data will be represented by the use of column charts. In all cases 5 represents the most positive response and 1 the most negative. The data are arranged in decreasing order of positive response

1.2   *Dyslexic People in Employment*

1.2.1   How important do you believe the following factors are in determining how successful an adult dyslexic person is in employment?

The factors were drive/confidence, self knowledge, support past/present, and literacy level. (1=irrelevant, 5=very important)
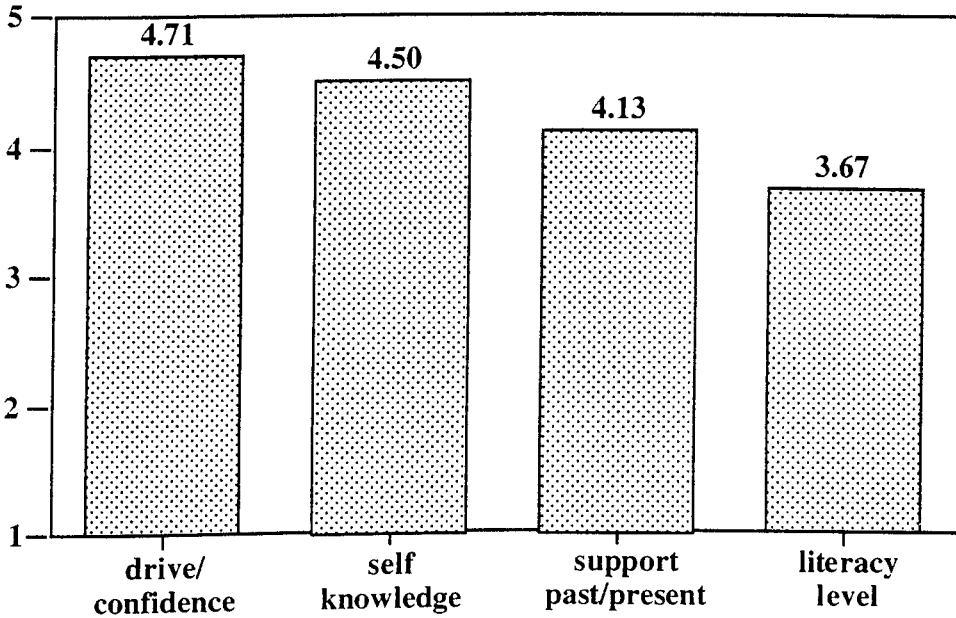
fig. 15. **Bar chart showing opinions on factors in success of dyslexic adults.**

1.2.3   How common do you think are the following strengths in employment amongst adult dyslexic people?

Strengths were determination, creativity and communication skill. (1=very uncommon, 5=very common)
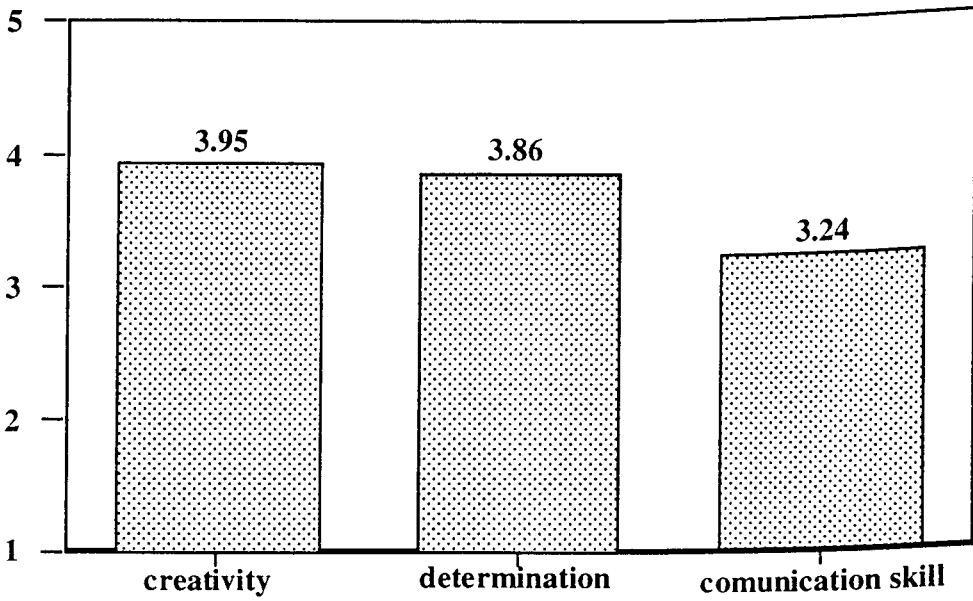
fig. 16. **Bar chart showing opinions on strengths of dyslexics in employment.**

1.2.5   How common do you think are the following weaknesses in employment
amongst adult dyslexic people?

Weaknesses were literacy, lack of self esteem, memory and organisation skill.
(1=very uncommon, 5=very common)
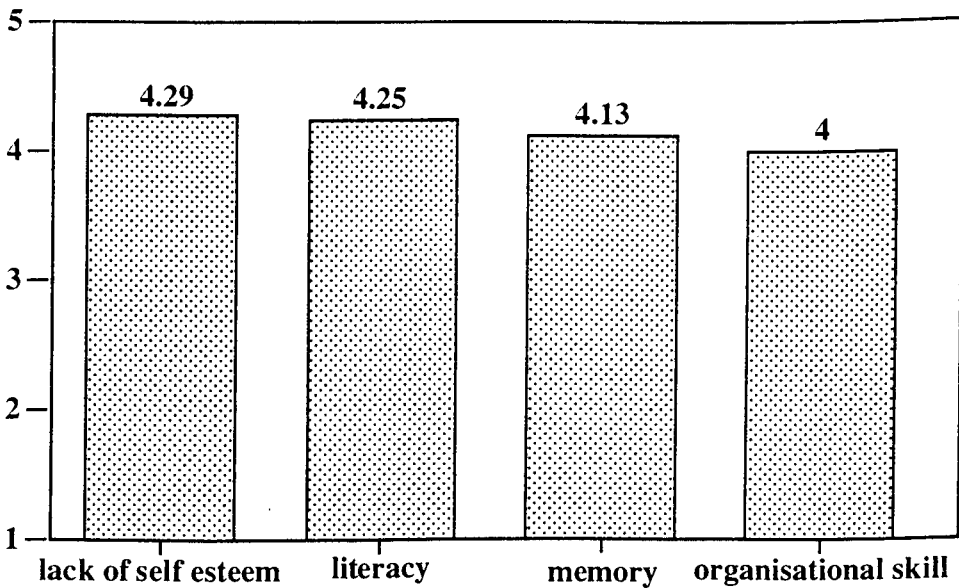
fig. 17. **Bar chart showing opinions on weaknesses of dyslexics in
employment.**

1.3. Specialist Careers Advice

1.3.1   From your experience how would you rate the following characteristics
of specialist careers advice available to adult dyslexic people?

The characteristics were availability, provision of appropriate material, staff
training and awareness, quality of advice. (1=very poor, 5=very good)
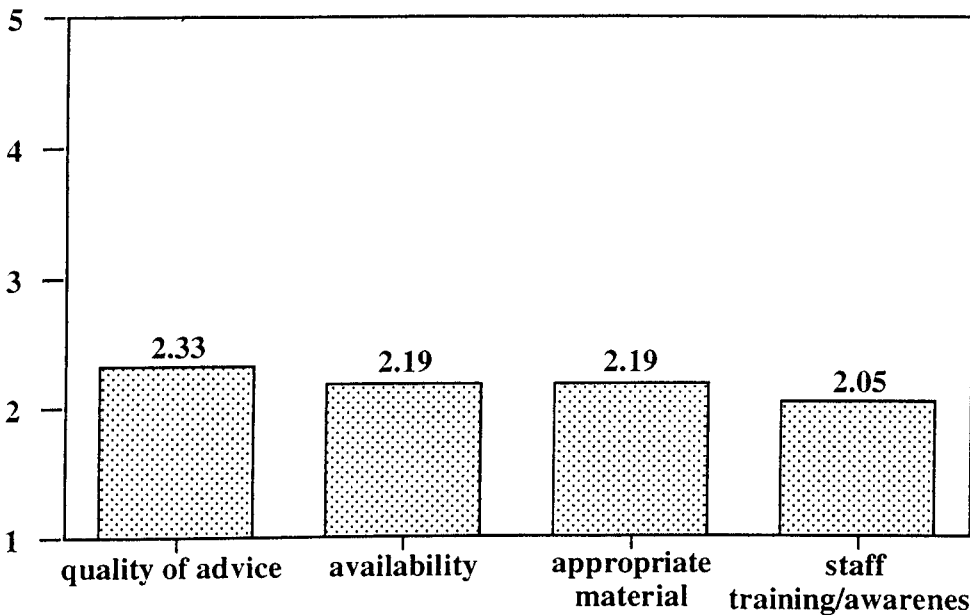
fig. 19. **Bar chart showing ratings for characteristics of available specialist
careers advice.**

1.3.3   How important is it to for a careers adviser to address the following
issues?

Emotional issues, facilitation of self knowledge, disclosure to employers, the latter
refers to the question of whether or how to tell employers about one's dyslexia.
(1=very important, 5=very unimportant)
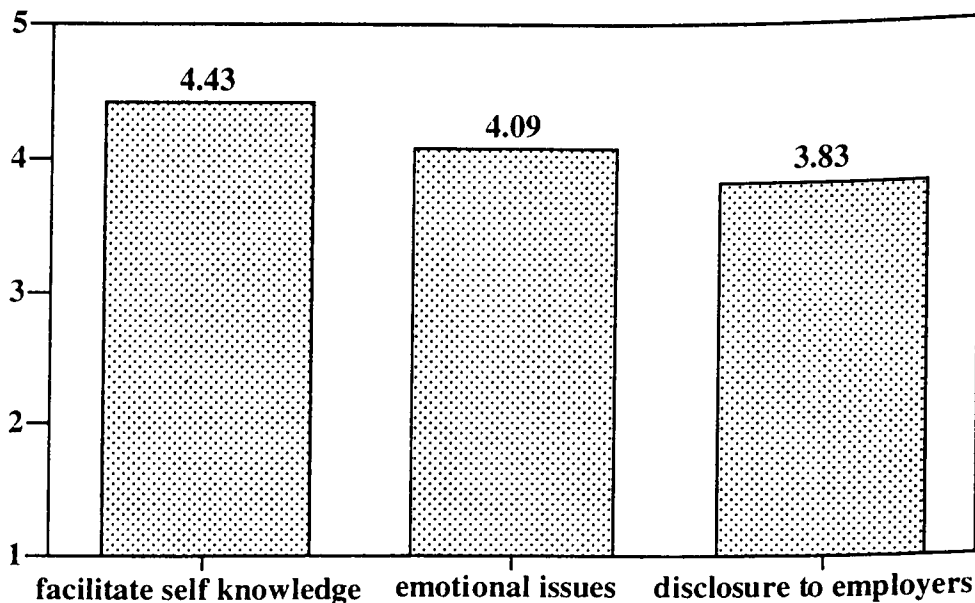
fig. 20. Bar chart showing opinions on important issues for specialist advisers

2.1   Feasibility of the Multimedia Careers Advice System

2.1.1   We are interested in what role a computerised careers advice system plays in the general careers advice processes. We have suggested a number of characteristics of such systems which may strongly influence that role.

How much of an advantage or disadvantage do you think the following characteristics are to staff and clients? (1=great disadvantage, 5=great advantage)

The points were-

a.   the provision of data as a springboard for clients and advisers in later advisery sessions.

b.   the provision of data as a springboard for the use of other resources by the client. e.g. a careers library.

c.   time saving for staff

d.   lessening of time restrictions on the client

e.   large number and broad range of potential job suggestions.

f.   systematic assessment of clients' characteristics

g.   lack of human contact

h.   lack of open ended questions.

i. limited depth of information on specific jobs.
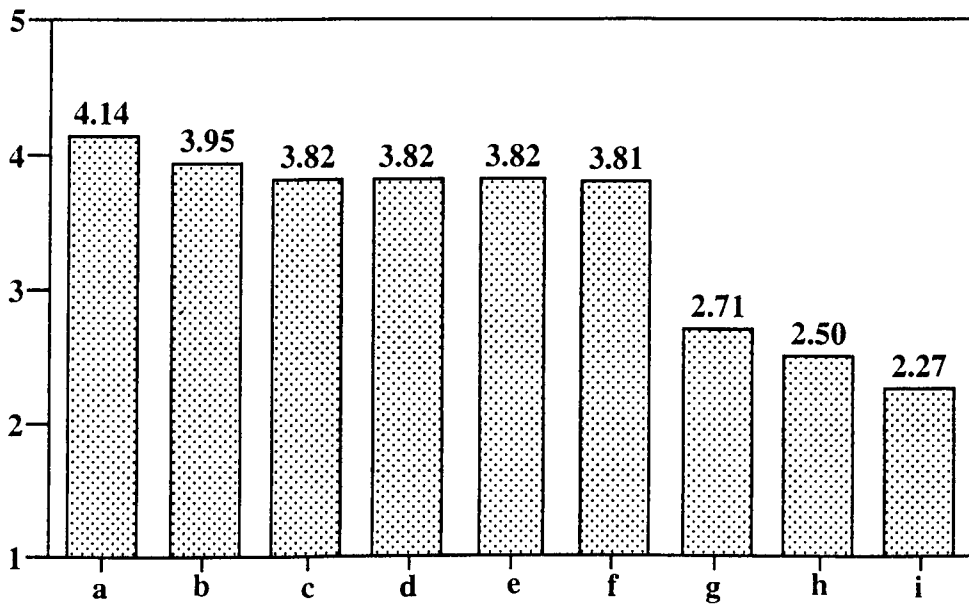
fig. 21. Bar chat showing ratings for specific characteristics of system.

2.1.3 How much of an advantage or disadvantage to adult dyslexic people is there in- (1=great disadvantage, 5=great advantage)

a. using computers (i.e. with icons, touch screen etc.)?
b. inclusion of video footage and sound?
c. interactive structure of the system?
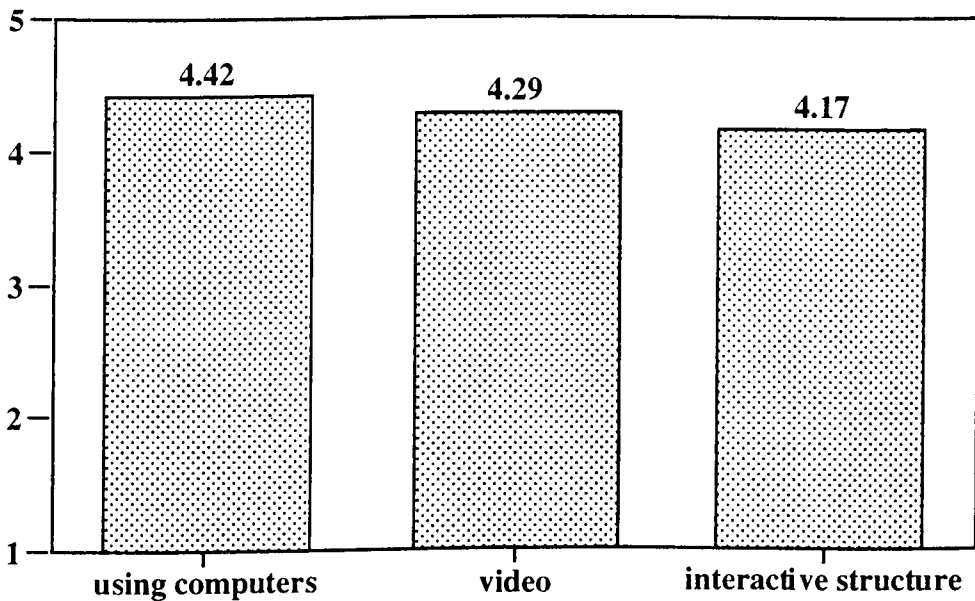
fig. 22. Bar chart showing ratings for general characteristics of system.

2.1.5   How feasible does the scenario sound to you? (1=definitely no, 5=definitely yes)

The mean response to this question was 3.75, i.e. falling in the top of the 'Probably yes' zone.

2.2   Specifications of the Multimedia Careers Advice System

2.2.1   We are thinking of making an introductory front end to the system. How useful do you think it would be to include- (1=not useful, 5=very useful)

   a.   information on how to work the system
   b.   some examples of well known successful dyslexics.
   c.   strengths and weaknesses of dyslexics in employment
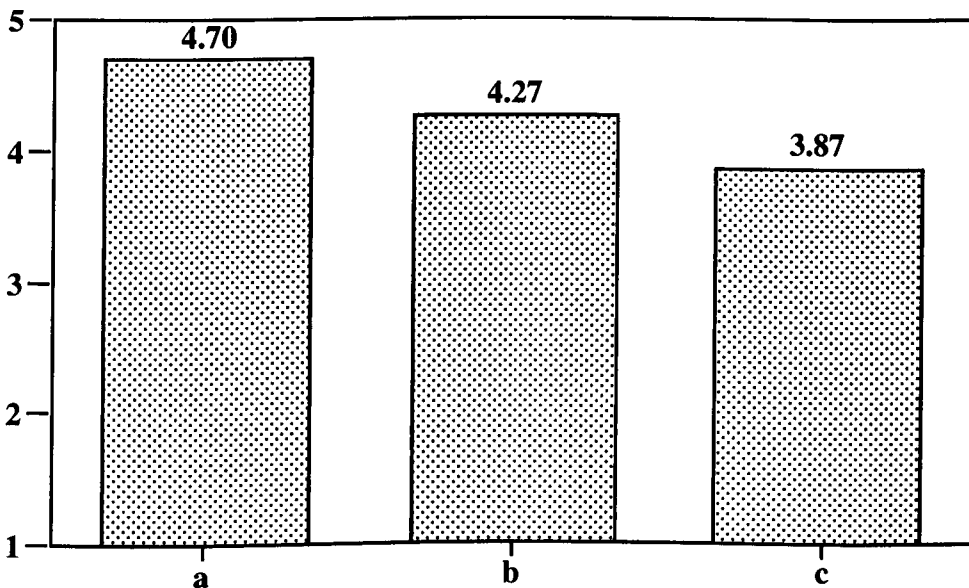
fig. 23. **Bar chart showing ratings for characteristics of the front end of the system.**

2.2.3   How useful would the following pieces of information on specific jobs or areas of employment be to the client? (1=not useful, 5=very useful)

The suggestions were-

   a.   outline of skills required

   b.   minimum qualification

   c.   reliance on literacy skills

   d.   outline of duties

   e.   wages

   f.   outline of working conditions

   g.   reliance on organisational skills

   h.   promotion prospects

   i.   willingness to make accommodations

   j.   information on social environment
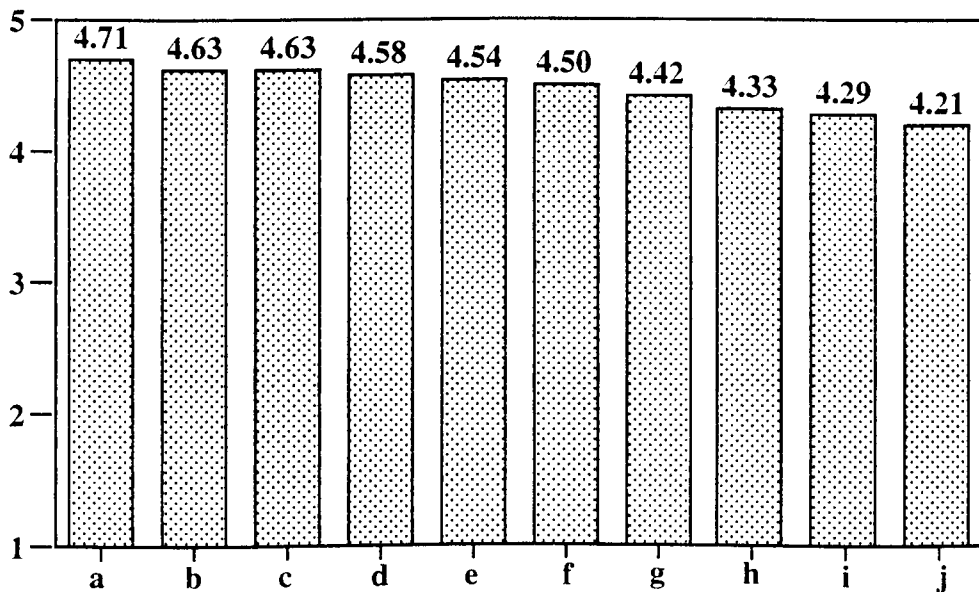
fig. 24. **Bar chart showing ratings for types of information on jobs offered by the system.**

2.2.5   How useful would it be to emphasise the following topics in videoed interviews with successful dyslexics in the work place? (1=not useful, 5=very useful)

The suggestions were-

   a.   ways they have overcome those problems (successful strategies)

   b.   account of problems faced finding/holding down a job

   c.   results of success

d.   their strengths and weaknesses in general

e.   brief personal history

f.   account of their priorities in life in general
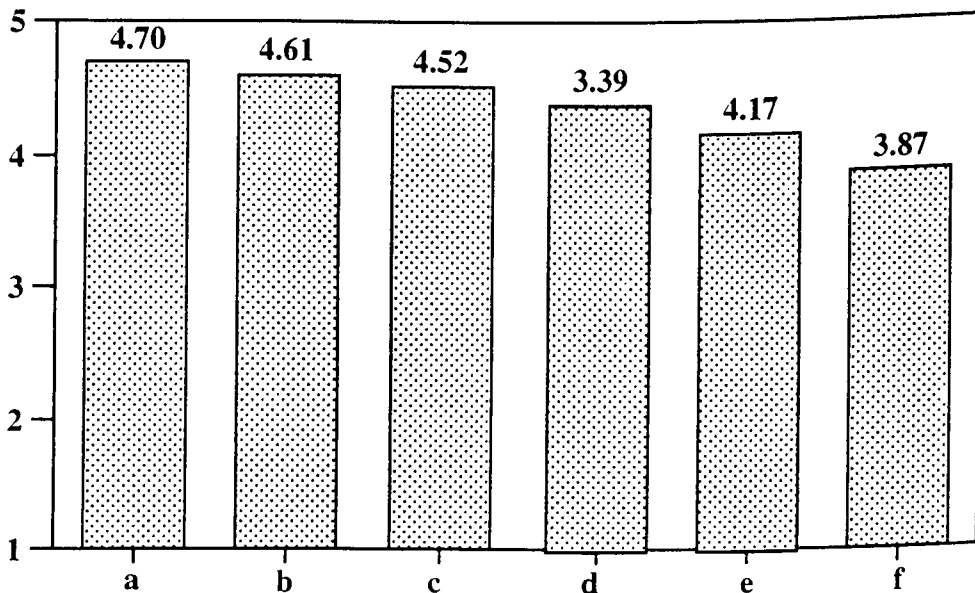
fig. 25. Bar chart showing ratings for types of information in videoed interviews with successful dyslexics.

2.2.6   How useful would it be to emphasise the following topics in a videoed general demonstration of the characteristics of the job? (1=not useful, 5=very useful)

The suggestions were-

a.   deadlines

b.   demonstration of skills required or most useful

c.   account of accommodations (allowances) possible

d.   demonstration of general duties

e.   prospects of, and requirements for promotion

f.   flexibility of hours and duties

g.   working environment

h.   impression of the social environment

153
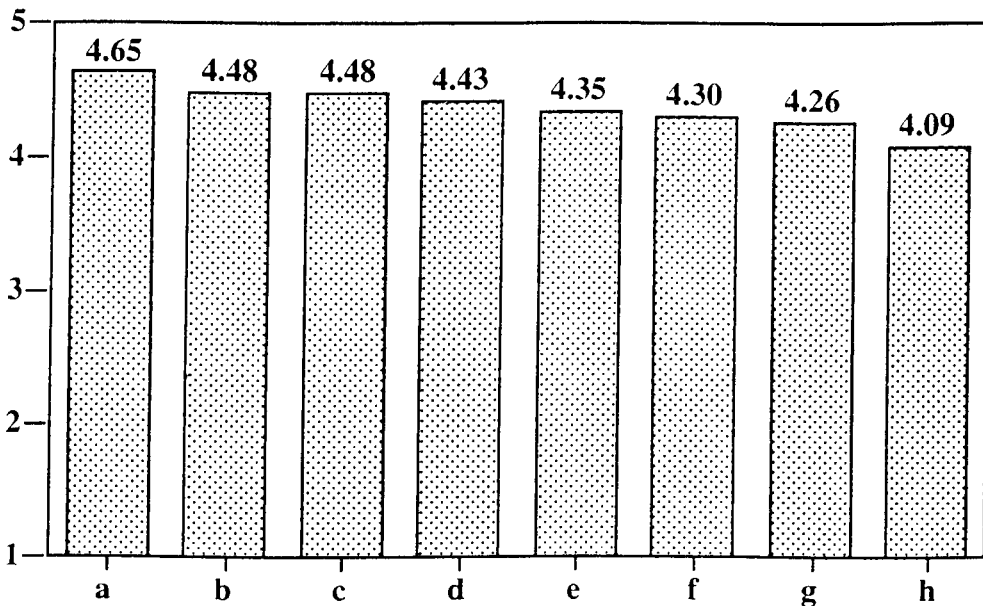
fig. 26. **Bar chart showing ratings for types of information in a videoed general demonstration of the characteristics of a job.**

2.2.8   How useful to staff and clients would it be to include the following pieces of information in the hard output given to the client? (1=not useful, 5=very useful)

The suggestions were-

a.   contacts for dyslexics

b.   list of further appropriate resources

c.   information on jobs the client has requested

d.   job lists compiled from individual assessments (e.g. skills, likes/dislikes)

e.   general information about dyslexia

g.   ratings on characteristics measured in assessments

h.   summaries of information in video segments which client has watched

f.   list/description of unexplored parts of system

i.   account of how client searched the system
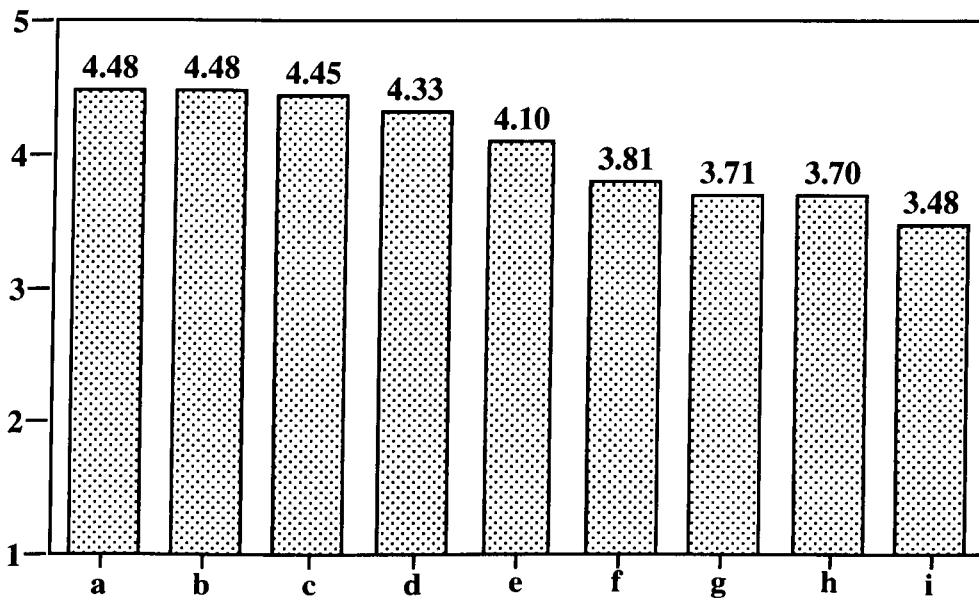
fig. 27. **Bar chart showing ratings for types of information in the hard output.**

7.4. Analyses Of Free Comments Including SWOT Analysis

In addition to quantitative questions the questionnaire contained many questions requiring free comments. These gave the respondent the opportunity to give alternatives to the options provided in the qualitative questions, and provide opinions, and specific factual information.

It would not be practical to provide a full account of the replies to the free comments questions here. Instead table 9 below provides a question by question summary of replies made by two or more respondents, except in cases where the question asks for purely factual information (e.g. question 1.3.2), where all the responses will be stated, along with the initials (in italics) of the respondent responsible. To overcome the difficulties in scoring and summarising free comments, rather than give a verbatim account of the replies, sample statements that capture the gist of replies with very similar content have been generated. It should be stressed that as these are free comments one would expect more respondents to endorse them than recorded here.

Each sample statement has been allotted a number (in italics). These act as a key to table x. in Appendix IIId. This contains a full account of which respondents made which comments.

table 9.a. **Summary of responses to free comments questions (1.1.6 to 1.2.6).**

Introduction		**total of responses**
1.1.6	Do you have any other experience which you think would be relevant to this study?	10
•	no consistency	

1.2	**Dyslexic adults in employment**	
1.2.2	Can you think of any other factors that are important in determining how successful an adult dyslexic person is in employment?	18
1	appropriate strategies	4
2	knowledge of personal learning style	3
3	attitude of employer	3
4	'fit' to job	3
5	interpersonal skill	2
1.2.4	Can you suggest any other strengths adult dyslexic people have in employment?	12
1	empathy/sensitivity	3
2	visual skill	2
1.2.6	Can you suggest any other weaknesses adult dyslexic people have in employment?	13
1	interpersonal skill	4
2	lack of confidence	2

table 9.b. **Summary of responses to free comments questions (1.3.2 to 2.6.1).**

1.3	**Specialist careers advice**	
1.3.2	Can you think of any material presently available that is especially suited to dyslexic people looking for work?	15
1	no	9
2	yes-	
•	Presidents Comity, Carol Dowdy, Alabama *RH* .	
•	PACT, BDA, ADO *FI*	
•	work by D McLoughlin or S Moody; Dyslexia Contact; article by Gerald Hales; ADO manual *GD*	
•	Morrisby Test Battery; Morrisby Profile *GW*	
•	I.T. aids *GG*	
•	Career Soft CD ROM *HuJ*	
1.3.4	Are there any other factors that you believe are important to address in order to gain the best results from careers advice?	9
1	support	2
2	interests of dyslexics	2
2.1	**Feasibility of the multimedia careers advice system**	
2.1.2	Can you suggest any other characteristics which influence the role such systems play, and what effects might these have?	7
•	no consistency	
2.1.4	Can you think of any other benefits and drawbacks of the system outlined in the scenario (page 1)?	10
1	need for human contact	3
2	computers intimidating to some dyslexics	2
2.1.6	What follow up services should be offered to the client after they have used the system?(a number of examples were provided with this question. These were, counselling, job shadowing, and training in CV and letter writing, interview technique, and job searching)	18
1	agrees with suggestions	11
2	human checks, counselling	4

table 9.c.   **Summary of responses to free comments questions (2.2.2 to 2.3.1).**

2.2	**Specifications of the multimedia careers advice system**	
2.2.2	Can you suggest anything else which we should include in this front end?	12
1	examples of normal dyslexics	2
2.2.4	Is there anything else we should include in this general information?	7
1	info. on training	3
2	attitude of employer	2
2.2.7	Can you think of anything in addition to the above that would benefit from presentation in digitised video and sound format?	7
•	no consistency	
2.2.7	Is there anything else we should include in the hard output?	3
•	no consistency	
2.2.8	Is there anything further you can suggest as far as architecture or content of the system which would be of especial benefit to dyslexic people?	4
•	no consistency	
2.3	**Conclusion**	
2.3.1	Can you think of any one else we should talk to?	6
1	yes-	

- careers office
  CM
- Marshall Raskind, Frostig Centre, LA
  RH
- ADO; dyslexic graduates
  GD
- Employment Rehabilitation Service (PACT)
  KJ
- Malcom Morrisby of the Morrisby Organisation
  GW
- Chris Singleton
  LD
- Dr. Gerald Hales, Open University
  MT

table 9.d.　**Summary of responses to free comments questions (2.3.2 to 2.3.3).**

2.3.2	Can you think of any further sources of information we should consult?	4

　1　yes-

- dyslexic computer experts
  CM
- American Occupational Psychology Research
  NM
- Chris Singleton
  GW
- BDA
  HB

2.3.3	Is there anything further you would like to add?	1

- criticises length of questionnaire
  CM

In addition to free comments respondents were asked to perform a SWOT (strengths, weaknesses, opportunities, threats) analysis on the proposed system. Unfortunately, as noted above, only 6 of the respondents took the opportunity to do this. However, a full account of the responses has been provided below, in table 10. As in the free comments above, where there was more than one similar response a statement capturing the gist of all of them has been generated.

Strengths	Weaknesses
• neutral (LD, GG) • objective (GG, LD) • allows independent search (DJ, MJ) • confidential (MJ, YB) • readily available (GG) • gives access to greater amount of info. (GW) • quick (LD) • consistent (LD) • reliable (LD) • encourages standardisation of help (GW) • cheep (LD) • 'safe' (MJ)	• lack of human contact (GW,GG) • some dyslexics don't like computers (MJ, YB) • regarded with suspicion (LD) • ongoing expense (DJ) • unproved (LD) • standardising therapy will lead to some people fitting into the model (GW) • may not be fool proof (LD)
Opportunities	**Threats or Dangers**
• fills gap between demand and supply (LD) • encourages dyslexics to think about success (MJ) • can provide feedback to Careers Office (GG) • chance to get employers involved (GW) • can be continuously updated (GW)	• acceptance, due to different theories of dyslexia (LD) • dyslexic is isolated (MJ) • dyslexic may prefer human adviser (GG) • over reliance by staff may lead to more shallow discussion of dyslexics problems (GW) • dyslexic may treat output as 'bible' (GW) • careers staff may not use it (DJ)

table 10.   **Full account of SWOT analysis results.**

7.5.   Analyses Of Sample Comments

Not all of those who responded completed the sample comments section, possibly because it was very long. However, enough did do it to make the results valuable. The full results suggest that some respondents may have given up part way into this section, or omitted to fill in some whole segments. This is particularly evident in the segments of this section dealing directly with the proposed system, i.e. 'Characteristics of the system', 'Feasibility', and 'Specifications of the system'. The most likely explanations of this are firstly, that these segments require more knowledge of computing and those who omitted them felt their experience was

insufficient in this respect. Comparison of the individual responses to the question on experience of computer use and those who omitted these sections suggests that this is not a strong effect. Secondly, these segments fall towards the end of the section. As a 'no response' could represent either an unwillingness to give an opinion, or alternatively a mixed opinion it would not be proper to remove any respondent or a proportion of their answers from the mean results, even if those answers are continuously zeros. This goes some way to explaining the lower means of sample comments in the above mentioned segments.

Table 11 below provides a section by section account of the most positively and negatively marked sample comments in descending order. No comment attracted a significant amount of controversy, i.e. a large amount of both positive and negative marks. A full account of the results for the sample comments can be found in Appendix IIIe. The numbers next to each sample comment are drawn from table xi (Appendix IIIe) and show the position of that comment within tables xi and xii.

The reader may note that the '% agree' and '% disagree' for each comment in the table below and in Appendix IIIe, do not add up to 100%. This is because the percentages of neutral responses, i.e. where respondents neither agreed nor disagreed, have not been included. Thus, for example, if 87.5% responses are agreements and 0% responses are disagreements the residual 12.5% are neutral responses.

table 11.a. **Summary of sample comments results (1.1 to 2.4)**

1	General	% agree	% disagree
1.1	here are people who can learn, who do learn, but who learn differently	87.5	0
1.2	There's no such thing as a standard dyslexic	87.5	0
1.3	three different categories at least. Some with verbal problems, some with visual problems, some with problems in both dimensions	56.25	0
1.4	generally careers advice is not brilliant.	50	0
1.5	rather than doing things in isolation you've got to be connected up with people like the Department of Employment and the Careers Service	50	0
1.6	They felt to be loners	50	0
1.7	adult dyslexics aren't just children grown up	50	0
1.8	They often get stuck in using a lot of energy covering up	43.75	0
1	**Employment of adult dyslexics**		
2.1	if you (the dyslexic) feel you can actually do the job, then go for it	62.5	0
2.2	most of them are making decisions based on years of being told what they can't do	43.75	0
2.3	provided people understand what they're dealing with they can be successful in any sort of sphere	37.5	0
2.4	Its not until they get in the work place that they really can find out whether they can do it or not	37.5	0

table 11.b. **Summary of sample comments results (2.5 to 9.2)**

2.5	dyslexics get very depressed by failure, and they should learn how to handle it	37.5	0
3	**Factors in Success**		
3.1	if they're going to break into successful employment they must be aware of their abilities, they must be equally aware of their difficulties	87.5	0
3.2	the ability to pick yourself up and restart is very important.	56.25	0
3.3	(the major factor in success is) extent to which they've been prepared to persist	43.75	0
4	**Strengths**		
4.1	many dyslexic people are often sort of more lateral in their thinking so sometimes they can be the creative one in an organisation	81.25	0
4.2	often people are getting somebody who has been very determined and persistent	50	0
4.3	Verbally their usually OK so that's usually a strength	37.5	12.5
5	**Weaknesses**		
5.1	lack of confidence that they will in fact be able to do it, that sometimes in fact creates a problem	56.25	0
5.2	you don't want to expose your self in terms of giving an opportunity where you are shown up in your reading writing or spelling	50	0
5.3	getting emotionally upset by other peoples attitudes is something which does happen to dyslexics	37.5	6.25
5.4	their main weakness is that they're people that often can't do things in conventional ways	31.25	6.25
5.13	if they succeeded they would fold up, because they would be so unused to success	0	31.25
5.14	many, many dyslexics are over achievers and tend to collapse very easily	0	43.75
6	**Specialist careers advice**		
6.1	we must be responsible not just to the dyslexic but also to the client who will be using the services of that dyslexic	62.5	0
6.2	people still perceive it very much as a literacy difficulty; they don't understand any of the broader issues	56.25	0
6.3	train staff to recognise that lumping together people who are dyslexic doesn't work.	43.75	0
6.4	if you're focusing just on literacy skills then people with difficulty can wind up with poor advice	43.75	0
6.5	careers guidance has got to be a part of what assessment is all about	37.5	0
7	**For best results**		
7.1	there should be no door closing on potential sources of employment	50	0
7.2	person who is giving the advice, whoever it is, must have additional training	43.75	0
7.3	I think the most important thing is to match up a proper cognitive analysis profile of that person with the competencies for a job	37.5	0
7.4	it really needs a holistic approach to be any use at all	37.5	0
7.5	one (the careers adviser) would have to have a real knowledge, not just a theoretical knowledge about dyslexia;	37.5	0
8	**Characteristics of system**		
8.1	interactive structure I think is essential	43.75	0
8.2	(video presentation)The more realistic and life like you can make it, again, the better	43.75	0
8.3	that the client should feel less pressured is really very important	37.5	0
9	**Feasibility**		
9.1	if you do have somebody who's got literacy problems then there's an obvious advantage of using a computer	50	0
9.2	allot of dyslexics enjoy using the computers	43.75	0

	table 11.c. Summary of sample comments results (9.3 to 11.3)		
9.3	the main drawback of a computer system is that it is not going to do what a careers counsellor can do in terms of developing people's understanding and discussing options	37.5	0
9.19	instead of having video footage you can actually just have sound	0	18.75
10	**Specifications of system**		
10.1	I suppose speech output would be a helpful option	43.75	0
10.2	include the option to change the colour of the background and the print	43.75	0
10.3	not famous characters but people who they can relate to who actually are making a very good job of what they are doing	37.5	0
10.4	one has to be careful that the presentation of material is really at a level that is appropriate	37.5	0
11	**Conclusion**		
11.1	there should be a record of who has used the system and a link so for your long term study you can find out how this has benefited people	43.75	0
11.2	careers office should have a training video commenting on the use of the package	43.75	0
11.3	make a video or presentation which would actually be aimed at or went to the employers and that would take away some of the myths about dyslexia	37.5	0

7.6. Conclusion And Summary

A combined summary of the results of both questionnaires and the interviews can be found in Chapter 9 (Section 9.1) below. Presented here is a summary integrating responses to quantitative questions, free comments, SWOT analysis, and sample comments.

7.6.1. Dyslexic Adults in Employment

Drive/confidence was seen as the most important factor in success and literacy level the least. 'Lack of self esteem' was seen as the most common weakness, along with literacy, though others were not far behind. Sample comments suggest that dyslexic adults tend to lack confidence and are unwilling to expose themselves to the chance of being 'shown up'. All of this suggests that the most important factors for dyslexic adults in employment are not necessarily to do with skills, e.g. literacy, but to do with attitudes. The fact that determination comes a very close second to creativity when considering common strengths, both having a clear lead over communication skill, lends further support to the above. Having said this none of the quantitative questions gave a mean below the mid point of 3, most falling in the 4 to 5 range. Also suggested is the great value of self knowledge, which gains further support from suggestions that development of 'appropriate

strategies' and 'knowledge of personal learning style' are particularly important for success.

7.6.2. Specialist Careers Advice

The opinion on presently available careers advice was uniformly low, with only 6 respondents able to suggest any material especially suited to dyslexics. Supporting suggestions in the summary of 'Dyslexic Adults in Employment' above, 'facilitation of self knowledge' was seen as the most important issue for careers advisers to suggest. Again other suggestions were not far behind. As well as emphasising the need for advisers to have specialist additional training, the sample comments stress that advisers should match cognitive profiles to jobs, not limit job options, take a holistic approach and have more than theoretical knowledge of dyslexia. This suggests that each person should be considered very much as an individual. An idea which could be taken as emphasising the need for a human adviser.

7.6.3. Feasibility Of The Multimedia Careers Advice System

Most of the suggestions as to the advantages and disadvantages of computerised careers guidance were accepted at the 'some advantage' level (means of 3 to 4). However, 'limited depth of information', 'lack of open ended questions' and 'lack of human contact' were all viewed unfavourably. These are all things handled better by human advisers. 'Springboard for later advisory sessions' was the highest rated characteristic. Thus, despite strong support for the use of a multimedia system and the use of computers in general from quantitative questions, free comments, and sample comments, respondents constantly emphasise the continuing need for human advisers.

7.6.4. Specifications Of The Multimedia Careers Advice System

All the suggestions as to what should be delivered in the introduction, in the information on specific jobs, in the videos of dyslexic adults and places of work, and hard output were rated positively, most of them falling between the 'quite

useful' and 'very useful' categories, i.e. means between 4 and 5. The only consistent other suggestion regarding the introduction was that we not use 'normal' dyslexics rather than famous dyslexics in the introduction. It was also suggested that information on training and the attitudes of employers would be helpful.

7.6.5. Conclusion

Questions on 'further contacts', 'further resources', and 'any further points' all received a small range of answers with no consistency. With very few exceptions the suggestions of contacts and resources had already been consulted or considered.

Overall results from this questionnaire study strongly confirm the results of the previous interview study. Respondents have a similar amount and range of experience as in the interview study, and in the scaled questions gave very similar responses. In the free response questions a wider range of ideas were presented, but all the prominent points raised were mentioned in the interviews. Again there were no unexpected results in the sample comments section. The general opinion of the system as a whole was positive. However, it was emphasised throughout that there are important tasks that can only be done effectively by a specially trained, experienced human adviser.

8. Questionnaire Study of Adult Dyslexic People on the Feasibility of Computerised Careers Guidance

The objectives for this study were broadly the same as for the previous questionnaire study. However, because of the nature of the participants, some questions ask about personal experiences, where the equivalent questions in the previous questionnaire ask for more general opinions; for example many of the questions on careers advice (see Questionnaire Section 1 below). The opportunity has also been taken to enquire into the respondents' experience of computers (Questionnaire Section 4.1 below).

8.1. Rationale and Description of Questionnaire

The two previous studies gained the opinions of concerned professionals, and thus helped acquire informed opinions on the proposed computer system. However, when constructing any computer system it is vital to obtain the opinions of the end users. Indeed, it would be very presumptuous not to ask the adult dyslexics themselves. Though they are not as likely to have the same breadth of knowledge of the issues covered, they are likely have a more intimate knowledge, and may well be more impassioned.

8.1.1. What was in the questionnaire?

The questionnaire (Appendix IVa) was very closely based on the questionnaire that was sent to professionals (see Chapter 7). Indeed, efforts were taken to make the two questionnaires as directly comparable as possible. However, it would be a mistake to send the same questionnaire to both groups. The dyslexic adults are not liable to be as well informed on some matters, such as technical terms, and the points of view of administrators of the system. They are also far less likely to be tolerant of large volumes of written material and complex explanation. Consequently, an effort was made to reduce the length of the introduction, scenario, and the main body of the questionnaire, as well as simplify the language and explain the less obvious points. Thus, in the context of the questionnaire for

professionals, some of the questions were shortened, and the entire Sample Comments and SWOT analysis sections were omitted. Some of the questions were omitted, such as those asking the likely benefits and drawbacks to staff administering the system. Often questions were reworded so that they referred specifically to the respondent. It would be unwise to expect the respondent to have, or be in a position to give opinions on dyslexics in general. The ordering of this questionnaire was also slightly different, in that it was thought wise to place questions dependent on the scenario closer to the beginning, and leave the simple questions on personal details to the end, when respondents are liable to be tiring. Many thanks to Donald Schloss and the ADO for their assistance in refining the design of this questionnaire, and for help in distributing it.

The body of the questionnaire consisted of 4 sections, the last being devided into 3 subsections. As many questions as possible made use of a 5 point scale for responses, in order to minimise effort for the participants, and ease the final processing of the data. However, a large number of questions requiring free comments were also included.

What follows is an outline of the sections with brief descriptions of the areas covered.

Section 1.	*Specialist careers advice-* what, and how good was the careers advice the respondent has received? What should it have been like?
Section 2.	*Feasibility of the multimedia careers advice system-* what are the advantages and disadvantages of the system?
Section 3.	*Specifications of the multimedia careers advice system-* what information should it offer? and how?
Section 4	*Your background-* divided in to the three following sections
4.1	*Computer use-* what experience do the respondents have of computers?
4.2	*Employment History-* how successful is the respondent? what are their strengths and weaknesses?
4.3	*Background details-* qualifications? time of diagnosis? work done? personal details?

8.2. The Respondents

500 copies of the questionnaire were distributed to dyslexic members of the Adult Dyslexia Organisation (ADO). As the ADO's main base is in the London area most of these people were in London. Membership of the ADO is, however, open to all adult dyslexics, even those not resident in Britain. As a non profit organisation all that is required is to pay a minimal subscription fee, which covers the costs of printing and distribution of the monthly publication 'Dyslexia 2000', and helps with the administrative costs associated with their help line. Most members initially hear about the Organisation through word of mouth. However, the ADO's regular awareness campaigns, and affiliations with local organisations have swelled their membership considerably. Of course it would be a mistake to assume that dyslexic members of the ADO were completely representative of the entire population of adult dyslexics. However, the same can be said of all available databases of dyslexic adults. For example, in order to be included in such a database one must first be diagnosed, which is not the case for many, possibly the majority, of dyslexic adults. As the ADO attracts members from all walks of life, social strata, and ethnic backgrounds their database is liable to form a relatively balanced sample of the population.

Correctly, the ADO did not wish to breach the confidentially of their members. Thus, they agreed to post the questionnaires themselves, rather than hand over their dyslexic membership list. The 500 recipients of the questionnaire were the first 500 names on that list. Thus, they form a relatively random sample of the ADOs dyslexic members.

500 questionnaires were sent out, and after several months when the return rate had dwindled each potential respondent was sent a short reminder letter. 73 questionnaires eventually were returned.

total of questionnaires sent out	total of questionnaires returned	percentage of questionnaires returned
500	73	14.6%

table 12. Questionnaire returns.

Of these 30(41.1%) were women, 43(58.9%) were men.

Respondents were asked a number of basic questions on their general background in section 4.1 'Background Details'. The full results can be found in Appendix IVb.

Respondents were asked about their age in question 4.3.2.

mean age in years	standard deviation	range
37.7	10.2	20-67

table 13. **Age of respondents.**

The figures above indicate that respondents come from a wide range of age groups, extending from the top to the bottom of the working years.

Question 4.3.3 asked for the home town or city. As the ADO's main base is in London it is no surprise that most of the respondents came from the London area, and the vast majority from the south of the UK.

In question 4.3.4 respondents were asked if they were diagnosed as dyslexic and when that was. 68 had received an official diagnosis, leaving 5 who were self diagnosed. Considering the wide age range the wide range of time since diagnosis below is unsurprising.

mean time since diagnosis in years	standard deviation	range
9.1	9.6	0.5-45

table 14. **Time since diagnosis of respondents.**

Question 4.3.5 asked if the respondent was presently employed. The level of unemployment found in the figures below seems rather high compared to the national average, though the national average may not include some of the people who count themselves as unemployed and available for work, in this study. Those counted as unavailable for work were mostly either students or retired, and would not be counted in the national statistic. Low employment rates among adult dyslexics have been noted before (see 'Introduction'). However, we cannot ignore the possibility that the sample may be skewed, for example those in employment may have less opportunity to fill in the questionnaire, or less interest in the subject matter.

presently employed	unemployed and available for work	unavailable for work
43(58.9%)	17(23.3%)	13(17.8%)

table 15. **Employment rates of respondents.**

Question 4.3.6 asked how long the respondent had been unemployed.

years unemployed	standard deviation	range
3.4	2.9	0.2-10

table 16.   Time unemployed for unemployed respondents.

Questions 4.3.7. and 4.3.8 asked what the respondent's present job was, and what their ideal job was, respectively. No discernible pattern could be found for these data. However, the broad range of jobs indicated does support the supposition that dyslexics are represented throughout the whole range of the employment market.

Question 4.3.9 asked for details of qualifications gained by the respondent. Part a. was on 'O' levels, CSEs and GCSEs.

respondents with 'O' levels CSEs or GCSEs	mean number	standard deviation
55(75.3%)	5.5	2.7

table 17.   'O' level, CSE or GCSE results of respondents.

Part b. was on 'A' levels.

respondents with 'A' levels	mean number	standard deviation
23(31.5%)	2.3	1.2

table 18.   'A' level results of respondents.

Part c. asked if they had a degree, and if so what was it in. 26 responded positively, but no clear pattern was discernible in the type of degree data.

Part d. asked about other qualifications.

number of respondents with other qualifications	mean number of other qualifications per respondent
50(68.5%)	1.2

table 19.   Other qualifications of respondents.

Thus, the sample had a wide spread of levels of qualifications, of all sorts. It varied from those with post graduate, and teaching qualifications, to those with none at all.

Overall the above data suggests that the sample is a relatively good mix of people. This lends the following results a higher degree of authority than they would do otherwise.

8.3. Analyses Of Quantitative Questions

A results table with number of respondents, means, and standard deviations for the questions requiring quantitative responses is available in Appendix IVc. What follows is a summary of the results by section. Almost all the quantitative questions were provided with a 5 point scale for answers, with 5 as the most positive response and 1 as the least positive. There were several exceptions to this that will be pointed out when they arise. Where practicable the results have been presented as, graphs with data arranged in decreasing order of positive response. Figures over the top of each column represent the means, and are provided to give the reader a more precise account of the results than is always possible with graphic formats.

1. *Specialist Careers Advice*

1.1   Have you ever received any formal careers advice?

   if yes

a.   was it in school/college/university

b.   the Department of Employment and Education careers service

These questions were simply answered 'yes' or 'no'. The table below gives the number of respondents who replied 'yes'.

formal careers advice?	school/college/ university?	Department of Employment and Education?
53(72.6%)	36(49.32%)	21(28.77%)

table 20. **Amount and location of formal careers advice received.**

You may notice that the figures for educational institutions and DEE do not add up to the total figure. A small number of people have received careers advice from both sources. They were also questioned on whether they had received formal advice from any other sources. 9 had, but that data will be discussed in the 'Analyses Of Free Comments' below.

1.2   How would you rate the careers advice services you have experienced on the following points?

The points were availability, quality of advice, staff awareness of dyslexia, and provision of appropriate material (5=very good, 1=very bad).
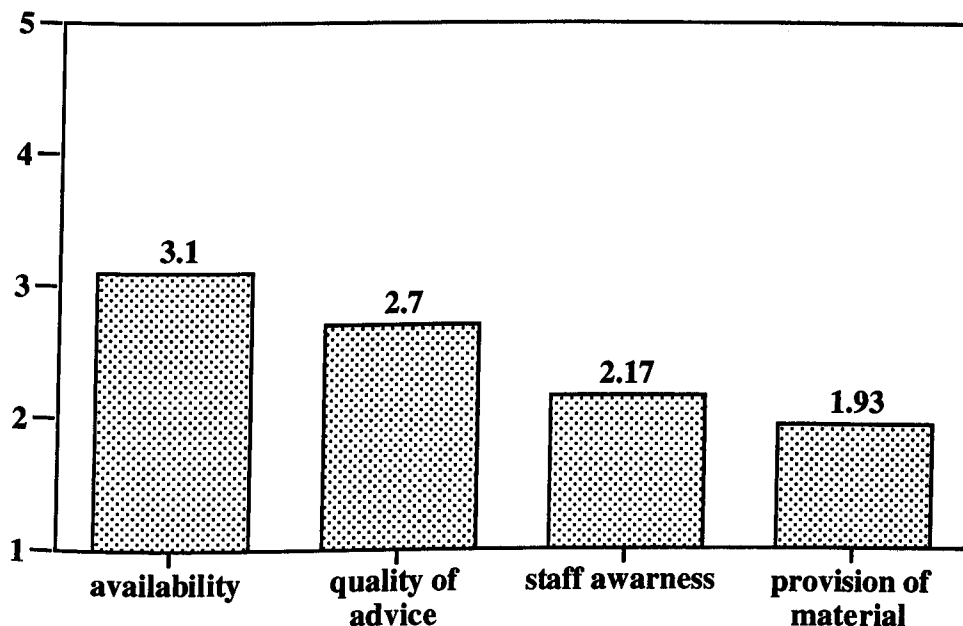
fig. 28. **Bar chart showing ratings of characteristics of careers services experienced.**

1.4   How helpful to an adult dyslexic person is it for a careers adviser to:

talk about the emotional issues to do with dyslexia?
encourage you to understand your strengths and weaknesses?
discuss whether or not to tell an employer about your dyslexia?

(5=very helpful, 1=very unhelpful)
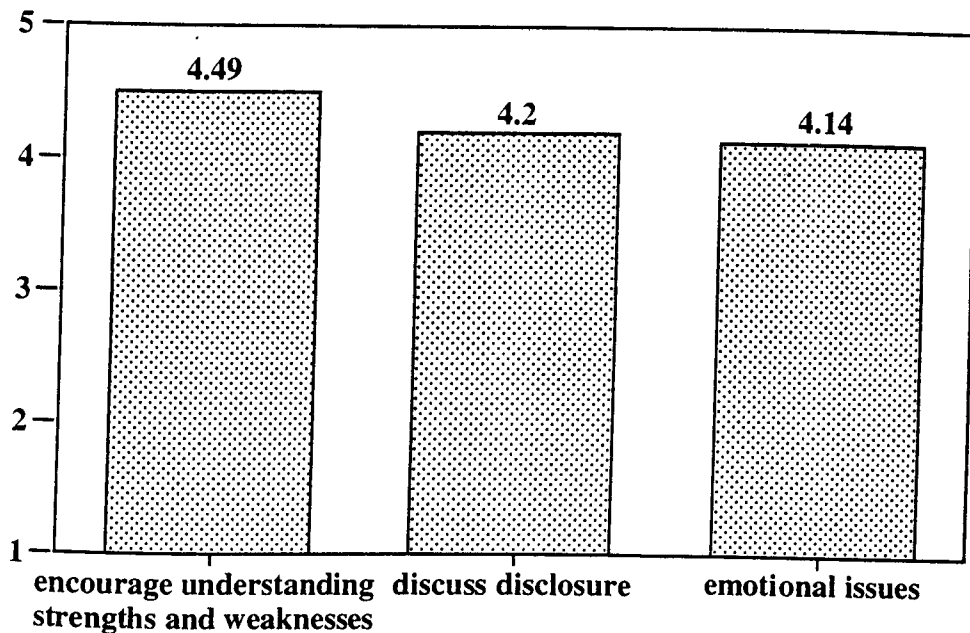
fig. 29. **Bar chart showing ratings on potential characteristics of specialist careers advice.**

2.   *Feasibility of the Multimedia Careers Advice System*

2.1   Please rate the following characteristics of our suggested computer system on how much of an advantage they would be to you? (5=great advantage, 1=great disadvantage)

The points were-

a.   that you can spend as long or short a time as you like, and run through it in several sessions

b.   that it will give you information that you can discuss with a careers adviser later

c.   that it will asses you strengths/weaknesses, likes/dislikes in a systematic way

d. that it will give you information that will lead you to other resources, e.g. books and pamphlets

e. that you can go through it unsupervised, i.e. there will be less contact with humans.

f. that it can give a lot of different job suggestions, but not much depth of information on each
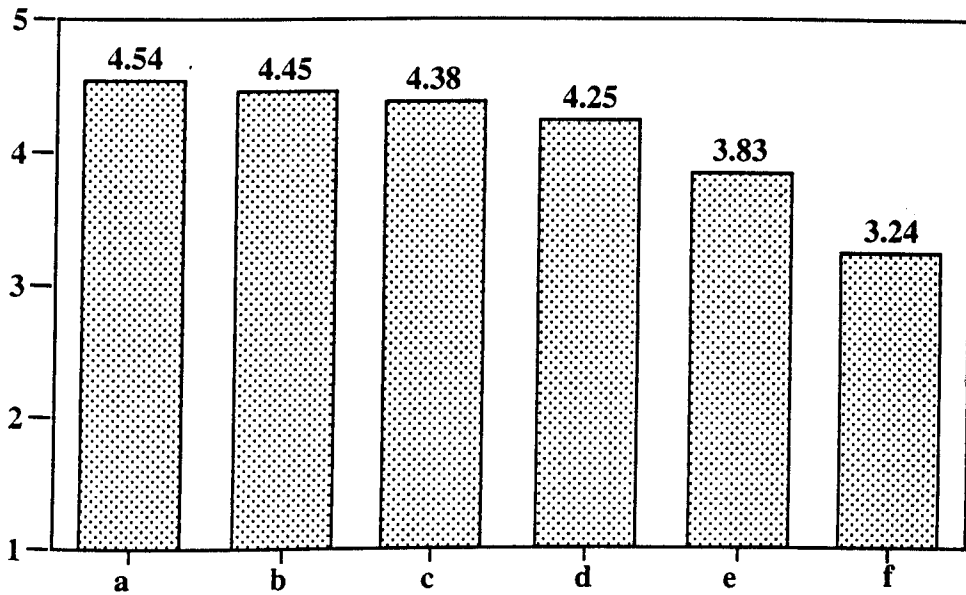
fig. 30. **Bar chart showing ratings on suggested characteristics of system.**

2.2 How useful would it be to include video footage and sound?(5=great advantage, 1=great disadvantage)

This idea was strongly supported, giving a mean score of 4.38, falling between the 'great advantage' and 'some advantage' levels.

2.3 Do you like the idea of the computer system we have proposed? (5=definitely yes, 1=definitely no)

Again the idea was strongly supported, giving a mean score of 4.35, falling between the definitely yes' and 'somewhat' levels.

3. *Specifications of the Multimedia Careers Advice System*

3.1.1   How useful do you think it would be to adults with dyslexia to include the following in the introduction?

Suggestions were, 'information on how to work the system', 'strengths and weaknesses of dyslexics in employment', and 'some examples of well known successful dyslexics' (5=very useful, 1=of no use)
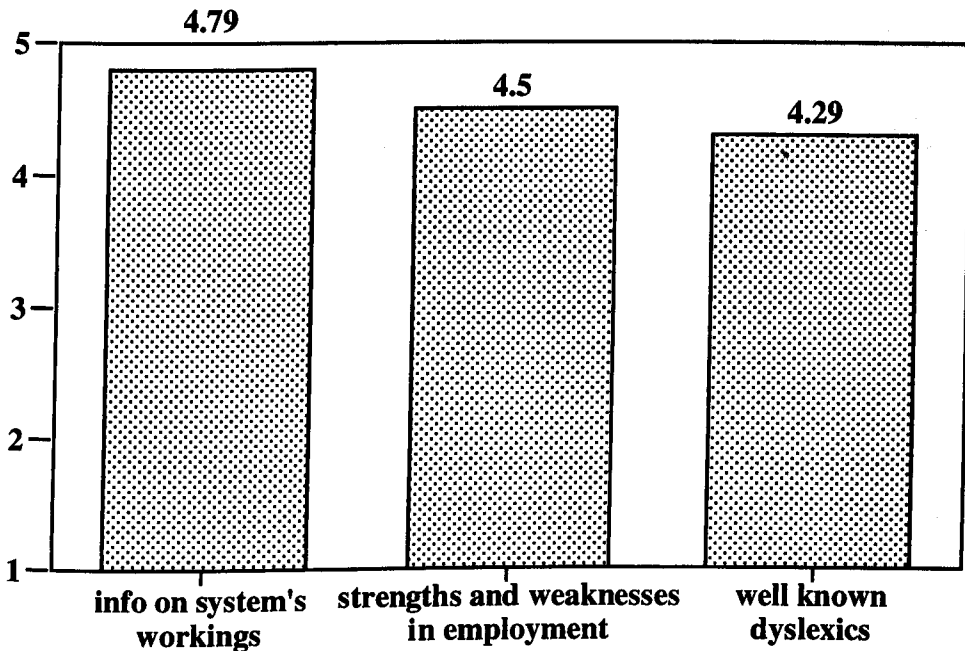
fig. 31. **Bar chart showing ratings on characteristics of introduction to system.**

3.2.1   How useful would the following pieces of information on specific jobs or areas of employment be to you?

What follows is an account of the pieces of information suggested with the mean results in table form. The results for this question were so uniform that they gain nothing from being presented in graph format (5=very useful, 1=of no use).

willingness to make accommodations for dyslexics	4.92
outline of skills required	4.81
outline of duties	4.73
reliance on literacy skills	4.71
reliance on organisational skills	4.71
promotion prospects	4.56
wages	4.54
minimum qualifications	4.50
outline of working conditions	4.49
information on social environment e.g. is it informal and friendly or impersonal?	4.44

table 21. **Ratings for types of information on specific jobs.**

3.2.3   We have suggested a few things that could be emphasised in videoed interviews with adult dyslexics in the work place. Please rate the following.

The suggestions in descending order of usefulness were (5=very useful, 1=of no use)-

a.   ways they have overcome those problems (successful strategies)

b.   account of problems faced finding/holding down a job

c.   results of success to them

d.   their strengths and weaknesses in general

e.   brief personal history by the person

f.   account of their priorities in life in general
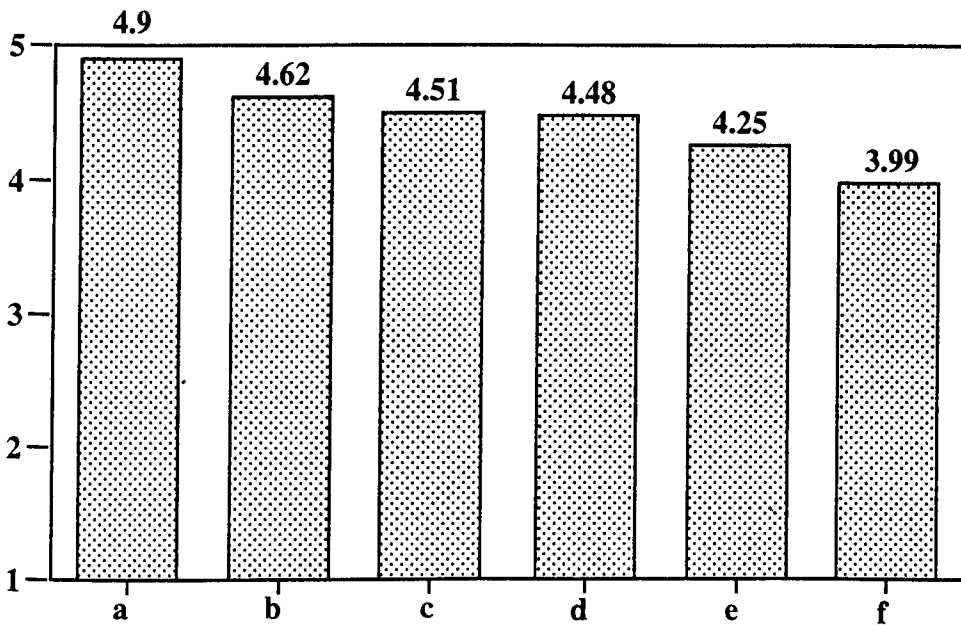
fig. *32.* Bar chart showing ratings for information in videoed interviews with adult dyslexics in the work place.

3.3.1   We have made a few suggestions on what else the printout could have in it. Please rate the following suggestions.

These suggestions were in addition to information on the jobs the user has looked at. Again, these results are so even that they would not benefit from presentation in graph format. Thus, the table below provides the suggestions with their mean results in descending order of usefulness (5=very useful, 1=of no use).

contacts for dyslexics	4.76
job lists compiled from individual assessments (e.g. skills, likes/dislikes)	4.66
list of further appropriate resources	4.56
ratings on characteristics measured in assessments	4.44
general information about dyslexia	4.40
list/description of unexplored parts of system	4.17
account of how client searched the system	4.09
summaries of information in video segments which client has watched	4.09

table *22.*   Ratings for types of information in the print out.

4   *Your Background*

4.1   *Computer use*

4.1.1   How much do you use a computer?

Options for this question were on a 5 point scale, varying from 'every day' at 5 points, through 'every week', 'every month or two', 'very occasionally', to 'never' at 1 point.

The mean of responses to this was 3.73, placing between the 'every week' and 'every month or two' levels.

4.1.2   What have you used it (a computer) for?

Following from the last question, respondents were asked to estimate how much of their computer use was in the following areas; 'word processing'; 'spreadsheets, working with numbers'; 'getting information. e.g. the internet, CD encyclopaedias'; 'games'. The reply options offered to the respondent were, 'often', 'sometimes', and 'never'. Numbers above the columns represent means, with 1, 2, and 3 being allotted to the reply options above respectively.
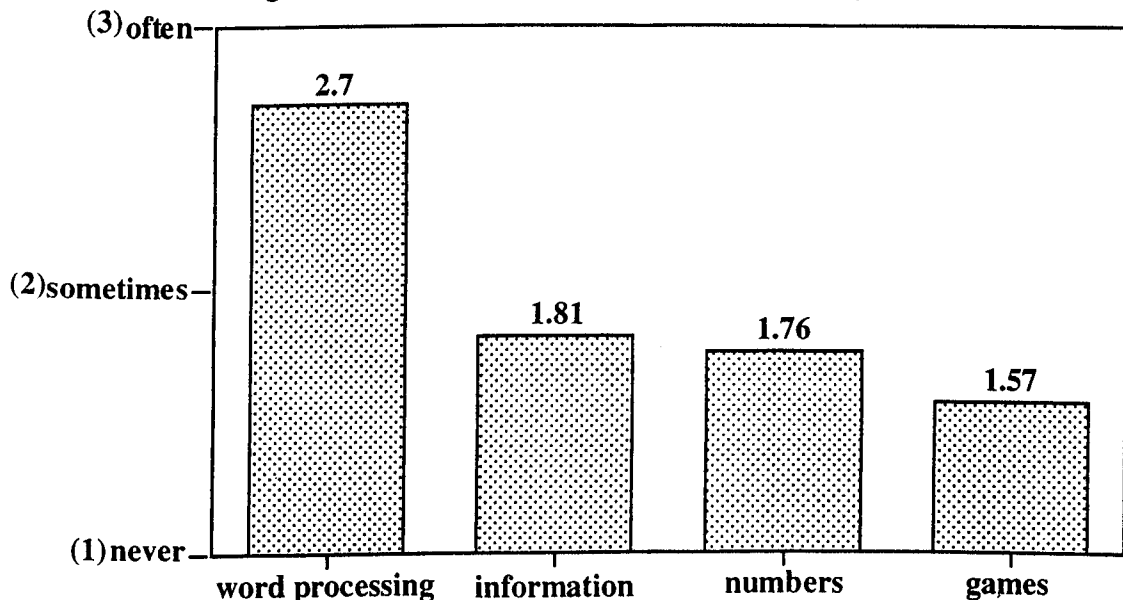
fig. 33. Bar chart showing computer use of respondents.

4.1.3 How comfortable do you feel with computers?

Respondents were asked to reply on a 5 point scale, with 5 being 'very comfortable'. and 1 being 'very uncomfortable'.

The mean response was 3.63, falling between the 'moderately comfortable' and 'neither comfortable nor uncomfortable' level .

4.1.4 How helpful have computers been to you?

Again, respondents were asked to reply on a 5 point scale, with 5 being 'very helpful', and 1 being 'very uncomfortable'.

In this case the mean response was 4.45, falling between the 'very helpful' and 'neither helpful nor unhelpful' levels.

4.2 Employment History

4.2.1 How successful do you feel you have been in employment?

Again, respondents were asked to reply on a 5 point scale, with 5 being 'very successful', and 1 being 'very unsuccessful'.

The mean response fell within the 'satisfactorily successful' level, but very close to the 'moderately successful' level, being 2.99.

4.2.3 How important to you are the following strengths in getting successful employment?

Options were, 'determination', 'creativity', and 'communication skill' (5=very important, 1=very unimportant)
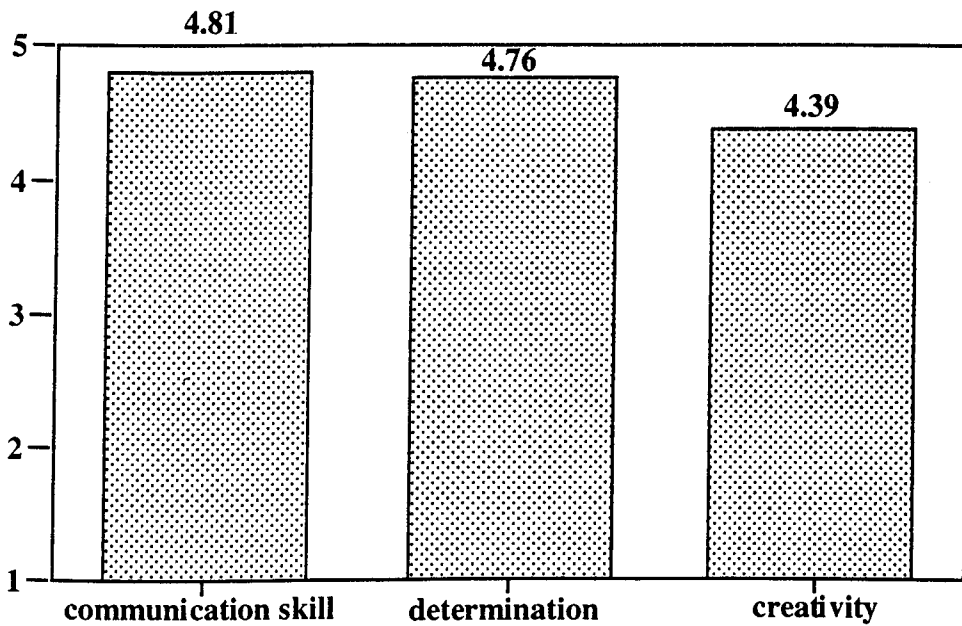
fig. 34. Bar chart showing ratings for respondents strengths.

4.2.5   How important to you are the following weaknesses in getting successful employment?

Options were, 'poor literacy', 'lack of self esteem', 'poor memory', and 'poor organisational skill' (5=very important, 1=very unimportant).
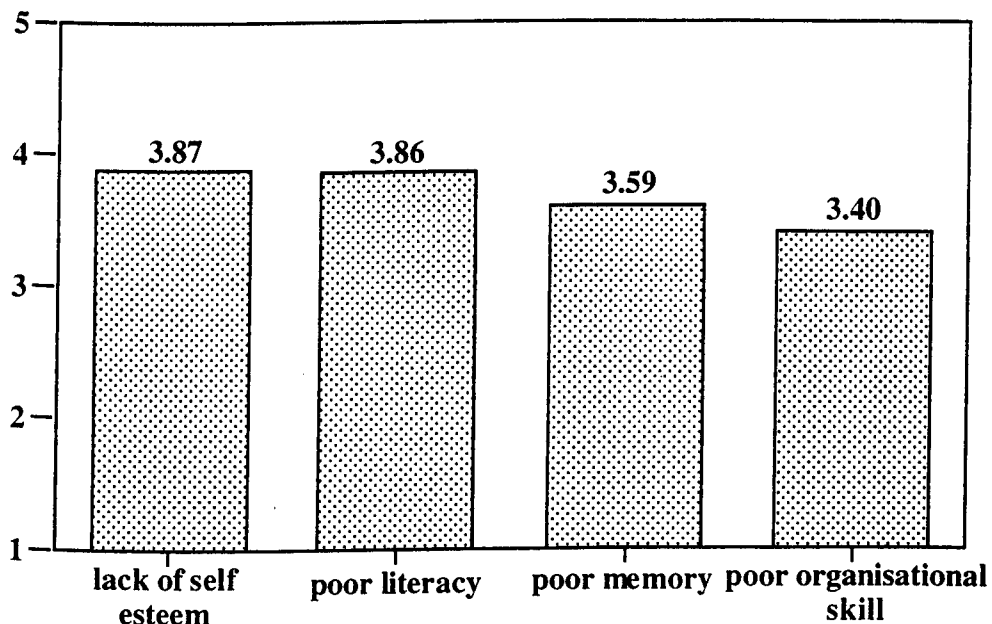
fig. 35. Bar chart showing ratings for respondents weaknesses.

8.4. Analyses Of Free Comments

As with the previous questionnaire, this questionnaire contained many questions requiring free comments, providing the opportunity for respondents to give alternatives to the options presented in the quantitative questions, put forward opinions, and give specific factual information.

It would not be practical to provide a full account of the replies to the free comments questions here. Instead, in table 22 below a question by question summary of replies made by two or more respondents will be provided. The exceptions to this are cases where the question asks for purely factual information (e.g. question 1.1c), where all the responses are stated, along with the initials (in italics) of the respondent responsible.. To overcome the difficulties in scoring and summarising free comments, sample statements were generated that capture the gist of replies with very similar content, rather than give a verbatim account of the replies. It should be stressed that as these are free comments one would expect more respondents to endorse them than recorded here.

Each sample statement has been allotted a number (in italics). These act as a key to table xii. in Appendix IVc. It contains a full account of which respondents made which comments.

table 23.a. **Summary of response to free comments questions (1.1 to 1.3).**

1	Specialist careers advice	total of responses
1.1 **c.**	Have you ever received any formal careers advice? other (please state)	10

1 These were-

'after completing a TOPs course'
TPe
'when made redundant'
RCh
'London careers advisery centre'
SJ
'Independent Schools Career Organisation'
RS
'local guidance centre'
SC
'paid for computerised aptitude test with careers guidance'
EL
'referred through Job Support Centre at Bracknell'
MBr
'gone to see Fitzgibbon and McLoughlin'
JM
'Fitzgibbons'
JC
'Jobclub'
BR

1.3	Are there any books, pamphlets, videos, or tapes that you have found particularly helpful in finding a career?	
1	no	24
2	yes	13

specific to dyslexics-

study skills from local Dyslexic Association(Sutton)
JPe
'Disability Now' quarterly
DS
'Creative Career Guide'
JA
'What colour is your parachute'
CA
'Radical Routes' booklets
Rs
'Dyslexia: Signposts to Success'
JL

table 23.b. **Summary of response to free comments questions (1.3 continued to 3.2.4).**

ADO leaflets *LJ* 'Dyslexics and Computers' *B W* 'Every Letter Counts' *JC*	

More general-

Employment Service literature *MH* 'Test Your Own Aptitudes' *AH* own research *LB* 'Diagnostic Careers Data Base' *MBr*	

1.5	Is there anything else specific to adults with dyslexia, that you think it would be particularly useful for a careers adviser to do?	47
1	assistance with applications	5
2	understand dyslexic is an individual	5
3	concentrate on strengths and strategies	4
4	be dyslexic	4
5	discuss college courses	2

3	**Specifications**	
3.1.2	Is there anything else you would like to suggest we should include in this front end?	18
1	encourage dyslexics to 'go for it'	2
2	information on coping with employers	2
3.2.2	Is there anything else you would like to see included in this general information?	26
1	training prospects	7
2	recruitment policies and disability law	5
3.2.4	Can you think of anything else we could present in video format that would be useful to adults with dyslexia?	24
•	no consistency	

table 23.c. **Summary of response to free comments questions (3.3.2 to 4.2.2).**

3.3.2	Is there anything else you would like to see in this print out?	13
1	support contacts	2
3.3.3	In general, is there anything else you would like to see in this system?	11
1	discuss self employment option	2

4	**Background**	
4.1	**Computers**	
4.1.2	What have you used it for?	
e.	other (please state)	26
1	graphic applications	9
2	databases	4
4.1.5	Is there any feature of computers that you have found particularly helpful?	64
1	spell check	37
2	graphic user interface (icons, mouse, etc.)	13
3	word processing in general	12
4	text editing	9
5	grammarcheck	4
4.1.6	Is there any feature of computers that you have found particularly hindering?	57
1	learning/using systems/applications	17
2	complex instructions	9
3	typing	4
4	grammarcheck	2
4.2	**Employment History**	
4.2.2	Just in a few words, can you tell us what you think is the most important factor in determining how successful an adult with dyslexia is in employment?	63
1	employer's/organisation's attitude	9
2	confidence	9
3	happiness/enjoyment	9
4	persistence/determination	8
5	stimulation	6
6	satisfaction	5
7	knowledge and understanding of strength/weaknesses	5
8	interpersonal skill	4

table 23.d. **Summary of response to free comments questions (4.2.2 to 4.2.6).**

4.2.4	Which other strengths have been helpful in getting successful employment?	56
1	flexibility/adaptability	9
2	persistence/determination	8
3	confidence	7
4	social skill	7
5	creativity/originality/lateral thinking	7
6	knowledge and understanding of strength/weaknesses	5
4.2.6	Which other weaknesses have caused particular problems in getting successful employment?	50
1	literacy emphasising form filling	12
2	lack of confidence	10
3	lack of qualification/training	10
4	prejudice lack of understanding	8
5	numeracy	3

8.5. Conclusion And Summary

A combined summary of the results of both questionnaires and the interviews can be found in Chapter 9 (Section 9.1) below. Presented here is a summary integrating responses to quantitative questions and free comments.

8.5.1. Specialist careers advice

A high percentage of respondents had received formal careers advice, the vast majority of this from educational establishments they had attended. However, there was little satisfaction with any aspect of the service they received, especially provision of appropriate materials. Indeed only 20 people found material of any use. In many cases these had clearly not been provided by careers advisers. Our suggestions for what a careers adviser should be covering were received fairly positively. There were also the additional suggestions that they should provide assistance with applications and written tests, and, moving away from the more practical angle of this, that careers advisers should 'understand dyslexic is an individual', 'concentrate on strengths and strategies', and 'be dyslexic'. This suggests that the emphasis in the accompanying quantitative question on the less

practical, and more psychological aspects was justified. These more psychological factors are clearly of great importance to dyslexic adults.

8.5.2. *Feasibility of the Multimedia Careers Advice System*

All our suggestions as to characteristics of the computer system were accepted, at mostly between the 'some advantage' and 'great advantage' levels (between 4 and 5 marks). Only 2 were rated below this level, these were that it will be unsupervised and that it can provide a lot of job suggestions but not much depth on each. The inclusion of video footage was also accepted at between the 4 and 5 levels, as was the idea of the computer system in general, i.e. these ideas were very favoured.

8.5.3. *Specifications of the Multimedia Careers Advice System*

All our suggestions as to information that should be provided at various points throughout the system were rated very positively. Indeed, out of information to appear in the introduction, in general job information, in video segments, and the final hard output only one suggestion fell below 4 marks. This was the suggestion of including an 'account of their priorities in life in general' in things that could be emphasised in videoed interviews with adult dyslexics in the work place, and this gained 3.99 points. The suggestions provided from free response questions in this section show low consistency, with only 2 receiving more than two responses each. These were both in reference to the general information on jobs. 7 people suggested we should include information on training prospects, and 5 suggested recruitment policies and/or disabilities law. As this section is the most important as far as the proposed computer system goes, one can take the very positive response to our suggestions, and the low level of additional suggestions, as an indicator of high support for our general idea.

8.5.4. Computer Use

Computer use amongst the respondents was fairly high, falling well within the 'every week' level. Maybe unsurprisingly the most common use for computers was word processing, which scored far higher than the next highest suggestion. 9 and 4 respondents respectively used graphic applications and data bases. Respondents felt between 'moderately comfortable' and 'neither comfortable nor uncomfortable' with computers, but found them between 'very helpful' and 'helpful', i.e. they found computers more helpful than they were easy to deal with. Spell check systems were seen very favourably with 37 respondents suggesting them as particularly helpful feature of computers. Indeed, the level of support for this factor can be seen from the fact that the next most supported factor, graphic user interface (in which were included use of icons, desktops, etc.) was supported by only 13 respondents, and was closely followed by word processing in general with 12 respondents supporting, and the ability to easily edit text with 9 responses. The above serves to emphasise the value computerised word processors have to dyslexics in overcoming problems with literacy. However, respondents did have problems learning to use the systems and applications, a common complaint being that manuals were difficult to understand. Strongly connected with this, respondents complained that they had problems learning the complex commands and instructions which some computer systems and applications require. This contrasts with the support for graphic user interfaces mentioned above.

8.5.5. Employment History

Respondents only saw themselves as falling within the moderate to satisfactorily successful range in employment. The employer's attitude to dyslexics, level of self confidence, happiness in the job, and the ability to be persistent were suggested by respondents as the most important factors in achieving employment success. Persistence and confidence were also suggested as skills of dyslexics, but were just topped by flexibility. These results together may suggest that the potential for reasonably high levels of employment success for dyslexics is there. Our suggestions for common strengths of dyslexic adults were also strongly supported, the lowest being 'creativity' at 4.39. Perhaps ironically, lack of confidence was suggested by a number of respondents as a common weakness of dyslexics,

raising the possibility of some dichotomy in dyslexics' attitudes or approaches to employment. Other suggestions as to weaknesses were perhaps more straight forward, literacy problems emphasising form filling and job applications, lack of qualifications/training, and prejudice. It is interesting to note that respondents' suggestions as to strengths seem to concentrate on more psychological or emotional factors, whereas suggestions as to weaknesses emphasise more practical matters. Our suggestions as to weakness of dyslexics received a fairly even level of positive support, falling from 3.87 for 'lack of self esteem' to 'poor organisational skill' at 3.40, though not as strongly accepted as our suggestions on strengths. Looking at the questionnaires there is a strong sense that respondents are more willing to dwell on ideas of strengths than weaknesses.

The following charts give the results of all the 5 point scale quantitative questions considered all together in order from the most positively rated to the most negative. This is presented here to allow the reader to assess the strength of each response compared to all the others.

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table 23.a. Summary of responses to quantitative questions ranked by respondents' level of agreement.

	1	2	3	4	5
3.2.1 willingness to make accommodations					
3.2.3 successful stratigies					
4.2.3 communication skill					
3.2.1 outline of skills					
3.1.1 info on systems workings					
4.2.3 determination					
3.3.1 contacts					
3.2.1 outline of duties					
3.2.1 reliance on organisational skills					
3.2.1 reliance on literacy skills					
3.3.1 lists from individual assessments					
3.2.3 problems finding work					
3.3.1 further resources					
3.2.1 promotion prospects					
3.2.1 wages					
2.1 time flexibility for dyslexic					
3.2.3 results of success					
3.2.1 minimum qualifications					
3.1.1 S&W in employment					
1.4 encourage understanding S&W					
3.2.1 outline of working conditions					
3.2.3 S&W					
4.1.4 how helpful?					
2.1 springboard for advisory sessions					
3.2.1 info on social environment					
3.3.1 assessment ratings					
3.3.1 general info on dyslexia					
4.2.3 creativity					

table **23.*b*.** **Summary of responses to quantitative questions ranked by respondents' level of agreement (continued).**

Chart labels (top to bottom), with horizontal axis 1 to 5:

- 2.2 video footage?
- 2.1 assesment of S&W etc.
- 2.3 do you like the general idea?
- 3.1.1 well knowen dyslexics
- 3.2.3 personal history
- 2.1 springbourd for resources
- 1.4 discuss disclosure
- 3.3.1 list unexplored parts
- 1.4 emotional issues
- 3.3.1 how client searched system
- 3.3.1 summaries of video segments
- 3.2.3 priorities
- 4.2.5 lack of self esteem
- 4.2.5 poor literacy
- 2.1 unsupervised
- 4.1.1 computer use how much?
- 4.1.3 how comfortable?
- 4.2.5 poor memory
- 4.2.5 poor organisational skill
- 2.1 large number low deapth of suggestions
- 1.2 availability
- 4.2.1 how successful in employment
- 1.2 quality of advice
- 1.2 staff awareness
- 1.2 provision of material

Overall the results of this study complement well the results of the previous two studies, though there does seem to be more acceptance of the whole system than amongst the professionals. For example, the use of famous successful dyslexics in the introduction received high support here, whereas the professionals preferred use of successful but not famous dyslexics. However, there were no results from either the quantitative or free response questions that could be called surprising or even unexpected.

9. A Multimedia Computer Assisted Careers Guidance System for Adults with Dyslexia

This is the final chapter in this thesis. The results of the research presented in Chapters 6, 7 and 8 are pulled together, along with the conclusions arising from previous chapters, and arrive at an outline of the most appropriate design for a multimedia computer assisted careers guidance system especially designed for dyslexics. Also, some ideas will be presented as to appropriate further work that may be useful in bringing such as system to fruition, as well as add some final thoughts and conclusions.

9.1. Summary and Discussion of Important Results From the Interview and Questionnaire Studies

This section is an integrated account of the findings presented in the three previous chapters, and an examination of those findings in the context of ideas presented in the rest of this thesis, i.e. chapters covering the subjects of dyslexia in general, learning among dyslexics, careers advice for dyslexics and computer assisted careers advice for dyslexics (Chapters 1, 3, 4 and 5 respectively). There are differences between the questions asked in the interviews and questionnaires, and in the ordering and positioning of the questions. However, the overall similarity does ensure that it is possible to compare like with like, and thus arrive at a meaningful set of overall conclusions. Indeed, all the studies were consciously designed to facilitate this.

9.1.1. Dyslexic Adults in Employment

The suggestions provided by the interviewees as to the strengths of dyslexics in employment, in order of preference, were determination, creativity and communication skills. In both questionnaires respondents were asked to rate these three skills in qualitative questions. The professional respondents were positive about all of them. However, the mean level of support, being fairly low in the positive, suggests a good deal of caution on their part. This supports the opinion gathered from the interviewees that one should be very careful when ascribing

strengths, or indeed any other characteristic, to dyslexics in general. This point was repeatedly emphasised in all three studies. Dyslexics must be seen as individuals, exhibiting the same level of variation as non-dyslexics. Thus, it is unwise to have any inflexible preconceptions as to an individual dyslexic person's capacities, styles and tastes. Practically speaking, there should be no automatic door closing on areas of employment. Such words of caution strongly reflect the opinions of McLoughlin et al (1994) presented in Chapter 4 (Section 4.3.2). Dyslexic respondents, on the other hand, were considerably less cautious. Indeed they were extremely supportive of the three suggestions, and very willing to suggest other strengths, such as flexibility persistence and confidence.

There is very little evidence that dyslexics are any more creative than others (see Chapter 1). However, it was has been suggested (see Sections 1.9. and 3.1.2) that dyslexics often tend to develop novel styles of learning and problem solving. If the dyslexic person is able to take advantage of this it could lead to a very creative approach. Speculating from the work of Gerber et al (1992, see Section 4.2.), who further stress the creative nature of adaptive strategy development (they term it 'learned creativity'), one would require a fairly high level of 'reframing' and an appropriate environment so that one can, in a sense, turn weaknesses into strengths. Similar speculations can be made when considering determination as a skill. This is a very similar idea to Gerber et al's concepts of 'desire' and 'persistence'. They emphasise that the highly successful dyslexics they interviewed had taken their feelings of frustration, dissatisfaction and even anger, and redirected these in a more positively, adaptive fashion. Thus, there is good reason to think that these strengths are, in a large part, the result of an adaptive response to weaknesses and the difficulties these cause. As was suggested in Section 4.3., these positive adaptive responses can be facilitated, or even taught, through appropriate counselling and guidance. Thus, there is a clear potential for an advanced multimedia computer system such as the one proposed to help dyslexics actually develop some general skills that are of great value in employment, rather than simply aid with damage limitation.

The suggestion that dyslexics may have skills in communication appears to have little backing in the relevant literature (see Chapter 1). However, following on from the previous argument, it may be the case that skills in this area develop as a result of strategies compensating for impairment in some aspects of language, for example poor written language, or poor vocabulary.

In respect to weaknesses, four common suggestions were drawn from the interviews, lack of confidence, memory, literacy and organisational skill, in that order. From the four other weaknesses proposed by only one interviewee, one could suggest that dyslexics suffer from difficulties with other people's reactions to them. The four common suggestions were put forward in both questionnaires as quantitative questions. The professional respondents gave fairly uniform, and strong support for these, rating lack of confidence/self esteem as the most important. Other responses give further support for this lack of confidence. This may connect with the suggestion that dyslexics are especially unwilling to take a chance, and expose themselves to situations where there is a potential for failure, that might make others aware of their incapacitys. In general, it is clear that both the interviewees and professional respondents considered problems to do with attitudes and emotions, i.e. secondary symptoms (see Section 1.6), equally if not more important than primary symptoms when considering dyslexic adults gaining successful employment. This is also strongly suggested throughout Chapter 4, most notably by McLoughlin et al (1994, see Section 4.3.2.).

Many dyslexics would benefit from remediation in basic skills, which could in part be provided through computers (McLoughlin et al, 1994, see section 4.3.2). However, this is clearly not an appropriate component of the proposed careers advice system. In this system we can only offer a limited amount of help with primary symptoms, such as information and assistance on how and where to find help, some suggestions as to compensation strategies, or even training in specific practical tasks, such as CV or letter writing. However, the system may be a particularly useful tool in boosting the user's confidence and self esteem, as well as helping with other less tangible secondary symptoms such as a sense of isolation, or helplessness. For example, providing the user with an appropriate and attractive occupational suggestion along with sufficient practical information to begin to follow it, could help reassure the user that they are capable of successful employment, instilling in them greater self-confidence, and hope for the future. The learner-centred nature of the system could increase users' sense of responsibility for identifying that occupational suggestion, which in turn could help increase users' self confidence and self esteem by demonstrating that they are capable of personal achievement, and taking active steps to improve their circumstances. Helping users to understand their condition and develop compensation strategies could similarly increase this sense of empowerment, by giving them control over their dyslexia rather than allowing it to control them.

Finally, the use of video as suggested in Chapter 5 (Section 5.5.2) could be very helpful. It can provide a very salient and clear demonstration that employment success is achievable and desirable for the user, as well as showing them that they are not alone in their problems, helping to relieve any sense of isolation.

All the professionals seemed far more definite when it came to ideas of weaknesses as compared to ideas of strengths. This contrasts with the dyslexic respondents, who although they accepted all the suggestions as to weaknesses, did not accept them with nearly as much confidence as the suggested strengths. Though lack of confidence received support other suggestions made by respondents concentrated on more practical problems, such as the implications of poor literacy, e.g. form filling, and lack of qualifications/training. The difference in emphasis as to strengths and weaknesses between dyslexics and professionals may be due to professionals commonly having to focus on weaknesses in their work. It could also be due to the fact that the common weaknesses are liable to be more prevalent among dyslexics than the common strengths, as the latter are likely to be largely positive responses to weaknesses. The dyslexics may find it more psychologically supportive to emphasise strengths, which could be a good policy bearing in mind the benefits of a positive approach suggested by Reiff et al (1994, see Section 4.3.1.). However, it also suggests that the dyslexics may underestimate the extent or impact of weaknesses, i.e. they have some deficiency in self knowledge. This is something that is fairly common among dyslexics (Spekman et al 1992, McLoughlin et al 1994, see Chapter 4)

The most important factors in success for the professionals interviewed were drive/confidence, self knowledge, and the level of support throughout their lives and during the job. These suggestions were well supported by the professional questionnaire respondents, even the order of priority is the same. The professionals were also asked to rate the importance of literacy level. Interestingly, though it was considered important, this came a poor fourth. Again, as one can see, the most important issues in both cases were not directly associated with primary symptoms. The professional questionnaire respondents also emphasised the need for the dyslexic to understand their own personal learning style and make use of that knowledge, i.e. develop appropriate strategies. The dyslexic questionnaire respondents were not provided with any suggestions as to important factors in employment success. However, they were asked to volunteer suggestions. Employers' attitude, level of self confidence, happiness in job and

persistence (in that order) were the most common. This is reminiscent of the responses in the previous two studies. Employers' attitude does suggest some idea of support, and level of self confidence and persistence speak for themselves. In this case there is even less emphasis on primary symptoms.

It is particularly interesting that all of these important factors in success fit neatly into the ideas of Gerber et al (1992, see Section 4.2). Drive/confidence and persistence compare directly with Gerber et al's concepts of 'persistence', 'desire' and general sense of control. Self knowledge and understanding of personal learning style are reminiscent of components of 'reframing', development of strategies is almost identical to learned creativity. Someone who has achieved high levels in all of these resembles very closely someone who has reached the final, action, stage of 'reframing', as well as McLoughlin et al's (1994) final level in their typology of dyslexics (see Section 4.3.2.). Further, level of support closely resembles quality of 'social ecologies', as does to some extent employers' attitude. These, along with happiness in the job, are primary components of 'goodness of fit'. Thus, the whole can be taken as an endorsement of many of Gerber et al's central ideas, and possibly as good an endorsement of the general model as one could hope for without explicitly outlining this model to those questioned. As this model deals exclusively with alterable factors in success, its application holds the clear potential to facilitate significant improvement in the employment success of dyslexics. Consequently, we can say with some confidence that this model can make an appropriate and valuable contribution to the concepts underlying the design of the proposed computer system.

9.1.2. Specialist Careers Advice

Those questioned in all three studies showed great dissatisfaction with the availability and standard of careers advice for dyslexics, and appropriate careers advice material. Thus, there is a clear desire for improved provision in these areas. The proposed computer system could be a very valuable component of this.

Interviewees suggested a number of additional issues for careers advisers when advising dyslexics. In order of frequency these were, address the question of whether and how to disclose one's dyslexia to a potential employer, be sensitive to the emotional issues implicated in dyslexia and facilitate self knowledge.

Professional questionnaire respondents gave good support for all three of these suggestions. However, they did rate 'facilitation of self knowledge' as the most important issue. The dyslexic respondents also gave fairly strong support for all the suggested issues. Again it is interesting to note the importance attributed to helping with secondary symptoms, i.e. the lack of self knowledge suggested in the section above, and emotional problems. Further suggestions from all three studies emphasise the idea that the adviser should be specially trained, having a sound practical knowledge of dyslexia and dyslexics. Thus, the issues in delivering careers advice to dyslexics are sufficiently different from those for others to warrant a need for specialist services. In other words, a definite niche exists for the proposed computer system.

Addressing the question of disclosure is clearly an issue which is only of relevance to those with disabilities that may affect their work, and are not immediately obvious to a potential employer. It becomes a particularly difficult issue when considering disabilities that are commonly misunderstood by the general population. It is unfortunately the case that dyslexics must expect to be confronted on occasions with small-mindedness and prejudice, often the result of others' ignorance. This in itself can be very demoralising and depressing. Therefore, simply telling an employer that one suffers from dyslexia is often not sufficient. One must be able to explain what dyslexia is, how it manifests in oneself, and most importantly how it could affect one's performance in specific jobs and how problems can be minimised. One must also possess the emotional fortitude not to be overcome by others' poor attitudes. Thus, this circumstance also serves to demonstrate the great value of a well developed understanding of one's strengths, weaknesses, tastes and styles (in other words self knowledge), as well as emotional stability and self confidence.

Highly successful dyslexics in the studies by Gerber et al (1992) and Spekman et al (1992) possessed high levels of such self knowledge, which is considered vital for overcoming difficulties and achieving success (see Section 4.2.). Spekman et al further note that highly successful dyslexics tend to exhibit considerable emotional stability and ability to reduce stress. McLoughlin et al (1994, see Section 4.3.2.) emphasise the importance of self knowledge, most notably as a necessary precursor to the development of conscious compensation strategies. They also point out that dyslexics are often deficient in such knowledge, as well as more vulnerable to affective problems. In support of this, note that lack of

confidence was seen as a major weakness of dyslexics in the previous section. McLoughlin et al are at pains to make clear that in order to facilitate the maximum probability of employment success both these issues must be dealt with. Thus, there is good support from the literature, as well as the three studies, that facilitation of self knowledge development and helping to deal with emotional issues should be tasks of paramount importance for the proposed computer/counsellor system. Clearly, with a lot of emotional difficulties there is no real replacement for a skilled counsellor. However, most counsellors do not have sufficient knowledge of dyslexia to understand how it may be implicated in their client's problems. In this case a system dedicated to dyslexics, such as that proposed, may help the client bridge that gap.

In the previous section (Section 9.1.1.) a number of suggestions were made as to how the proposed system may help with emotional difficulties, especially the closely associated problems of low self esteem and low confidence. These suggestions apply equally here. As said previously, the suggested video clips of dyslexics could be particularly helpful. Using videos of real people encourages the user to identify with the person in the video, and makes it easier for them to compare their own characteristics with those the person displays (see Section 3.2.5.). This in turn could facilitate the development of a better understanding of how their dyslexia relates to their lives on both a practical and emotional level. By allowing the user to make a fairly thorough and objective analysis of their characteristics as they relate to work, the assessment component of the system could help the them develop more accurate self knowledge. This is likely to be especially the case if the assessment process is of a more complex, adaptive type as opposed to simple and prescriptive (see Section 5.2.1). It may encourage the user to engage in greater thought and judgement, as well as question their assumptions more deeply. It is also important to remember that possessing a good knowledge and understanding of oneself is in itself empowering, and can thus provide a useful counter against a range of negative emotions and their accompanying thoughts (see Section 4.3.2). Finally, one should not underestimate the beneficial effect of the system adopting a positive approach to dyslexia (as suggested throughout Section 4.3.), rather than the negative one that dyslexics usually encounter. Indeed, the dyslexic respondents made it clear that they would prefer such a constructive approach, that emphasised strengths and strategy development rather than weaknesses.

As in the section above, all those questioned were at pains to point out that all dyslexics should be treated as individuals, and thus there should be no limiting of employment options simply on the basis of a positive diagnosis.

9.1.3. Feasibility of the Multimedia Careers Advice System

In the interview schedule that was provided to each of the interviewees there were a number of informal suggestions as to overall characteristics of the proposed system. Interviewees were asked for their ideas and comments. On the whole they chose to discuss the suggestions. Most of the characteristics were accepted as positive. Maybe surprisingly the fact that the system could only offer a limited depth of information was not seen as that big a problem. Too much information could overwhelm the user. This supports the supposition in Chapter 5 (Section 5.2.4.) that it is wise to limit the amount of information delivered at one time to the dyslexic user, as they are particularly vulnerable to the effects of increased cognitive load (see Section 1.3) that would be produced by having to process large amounts of detail. However, they did see a strong continuing need for human contact, and some were particularly worried that a systematic assessment process could be too insensitive and inflexible for dyslexics. The latter is reminiscent of McLoughlin et al's (1994) warnings on using inappropriate tests and assessments (see Section 4.3.2), as well as the problems that could arise from using a simple, prescriptive, trait matching approach in the assessment phase of the proposed system suggested in Section 5.2.2.1. Thus, this worry supports the use of more complex, user centred approaches also outlined in that section. These are inherently more flexible and sensitive to the individual.

In the questionnaires respondents were asked to indicate how favourably they viewed each characteristic. Results from the professionals provide strong support for the conclusions of the interviewees, with the fact that 'springboard for later advisory sessions' was most highly rated adding additional support for the idea that human contact would still be essential. The dyslexic respondents tended to be even more favourable towards the suggested characteristics. The fact that system use will be unsupervised was seen as less favourable again suggests the need for human contact. Thus, there is support from all three studies for this idea. This, in conjunction with explicit support from various perspectives throughout this thesis, (notably Sections 3.1.5, 4.3, and 5.3) builds a particularly strong argument. Be it

from friends, colleagues, family, support groups, other dyslexics, or professionals, human contact and support is an important component of the careers guidance process. The use of video segments of dyslexics is intended to add a human touch, compensating for a lack of appropriate human support, and the system should be designed to stand alone. Nonetheless, the conclusions of the studies serve to emphasis that the system is only likely to be truly effective if it is a fully integrated component of a careers guidance program, including such things as counselling and human follow up.

Interviewees viewed the use of video, the interactive structure of the system and its implementation on computer very favourably. They were strongly supported in this by responses to both questionnaires. All of those questioned in the three studies viewed the system as generally feasible, despite some worries about the cost, and that organisations may be tempted to use it as a replacement for trained, sympathetic personnel. Sampson (1996b) also suggests this is a distinct possibility that must be watched out for.

Interviewees were slightly more cautious about the suitability of computers in general to dyslexics. Some worried that dyslexics may be more prone to becoming confused and feeling daunted. This is a potential problem pointed out in Section 3.2.1. that would be particularly disruptive to learning among dyslexic users (see Section 3.1.3).

It was considered that the dyslexic respondents would be in an especially favourable position to provide more detail on this matter. Thus, in the questionnaire for dyslexics we asked a number of questions regarding the respondents' computer use that have no real comparisons in the two other studies (see Questions 4.1.1. to 4.1.6. in Chapter 7, or Appendix IVa). Those questioned were fairly familiar with computers, found them helpful and were moderately comfortable in using them. They especially favoured the use of graphic user interfaces, and word processors with spellchecking and text editing capacities. The major problems were with learning to use systems along with the necessary commands, and with manuals.

Contrary to some of the worries expressed by the interviewees, this supports the idea that dyslexic users are liable to be sufficiently sympathetic to computers to be willing to use the proposed system, and sufficiently capable to use it effectively. However, as suggested above (Section 3.2.1.), this is far more likely if the system

is equipped with a graphic interface that makes system use simple and intuitive, and well designed orientation and help facilities that eliminate the need to refer to a manual. However, one must consider dyslexics' problems with externally paced tasks, use of symbols, and implicit learning, presented in Chapter 2.

Not many of the interviewees made suggestions as to what follow up services should be offered after system use, although it was generally agreed that some follow up was necessary. In the questionnaire for professionals a number of examples were presented with this question to provide some guidance for the respondent. However, the majority simply agreed that the suggestions were good. Professionals in both studies did emphasis that there should be some human checks after system use. Dyslexic respondents were not asked explicitly about follow ups, but results from other questions do support the idea of help with CV and letter writing, and application forms. Related ideas are also put forward by McLoughlin et al (1994, see Section 4.3.2.).

9.1.4. Specifications of the Multimedia Careers Advice System

Interviewees were asked to comment on the use of video segments of famous successful dyslexics in an introduction to the system. They were in general fairly sceptical. Though the use of successful dyslexics received good support, many worried that users would not be able to identify with famous dyslexics, and would be put off by them. Thus, they emphasise the beneficial effect of using positive role models that are easily comparable to the user. This argument received some support from the professional questionnaire respondents. In both questionnaires respondents were asked to rate the value of using the above mentioned video clips in the introduction, as well as the idea of including information on the 'strengths and weaknesses of dyslexics in employment', and 'information on how to work the system'. All of these were given positive ratings by both groups, though the dyslexic respondents were generally more enthusiastic. Thus, those questioned see a clear need for effective orientation to the system (as suggested in throughout Chapter 5) and to dyslexia prior to engaging in any further action. Furthermore, the introduction section as a whole should not only provide help with using the system, but also help build a wider context for system use, making it more relevant to the user's life, and motivate the user to continue.

All of those questioned in the three studies were asked about what information or topics should be included in general 'information on specific jobs', 'video segments of successful dyslexics in the work place' and in the final hard copy the system will provide. In the interviews a number of informal suggestions (drawn from ideas presented in Section 5.2.6.) were provided for each. Most interviewees chose purely to comment on these. In both questionnaires respondents were asked to rate the value of each of these suggestions, and were given the opportunity to propose more. In all three studies all the suggestions were well accepted. Once again the dyslexic respondents were the most enthusiastic. Additional suggestions from all three studies support the idea that it may be wise to include information on attitudes and policies towards dyslexics, and training prospects and requirements prevailing in specific professions. The former would be particularly helpful in ensuring 'goodness of fit' (Gerber et al 1992 see Section 4.2.2.), and also help with the question of disclosure when considering specific fields of employment (see Section 9.1.2). The latter supports ideas presented by McLoughlin et al (1992, see Section 4.3.2), i.e. that many dyslexics would benefit from further training or education, but must also be especially careful in assessing what is involved.

9.2. Background to Design for a Multimedia Computer Assisted Careers Guidance System for Dyslexic People

In this section conclusions presented in the section above, as well as other ideas presented throughout this thesis (especially Chapter 5), will be applied to arrive at a broad design for the proposed system.

On a general note, it must be emphasised that great care should be taken in designing the graphic user interface for the system, so as to make it as easy and intuitive to use, while requiring the user to enter the minimum amount of text (see Section 3.2.1., on the 'Graphic user interface'). Likewise the ideas and suggestions in Sections 4.2.2 (on 'Graphically mediated text'), 3.2.3. (on 'Speech'), 3.2.4. (on 'Diagrams and Photographic Stills'), and 3.2.5. (on 'Digitised Video') should be fully taken into account and used where ever possible and appropriate throughout the system, even where it has not been explicitly stated that such facilities, or features could be included.

The outline design that has been derived is presented in Section 9.3., but before discussing this actual design it is necessary to outline a few 'general facilities'.

9.2.1. Some General Facilities Available to the User

Throughout their time on the system the user could have access to a number of facilities designed primarily to make the use of the system easier. As these are constantly available they are not included in the design proper below (Section 9.3.). They could be accessible via a menu bar, or constantly displayed set of icons.

9.2.1.1. On-line help.

Efforts must be been made to keep the user fully informed as to how the system works and what each piece of it does. Following from the study outlined in Chpater 2, it would be especially wise to include some explicit training in the meanings and functions of symbols used throughout the system. This has been done via an overall 'Introduction/orientation to system' (No. 2. in design below), and a number of more specific introduction/orientations throughout the system. In all of these cases the user is obliged to view each at least once, and can return to them at any time. However, it may be wise to include supplementary support facilities via the menu bar or its equivalent. Two options which have been used extensively in other computer systems, and are thus familiar to the many computer users, are on-line hyperlinked user manuals, and 'balloon help'.

On-line hyperlinked user manuals commonly take the shape of a complete set of instructions on how to use every part of the system, often accompanied by brief explanations, examples, and tips. These can be accessed via a hyperlinked contents or index page. Sets of instructions that share some relevant features are often directly hyperlinked to each other. The front end of this system is usually a separate window that appears when necessary on top of the normal system display window. This can also include controls that allow the user to move backwards and forwards through the sets of instructions they have viewed. Another facility which is commonly provided with this is an option to query features on the screen. The user can select a feature, access the help system, and the instructions and other

accompanying information on that feature will be automatically displayed in the help window.

'Balloon help' is in some senses more convenient for the user in that it does not require them to navigate through a hyperlinked system, or jump back and forth between a help window and the normal system display window. After engaging 'balloon help' via the menu bar or its equivalent any feature on the screen that the mouse cursor passes over will bring up a small 'balloon' containing information on that feature. Apart from obscuring a small portion of the screen this system does not interfere with the user's ability to perform any task that they would normally be able to perform. 'Balloon' help is not appropriate for providing the user with full detailed instructions, but is suitable for providing brief tips, hints, explanations and descriptions. This approach is particularly suited to explicitly outlining the meanings and functions of symbols used by the system, as advised in Chapter 2.

Both of these options could be made available to the user in the system. In the case of the on-line hyperlinked user manual, links could be provided from sets of instructions to relevant introduction/orientations.

9.2.1.2. Speech output

The issues surrounding use of speech are covered in Chapter 3 (See Section 3.2.3.). It is clear that many dyslexics would find it useful to have some facility which allowed text on the screen to be presented as speech. This should be optional for the user, but available for any text the system presents. Thus, it would be helpful if that option was constantly available via the menu bar or its equivalent. Using the mouse the user could select a section of text engage the speech output system and have that text read to them.

For much of the textual information presented by the system it would be unfeasible to use digitised recordings of actual people dictating the text. Such recorded speech takes up a significant amount of computer memory, and there are a number of components that could deliver a great deal of textual information. In these cases the system could make use of synthesised speech. For components that only deliver a comparatively limited amount of textual information, such as the introduction/orientation components, it may be possible to provide digitised speech on demand. If possible, this is advisable, as these components could benefit

greatly from the 'human touch' provided by digitised speech, i.e. it would be good if the user were encouraged to consider them fairly 'friendly', as they are meant to be supportive. Digitised speech also has the advantages of being easier to understand, and making a more memorable impact (due to natural variations in such things as intonation etc.) than synthesised speech. As computer memory gets cheaper in the future, a more universal use of digitised speech may become feasible.

One final option would be to use speech for the alert sound that accompanies the initiation of all operations, i.e. if the user makes any action on the screen (e.g. activating a link, or marking and saving information) that action could be acknowledged through a very brief spoken description of what has been initiated. For example, upon following a link to some other part of the system the user could be told that they are going to that other part, something along the lines of 'entering [title of the part being entered]'. Despite the fact that there could be a large number and variety of such segments, as they are very short it may be possible to use digitised speech. Again, this may be particularly helpful in making explicit the meanings and functions of symbols used by the system, as advised in Chapter 2.

9.2.1.3. Navigation aids

It is important that the user knows where they are in the system, where they have come from or been, and where they can go to, otherwise there is a chance of them getting lost or side-tracked. This information is partly provided to the user via what has been termed in thesis 'hub navigation screens', these being hyperlinked graphic maps of the system, or individual components (see 'Main hub navigation screen', No. 1.3. in design below). In addition, links to components that have been visited before should be visually altered to indicate this, and at every stage the user will be provided with standard options as to where they can go next. Having said this, the system is designed to allow the user to take a very wide variety of different routes. Though the less conventional routes require the user to pass via 'hub navigation screens', which act as navigation aids, it may be wise to provide the user with some additional navigation facilities via the menu bar or its equivalent.

In particular it may be wise to allow the user to move freely backwards and forwards through the screens they have visited. If they do become lost, or side-tracked they can easily return to a screen they were on before the trouble started. The user could be allowed to see every intermediary screen if they wish, and thus gain a practical knowledge of how they got from 'point A' to 'point B'. The most conventional method for allowing this is to provide 'backwards' and forwards' buttons at all times, and access to a hyperlinked search history. The former are self explanatory. The hyperlinked search history could simply be a menu containing the titles of each screen visited, each one hyperlinked to its respective screen. These are all fairly standard to hyperlinked systems including widely used internet navigators. As such they are well tried and tested, and very familiar to many computer users.

One problem with a conventional hyperlinked search history is that it can be quite difficult to quickly identify the desired screen from a list of titles. Problems with reading could make this especially difficult for dyslexic people. It could be helpful if some means were provided to allow the user to identify specific types of screens at a glance, thus reducing the number of titles they had to examine. For example, the title of each screen of a certain type (e.g. screens displaying 'occupational information files', see No. 6.3 below) could be in a specific colour matching that of the background, or some other prominent feature, of all the relevant screens. Otherwise, the title of each screen of a certain type could be accompanied by a specific symbol which would be prominently featured on all the relevant screens. One could use separate menus for specific types of screens. However, this last option has the disadvantage of making the navigation system considerably more complex, and places much more emphasis on the user knowing exactly what kind of screen they are looking for. It would also make it difficult for the user to determine the position of any title in the order of screens visited, removing a valuable clue as to which title represents the desired screen. For these reasons it is probably best to stick to a simple, one menu approach.

9.3. The Design

What follows is a design and description of the proposed system. The system is broken down into its possible separate components, and the potential contents and workings of each of these is described. Each component is broken down into a number of subcomponents, and in some cases these can be broken down further. For the sake of clarity the number of component levels has been restricted to two. Level one components are headed in bold, level two in italic. In addition, each component has been allotted a number, so as to make it easier to locate. Under these are subheadings, which are in plain text, and have been allotted a letter. As the reader may be unfamiliar with some of the terms used in the following design and description, a small glossary is provided at the end (page 260).

The following system design is linear in presentation in order to demonstrate the most conventional pattern of use for the system. However, it is wise to remember that in fact it possesses a more branched structure, and that the user will be allowed to move about the system fairly freely, despite there being advised routes. Thus, the user will be allowed to skip to apparently later, or earlier components. Consequently, the positioning of some components and subcomponents in the design is, to some extent, fairly arbitrary, e.g. the positioning of 'Main hub option screen' (No. 1.3.).

Immediately following the linear design and description is a design diagram (fig. 37). This is intended to supplement the linear design and description by providing the reader with an overview of the system, emphasising its branching, interconnected structure and the user's freedom of movement. To help the reader towards a full understanding of this diagram, the description of each component or subcomponent in the linear design and description is preceded by a depiction of the relevant section of the design diagram. It may be helpful and informative to the reader if they were to quickly glance at the design diagram before reading the linear design and description.
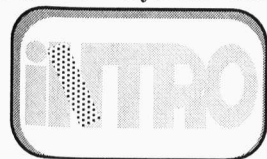
Due to restrictions of space, and the requirements of clarity, it is not feasible for the aforementioned depictions, or indeed the design diagram proper, to show all the fine structural detail and other subtleties outlined in the following linear design and description. Thus, for example, the internal structures and workings of specific

objects (i.e. level two components) are not represented, neither is the transfer of information to the personal record.
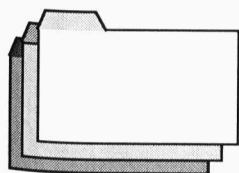
The following is a key to the symbols used throughout the subsequent linear design and description and in the design diagram. Parts of the system that have broadly similar functions have been allotted the same symbol. For reasons stated in the last paragraph the reader is cautioned to take these as only a general guide. In the depictions throughout the linear design and description, components connecting to the component under discussion are represented by small boxes containing six point type. This has been done so as to provide the reader with the relevant information without distracting from the central feature.

As the symbols are used in the linear design and description, it is clearly essential for the key to the design diagram to be presented here. However, in the interests of clarity, and to reduce memory load, a second copy of this key is included adjacent to the design diagram (fig. 37). Finally, due to minor incompatibilities between the drawing program used to construct the design diagram (MacDraw Pro) and the word processor used for the text of this thesis (Microsoft Word), the graphics appearing in the key to the design diagram, and throughout the linear design and description below, have experienced some minor distortions of line and texture. It is unfortunate that no efficient way has been found to rectify this.

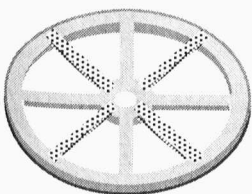*fig. 36* **System design diagram key.**

Introduction screens.
Components that are designed to orientate the user to other components.

User information requests.
Components that ask the user to respond to specific questions.

Data files.
Stores of information or data in any medium. This is accessed via 'Selection components' and displayed via 'Information display screens'.

Selection components.
Screens that show the user what information in 'data files' they have access to, and allow them to select information for display. These can also act as interfaces for 'Comparison processes'.
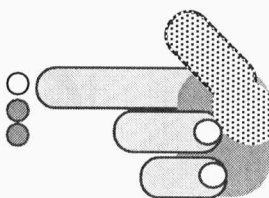
Comparison processes.
Processes that compare criteria generated from the user with occupational information. These generate suggested occupational alternatives that are presented in 'Selection components'.
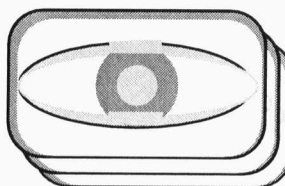
Information display components/screens.
Screens or components that display specific information to the user. Stacks of 'screens' represent components that consist of an number of interlinked information display screens.

Hub navigation screens.
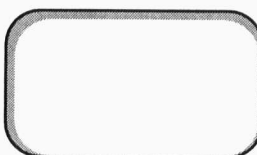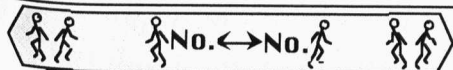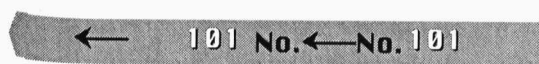See No. 1.3. in linear design and description above for an exemplary description.

Miscellaneous components.
Only used for 'Additional components'. See *, below.

Hyperlink.
Routes the user can take around the system. These can be bi-directional, or one directional.

Data pathway.
Routes by which data is transferred around the system. These are always one directional.

Suggested common route.
The route the user could be encouraged to take through the system as suggested in linear design and description above.

*In the design diagram you will note that the 'Additional components' (No. 8.) are presented in a different fashion to the others. In particular, no graphical information has been provided as to their general functions or structure (having used a 'Miscellaneous component' symbol in each case), and little information on how each of these components could be linked to others. The reason for this is two fold. Firstly, the reader is referred to No. 8. in the linear design and description below. Note that the suggestions made concerning them are shorter and contain considerably more uncertainties than for others. Considering that the design diagram is not really intended to be a fully detailed representation of the system (as said above), it is reasonable to reflect these uncertainties as a lack of detailed information. Secondly, the design diagram in its present state is already fairly dense and complex. Including information on the structure and connections of 'Additional components', which would have to be at least as complex as for other components, would make it significantly more so. The resulting loss of clarity would reduce the design diagram's overall value to the reader considerably.

1. Front end
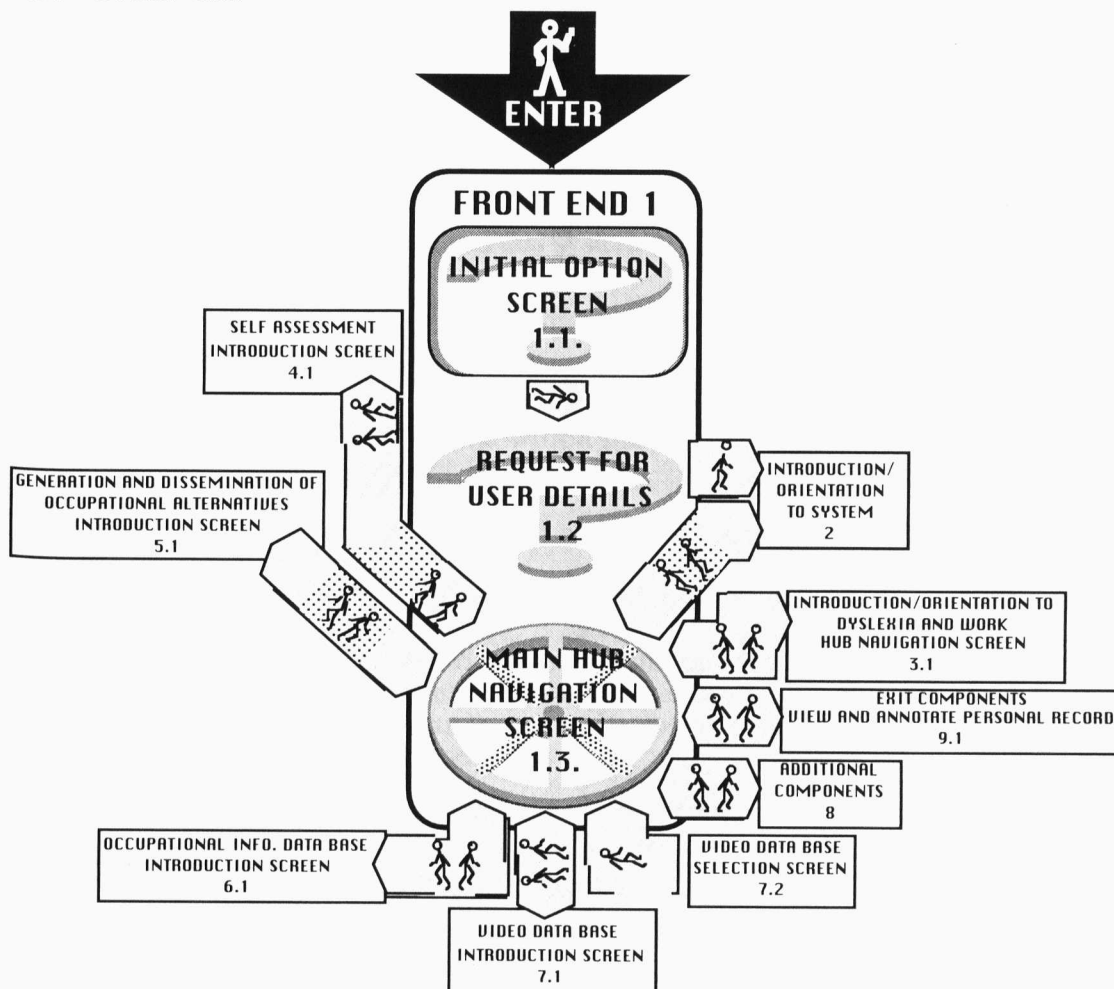
1.1. Initial option screen
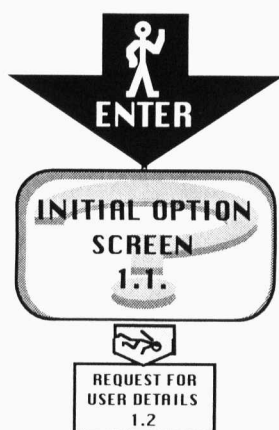

The user should be presented with a brief title for the system and an outline of its function.

a.   User is asked if they have used a computer before.

- If no, user is presented with brief training session in the basic skills necessary for using the system, e.g. use of mouse, icons and hyperlinks, and goes to the next subcomponent (No. 1.2).

- If yes, user goes to the next question.

b.   User is asked if they have used this system before.

- If no, user goes to the 'Request for user details' (No. 1.2).

- If yes, user is provided with the following options

  - continue with a previous session from the point they left off.

  - go to 'View and annotate personal record' (No. 9.1).

  - go directly to the 'Main hub navigation screen' (No. 1.3).

  Access to these should be password protected to ensure confidentiality. If the user cannot recall the password, system administrators must be able to subvert the password protection on their behalf.

1.2.   Request for user details
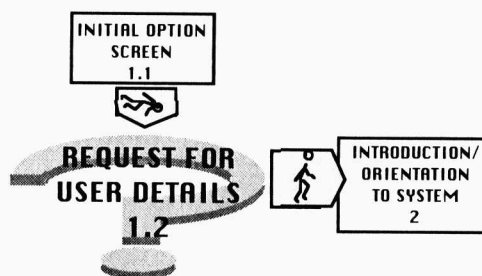
This subcomponent is available only to first time users.

a.   User is asked to enter personal information

This could include:

- name. To allow for personalisation of output, especially the print-out.

- age. To allow for later analysis of system use.

- sex. To allow for later analysis of system use.

- some information on employment history. To allow for later analysis of system use.

This is best done by allowing the user to select options from lists, as it:
- standardises input, facilitating later analysis
- reduces writing burden on user

- password for record protection.

b. on completion of this component

User goes to the 'Introduction/orientation to system' (No. 2).

1.3. Main hub navigation screen
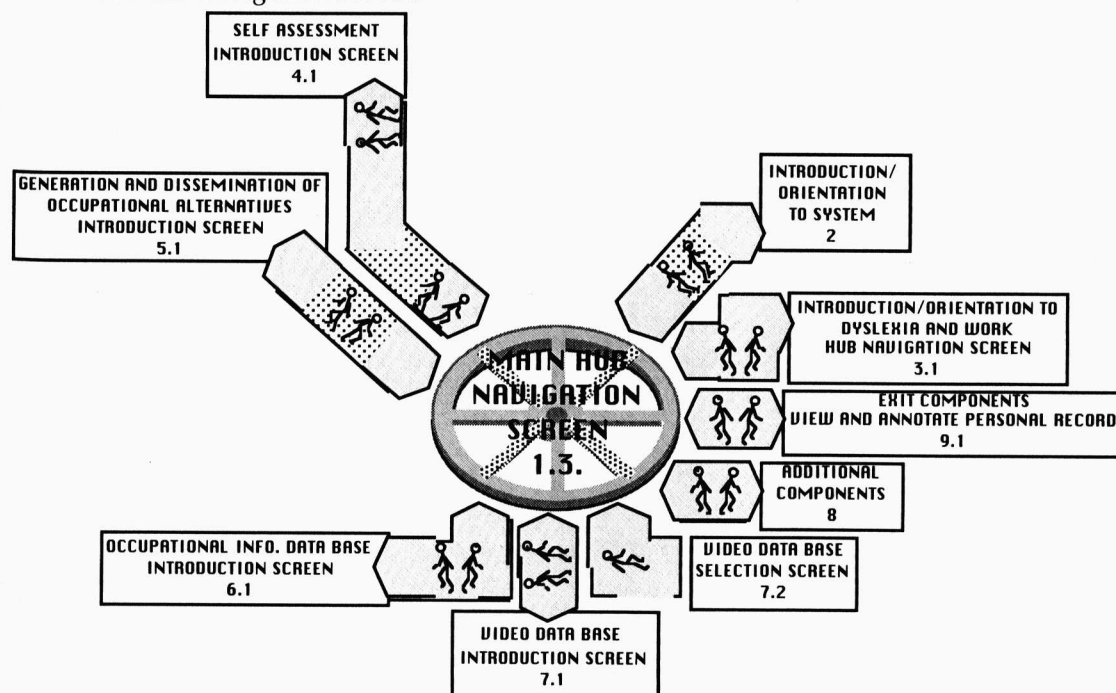
Provides user with the option to select from components. Components could be presented in the form of an iterative graphic map of the system.

a. characteristics of graphic map

- components represented by informative icons as well as text, which are hyperlinked to the components.

- brief descriptions of function and content of component should be provided. These should be optional in order to reduce the clutter on the screen. Use of pop-up labels on selection, would be appropriate.

- map should indicate the common sequence of component use.

- map should indicate components that are not yet available to the user (possibly by fading the icons) as they require other components to be completed first.

- map should indicate the connections and routes between each component.

- map should indicate graphically (possibly by highlighting) as default:

  - the component the user last used, before entering the 'Exit components' (No. 9), if the user is re-entering the system.

  - component(s) that are the most appropriate to enter next, if the user is returning to this screen from other components.

- map should indicate graphically components that have already been entered or completed.

2. Introduction/orientation to system
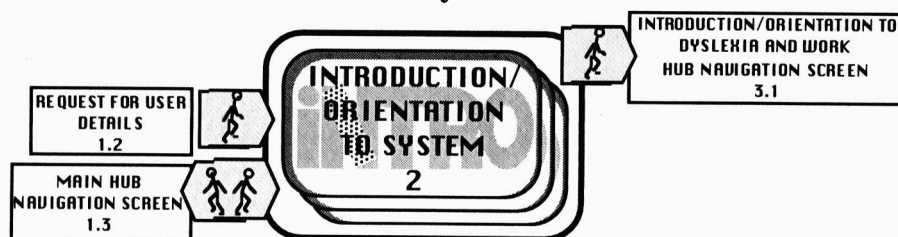
This section is essential for system use, and should thus be obligatory for first time users.

a. information provided to user

- the aims of the system as a whole, and its limitations.

- meaning and function of common icons

- structure of system, and structure and function of each component.

  This could be provided through the use of a simulation of 'Main Hub Navigation Screen' (No. 1.3) that does not contain links to components, in conjunction with an instructional commentary.

- explanation of general facilities provided throughout the system, i.e. help system, speech output system, system dialogue preferences, personal record (see No. 9.1) facility, and search history, 'back' and 'forward' functions.

  This could be done through use of active demonstrations with commentary, and training simulations.

Where appropriate it would be advisable to use digitised speech in conjunction with a text summary as the default option in this section. It may also be useful to deliver some general information via short digitised video sequences presented by an appropriate individual (the system designer?!). Both the latter and the use of this individual's speech could help provide a more 'human face' to the system. Extensive use of multimedia features can be afforded in this section as its content is relatively limited and inflexible.

In addition to the above the user could be offered the option to customise the preference settings for system dialogue, e.g. text size, font and colour, standard background texture and colour.

b. additional on screen options

- go to the 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1). This is the default setting and would best be strongly advised.

- go directly to 'Main hub navigation screen' (No. 1.3). User should be cautioned and asked to confirm decision.

3. Introduction/orientation to dyslexia and work
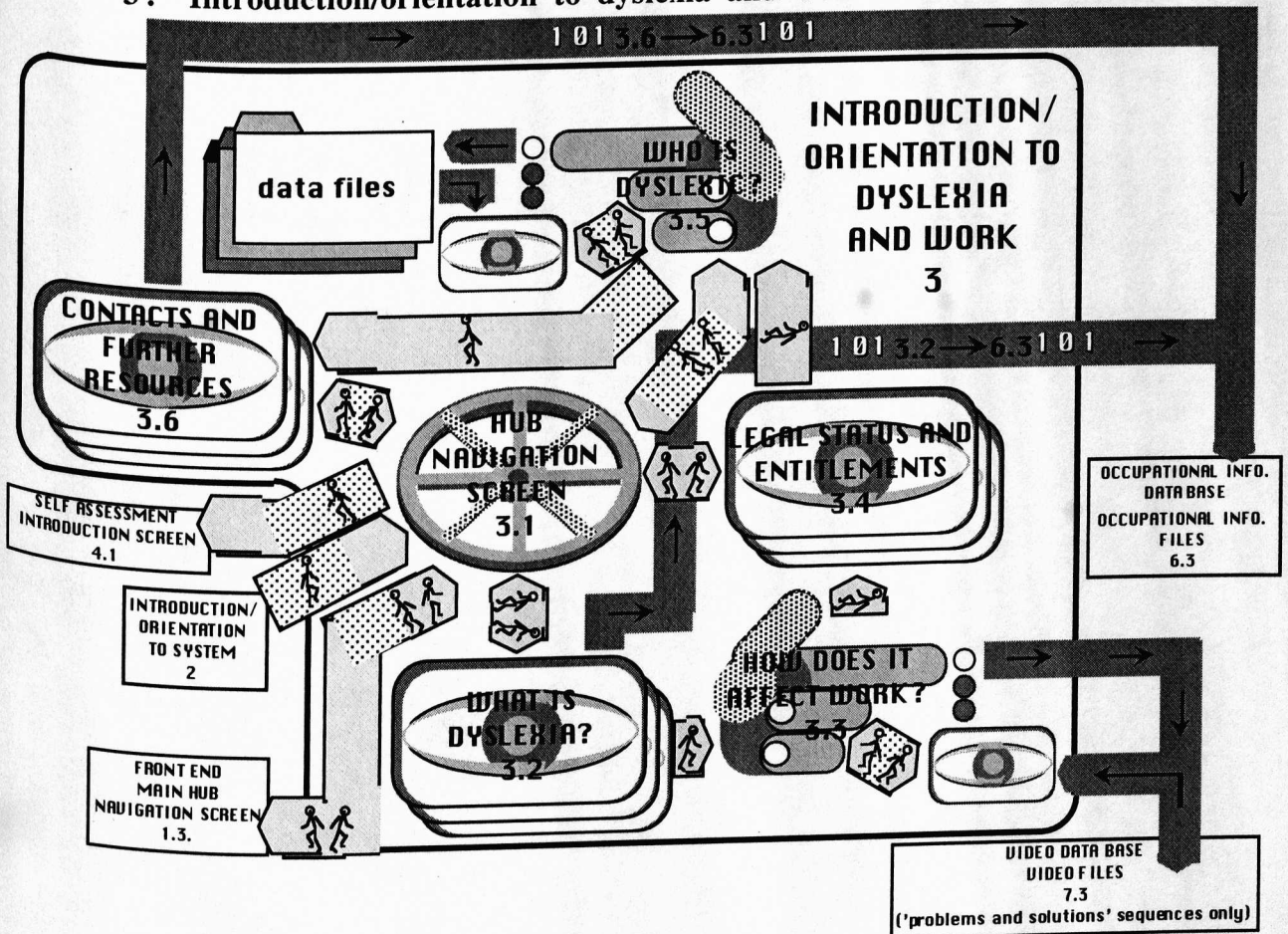
As information in this subcomponent is not absolutely essential to using the system it should be optional. However, it should be strongly advised, as this subsection is designed to fill in any gaps in the user's knowledge of dyslexia and work, as well as further motivate them to use the system.

3.1. *Hub navigation screen*
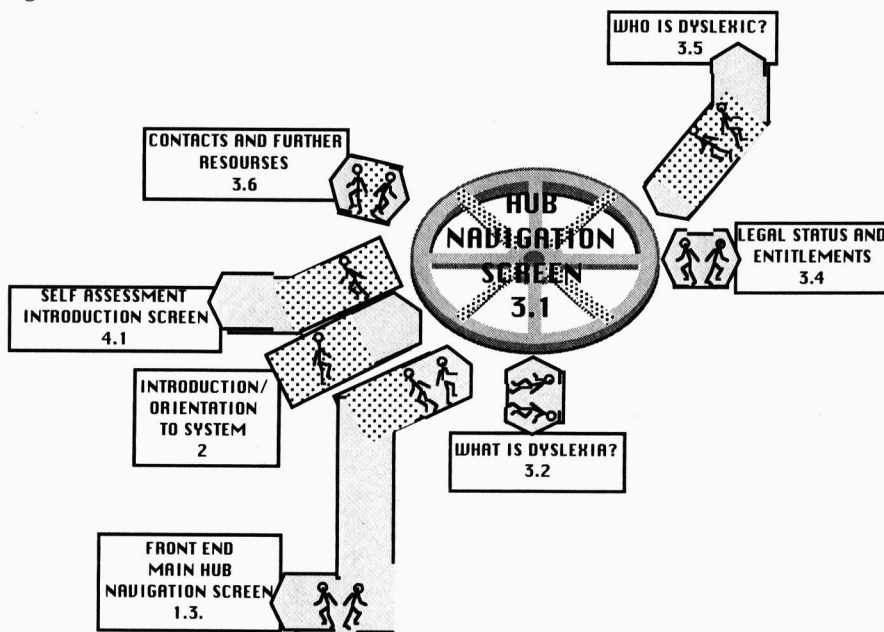
Again, access to separate subcomponents of this component could be provided via an iterative graphic map, with broadly the same structure and characteristics as the 'Main hub navigation screen' above (No. 1.3), for the sake of consistency.

As well as links to the components below the user will be provided with the opinion to:

a. additional on screen options

- go to 'Assessment profile sheet' (No. 4.2). User will be encouraged to follow this route once they have finished their search.

- go to 'Main hub navigation screen' (No. 1.3).

b. on exiting this component

If the user has not sufficiently searched this component, it may be advisable to encourage them to search more before allowing them to leave.

3.2. What is dyslexia?
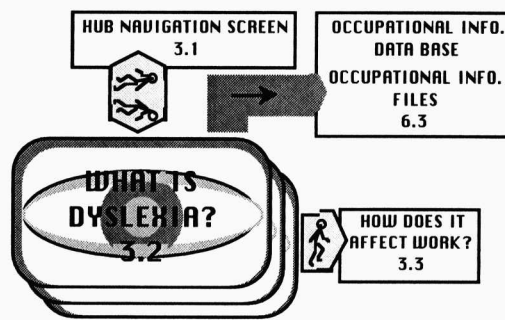
This component is included to help users improve their general understanding of dyslexia.

a.   information provided to user

- basic definitions of dyslexia.

- list of symptoms with a very brief explanation of each. Items on the list could be hyperlinked to more complete explanations, with examples where applicable. Items on list could also be accompanied by a link to some suggested solutions, i.e. outlines of compensation strategies with examples.

- direct link to outlines of compensation strategies suggested above.

Efforts should be made throughout to reassure the user that difficulties are not insoluble, and take a positive, constructive approach to dyslexia. For each segment of information the user should be reminded that it can be included in their personal record (see No. 9.1).

b.   additional on screen options

- link to 'How does it affect work?' (No. 3.3).

- link back to 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1).

3.3. *How does it affect work?*
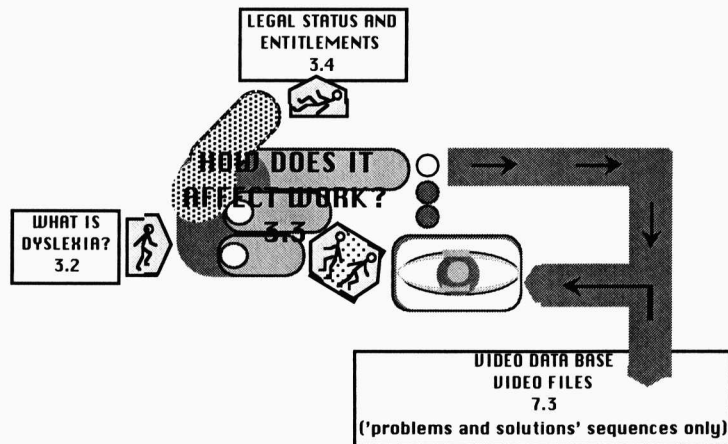
User could be asked to select from video sequences presented by successful dyslexics in their places of work. Care should be taken to represent a wide range of occupations.

The video sequences in question will be those dealing with 'Problems and solutions' in the 'Video data base' (No. 7) discussed below (see 'Video files' No. 7.3). As the method of selection and presentation should be identical to that suggested below it will not be discussed here. The only difference is in the additional on screen options offered to the user.

a. additional on screen options

- go to 'Legal status and entitlements' (No. 3.4).

- go back to 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1).

3.4. *Legal status and entitlements.*
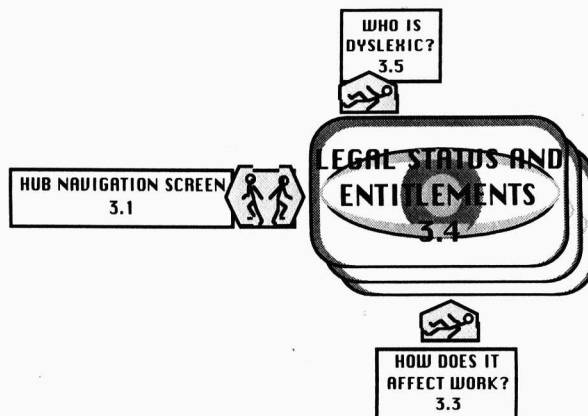
The function of this section is self explanatory

a.   information provided to user

- the legal status of dyslexics.

- what accommodations and support they are entitled to.

- where and how to gain these accommodations and support.

In each of these special consideration should be given to employment, education and state benefits.

b.   presentation style

Due to the hard factual nature of this information and its great value as reference material it may be best to present this primarily as hyperlinked text, and encourage the user to include any material viewed in their personal record (see No. 9.1).

c.   additional on screen options

- go to 'Who is dyslexic?' (No. 3.5).

- go to 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1).

3.5.   *Who is dyslexic?*
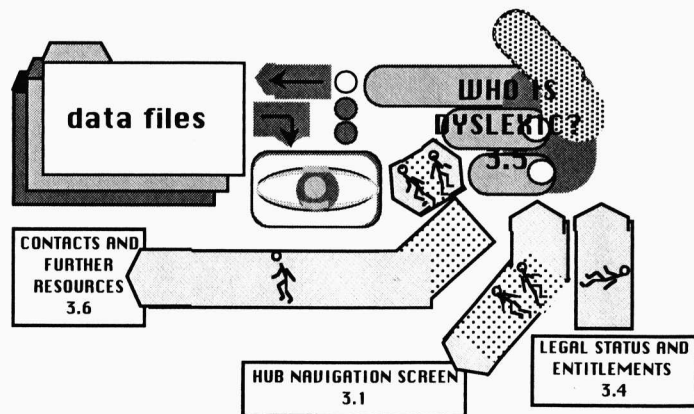
This component included primarily to motivate the user toward success and facilitate interest.

The user could be presented with stills of famous successful dyslexics, accompanied by their names and professions, or their claim to fame. These could be hyperlinked to data files.

a. contents of data files

- brief biographical information, emphasising education and employment histories.

- brief accounts of experiences where their dyslexia played an important role.

- comments on how dyslexia has and does affect them.

Some of the above could be very effectively augmented with brief sequences of digitised speech or video.

Care should be taken to remind the user that:

- these people are also exceptional in ways other than being dyslexic.

- their problems, background and experiences are shared by many dyslexics.

The people in question should be selected on the basis of how much they conform to the latter characteristic.

b. additional on screen options

- go to 'Contacts and resources' (No. 3.6).

- go back to 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1).

3.6. Contacts and further resources
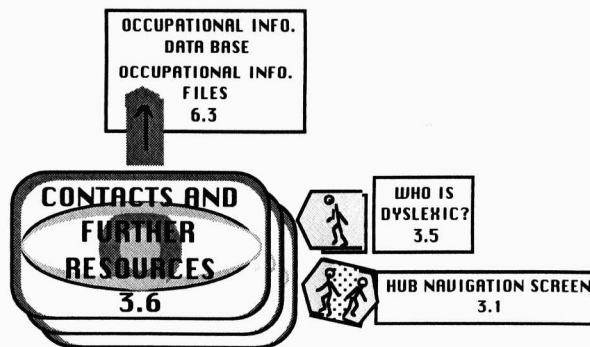
As this component is a reference resource, the user may not see it as necessary to search it at the present time if ever. However, it is important that they:

- be made aware that this component is included in the system.

- be made aware that they can return to it at any later time.

This can be done through a brief introduction.

a. additional on screen options

- go to 'Introduction/orientation to dyslexia and work hub navigation screen' (No. 3.1)

This would be best placed immediately after the introduction

b. contents of this component

The user should be provided with information necessary for contacting:

- organisations offering advice and support.

- relevant service providers.

and references to:

- resources pertaining to dyslexia in general.

- resources pertaining to legal issues and entitlements for dyslexics.

- resources pertaining to employment and finding employment.

Where necessary it may be wise to accompany each item with a brief description of its relevance to dyslexics.

c. presentation style

As this component is a factual, reference resource, a clear, primarily content driven hypertext format should suffice.

4. Self assessment
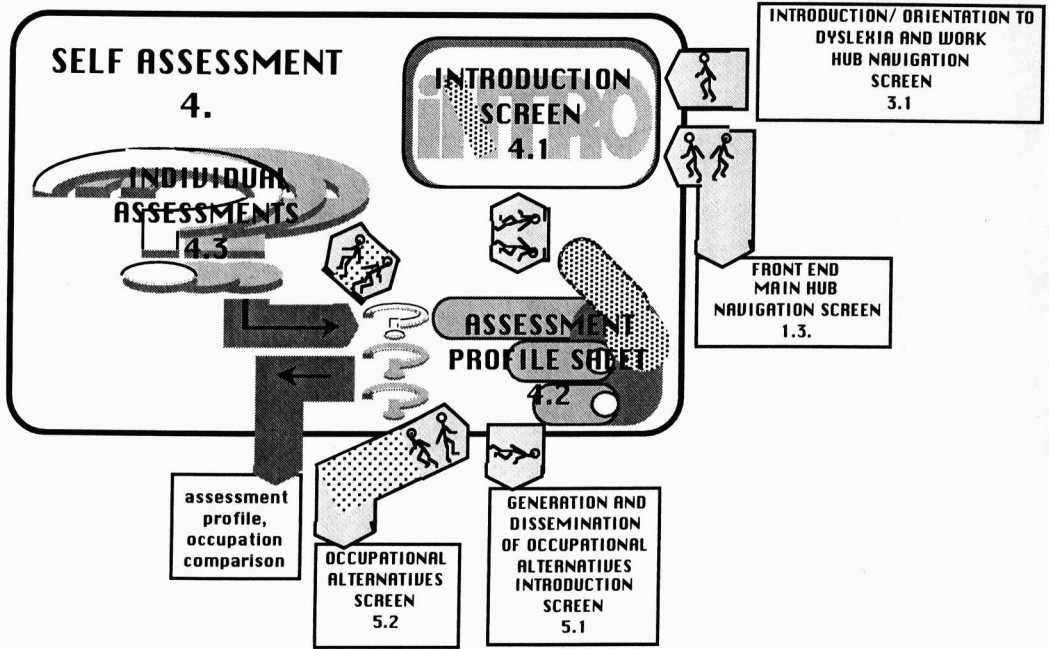
This component is the first of the core elements (Sampson 1996a, see Section 5.2.) of the system. Its function is to generate a profile of the user which helps them develop insight in to their own characteristics as they relate to the world of work. This profile is further used to generate occupational alternatives The exact details of this process are fairly complex, and thus it would not be appropriate to enter into a full discussion of the options here. However, a full discussion will be provided in Section 9.4, immediately after this design. Thus, the following will be restricted to providing broad suggestions based on the ideas presented in Chapter 5 (see Sections 5.2.2.2 and 5.2.3.3). It may be that not all these suggestions can or should be implemented in the same system.

4.1 Introduction screen
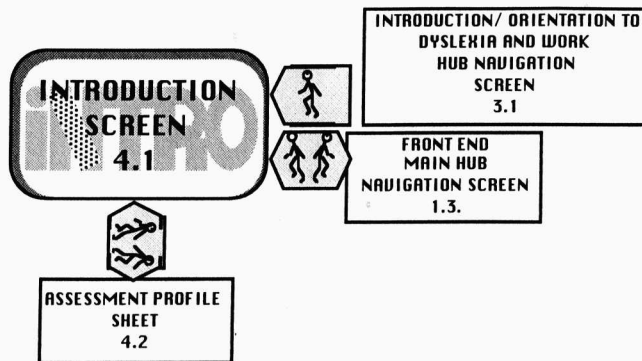
If the user has entered this section before the introduction will be automatically skipped.

a.   suggested contents of the introduction

- describe the function of this component.

- provide an explanation with examples of the 'Assessment profile sheet' (No. 4.2)

- make it clear that the assessments cannot provide 'magic answers' but can act as a guide and basis for further thought and discussion.

- make it clear that the results on the profile sheet are flexible and can be altered in response to later insights

If the user has entered this section before the introduction will be automatically skipped.

b.   additional on screen options

- go to the 'Assessment profile sheet' (No. 4.2).

- go to the 'Main hub navigation screen' (No. 1.3)

4.2.   *Assessment profile sheet*
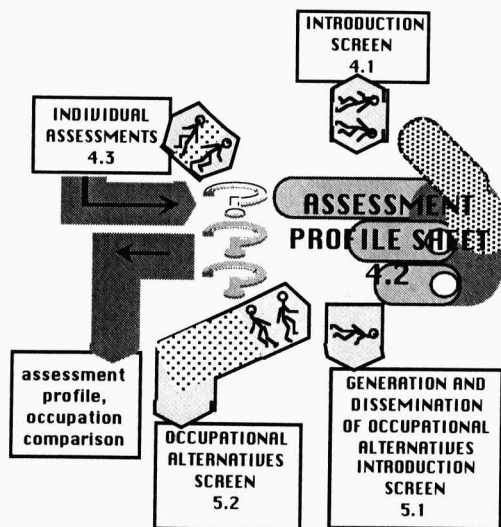
In some respects this serves as the assessment component's hub navigation screen. It allows the user to access, via hyperlinks, a number of individual assessments covering labour market constructs and psychological constructs.

However, in this case the navigation screen doubles as a means to displaying and manipulating the results of the assessments, the user's assessment profile. Thus, it would be better to use a more form like structure, as opposed to a graphic map. However, in all

other respects it should have the same characteristics as hub navigation screens (see No. 1.3).

a.   For each assessment this screen could provide

- a title and very brief description/explanation of the assessment.

- a hyperlink to that assessment.

- a dialogue box or boxes that display the results of the assessment when it has been completed. Efforts should be made to augment any data with a graphical representation if appropriate. One should attempt to maintain the consistency of these representations through the assessments, in order to facilitate comparison.

b.   possible options ranking, rating and marking

One further idea put forward in Section 5.2.2.2 is that users could be given the option to determine what assessments are used in the generation of occupational alternatives, or in what order the assessments are used. Exactly how this information could be applied in the generation process is discussed further in Section 9.3.1.

Thus, for each assessment one could provide:

- a tick box which becomes available after the assessment is completed, and if ticked designates that assessment result as one to be used. The default should be the ticked position.

- a box which allows the user to enter some rating of the importance of that assessment to them. These ratings could be used to determine the order of assessment results use.

- the capacity for the user to rank the assessments in order of preference. This could be done via entering a number in a box, or by allowing the user to physically rearrange the sequence assessments on the screen.

In the latter two cases it is not clear whether this would best be done before or after completing the assessment, or whether this decision should be left to the user.

c.   additional on screen options

- go to introduction to this component (No. 4.1), just in case this was skipped and the user wishes to review it.

- go to the 'Hub navigation screen' (No. 1.3). If this is the first time the user has entered the system they should be cautioned that it could be more appropriate to go to 'Generation and dissemination of occupational alternatives, introduction screen' (No. 5.1), and given the opportunity to do so.

- go to the 'Generation and dissemination of occupational alternatives, introduction screen' (No. 5.1). This would be more appropriately phrased as 'view jobs which mach your profile', and should be marked as the default option.

d. exiting this component

With the above approach the user need not be obliged to complete all the assessments before exiting. However, they should be cautioned to do so if they attempt to exit this component before all assessments are completed. On exiting this component the assessment profiles sheet should be automatically saved in the user's personal record (see No. 9.1).

4.3. *Individual Assessments*
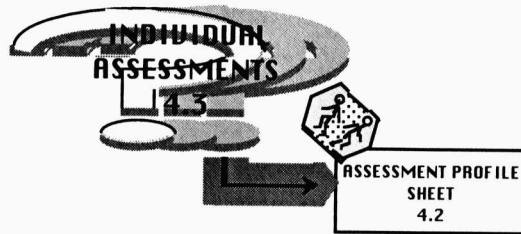
Further work is required to ascertain which constructs and what dimensions of these, would be the most appropriate to assess. The same is true for the methods used for the assessments.

a. possible assessments

There are a number of possible assessment variables mentioned in Section 5.2.2., these are:

Labour market constructs:

- aptitudes/skills

- past accomplishments

- disabilities

- pay scales

Psychological constructs:

- attitudes

- values

- interests

- temperaments

In addition to these one could include assessments based on constructs of specific relevance to dyslexics. There are a number of fairly complex issues surrounding this option, which make it inappropriate for discussion here. Thus, this will be fully covered in Section 9.4 below.

b.   general characteristics of assessments

- assessments should be kept as short and to the point as possible.

- efforts should be made to make the most use of user manipulated graphical representations for responses, or at least minimise the use of the keyboard (See Section 9.3 for a possible response option)

- assessment results should be immediately displayed, and if helpful explained, immediately after the assessment has been completed.

- assessment results should be automatically entered into the 'Assessment profile sheet' (No. 4.2.) upon completion.

c.   possible options

Following on from the possible options mentioned in No. 4.2. above, it may be more appropriate to request priority rankings or ratings in conjunction with the individual assessments, rather than via the 'Assessment profile sheet' (No. 4.2.). If this is the case ratings or rankings should be automatically entered into the 'Assessment profile sheet' (No. 4.2.) upon completion.

Users could also be asked to give 'acceptable levels' as well as 'ideal levels' for constructs where such concepts can be applied, e.g. pay scales. If this is the case both pieces of data should be included in the 'Assessment profile sheet' (No. 4.2.).

d.   additional on screen options

After completing the assessment the user can:

- go to next assessment.

- go to the 'Assessment profile sheet' (No. 4.2.)

5. Generation and dissemination of occupational alternatives

GENERATION AND DISSEMINATION OF OCCUPATIONAL ALTERNATIVES 5.

assessment profile, occupation comparison

ASSESSMENT PROFILE SHEET 4.2

INTRODUCTION SCREEN 5.1

OCCUPATIONAL ALTERNATIVES SCREEN 5.2

MAIN HUB NAVIGATION SCREEN 1.3.

OCCUPATIONAL INFO. FILES 6.3

OCCUPATIONAL INFO. DATA BASE SEARCH SCREEN 6.2

OCCUPATIONAL INFO. DATA BASE 6 INTRODUCTION SCREEN 6.1
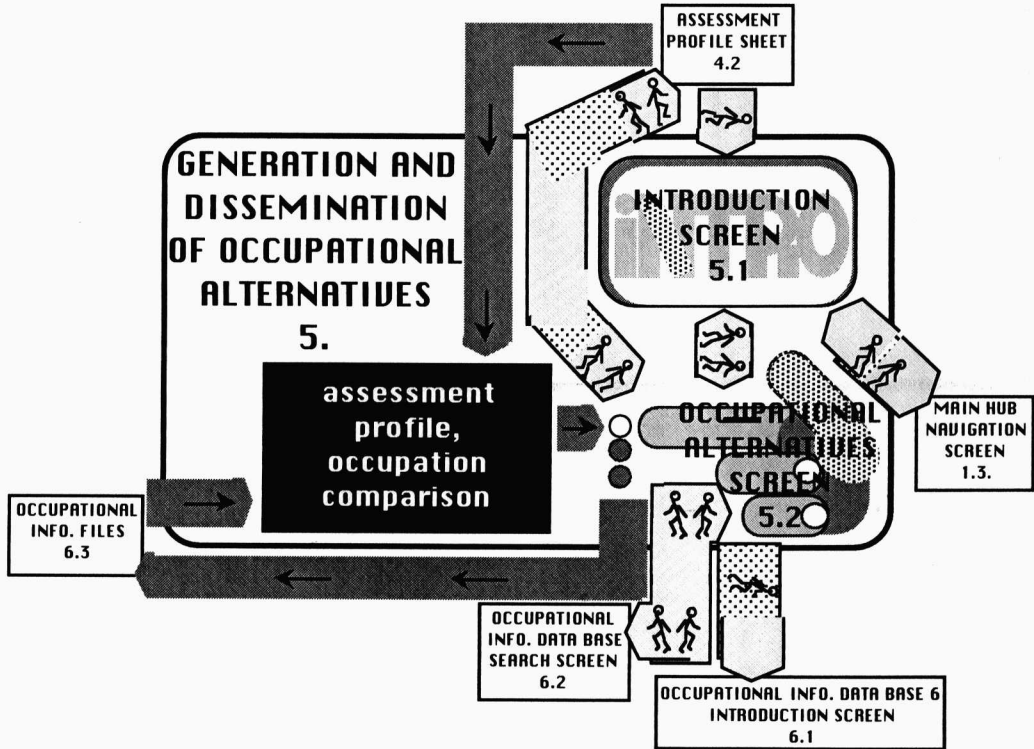
This component is very strongly associated with the 'Self assessment' component (No. 5.), as the this must be completed before this component can be used. As well as this, the user could be allowed to return directly to the 'Assessment profile sheet' (No. 4.2) so as to allow them to alter various parameters of the assessment, and thus generate a new, alternative set of occupational alternatives.

a.   generation of occupational alternatives

The exact nature of the generation of occupational alternatives process is fairly complex, and is thus discussed more fully in Section 9.3, below. The following can be drawn from the ideas presented in Section 5.2.3.3.. However, this is not the only option (see Section 9.3.1).

Each occupation in the system's occupational database is accompanied by ratings for the constructs assessed above (see No. 4.3. and Section 9.3 below).

1 .   user's first assessment result is compared against the equivalent rating for each occupation.

2 .   occupations that do not fit the user's result are rejected.

3 . the remaining occupations are exposed to the procedure again, using the user's second assessment result.

4 . cycle is terminated when the number of remaining occupations falls between prespecified levels, or when all the assessment results have been applied.

b.   possible option, applying 'acceptable levels' data

If data on 'acceptable levels' (see No. 4.3.) has been acquired from the user some general applications for this data can be suggested:

- during each cycle if the number of occupations rejected exceeds a prespecified level.

- at the end of the process for occupations that conform well the user's total 'ideal level' profile on all but one or two constructs.

Thus, this can be used to ensure that enough occupational alternatives are generated, and that potentially very suitable occupations are not rejected due to comparatively minor inconsistencies with the user's profile.

In addition this provides a means of generating additional occupational alternatives for the user, if they are not satisfied with the first set of alternatives they are offered.

5.1.   *Introduction screen*
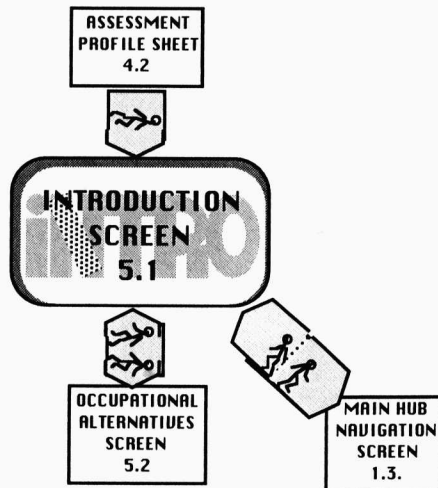
If the user has entered this component before the introduction will be automatically skipped.

a.   suggested contents of the introduction

- describe the function of this component.

- briefly describe the process outlined above.

- make it clear that this process cannot generate 'magic answers', but that the occupational alternatives can act as a guide and basis for further thought and discussion.

- describe/explain with examples the 'Occupational alternatives screen' (No. 5.2.).

b. additional on screen options

- go to the 'Occupational alternatives screen' (No. 1.3).

5.2. *Occupational alternatives screen*
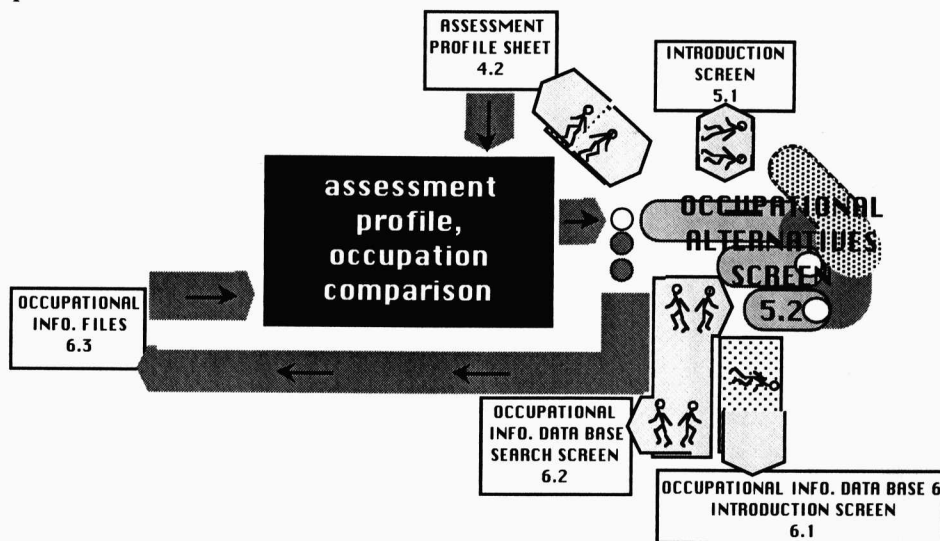
The processes outlined immediately above are not observed by the user. After completing the assessments (No. 5.), and seeing the introduction if necessary, the user is presented with this screen. Its primary functions are to:

- disseminate occupational alternatives generated.

- provide means by which the user can generate and view additional occupational alternatives.

- act as a means of accessing the 'Occupational information data base' (No. 6.)

a. characteristics of list(s) of occupational alternatives

The primary method of disseminating occupational alternatives should be through textual lists. One can suggest the following characteristics.

- Following on from Section 5.2.4.1 lists should contain seven to ten items. If additional occupational alternatives are requested, these should be presented as separate lists.

- Items could be presented in order of appropriateness. However, following from suggestions in Section 5.2.4.1 it may be better to present them in alphabetical order, or some order derived from a categorisation of the world of work.

- Lists should not primarily be full screen so as to allow for the simultaneous display of a number of lists. It would be wise to limit this to two lists at a time to prevent confusion and screen clutter.

- Each list should be accompanied by a title that indicates how it is generated, so the user knows what list they are looking at.

- The primary occupational alternatives list should be automatically saved to the user's personal record (see No. 9.1).

- For secondary lists the user could be actively encouraged to save these to their personal record (see No. 9.1), or there should be a facility to mark individual items for saving, as well as un-mark items. In both cases any list, or marked item, should be accompanied by its list title.

In addition, each list item could have the following characteristics:

- Items on the lists should be hyperlinked to the appropriate file in the 'Occupational information data base' (No. 6.).

- Items that have been further investigated via the 'Occupational information data base' (No. 6.) should be indicated.

- If secondary lists are requested, items that appear on more than one list should be identified as such, preferably using some graphic indicator.

b.   secondary lists

As suggested above the system should give the user the option to generate additional lists of alternatives to the initial, primary list. The screen should be able to display, or print out, two lists simultaneously, in order to facilitate comparison. The user should be provided with the facility to move freely between lists that have been generated. For example a navigation column, or columns, containing list titles could be provided, where clicking on a title brings up that list in the appropriate section of the screen.

If there are two sections of the screen for displaying lists, one possible option is that a newly selected or generated list should appear in the right hand section, and the list that this replaces should

be moved to the left hand section, replacing any list already there. Thus, the lists rotate as the user selects them.

The following are suggestions as to additional secondary lists the user could be given the option to generate. These options could be provided via informative icons each of which could be accompanied by a pop-up description of function and use. The above suggested navigation columns for list titles could best be placed below their appropriate icon.

- List(s) of alternatives that were generated during the initial process but were not included in the primary list as it would have exceeded the ten item limit. These may not always be available.

- List(s) of alternatives generated by making more use of the 'acceptable level' ratings (see No. 4.2.).

- Lists of occupations similar to, or associated with a particular occupation. These can be generated by highlighting an item on any list and clicking this option's icon.

- The list of items that have been marked by the user for saving into their personal record (see No. 9.1.). This should be accompanied by an option to delete items from this list.

- 'What if?' lists. The user is presented allowed to return to an adapted version of the 'Assessment profile sheet' (No. 4.2.) and make a variety of alterations. This secondary, adapted 'Assessment profile sheet' is used to generate a new list which is displayed on returning to the 'Occupational alternatives screen'. In order to help the user to make decisions secondary 'Assessment profile sheets' could show:

  - how many occupations came up to the criteria set by each assessment result.

  - assessment results that cause particularly large reductions in the number of alternatives generated.

  - assessments where it was necessary to use the 'acceptable level' (see No 4.2), if there were any.

  The user could be allowed to alter:

  - the ranking or rating of each assessment.

  - which assessment results are used to generate the occupational alternatives.

  - some assessment responses.

  This secondary 'Assessment profile sheets' will only be included in the user's personal record (see No. 9.1) if the resulting list, or items from it, are included.

As opposed to the primary 'Assessment profile sheets' (No. 4.2) the only additional on screen option should be:

- go to 'Occupational alternative screen'.

c. 'World of Work map'

Even if large font sizes and spacings are used, ten item lists of occupational alternatives need not take up a great deal of screen space. The same is true of secondary list option icons and navigation columns. Thus, room could be made to display some graphical representation of the world of work indicating, via a label, the position of each occupational alternative. This could be of help to the user as it:

- is a more motivating and engaging display than simple lists, and thus could be a very appropriate alternative display and interface.

- intuitively shows any clustering of occupational alternatives in general occupational areas.

- provides the user with a metaphor that can assist them in gaining a greater understanding of the world of work as a hole, and their relation to it.

- can be used to display occupations similar to, or associated with a specific occupation (or occupations) in a more intuitive manner than a simple list.

d. general features

Further work is required in order to arrive at the most appropriate form for this World of Work map. However, some suggestions as to general features are:

- As a default the map should be shown in its entirety, and should indicate with labels the positions of occupational alternatives on any list that is highlighted by the user. Any individual item that has been highlighted on this list should be highlighted on the map, and any item selected on the map could be highlighted on the list.

- Occupational alternatives appearing on all other lists the user has generated could be indicated by unlabelled points.

- All labels could be hyperlinked to the appropriate file in the 'Occupational information data base' (No. 6).

- All labels could have the capacity to be marked for inclusion in the list of marked items in the user's personal record (see No. 9.1).

- Users could be given the capacity to zoom in and out of the map. This could be done via a set of on screen controls, or by the user placing the mouse cursor on any area of the map and holding down a mouse button.

As the user zooms in their could be a general increase in detail.

1. Occupational alternatives appearing on all other lists could be given labels. These should be differentiated from the labels of items appearing on the highlighted list. The user selecting one of these could cause the automatic display and highlight of the list that item is a member of.

2. With even more increase in detail, all the occupational alternatives existing within the 'Occupational information data base' (No. 6) could be indicated by labels. Again these labels should be differentiated from those for items in the highlighted list, and items on all other lists. Selecting one of these could display and highlight a list of occupations similar to it.

e. additional on screen options

This screen could also provide the user with the options to:

- go to the 'Introduction' to this component (No. 5.1) just in case this was skipped and the user wishes to review it.

- go to the 'Occupational information data base, introduction screen' (No. 6.1), though it may be better to use a title something along the lines of 'look for information on any other job you are interested in'.

- go to the 'Main hub navigation screen' (No. 1.3).

6. Occupational information data base
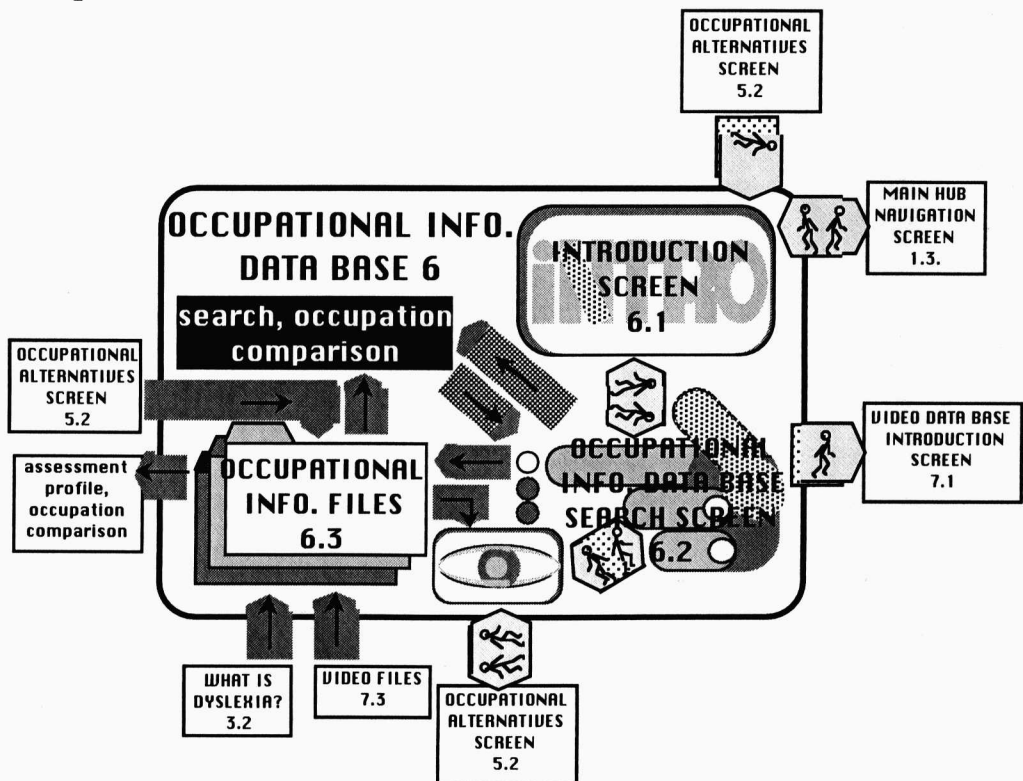
This component contains all the basic information stored in the system on individual occupations. Access to these files of information can be via the 'Occupational alternatives screen' (No. 5.2.) or the 'Occupational information data base search screen' (No. 6.2.). This second component provides the user with the facility to retrieve and examine information in the data base without going through the assessments and resulting suggested occupational alternatives, or to examine information on occupational alternatives that were not generated by the system. Thus, it allows the system to be used purely as a reference system for occupational information.

6.1 Introduction screen
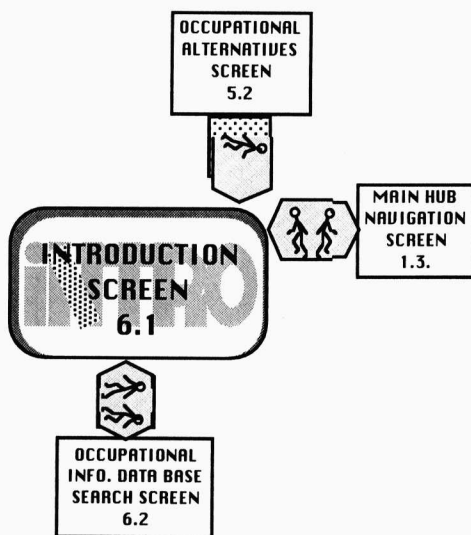
```
        ┌──────────────┐
        │ OCCUPATIONAL │
        │ ALTERNATIVES │
        │   SCREEN     │
        │     5.2      │
        └──────────────┘
```

```
  INTRODUCTION          ┌──────────────┐
     SCREEN             │  MAIN HUB    │
       6.1              │ NAVIGATION   │
                        │   SCREEN     │
                        │    1.3.      │
                        └──────────────┘
```

```
        ┌──────────────┐
        │ OCCUPATIONAL │
        │ INFO. DATA BASE │
        │ SEARCH SCREEN │
        │     6.2      │
        └──────────────┘
```

If the user has entered this component before the introduction will be automatically skipped.

a. suggested contents

- describe the function of this component.

- describe/explain with examples the structure and user of the 'Occupational information data base search screen' (No. 6.2), including the types and use of searches.

b. additional on screen options

- go to the 'Occupational information data base search screen' (No. 6.2).

- go to the 'Main hub navigation screen' (No. 1.3).

6.2. Occupational information data base search screen
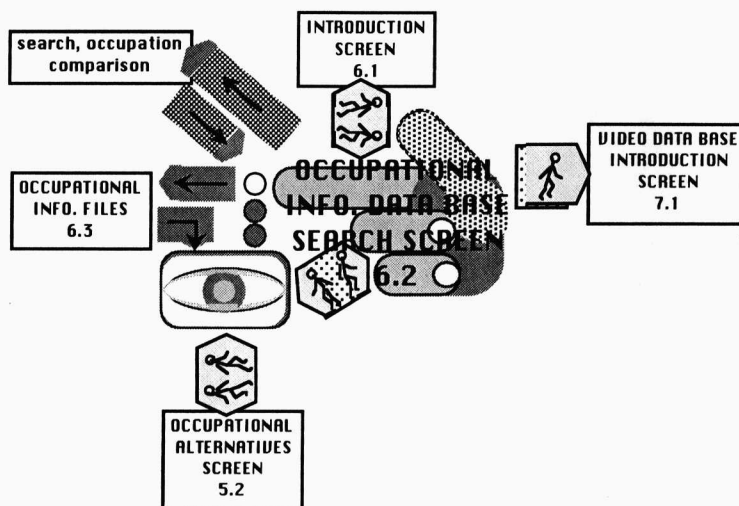
In essence this screen is the interface for a search engine. There are a number of issues to be borne in mind.

- the user should be provided with as many different ways of searching the data base as possible.

- the procedures should be as simple and consistent as possible.

- the requirement on the user to enter text should be reduced to a minimum.

a. types of searches

The user could have a number of different types of search available to them at all times, via labelled buttons. Different search types may require slightly different formats for data entry. If necessary the format of the appropriate part of the screen will change accordingly on selecting a search type. In each case the system could offer step by step instructions as the user goes through the procedure. Types of searches could include:

- A name or alphabetical search. The user could be provided with an alphabet where each letter is hyperlinked to an alphabetical list of the tittles of all the occupations included in the data base beginning with that letter. They can then scroll through these until they find the desired occupation.

An alternative to this would be to ask the user to type in the title of the occupation they are looking for. And present them with a list that reduces with every letter entered. Again they could scroll through this list at any time. Thus, the user need not enter the full title of the occupation. Despite having a written component, this procedure is likely to locate the desired occupation more rapidly than the former.

As neither need take up much screen space both could be offered at the same time.

- Searches based on the assessment constructs. These searches are fairly easy to include as an identical process is used in generating the lists of occupational alternatives (No. 5). Some of these searches may require the entry of qualitative search criteria, some quantitative, and some both. Qualitative criteria can be entered via the keyboard or by manipulating some sort of graphic scale using the mouse. As qualitative criteria must be represented by text, and would be strictly limited and predetermined, it may be best to allow the user to enter these via selecting the desired criteria from a menu or list.

- Search by occupational classification. The occupations in the data base can be broken down into a number of general types of occupation, e.g. manual, or clerical. These can further be broken down. Again, these classifications are best represented by text, and would be strictly limited and predetermined, it may be best to use the menu or list approach mentioned above.

Titles of searches which have been done, and the number of items found by each could be recorded in a list, and hyperlinked so that they can be used to recall their respective search results.

Alternatively each button or icon that is used to select a search type could have its own list containing all the titles of searches of that type.

b. combining searches

The system could provide the user with the facility to conduct more advanced searches by combining the results of previous searches. Such facilities are fairly common amongst abstracting systems and internet search engines. However, in these cases, use often requires a level of practice or knowledge that we cannot assume for the user of this system. One of the simplest procedures could be as follows. All the features mentioned below are on the screen at the same time.

1. The user chooses one search from a menu or list containing all previous searches. This search title will be displayed in a box.

2. Following this box on the screen will be a second box that allows the user to select 'and' or 'or'. For the sake of clarity it may be better to phrase these in more informative, less abstract terms.

3. This is followed by a third box that has identical characteristics to the first. If the search assigned to this box is the same as that in the first box, the user should be asked to select another.

4. The user then presses a search button which generates and displays the search results. If the 'or' setting is used then the

results of the two original searches will be combined, if 'and' then only the items common to the results of both searches will be displayed.

Alternatively the search title in the list of searches done, mentioned under 'types of searches' above, could be allotted a number. Typing this number in the appropriate place could be used in the above procedure instead of selecting a title from a menu. This approach may make the procedure somewhat less cumbersome, though it may also reduce its intuitiveness.

A final option is to use the same basic format but allow the user to 'drag and drop' titles from the list of searches into the appropriate boxes.

c.   displaying search results

Search results could be displayed via a column with the following characteristics. In addition the user should be given the option to view the list of occupations that have been marked by them for saving into their personal record (see No. 9.1.) via this column.

- It should be clearly headed with the appropriate search title and how many occupations were found.

- The user should have the capacity to scroll up or down if the number of occupations found exceed the columns maximum size.

- Occupational titles in the column should be presented in alphabetical order.

- The title of the search being displayed should be highlighted in the list of searches done.

In addition, each item displayed in this column could have the following characteristics. These are similar to the characteristics of items appearing in the 'Occupational alternatives screen' (No. 5.2) lists.

- Items should be hyperlinked to the appropriate information file.

- Items for which the user has viewed the information file should be indicated as such.

- The user should be given the option to mark any individual item for saving into their personal record (see No. 9.1), this should be accompanied by the appropriate search title. Likewise, they should be able to un-mark items. Implicit in this is the idea that marked items, even those marked via the 'Occupational alternatives screen' (No. 5.2), should be indicated as such.

- Items that have appeared on any list generated via the 'Occupational alternatives screen' (No. 5.2), should be indicated as such.

d.   'World of Work map'

The 'World of Work map' that appears on the 'Occupational alternatives screen' (No. 5.2) could also appear on this screen. However, some of its characteristics will have to be different:

- It should indicate with labels the positions of occupational alternatives in the search results being displayed. If the search has produced a lot of occupational alternatives it may be necessary to use unlabelled points for some, for example those not currently visible. These could be labelled as the user zooms in to the map.

- Individual items that are selected and highlighted on the displayed search results should be likewise on the 'World of Work map'.

- As the user zooms in on a section of the map:

  1. occupational alternatives generated through all other searches done could appear on the map. These should be visually differentiated from the results of the search currently on display. Due to the potentially huge number of items these may have to be represented by unlabelled points, which could be labelled as the user zooms further into the map. Selecting one of these could cause the results of the search which generated that occupational alternative to be displayed. If this item was generated by more than one search, selecting it again could display the results of a further search that generated it, and so on.

  2. Zooming in further could cause all the occupational alternatives existing within the 'Occupational information data base' to be indicated by labels. These should be visually differentiated from the results of searches done. Selecting one of these could cause the display of all the occupations similar to it in terms of the types of basic searches that the user has so far engaged in. Alternatively on selecting one of these the user could be asked to select a search type. That search could then be automatically carried out, taking for its criteria the appropriate rating from the selected occupation.
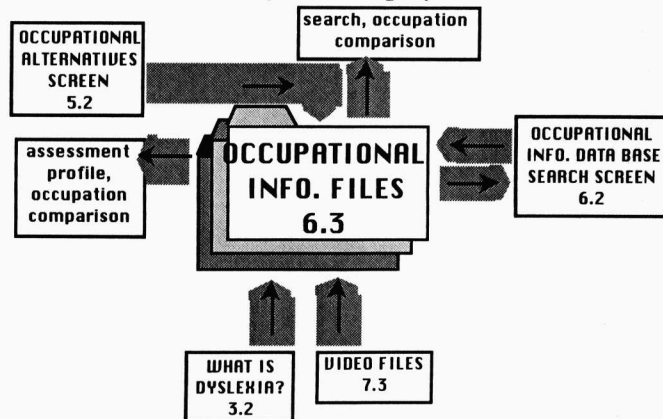
e.   additional on screen options

This screen could also provide the user with the options to:

- go to the 'Introduction' to this component (No. 6.1) just in case this was skipped and the user wishes to review it.

- go to the 'Video data base: Introduction' (No. 7.1)

- go to the 'Main hub navigation screen' (No. 1.3).

6.3. *Occupational information files* (including their display)

```
┌──────────────┐                    ┌──────────────────┐
│ OCCUPATIONAL │                    │ search, occupation│
│ ALTERNATIVES │                    │   comparison     │
│   SCREEN     │                    └──────────────────┘
│    5.2       │      →      ↑
└──────────────┘
┌──────────────┐   ┌────────────────┐   ┌──────────────────┐
│ assessment   │ ← │ OCCUPATIONAL   │ ← │ OCCUPATIONAL     │
│  profile,    │   │  INFO. FILES   │   │ INFO. DATA BASE  │
│ occupation   │   │     6.3        │ → │ SEARCH SCREEN    │
│ comparison   │   └────────────────┘   │     6.2          │
└──────────────┘                        └──────────────────┘
          ↑            ↑
  ┌──────────────┐  ┌──────────────┐
  │  WHAT IS     │  │ VIDEO FILES  │
  │ DYSLEXIA?    │  │    7.3       │
  │    3.2       │  └──────────────┘
  └──────────────┘
```

These are accessed by the user via hyperlinked occupational titles appearing on the 'Occupational information data base search screen' (No. 6.2) or the 'Occupational alternatives screen' (No. 5.2). Each occupation possesses its own information file. Below are provided suggestion as to the various types of information could be included in each of these files (see Section 5.2.5.1).

In some cases below the user could be allowed to go from an occupational information file to information that can be accessed via other components of the system. If so, it may be best to only allow the user to return from this information to the occupational information file in question. Allowing the user full access to another component from here is liable to distract the user from the task at hand, and/or lead to them getting lost in the system.

- Ratings on the assessment constructs. In order to maintain consistency throughout the system, and facilitate a comparison these could be presented in an analogous manner to the presentation of that users assessment results in the 'Assessment profile sheet' (No. 4.2).

- Special factors of particular importance for dyslexics, for example the literacy level required, or the level of organisation required (see Section 9.3.2 below). In cases such as these the minimum level should be indicated. Any characteristics of the occupation that may cause particular problems for dyslexics could be indicated. Where possible each one of these items could be accompanied by a link to:

  - some suggested solutions to the problem, i.e. outlines of compensation strategies with examples, that were accessed through the 'What is dyslexia?' (No. 3.2) component.

- any of the video sequences which were accessed via the 'How does it affect work?' (No. 3.3) component that are appropriate to the problem.

- Information on the minimum qualifications or training required to enter the occupation, or which must be undertaken after entering. Again, as with information on characteristics that may cause particular problems, this could be linked to any other pertinent information contained within the system, for example relevant contacts for further information and support contained in 'Contacts and further resources' (No. 3.6.).

- Information on skills required. This could well be covered under information from ratings on the assessment constructs. Where appropriate this could be linked to other information in the system on training, contacts, and compensation strategies.

- Outline of common duties, working conditions including prevailing social environment. This constitutes an overall description of what it is like to work in that occupation. Where appropriate links could be provided to information on compensation strategies, or the appropriate occupational cluster video file in the 'Video data base' (No. 7).

- Information on promotion prospects, where does the occupation lead?

- Information on wages. This is very likely to be covered under information from ratings on the assessment constructs.

- Information on specific contacts and further resources, i.e. organisations and resources that are related specifically to that occupation or the group of occupations it is a member of. This could be provided via a link to an appropriate section of 'Contacts and further resources' (No. 3.6).

- A link to the appropriate occupational cluster video file in the 'Video data base' (No. 7). This could be achieved via a hyperlinked still of the person who is the subject of that video file, and would best be accompanied by some very brief, general explanation of the content and function of that file.

In some cases items of information could require further elaboration and/or explanation. If so, it may be advisable to place this on a separate, secondary screen that is hyperlinked to the item in question. Some of these screens could be shared by a number of occupational information files. If this is the case it may be best not to allow the user to enter any occupational information file other than the one they have come from.

Where it is deemed appropriate, the links to information shared by other components (mentioned above) could be on these secondary information screens.

a.   other features and options

A number of other features appear in conjunction with the information suggested above.

- The list (which could be the list of occupations marked by the user for saving into their personal record (see No. 9.1) , or set of search results from which the user accessed the occupational information file, should be displayed at all times. These, and the items within them, should retain all the characteristics they possess in the 'Occupational alternatives screen' (No. 5.2) in the case of lists, or the 'Occupational information data base screen' (No. 6.2) in the case of search results.

  - The item for which the occupational information is being displayed should be highlighted in the list or search results column.

  - The user selecting another item from the list or search results column should change the occupational information on display to that of the newly selected item.

- The titles of all the lists and sets of search results which include the item for which the occupational information is being displayed should be made available to the user. This could be via two columns or menus of titles. In this case the list of occupations marked by the user should appear in both columns or menus.

  - The list or set of search results that is on display should be highlighted in its appropriate column.

  - The user selecting another list or set of search results from one of these columns should change the list or set of search results on display to that which has been newly selected.

- The user should be presented with an option to return to:

  - the 'Occupational information data base search screen' (No. 6.2) if a set of search results is on display. That set of search results will be displayed upon returning.

  - the 'Occupational alternatives screen' (No. 5.2) if a list is on display. That list will be displayed upon returning.

  - either the 'Occupational information data base search screen' (No. 6.2), or the 'Occupational alternatives screen' (No. 5.2) if the list of occupations marked by the user is on display. This list will be displayed upon returning.

If the user accessed the present screen from the 'Occupational information data base search screen' (No. 6.2) and chose to return to the 'Occupational alternatives screen' (No. 5.2), it may be best to caution them, and offer the opportunity to change that decision. The same should be true in the reverse circumstances.

- If the user has completed the 'Assessment profile sheet' (No. 4.2) they should be given the option to display their assessment results adjacent to the ratings on the assessment constructs (see above) presently on display, in order to compare them. Points of significant agreement and disagreement between the two should be visually indicated as such.

- The user should be provided with the opportunity to mark or un-mark the occupational information on display for saving in their personal record (see No. 9.1). If they choose to mark it:

  - all the additional information accessed via the occupational information on display should be automatically saved to their personal record (see No. 9.1). The reverse should be true for unmarking.

  - the title of the occupation will be automatically included in their list of marked occupations.

  If the user has not completed the assessments or has not performed any searches any features and options pertaining to these need not be presented.

7. Video data base
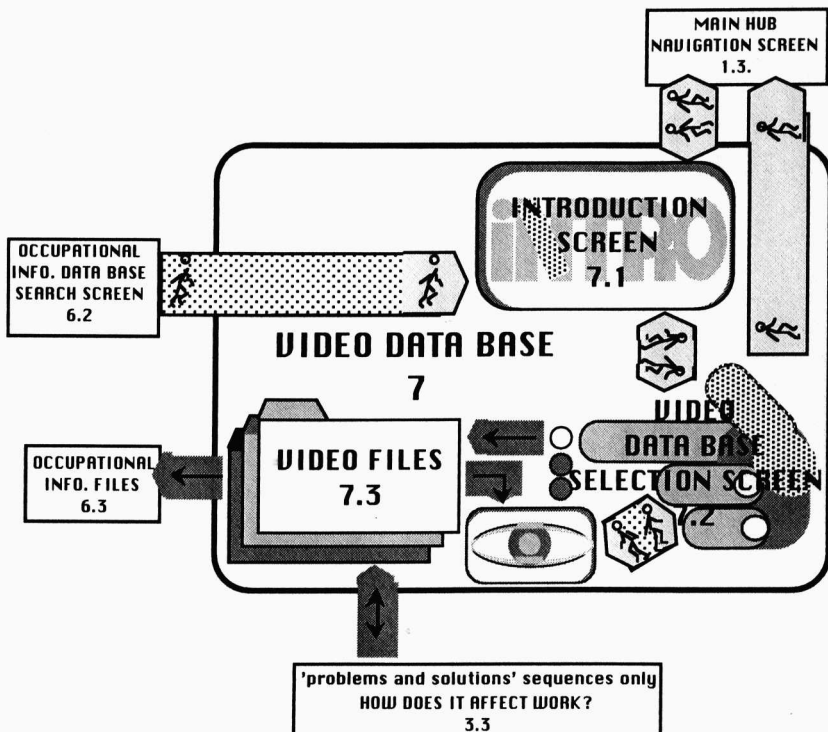
This component contains digitised 'Video files' (No. 7.3) of successfully employed dyslexics discussing and demonstrating various aspects of their particular job. These are intended to supplement the information in the 'Occupational information files'

(No. 6.3), and provide the user with some more general guidance and advice, in an engaging and salient manner. These 'Video files' (No. 7.3) can be accessed fully via the individual 'Occupational information files' (No. 6.3) or via the 'Video data base selection screen' (No. 7.2). In addition, certain sequences in these 'Video files' can be accessed via the 'How does it affect work?' (No. 3.3) component, i.e. those concerned with problems that being dyslexic often can cause in employment, and suggested compensation strategies for overcoming those problems. In this latter case the user should not be allowed to view video sequences on any other topic. Thus, in effect they will be confined to the 'How does it affect work?' (No. 3.3) component.

It is not feasible to provide a video file for every occupation in the 'Occupational information data base' (No. 6). Thus, each video file should have as its subject a dyslexic person who is fairly representative of the dyslexic population, and is in a job that is as typical example as possible of a whole group, cluster, or category of occupations. Further work is required to ascertain the most appropriate way of categorising occupations for the above function.

7.1. Introduction screen
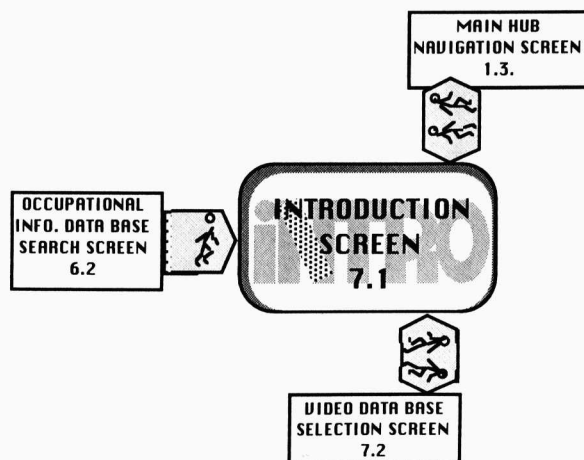
If the user has entered this component before the introduction will be automatically skipped.

a. suggested contents

- describe the function of this component, including why video is useful.

- describe/explain with examples the structure and use of the 'Video data base selection screen' (No. 7.2).

- describe/explain the use, structure and contents of the video files.

b. additional on screen options

- go to the 'Video data base selection screen' (No. 7.2).

- go to the 'Main hub navigation screen' (No. 1.3).

7.2. *Video data base selection screen*
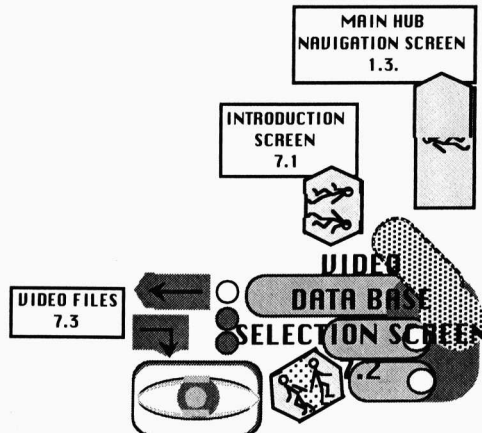
This screen provides the user with an interface for selecting which video files, or sequences in video files to view. Video files could be accessed by occupation, or by topic.

a. accessing video files by occupational category

This should be considered the primary route of access to the video files, and thus should be emphasised far more strongly then accessing via topic. Each video file could be represented by a still image of its human subject. These could have the following characteristics.

- Each still should be hyperlinked to its appropriate video file occupational front end.

- Each still should be accompanied by some brief biographical data for the presenter, e.g. name , age.

- Each still should be headed with the title of the category of occupations the video file covers, and, less prominently, the title of the occupation covered in the video file.

- If a still represents a video file that covers a category of occupations containing an occupation that has previously been marked by the user, or appears on a list that has been saved into the user's personal record (see No. 9.1), then it should be visually identified as such.
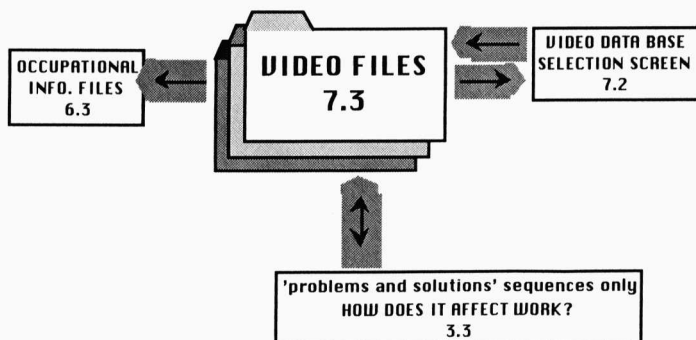
b. accessing video files by topic

>   As each video file on an occupation is divided into sequences based
>   on different topics, the user could be given the option to access
>   video files via topics rather than occupations. However, as
>   mentioned previously, access via occupation should be considered
>   the primary route. Each topic could be represented by a brief title
>   on the screen. These could have the following characteristics.

>   • Each title could be hyperlinked to its appropriate video file topic
>   front end.

>   • Each title could be accompanied by a brief description of what
>   that topic covers.

c. additional on screen options

>   • go to the 'Introduction' to this component (No. 7.1) just in case
>   this was skipped and the user wishes to review it.

>   • go to the 'Main hub navigation screen' (No. 1.3).

7.3. *Video files*


```
 OCCUPATIONAL  ←      VIDEO FILES      ←   VIDEO DATA BASE
 INFO. FILES   ←          7.3          →   SELECTION SCREEN
     6.3                                          7.2

                        ↕
              'problems and solutions' sequences only
                   HOW DOES IT AFFECT WORK?
                            3.3
```

>   As said above, these can be accessed from the 'Video data base
>   selection screen' (No. 7.2) via occupation, or via topic. Accessing
>   one of these files from 'Occupational information files' (No. 6.3) is
>   identical to accessing these files via occupation, except that in the
>   former case the user will only be allowed to return to the
>   occupational information file they came from and not to the 'Video
>   data base selection screen' (No. 7.2). In effect, information is
>   transferred to the 'Occupational information files' (No. 6.3).

a. occupational front end

>   If the user has selected one of the stills on the 'Video data base
>   selection screen' (No. 7.2), they will be presented with a screen
>   having the following characteristics.

>   • The appropriate still will appear at the top of the screen. This
>   will retain all the characteristics it has on the 'Video data base

selection screen' (No. 7.2), with the exception that it will not need to be hyperlinked to anything.

- A column counting titles of all the occupations covered by the video file that have previously been marked by the user, or appear on a list that has been saved into the user's personal record (see No. 9.1) could be included. Each item in this column could be hyperlinked to the appropriate occupational information file. In which case items for which the occupational information file has already been viewed should be indicated as such.

- The topic titles that appeared on the 'Video data base selection screen' (No. 7.2) should also appear here. They should have the following characteristics:

  - Each title should be linked to the video sequence dealing with that topic in the individual video file in question.

  - Initially the first topic title should be highlighted, to indicate to the user where to begin. After the accompanying video sequence has been viewed the second topic should be highlighted if its sequence has not already been viewed. This continues until all the sequences in the video file have been viewed.

  - Titles of topics the video sequence which has been viewed should be indicated.

- The user should constantly have the option to:

  - return to the 'Video data base selection screen' (No. 7.2), unless they have come from an occupational information file.

  - return to the 'Occupational information data base search screen' (No. 6.2) if they have come from an occupational information file.

b. topic front end

If the user has selected one of the topic titles on the 'Video data base selection screen' (No. 7.2), they will be presented with a screen having the following characteristics. As accessing video files by topic should be considered very much a secondary route, this screen (as opposed to the occupational front end) need not offer the user any information on occupations marked by the user or appearing on saved lists.

- The appropriate topic title will appear at the top of the screen, accompanied by its brief description.

- The stills appearing on the 'Video data base selection screen' (No. 7.2) should also appear here. They should retain all their characteristics with the exception that they are hyperlinked only to the specific video sequence dealing with the topic in question. Because of this it may be wise to accompany each still with some description of the specific contents of the video sequence it accesses.

- The user should constantly have the option to return to the 'Video data base selection screen' (No. 7.2.).

c. suggested video file topics

As suggested above each video file could be composed of a number of sequences, each covering a particular topic. Drawing on ideas presented in Section 5.2.6.2 one can suggest the following topics, in broadly the following order.

1. Personal history. The presenter of the video provides a brief history and description of themselves, concentrating on their experiences and achievements in education and employment.

2. General information. The presenter outlines and shows the types of duties they do, the working environment, and the social environment.

3. Problems and solutions. The presenter describes and demonstrates problems they have had to, or continue to face. With each problem they provide an description and demonstration of the strategy they have developed to overcome it. It is these sequences that can be accessed via 'How does it effect work?' (No. 3.3).

4. How did the person succeed? The presenter outlines and, where applicable, demonstrates things which they believe lead to their success. This also provides the opportunity to give some more general hints, tips and guidance within a positive context.

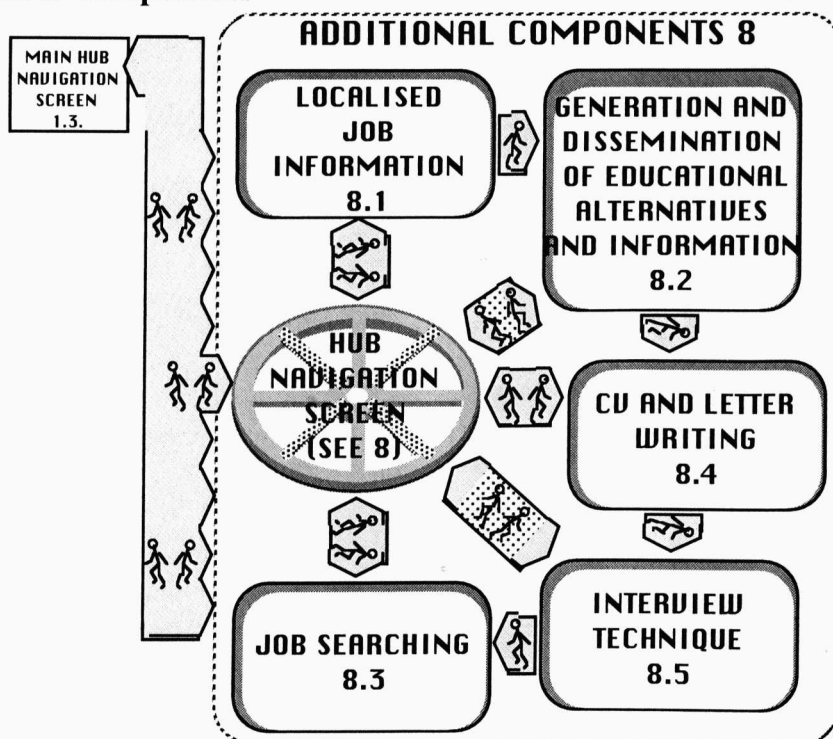5. Results of success. The presenter discusses and shows the positive effects of employment success.

Care should be taken to ensure that the subject of the video file conforms as closely as possible to the average profile of abilities amongst dyslexics, i.e. despite their success in their chosen field they should be as 'normal' dyslexics as possible. One could possibly afford to be more flexible when considering exceptional difficulties.

d.   presentation of video sequences

All the video sequences could have a standard presentation style with the following characteristics.

• The user should be given the facility to wind backwards and forwards through a sequence, and pause it as desired. A very familiar interface for this could be provided by modelling the controls on those of a standard video recorder.

• Each sequence could be accompanied by a brief summary of the major points, presented as bullets and headings. These should appear adjacent to the video display. As the point is raised the relevant bullet or heading could be added to the summary.

• Immediately following the sequence the user could be presented with the above summary, along with the option to save it in to the user's personal record (see No. 9.1).

• Headings within the summary could be hyperlinked to the appropriate point in the video sequence so as to allow the user to selectively review.

• The user should have the option to return to what ever front end screen they accessed the sequence from, or go on to the next sequence.

8.   Additional components

ADDITIONAL COMPONENTS 8

MAIN HUB NAVIGATION SCREEN 1.3.

LOCALISED JOB INFORMATION 8.1

GENERATION AND DISSEMINATION OF EDUCATIONAL ALTERNATIVES AND INFORMATION 8.2

HUB NAVIGATION SCREEN (SEE 8)

CV AND LETTER WRITING 8.4

JOB SEARCHING 8.3

INTERVIEW TECHNIQUE 8.5

All of the above is designed to achieve the primary functions of the system, i.e. to provide the user with some suggestions as to occupations, information on occupations and on how dyslexia relates to employment. The 'Additional components' comprise a number of facilities that could be included in the system, and provide the user with support, tutoring or guidance in areas that are related to employment. As none of these are really essential to the system, the descriptions of them will be as brief as possible. The suggestions as to what could be included are drawn from Sections 5.2.5, 5.2.7 and 9.1.3. Not all of these suggestions have been covered, instead a number of suggestions that may be particularly appropriate for the system and dyslexic users, have been provided.

a.   Hub navigation screen?
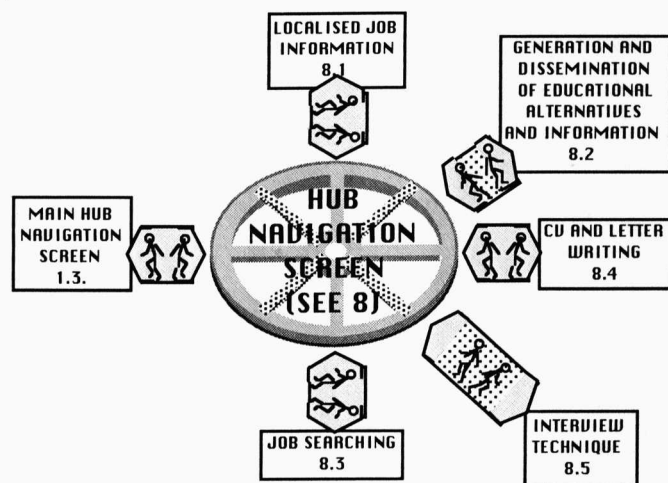
An 'Additional components hub navigation screen' could be provided. However, the potential additional components show a wide range of variation in both form and function, and thus it may not be sensible, or meaningful to group them under a single heading, or under a single icon on the 'Main hub navigation screen' (No. 1.3). Though the user should be encouraged to explore them, it may be better to allow access to individual additional components via a cluster of separate icons on the main hub navigation screen. Of course it would be possible to provide an 'Additional components hub navigation screen' on top of this, just for when a user does come directly from another component. If so that screen should amount to a close up of the relevant area of the 'Main hub navigation screen' (No. 1.3), and conform to all the characteristics of other hub navigation screens.

The following are a number of suggestions as to additional components. In each case when the user has finished with the component they will have the option to return to the 'Additional components hub navigation screen' or the 'Main hub navigation screen' (No. 1.3). Any textual that the following provide to the user can be saved to their personal record (see No. 9.1).

8.1. *Localised job information*
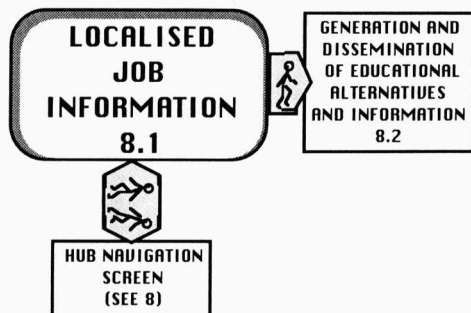
Many organisations that could provide this system have access to information on vacancies in the local area. In many cases this basic information on these vacancies is already being stored on computers (e.g. the Employment Service). Thus, it may be feasible to allow the user access to this information via this system.

a. searching local vacancies

In this case the user could be provided with a search engine, and allowed to search the local vacancies using any of the types of information which are stored for each one, for example occupational title, wages or qualifications required. It may be useful to provide the user with the capacity to display all the lists of occupational alternatives they have saved (including the list of marked occupations). In which case selecting an item will bring up a list of local vacancies that fall within that occupation. Selecting an item on the list will display its details.

b. access through occupations

Alternatively each occupational data file could be linked to such a list of local vacancies. It may be advisable not to allow the user to enter the 'Local job information' component itself if the user has take this route.

8.2. *Generation and dissemination of educational alternatives and information*
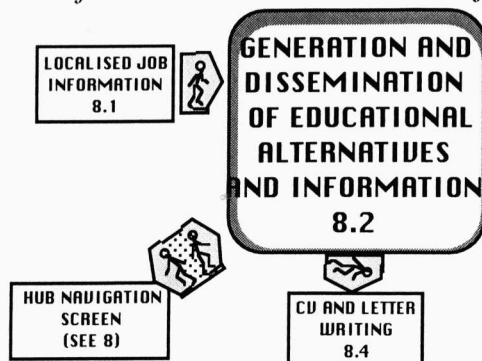
Many dyslexics have missed out on further education and training. This is often a major stumbling block in finding successful and

satisfying employment. However, finding an appropriate course or program can be a particularly daunting prospect for many dyslexics. Thus, this additional component should be designed to help the user identify what sort of courses might particularly suit them, and find out where such courses are available, and under what conditions.

a. structure, a component or separate system?

Though this certainly is classed as an additional component, to do it justice it would have to occupy a fairly central position in the system, as it should be directly comparable in structure, size and complexity to at least the 'Generation and dissemination of occupational alternatives' (No. 5), and the 'Occupational information data base' (No. 6) components. Indeed every component of this system could have its educational equivalent. Thus, it would be reasonable to, in effect, construct a completely parallel system, designed to help the user explore educational alternatives and all the accompanying issues. If it is a good idea for employment, then it is also a good idea for the equally complex realm of education and training.

However, this thesis is concerned with a careers advice system, thus exploring this option much further would be outside of the scope of this work. It should suffice to say that bearing specific types of information requested and delivered, this system design would form an appropriate basis for a computer assisted education guidance system.

b. interdependence of educational and occupational systems.

Clearly such an educational system, whether it is integrated in to the careers advice system under discussion or functionally separate, could use some of the information generated by the careers system. The assessment profile and suggested occupational alternatives could contribute to the generation or location of suitable educational alternatives. Likewise the reverse could be true for suggested educational alternatives. Thus, whatever form this educational system takes it would be best to make it compatible with this careers system, and allow for an exchange of information.

8.3. *Job searching*
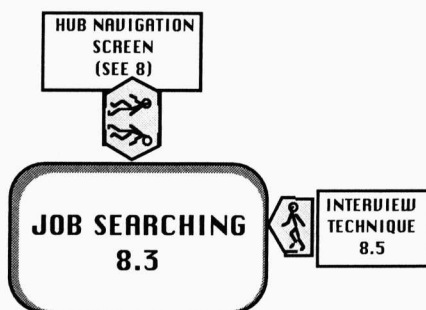
As suggested throughout Chapter 4, dyslexics often tend to show a lack of self dependency. One manifestation of this is a passive approach to finding employment. Thus, they are often less familiar with the processes involved in actively searching for a job.

a. contents

> This component could describe to the user the various different approaches to finding a job, as well as the benefits and drawbacks of each approach, and which are best suited to which occupations, or types of occupation. As it is unlikely that any one approach will be totally inappropriate for any particular occupation type, it would be unwise to encourage the user to study some approaches over others based upon the occupations they have shown interest in. Information on general job searching resources, and organisations offering general support should also be provided here. As all of this constitutes quite a large amount of information, it would be best to provide it via a number of hyperlinked screens along with an index of some sort.

b. other relevant components

> A number of other components are directly relevant to this component, i.e. 'Localised job information' (No. 8.2), 'Legal status and entitlements' (No. 3.4), and 'Contacts and further resources' (No. 3.6). Where appropriate the user should be encouraged to examine these. It may be a good idea to offer the user the option to go to these components, or provide hyperlinks to the relevant sections of these components at appropriate places throughout the information in this component.

c. a job search plan

> Another option is to allow the user to use the information in this component to develop their own job search plan. For example, some sort of blank job search form could be provided into which the user can paste, or drag and drop relevant text. This could be accompanied by appropriate instructions, suggestions, and examples to guide the user through the process. Thus, they can

walk away with not only a better general understanding of how to go about looking for a job, but also a clear idea of how to bring to fruition all their work on the system, and what to do next.

8.4. CV and letter writing

```
            ┌──────────────────┐
            │ GENERATION AND   │
            │ DISSEMINATION    │
            │ OF EDUCATIONAL   │
            │ ALTERNATIVES     │
            │ AND INFORMATION  │
            │      8.2         │
            └──────────────────┘

┌──────────────┐        ╭──────────────────╮
│ HUB NAVIGATION│       │  CV AND LETTER   │
│   SCREEN      │  ⚇    │    WRITING       │
│   (SEE 8)     │       │      8.4         │
└──────────────┘        ╰──────────────────╯

            ┌──────────────────┐
            │  INTERVIEW       │
            │  TECHNIQUE       │
            │     8.5          │
            └──────────────────┘
```
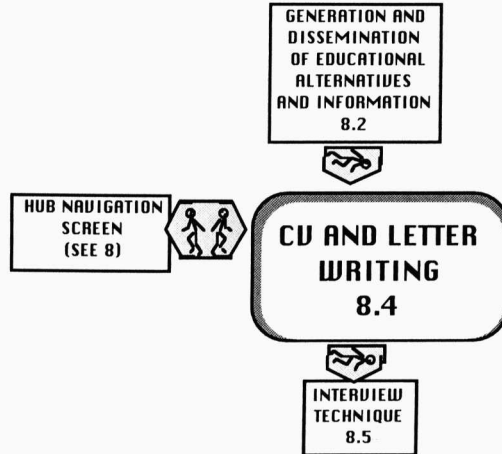
When it comes to finding employment the ability to provide potential employers with a good CV and letters is invaluable. Because of their written content, producing these can be an exceptionally hard and daunting task for dyslexics. Thus, a component that helps them do this could be particularly useful.

a.   an advanced approach

This component could be comprised of an interactive tutoring system which also makes suggestions based upon the user's personal details and assessment results, and integrates a word processor to allow the user to produce and print completed CVs and letters there and then.

This approach may consume too much of the system's time, considering that the vast majority of the work will be simple word processing that could easily be done on another machine. It is also not at all clear how much useful information can be generated from the users personal details and assessment results. It could further encourage the user to produce transparently formulaic products.

b.   a simpler approach

On the other end of the scale, one could merely provide a number of sample CVs and letters and blank templates along with an appropriate set of instructions hints and tips. However, it would be helpful if these were available in a format that was accessible to a common word processor. The user could be given the option to save them to disc and work on them on another machine.

In the end the most acceptable solution will probably be somewhere between the two suggestions above.

8.5. *Interview technique*
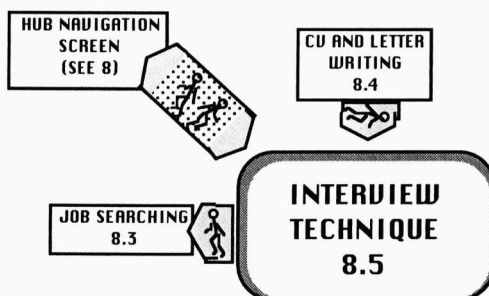
Dyslexics often have particular difficulties with the interview situation. A component that provides some information on best practices, and helps to improve the user's sense of control over such situations could be very helpful.

a. use of video, and contents

This could be a perfect opportunity to use digitised video. This would provide an excellent medium for demonstrating good and bad practices. These videos could also be accompanied by a verbal commentary with text notation along much the same lines as in the occupational 'Video files' (No. 7.3). It may be useful here to address the question of disclosure of one's dyslexia, as this is liable to arise during interviews.

b. ensuring mastery

The user could be assessed as to their mastery of the topic with a question and answer section. In which case they should be offered appropriate revision and retesting on any points they are weak on.

Thus, the overall idea is to offer a multimedia training program in interview technique, that is sensitive to the user's level of competence.

9. Exit components
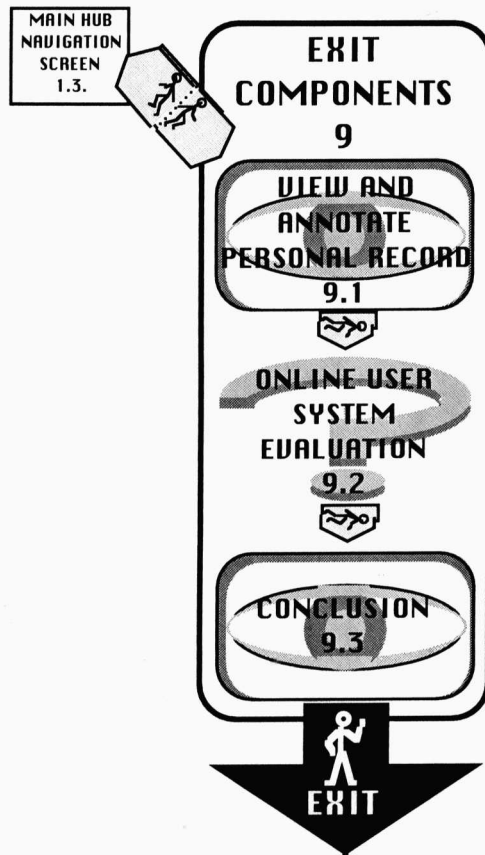
As well as providing the user with access to the components, the 'Hub navigation screen' (No. 1.3) offers the user the option to exit the system. If the user chooses to do this they could be presented with the option to enter the following components.

Alternatively, or in addition, the user could be given the option to access some of these components directly from the 'Main hub navigation screen' (No. 1.3).

9.1. *View and annotate personal record*
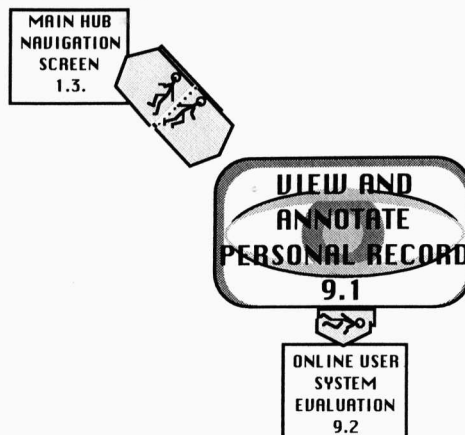
Throughout using this system the user has the option to save any information into a personal record. Some items are saved automatically to the personal record.

a. contents of personal record

The following is a summary of what the personal record could contain in approximate order. This order is determined mostly by the ordering of processes in the system and the salience of the information to the primary objective of the system, i.e. providing the user with occupational suggestions and information, and help to act upon these All lists and sets of search results should be accompanied by their descriptive titles. If any information associated with an item on a list or set of search results has been saved by the user, that item should be accompanied by references to the sections and pages where that information can be found. Each section should be titled, and have a brief general introduction.

1. A title page with an title of the system, the user's name, and name and address of the institution providing the system.

2. A brief introduction to the system including an outline of the function of the system. The 'system use overview', mentioned in the 'Conclusion' (No. 9.3), could also be reproduced here. In this case components that have been used should be accompanied by references to the relevant sections of the personal record.

3. A full list of contents, with section titles and sub titles, and brief descriptions if necessary. Each should be accompanied by a section number, and a page number.

4. The completed 'Assessment profile sheet' (No. 4.2). It may be wise to include some commentary or explanations with this.

5. The primary list of occupational alternatives.

6. Any secondary lists of occupational alternatives that the user has saved. Lists generated via secondary assessment profile sheets should be preceded by their appropriate secondary profile sheet.

7. The list of occupational alternatives that have been marked by the user for saving into the personal record. Each item could be accompanied by the title of the set of search results, or list it originally appeared in.

8. Information on specific occupations from 'Occupational information files' (No. 6.3). Information on occupations that are in the same occupational category could be grouped. This would allow information extracted from the 'Video files' (No. 7.3) to be physically associated with information on occupations that video file is relevant to. The 'Problems and solutions' information (see No. 7.3) could be presented later

with the information saved from the 'Introduction/orientation to dyslexia and work' component (No. 3). If so a reference to the latter should be provided here. Within occupational categories the occupations could be in alphabetical order. Any information on further resources or contacts the user has saved that is specific to an occupation or an occupational category, should be placed accordingly.

9. Any information extracted from 'Video files' (No. 7.3) that has been saved but not already been included, with the possible exception of 'Problems and solutions' information (see No. 7.3.).

10. 'Local job information' (No. 8.1). Information on vacancies should be grouped by occupational category, and then alphabetically. These should be accompanied by references to relevant occupational information etc., if any has been included. The opposite should also be true.

11. Any information from the 'Generation and dissemination of educational alternatives and information' component (No. 8.2), if it is available. References to appropriate occupational information should be provided throughout.

12. Anything saved from the 'Job searching' component (No. 8.3). Reference should be made to appropriate contact and further resource information.

13. Anything saved from the 'CV and letter writing' component (No. 8.4), including sets of guidelines for producing these documents.

14. Any notes from video sequences or other information that has been saved from the 'Interview technique' component (No. 8.5).

15. Information saved from the 'Introduction/orientation to dyslexia and work' components (No. 3).

   • Information saved from the 'What is dyslexia?' component (No. 3.2), with appropriate references to relevant information saved from the 'How does it affect work?' (No. 3.3) component.

   • Information saved from the 'How does it affect work?' (No. 3.3) component, i.e. the notes from the 'Problems and solutions' (see No. 7.3) video segments that have been saved. The latter could be here even if they were originally accessed via another route. These should be accompanied by reference to appropriate occupational information, and other information extracted from video sequences in the same video file if any has been included.

- Information saved from the 'Legal status and entitlements' component (No. 3.4). Due to its importance this information could be automatically included.

- Anything saved from the 'Who is dyslexic?' component (No. 3.5).

- Any information saved from the 'Contacts and further resources' component (No. 3.6) that has not already been included. A list of particularly helpful contacts and further resources could be automatically included.

16. The 'concluding comments' from the 'Conclusion' (No. 9.3).

The overall intention is to provide the user with a well constructed, and easily accessible document that can be bound into a booklet (rather than being an unwieldy, continuous roll of paper), and has an overall impression of being a 'serious' and 'official' document. The integration of graphic features could be very helpful in achieving these aims.

b. annotation

The user could be provided with a column in the personal record where they can add personal notes adjacent to any information they wish. The contents of the personal record should not be open to alteration in any other way via this component.

c. additional on screen options

- return to the 'Main hub navigation screen' (No. 1.3).

- exit the system. This will take the user directly to the 'On-line user system evaluation' (No. 9.2) if this is the first time they have used the system. If it is not they should be given the option to skip this and go straight to the 'Conclusion' (No. 9.3).

9.2.   On-line user system evaluation

VIEW AND ANNOTATE
PERSONAL RECORD
9.1

ONLINE USER
SYSTEM
EVALUATION
9.2

CONCLUSION
9.3
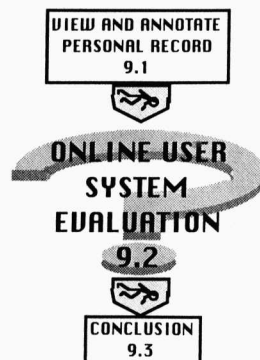
Here the user is given the opportunity to comment on, and offer their assessment of, the system. The resulting data could be very useful to developers and administrators of the system for improving its construction and implementation. As this component is obligatory to first time users it should be as short and to the point as possible, and make maximum use of methods of response that do not require the use of the keyboard, while providing sections where the user can type in free comments if they wish.

a. contents and structure

The actual contents and structure of this component are very heavily dependent on the final contents and structure of the whole system. Thus, these matters are best decided upon after the system has been constructed. Due to this, it is wise to refrain from any further comment here.

b. additional on screen option

- go to 'Conclusion' (No. 9.3), then exit the system.

9.3. *Conclusion*
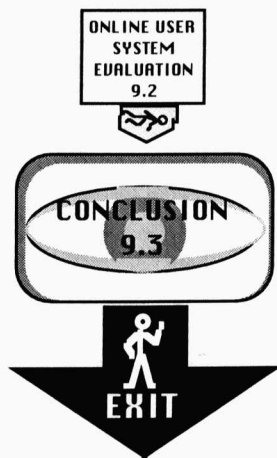
This component is included simply to round off the system. It should allow the user one last chance to view broadly what they have done and go back into the system if they are not satisfied. It also offers the opportunity to present the user with some general concluding comments.

a. system use overview

This could be a list of all the component parts of the system that indicates those components from which the information in the personal record has been extracted, as well as those the user has visited. Alternatively, this could be replaced by some graphic

representation which indicates the same information, e.g. an adapted and more detailed mock up of the 'Main hub navigation screen' (No. 3.1).

b.   concluding comments

It would be best if these were phrased as positively and succinctly as possible.   Within these concluding comments it should be stressed to the user that:

- The user can return to the system at any time if they wish, and pick up where they left off. They should not feel bad if they have not achieved as much as they hoped.

- The user should feel free to take full advantage of any other sources of advice and support available if they have any problems or enquiries that the system has not, or cannot help with, or indeed if they simply desire to do so. They should be advised to take a copy of the printed personal record with them.

- If there is anything in the personal record they do not understand they should feel free to seek the assistance of staff.

- The system and personal record do not provide any 'magical solutions', they are merely tools to help the user explore the issues and generate some ideas. If it does not seem to have provided any help they should feel free to take full advantage of any other sources of advice and support available, or return to the system later for another go.

- The user should be encouraged to take action based upon the work they have done with the system.

c.   additional on screen options

- return to the 'Main hub navigation screen' (No. 1.3).

- exit the system via the 'printing personal record option.

d.   printing personal record

Upon exiting this the system the user should be given the option to have the personal record printed, and they should be informed before hand that this is the case. It would probably be best if the user had to actively indicate that they do not want a printed version, i.e. if printing was the default.

Glossary of terms for the design and description

component   In the context of this system, a basic unit designed to carry out some specific function for the user, or deliver some specific type of information to the user. These can be further broken down into subcomponents.

digitised   As in digitised video, or digitised speech. Visual or sound recordings that have been converted into a digital data format, and thus, can be manipulated or disseminated through a computer system.

drag and drop   A method of manipulating objects on a computer screen. The user selects an object, and can then move and deposit this object in another area of the screen. This is usually done via a mouse. The process is analogous to picking up and moving a physical object.

hypertext   A collection of documents each containing hyperlinks that allow the user to move easily from one document to another within the collection. The term is most appropriately applied to systems that are primarily text based.

hyperlink   In a multimedia system, a cross-reference between files that is embedded within a visual resource, either textual or graphical. Upon activation of the hyperlink, the user is moved to the relevant file. This file can be of any media type.

marking   In the context of this system, the process of the user designating a specific file for inclusion into a set of files of particular interest to the user. Any member of this set of files can be readily reviewed by the user without having to relocate it within the system as a whole.

synthesised speech   In contrast with digitised speech, speech that is generated purely via a computer program, and thus requires no prerecording of specific messages.

ENTER

SELF ASSESSMENT 4.

INDIVIDUAL ASSESSMENTS 4.2

INTRODUCTION SCREEN 4.1

iNTRO 4.1

ASSESSMENT PROFILE SHEET 4.2

GENERATION AND DISSEMINATION OF OCCUPATIONAL ALTERNATIVES 5.

assessment profile, occupation comparison

INTRODUCTION SCREEN 5.1

iNTRO 5.1

OCCUPATIONAL ALTERNATIVES SCREEN 5.2

FRONT END 1

INITIAL OPTION SCREEN 1.1

REQUEST FOR USER DETAILS 1.2

MAIN HUB NAVIGATION SCREEN 1.3.

4.1 ← 3.1

4.1 → 3.1

data files

INTRODUCTION/ ORIENTATION TO DYSLEXIA AND WORK 3

WHO IS DYSLEXIC? 3.5

CONTACTS AND FURTHER RESOURCES 3.6

HUB NAVIGATION SCREEN 3.1

LEGAL STATUS AND ENTITLEMENTS 3.4

HOW DOES IT AFFECT WORK? 3.3

WHAT IS DYSLEXIA? 3.2

INTRODUCTION/ ORIENTATION TO SYSTEM 2

iNTRO 2

1.3 ↔ 3.1

1.3 → 9.1

EXIT COMPONENTS 9

VIEW AND ANNOTATE PERSONAL RECORD 9.1

ONLINE USER SYSTEM EVALUATION 9.2

CONCLUSION 9.3

EXIT

1.3 ↔ 8

ADDITIONAL COMPONENTS 8*

LOCALISED JOB INFORMATION 8.1

GENERATION AND DISSEMINATION OF EDUCATIONAL ALTERNATIVES AND INFORMATION 8.2

HUB NAVIGATION SCREEN (SEE 8)

CV AND LETTER WRITING 8.4

JOB SEARCHING 8.3

INTERVIEW TECHNIQUE 8.5

1.3 ← 7.2

OCCUPATIONAL INFO. DATA BASE 6

search, occupation comparison

INTRODUCTION SCREEN 6.1

iNTRO 6.1

OCCUPATIONAL INFO. FILES 6.3

OCCUPATIONAL INFO. DATA BASE SEARCH SCREEN 6.2

VIDEO DATA BASE 7

INTRODUCTION SCREEN 7.1

iNTRO 7.1

VIDEO FILES 7.3

VIDEO DATA BASE SELECTION SCREEN 7.2

6.3 ↔ 5.2

6.1 ↔ 1.3

7.1 ↔ 1.3

5.2 → 7.2

5.2 ↔ 4.2

1.3 ← 7.2

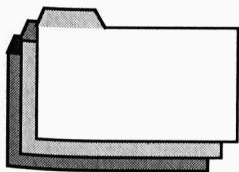'problems and solutions' sequences only

6.3 ← 7.3

6.3 ← 3.6, 3.2

6.3 ← 3.6, 3.2

7.3 ↔ 3.3

fig. 37 **System design diagram with key.**

Introduction screens.
Components that are designed to orientate the user to other components.
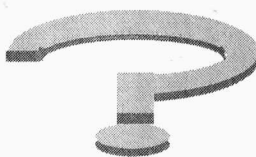
Data files.
Stores of information or data in any medium. This is accessed via 'Selection components' and displayed via 'Information display screens'.
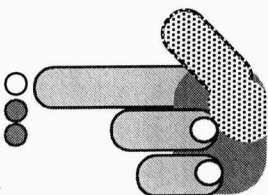
Comparison processes.
Processes that compare criteria generated from the user with occupational information. These generate suggested occupational alternatives that are presented in 'Selection components'.
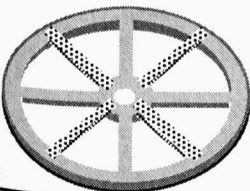
Hub navigation screens.
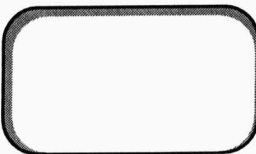See No. 1.3. in linear design and description above for an exemplary description.

User information requests.
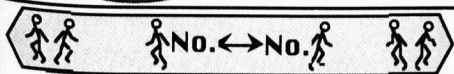Components that ask the user to respond to specific questions.

Selection components.
Screens that show the user what information in 'data files' they have access to, and allow them to select information for display. These can also act as interfaces for 'Comparison processes'.
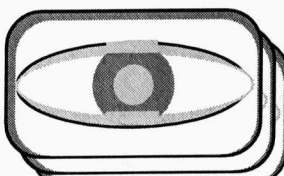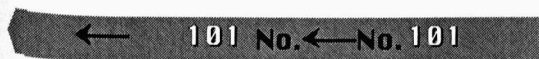
Information display components/screens.
Screens or components that display specific information to the user. Stacks of 'screens' represent components that consist of an number of interlinked information display screens.

Miscellaneous components.
Only used for 'Additional components'. See *, below.

Hyperlink.
Routes the user can take around the system. These can be bi-directional, or one directional.

Data pathway.
Routes by which data is transferred around the system. These are always one directional.

Suggested common route.
The route the user could be encouraged to take through the system as suggested in linear design and description above.

*In the design diagram you will note that the 'Additional components' (No. 8.) are presented in a different fashion to the others. In particular, no graphical information has been provided as to their general functions or structure (having used a 'Miscellaneous component' symbol in each case), and little information on how each of these components could be linked to others. The reason for this is two fold. Firstly, the reader is referred to No. 8. in the linear design and description. Note that the suggestions made concerning them are shorter and contain considerably more uncertainties than for others. Considering that the design diagram is not really intended to be a fully detailed representation of the system, it is reasonable to reflect these uncertainties as a lack of detailed information. Secondly, the design diagram in its present state is already fairly dense and complex. Including information on the structure and connections of 'Additional components', which would have to be at least as complex as for other components, would make it significantly more so. The resulting loss of clarity would reduce the design diagram's overall value to the reader considerably.

9.4. The Process of Generating Occupational Suggestions from Assessments.

The actual process of turning the user's responses to assessments into a list of occupational suggestions can be a complex one, more in the realm of mathematics than anything else. For this reason it is a good idea to devote a separate section to its discussion, rather than include this in the linear design and description' (see Section 9.3) above. However, it is possible to suggest a fairly straightforward method that is effective nevertheless.

As said above (Section 5.2.1), each occupation in the occupational data base is defined in terms of a number of constructs. These constructs are themselves defined by a set of factors that they cover. For example Prospect (HE) (Tomkinson, 1998), a widely used and fairly advanced CACG system for students in higher education, uses four constructs, 'general skills', 'people skills', 'interests' and 'motivations'. Each of these covers 11, 10, 12 and 10 factors respectively, yielding a total of 43 factors, e.g. "general skills' is defined by 'numeracy', 'memory', 'spatial sense', 'dexterity', 'planning, 'decision making', 'problem solving', 'creativity', 'verbal comprehension', 'oral communication' and 'written communication'. Thus on the most basic level each occupation is fully defined by its characteristics with regard to all the factors.

In all CACG systems the user is asked to respond to each factor. This response can take a number of forms. However, for the sake of simplicity, let us say that the user is allowed to rate the factor at one of 4 levels, high, medium, low and irrelevant. This 4 level rating is actually sufficient, as can be testified to by Prospect (HE), which uses such a system. The actual definition of these levels varies depending on the type of factor being rated. However, as an example for a skill the 4 levels could be:

1. *High.* I am good at this skill, or can develop it until I am good, and would like to make extensive use of it in a job.

2. *Medium.* I am competent in this skill, or can become so, and would not mind a job where I had to use this skill sometimes.

3. *Low.* I am not good at this and/or do not want a job where this plays any significant part.

4. *Irrelevant.* I am not concerned how much this skill is necessary for a job.

Similarly each occupation is rated as high, medium or low for each factor. Thus, one can perform a simple correlation between factor ratings comprising the users assessment profile and factor ratings comprising each occupation's profile. In fact all that is really necessary to generate an assessment construct score is to derive a score for each factor within the assessment construct, representing the level of agreement between the occupational and user profile, add these scores together, and divide by the number of factors used. The greater the similarity between profiles the higher the score. So, for example:

	User profile	Occupation profile	agreement score
Perfect match	High Medium Low	High Medium Low	2
Imperfect match	High Medium Medium Low	Medium High Low Medium	1
Mismatch	High Low	Low High	0
Irrelevant	Irrelevant	High Medium Low	no score

table 24 **Scores allotted for levels of agreement between user and occupation profiles**

A response of 'irrelevant' from the user effectively removes that factor from any subsequent calculations. The actual scores allotted need not assume exactly these values, indeed they could be altered for different occupations and factors so as to provide a more accurate representation of the real world.

Thus, using the system above one can create a list of occupations in order of suitability to the user. To help the reader visualise this process Figure 37 below provides a summary for an assessment construct containing 3 factors.
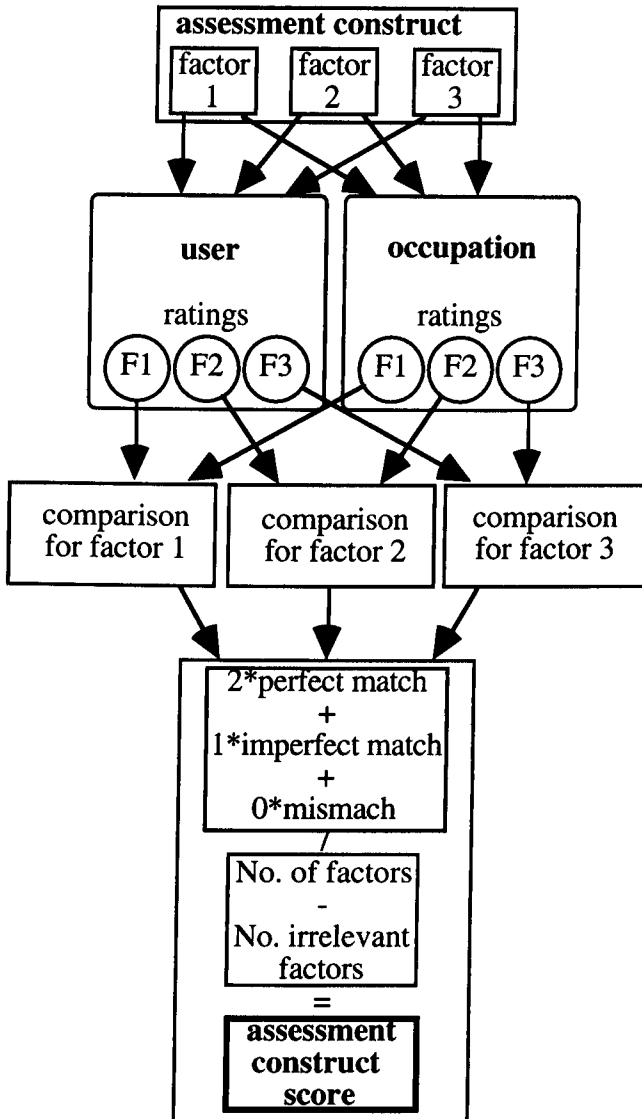
fig. 37 **Generation of user/occupation comparison score for one assessment construct**

9.4.1. Combining Constructs and Incorporating User Priority Ranking

Using the above approach to search with more than one construct is a fairly easy matter. One simply generates an assessment construct score for all the factors from each of the constructs selected. However, it has been suggested in Section 9.3 (No. 4.2.b) that one might what to allow the user to prioritise the assessment constructs, by placing them in rank order. If the user ranks two or more assessment constructs equally, it is a simple matter of combining them in the

manner suggested immediately above. However incorporating the ranking in general is not quite so straightforward.

Ideally the user should be made to place all the factors in rank order of priority. However, CACG systems must make use of too larg a number of factors for this to be a reasonable proposition, as mentioned earlier Prospect (HE) for example uses 43 factors. Thus, factors must be clustered into assessment constructs. A compromise must be struck between dividing the factors into as small a number of assessment constructs as possible, and using enough assessment constructs to create clusters of factors that are sufficiently closely and meaningfully related to be realistically considered as a single unit.

9.4.1.1. A Simple Approach to Incorporating Prioritisation

A fairly simple approach to incorporating the prioritisation of assessment constructs would be to use the basic process outlined in Section 9.3.2 (No. 5.a). Thus, one would go through the following stages.

1. A score on the highest priority assessment contract is calculated for each occupation in the data base, using the process described in Section 9.4.

2. Those occupations not exceeding a threshold score, which is determined through empirical research or expert judgement, are discarded.

3. The remaining occupations are passed to the second highest priority assessment construct, which undertakes the same process, then on to the third, and so on.

4. The process is terminated when the number of occupational suggestions reaches a prespecified limit, between 7 and 10 has been suggested earlier (Section 9.3.2, No. 5.2.a). However, in reality it would have to be the number available at the last stage before the number is reduced to less than 7.

Though conveniently straightforward, this approach has the notable disadvantage that in a great many cases the process will be terminated before the lower priority assessment contracts can have any input. In other words these will often be totally disregarded. Though they may not be as important to the user, this would nevertheless seem to constitute an underuse of available data.

9.4.1.2. A More Complex Approach to Incorporating Prioritisation

One approach that gets round the above difficulty is to ascribe weightings to each assessment construct. In this case one would go through the following stages.

1 . Each assessment construct is ascribed a weighting dependent upon its priority. The highest priority assessment construct is given a weighting equal to the total number of assessment constructs used, the second highest a weighting equal to that total minus 1, and so on until the lowest priority assessment construct has a weighting of one.

2 . A score is generated through each assessment construct for every occupation in the data base (as in Section 9.4). Thus, if one is using 10 constructs then each occupation will have 10 separate scores.

3 . Each of these scores is multiplied by the weighting of the assessment construct through which it was generated.

4 . All the scores generated for each individual occupation are then added.

5 . The highest scoring occupations are delivered to the user as suggestions.

This has a number of advantages over the process described in the previous section.

• All the assessment constructs, even those of the lowest priority, contribute to calculating the most appropriate occupational suggestions.

• All the occupations in the data base can potentially be included in the final output, making it an easier matter to deliver more suggestions if necessary. Using the approach in Section 9.4.1.1 one would either have to reduce the threshold scores for the assessment constructs, or terminate the process at an earlier point, and thus make use of even less of the assessment constructs. Neither of these is an attractive option.

• The approach in Section 9.4.1.1 must make use of threshold scores which are determined through empirical research or expert judgement. There is a chance

that these may not be appropriate (see Section 5.2.3.1). The approach in this section makes no use of such thresholds.

Thus, this second approach seems preferable to that in Section 9.4.1.1.

One final possibility is for the system to generate a preliminary ranking of assessment constructs. This could be achieved through examining how extreme the user's overall response is to each assessment construct, and how many irrelevant responses were given by the user within each assessment construct. One can predict that those receiving a less extreme overall response and/or more irrelevant responses are likely to be of lower priority to the user. However, in this case the user should be advised strongly to examine and adapt the prioritisation so that it genuinely fits their personal priorities. Such an automatic prioritisation, however cleverly produced, can only hope to be at best an approximation of the actual state of affairs.

9.4.2. Incorporating Assessment Constructs of Specific Relevance to Dyslexic people

It may be helpful to explicitly enquire into a number of constructs that have particular relevance to dyslexics considering employment (see Section 9.3.2, No. 4.3.a). Drawing from previous chapters and research (see particularly chapters 1 4 6 7 and 8) one could suggest:

- literacy level

- working memory capacities

- organisational capacities

- level of support or accommodations

- work stress level

Clearly in order to do these constructs justice, each would have to be divided into a number of individual factors, as in all the other constructs used. For example, literacy level could include such factors as:

- speed and effort of writing

- ability to express complex ideas/instructions in writing

- speed and effort of reading

- ability to comprehend complex ideas/instructions from written sources

Each occupation can be rated for these factors exactly as with more general factors, the comparison process (see Section 9.4) would be identical. However, whereas providing responses for other assessment constructs is optional for the user, these should be obligatory.

9.4.2.1. *Incorporation of Assessment Constructs of Specific Relevance to Dyslexic People in the Mainstream Generation Process*

These assessment constructs can be treated like any other and included in the general prioritisation. This allows user to factor in how much they believe the various assessment constructs representing characteristics that may be the result of dyslexia should influence their career choice. However, due to the likely significant influence of these assessment constructs it may be best to allot them an automatic minimum priority ranking, for example in the middle of the general assessment constructs ranking.

However, this approach raises three problems:

- The system would normally allow the user to select and, more importantly, deselect which assessment constructs are used in the generation process. Through this they could cause the system to disregard the influence of their dyslexia. As this influence is liable to be significant this would be unwise, and especially so if one considers the following bullet point. This can be solved by not allowing the user to deselect these assessment constructs, in addition to making responding to them obligatory. However, it may be helpful to allow the user a limited capacity to examine the results of not taking their dyslexia in to account. If so great caution would be advised.

- As suggested throughout Chapter 4 dyslexics often have problems assessing the true scope of their difficulties. Thus, the priority ranking for assessment constructs liable to express these difficulties, stands a good chance of not being

highly representative of the true significance of those difficulties to a career choice.

- Including these clusters in the general process could lead to the rejection of occupations that would otherwise be accepted, or their movement to lower positions that the user is likely to disregard. This is particularly important considering the bullet point immediately above. As further suggested in Chapter 4 (see Section 4.3.2) it may not be wise to overly restrict the number or nature of job options based upon the user's dyslexia, as this can serve to encourage misconceptions as to the potential and competence of the individual.

Thus if these assessment constructs were included in the mainstream process it would be advised to provide them with special conditions, and exercise particular caution. The latter could extend as far as presenting the user with cautionary notes.

9.4.2.2. A Parallel Process for Assessment Constructs of Specific Relevance to Dyslexic People

In this case as with the above, responding to these assessment constructs would be obligatory for the user. However, they would also not be allowed to deselect them or rank them with the other general assessment constructs. Instead the assessment constructs of specific relevance to dyslexics would be processed separately.

They could be used to generate the user's dyslexia score for each occupation, and not allowed to influence the content or structure of the final output of occupational suggestions. Instead, each occupational suggestion could be accompanied by its corresponding user's dyslexia score. These could be highlighted with some sort of graphic indicator of the level of caution the user should adopt when considering that occupation. However, the user should still be strongly encouraged to examine attractive possibilities carefully, even when they are accompanied by a high caution rating, i.e. they should not take a high caution rating as an absolute indicator of unsuitability.

Finally, within the assessment constructs of specific relevance to dyslexics one could allow the user the option of prioritisation. In this case they would be allowed to include information as to what problem areas are of particular importance to them. However, again one should be cautious of this, considering

the problems many dyslexics experience assessing the true influence of their difficulties.

In the final analysis it may be feasible to combine the option presented in this section with that of including these assessment constructs in the mainstream generation process. One could allow for mainstream ranking, and even deselection, of these assessment constructs, but also display the user's dyslexia score and graphic caution indicator for each occupational suggestion, whether these assessment constructs were are selected or not, and what ever their ranking in the mainstream process. This would allow the user to examine the influence of their dyslexia on the suitability of occupations, without simultaneously providing the option to totally disregard it. In this case it could even be a good idea to prompt the user to try it with all dyslexia clusters deselected.

Whatever approach one chooses, when viewing the information for a particular occupation special provision should be made for comparing the dyslexia oriented characteristics of the occupation and the user. This would be done on a construct by construct, or even factor by factor basis, so that the user can make a more deeply informed, personal judgement of whether the occupation in question is suitable or not. This in itself could help them increase their general understanding of their dyslexia and how it relates to employment.

9.5. Suggestions for Further Work

Fairly obviously, more research into general design and use of multimedia systems with specific reference to dyslexics would be very helpful, as would more work into CACG systems and dyslexics. However, there are a number of other more specific issues which should to be examined before the system can be completed. Most of these have been raised in the 'Linear design and description' (Section 9.3.2). Furthermore, there are a number of questions regarding the implementation of the system and its delivery to the public. The following is a brief outline of all of these suggestions.

- *More work into practical compensations strategies relevant to employment.*
  As one can see from Chapter 4. there is a significant amount of work on problems dyslexics face in gaining and retaining employment, and what measures will help. However, it is vital for this system to deliver

information on specific practical compensation strategies for a fairly full rage of specific problems experienced by dyslexics. Though there is anecdotal information and some other research on this, some fuller and more formal studies or surveys would be of great value. Potential researchers could use a similar approach to that used in this study, i.e. interview studies, backed up later with questionnaire studies.

- *Work to ascertain the most appropriate assessment constructs and dimensions of these for use in this system.* As said in Chapter 5. (Section 5.2.2) presently available CACG systems use a very wide and fairly inconsistent range of constructs, and dimensions of those constructs in their assessment phase. There is little in the way of clear general purpose guidelines, and none when considering dyslexics. The constructs used can have a very significant bearing on the effectiveness of the system. Thus, some inquiry as to what general constructs provide the most accurate and helpful assessment of occupations for dyslexics, and of dyslexics themselves would be almost essential.

- *Breaking down the world of work into occupational categories, and finding occupations typical of each category.* In order to complete the system it would be necessary to divide the occupations in the 'Occupational information data base' (see Section 9.3, No. 6) into categories. Occupations in each category should share some central characteristics. For the sake of consistency, the characteristics used to determine this classification would best be generated from the assessment constructs and the dimensions of these used by the system. In addition, the fact that the user is a dyslexic person should have influence over what characteristics are actually selected from those potentially available, for example one may want to include literacy level as a factor.

This categorisation is used at various points in the system. Each category is used to determine the nature of each video file (see No. 7). However, this raises another question which must be answered, namely what occupation within each category is the best example of that category? Again the user's dyslexia would be an important factor in deciding this. For example, one may want to choose occupations that are particularly effective for demonstrating all the problems that a dyslexic person is liable to face in the respective categories of occupations. In this case care would need to be taken

to ensure that each occupation selected was, nevertheless, generally typical of its category, and did not present so many problems as to put the user off.

In addition, the structure of the World of Work Map (see No. 5.2.c in Section 9.3. above) will also be mostly determined by this categorisation and the characteristics chosen to generate it. In this case it may be best if the number of dimensions within the categorisation is kept as low as possible to facilitate a visual representation.

- *A parallel or related system dealing with education and training.* The reader is referred back to No. 8.2. in the 'Linear design and description' (Section 9.3.) for a brief discussion of this issue. In essence, it would be entirely justifiable to develop a system very much like the one proposed, except designed to discover and evaluate educational and training alternatives. Most of the work presented in this thesis would be applicable to this educational system. However, the specifics, such as the information delivered, will be very different. Another issue that will need to be investigated is how any educational system should interact with the system proposed in this thesis. For example, it would be very useful if any educational alternatives generated could be used in turn to generate occupational alternatives.

- *Where and how would it be best to implement the system?* It is essential to bear in mind that this system does not work in a vacuum. Thus, research will have to be done to find out the most suitable environment for the system to be used in. Issues such as the extent, timing and nature of human support and back up, as well as the development of appropriate support materials and resources will have to be fully examined. Furthermore, it will be necessary to design administrative procedures and training programmes for those who will be administrating the system. All of this should be done with a view to fully integrating the system into organisations, ensuring the user is provided with the most appropriate environment and additional support, and facilitating further development and tuning of the system. The results of an examination of these issues could be used to determine which organisations are suitable. For example, Jobcentres are likely to have the procedures in place to offer sufficient support as well as the expertise to organise and incorporate appropriate administrative procedures and training programmes. Thus, they are liable to offer a better environment for this system than, for example, public libraries. Likewise, collaboration with these organisations should

determine the most appropriate manner to practically implement these results, as well as generate suggestions as to how the system itself should could be improved. Thus, one can envisage a type of dialectic relationship between developers and organisations, hopefully leading to a steady improvement of the system and its implementation.

- *Implementation over the internet.* As the proposed system is multimedia and hyperlinked, another prospect worth considering is not only to implement this system via machines provided by organisations, but also over the internet as it is the example par excellence of these characteristics. The internet presents the enormous advantage of providing easy access to a vast amount of people. However, it will be necessary to determine whether internet implementation will provide access for the people who most need the system, bearing in mind that we are targeting dyslexics who have difficulty finding suitable employment, and are thus less likely to have the resources to afford a personal machine or have access via machines at their place of work. Internet implementation also has the problem of making it extremely difficult to provide the user with a sufficient level of human support, which is vital to the process (see Chapter 4 in general, and Section 5.3). One way this could be countered would be to provide the user with a facility to make an appointment with appropriate organisations in the local area via e-mail, or talk to a careers adviser via 'internet relay chat'. Another problem with the internet is that it can often be slow and cumbersome. However, this can be countered by downloading sections of the system into the user's computer. This in itself could take some time, but would prevent some of the more frustrating breaks in the flow of system use. Finally, the internet does have the advantage of being able to provide the user at the press of a button with a potentially very large amount of additional support material and resources, even being able to take the user to areas entirely outside the system and its surrounding facilities. All of this can be very easily stored by the user for later reference, whether it be text, video or any other medium. Thus, the user could easily build up a very sizeable and varied personal resource. Of course, there is a danger that the user will be led astray and lose the thread of what they are meant to be doing. Unfortunately, it is doubtful if this 'lost in hyperspace' problem of the internet will ever have a truly satisfactory solution.

- *Developing the system.* This thesis is really the beginning of the process. A great deal more work would have to be done before the proposed system could be released for general use. In addition to this the system would require on going maintenance and development in order to assure its long term effectiveness.

Fully developing the proposed system would require a team of computer programmers, and a team of experts to gather and vet the information included in the system. Both of these tasks call for a substantial amount of work. Further more, the system will need to be constantly updated as new occupations are created, and the characteristics of older occupations change. Information on contacts and statutory rights will also need constant updating. In order to get the best from the system it would be vital to examine the way the system is used once in service, and have the facilities and staff available to adapt and improve it in response.

One can see from the above that full development and maintenance of the proposed system would make necessary the employment of a permanent multidisciplinary team, and incur sizeable long term costs on top of any initial investment. Unfortunately, there is little chance that anyone will take on this responsibility at present.

However, it may be feasible to develop some of the components of the system as independent projects. These would require considerably less resources. The 'Introduction/orientation to dyslexia and work' component (No. 3 in the design above) has potential for this, as does the 'Video data base (No. 7 in the design above). In both cases these components could be of great help to the dyslexic, but do not directly rely upon the components that comprise the core elements of (see Section 5.2) the system. Having said this, such smaller independent projects would still require a significant amount of initial work and ongoing maintenance. However, this is likely to be far more within the range of smaller organisations with smaller budgets. It seems unlikely that any part of the system could be satisfactorily constructed by any lone individual. It would be a rare individual who had the necessary programming skill, along with the required specialist knowledge of dyslexia, and information gathering skills.

Conclusion

Dyslexia affects a significant proportion of the population. However, many adults have gone through their lives not knowing that they suffer from dyslexia, or with only the suspicion. This has prompted interest in the idea of wide scale screening for dyslexia amongst adults, and more specifically, in computer mediated screening. However, a diagnosis of dyslexia should rightly only be seen as the beginning. The provision of appropriate follow up support is essential for the dyslexic individual to appreciate the implications of that diagnosis, and act to improve their position. Not to do the latter would be analogous to diagnosing a disease, but offering the patient no further information or treatment. The statutory rights provided by the 1995 Disability Discrimination Act to disabled people, including people with dyslexia, makes this a particularly pressing issue, especially for organisations undertaking such screening. Unfortunately, individuals with enough experience and knowledge of dyslexia to undertake such specific support are comparatively rare, and training a sufficient number of people would be a very time consuming, and costly undertaking. One partial solution to this problem would be to follow the example of computerised screening and offer some sort of computerised support or guidance. Though it would be unwise to assume that this can replace well trained specialists, it could act as a valuable stop gap, compensating for a lack of specialist input in any subsequent human mediated support.

This last possibility has been made even more feasible by improvements in computer technology. The days when computers require the user to perfectly enter obscure commands through the keyboard are behind us. Modern systems can be controlled via a graphical user interface. Making use of such things as icons, menus and a mouse one can construct a control system that requires little or no keyboard skills, and is intuitive enough to be mastered by someone with comparatively little experience of computers and virtually no experience of the system in question. Hand in hand with this reduction on the reliance on text for controlling systems, there has also been a reduction in reliance on text as a medium for what the system can deliver. Modern multimedia systems can now present the user with a wide variety of media, from simple text all the way to high resolution digitised video and sound. All of this coupled with the increased speed, power and memory capacity of such systems raises the possibility of producing large,

branching systems that are nevertheless fairly easy to control and understand, and provide the user with a rich and engaging environment.

Such systems are far better suited to implementation of open learning techniques. They are generally far more able to adapt to the individual's tastes and styles, and lend themselves to an active, exploratory approach to learning. Due to difficulties with memory, attention and skill development, not to mention a wider variation in personal styles, such an open learning approach is likely to be far better suited to dyslexic people than more conventional passive, route learning approaches. Furthermore, the removal of the emphasis on text and the comparative transparency of multimedia systems are particularly beneficial for people with dyslexia.

Careers is one area where dyslexic adults could use support and guidance. Dyslexic people are often less successful in employment than the general population. Often this is not due purely to basic cognitive impairments or a lack of intrinsic ability, but more to a lack of understanding or misunderstanding with regard to the nature of their condition and the world of work, coupled with affective problems such as low self esteem, or a sense of helplessness. Thus, in addition to some basic remediation and accommodations, many dyslexic job seekers would benefit from the opportunity to examine the implications of their dyslexia when it comes to work, and learn about the career decision making process. In the past this could only be effectively facilitated by a trained specialist careers adviser. However, there now exists the possibility to develop a computer systems of the sort mentioned above which can assume at least some of this role.

There is nothing particularly new in the idea of computer assisted careers guidance systems. Many such tools have been developed over the years. However, the vast majority of these have been comparatively simple devices, that merely request specific information from the user, and via a completely hidden and automatic process, generate a number of more or less suitable occupational suggestions. Such systems are far from perfect for dyslexic people as they generally encourage a passive learning style, provide little by the way of increased understanding, and work to a model of the user that is not accurate for many dyslexic people. However, a more complex, adaptive, multimedia system could be far more effective.

Imagine a system operated through an intuitive easy to use graphical user interface, with comprehensive orientation and help facilities available at all times, that makes

use of the widest variety of media to present information and assist the user. Imagine that it possesses a branching structure that allows the user a number of different means of accessing information, and encourages the user to take an exploratory approach. Furthermore, imagine that it allows the user to manipulate the systems basic processes in a completely reversible manner and thus allows for, and even encourages experimentation.

Imagine it could provide a whole range of information on specific occupations, and information specifically for dyslexic people at the touch of a button. One could make use of interactive video techniques to demonstrate in an engaging and realistic manner what is actually involved in an occupation and what effects one's dyslexia may have, as well as give the system a more human touch. Imagine that it could provide a range of support facilities of particular relevance to dyslexic people, and a detailed yet clear and well organised document at the end of the session, that can be effectively used as a reference document and an aid in later sessions with a human adviser. Imagine a device that takes a consistently positive approach to dyslexia, that cannot judge, sneer, get bored or impatient.

Further, imagine that such a tool was fully integrated into a careers guidance service, so that dyslexic people and issues arising from dyslexia were not marginalised. It could even encourage the development of greater understanding amongst staff, and the rendering explicit of dyslexia policies and approaches, maybe leading to more systematic and clearly thought out practices.

Such a system has the potential to encapsulate the best practices in careers advice for people with dyslexia, and make use of very appropriate open learning techniques. It could not only provide the user with information of immediate value, but expand their understanding of themselves and the world of work, facilitating the development of knowledge and skills that could prove invaluable to the individual throughout their working lives.

I believe that such a system is not only feasible but highly desirable, and those I have questioned have strongly supported that belief. Furthermore, the research reported in this thesis provides clear guidelines for how such a system should be constructed. It would take a considerable amount of effort and resources to bring this to its fruition. However, how much effort and resources are wasted as a result of dyslexic people entering inappropriate occupations or not being aware of what can be done, and failing to exhibit their full potential as a result? In addition to the

pure economics of the situation we must remember that work, and the achievements associated with it, makes a vital contribution to our impressions of ourselves, and the impressions others have of us. Failure in work can easily reflect itself into a sense of failure in life. It is difficult, if not impossible, to quantify the amount of distress and dissatisfaction such failure causes for the millions of dyslexic people in this country, but in the end this is maybe the most important factor in the equation. I believe that if we can genuinely help our dyslexic citizens achieve satisfying, worthwhile lives, that yield the level of respect they deserve, then the effort and resources needed are a comparatively small price to pay.

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