Understanding dyslexia

Introduction

Dyslexia is a condition affecting literacy skills. This unit analyses how our image of normality affects the way we as a society define such conditions. You will learn how important it is to integrate the different psychological accounts of dyslexia in order to provide a full explanation of potential causes and strategies for remediation.

On completion of this unit, you should be able to:

- identify and discuss the issues that relate to the definition, explanation and remediation of ‘abnormal’ psychological functioning;
- understand the complexities involved in identifying, explaining and managing dyslexia.

1 Approaches to the definition of ‘abnormality’

1.1 Introduction

You may have noticed that we often discuss people with the assumption that there is a ‘normal’ pattern of behaviour, which some people do not conform to, while the rest do. This idea of ‘normality’ is implicitly subscribed to in many areas of psychology. We theorise about ‘normal development’, ‘normal memory functioning’, ‘typical perceptual experiences’, ‘gender appropriate behaviour’, and refer more explicitly to examples of unusual psychological functioning as being of interest, because of what they can tell us about ‘normal’ functioning.

The concept of psychological ‘normality’ is not simple. This unit addresses the issues surrounding the idea of ‘normal’ psychological development, and shows that how we define ‘normality’ will influence the way we think about and deal with ‘abnormal’ psychological functioning. To illustrate how ‘abnormality’ is defined in practice, and what issues are important when considering its causes and treatment, we will refer to the specific example of developmental dyslexia. However, these issues will also apply to many other types of ‘abnormal’ functioning.

We need to consider multiple perspectives in psychology, as our understanding of a topic is enhanced by the comparison of research findings from different perspectives. This unit shows how research from cognitive, biological and neuropsychological perspectives can be combined to offer a more complete account of conditions like dyslexia. The unit therefore presents dyslexia as a ‘case study’ in how different perspectives might be complementary to each other.

1.2 Definitions of ‘normality’

What do we mean when we say something is ‘normal’?

Activity 1

Write down what you would consider to be ‘normal’ for each of the following examples:

- women's height;
- eyesight;
- behaviour when waiting for a bus;
- consumption of alcohol.

Discussion

Each of your answers to Activity 1 will reflect a different approach to defining ‘normality’. We will examine each of these approaches in turn. Note that there are quotation marks around the word ‘normality’. This is to show that we are exploring the meaning of the word, and accept that there is no one unproblematic definition. Throughout the chapter, quotation marks around any word indicates that there are issues or debates about the definition of the word.

End of discussion

1.2.1 Statistical approaches to ‘normality’

What did you base your idea of ‘normal’ height on? It might have been based on your own experience, reflecting the *average* height of women in your community. Similarly, ‘abnormality’ can be defined in terms of low statistical frequency. If what is most common in the general population is considered ‘normal’, then any behaviour or psychological characteristic that occurs only rarely may be regarded as ‘abnormal’. From this viewpoint, above average individuals are just as ‘abnormal’ as those who are below average. This approach is particularly suited to variables that are **dimensional**, such as height or scores on a test. These variables lend themselves to measurement on a continuous scale. You can relate this to what you have already learned about the normal distribution. If you look at Figure 1, you can see the normal distribution curve with the mean value in the middle.

About 68 per cent of all values are within one standard deviation of the mean (Dancey and Reidy, 2002). This is termed the ‘normal’ zone of the curve. Note that this choice of the percentage of values which comes under the ‘normal’ zone of the curve is arbitrary in the sense that it was defined by statisticians, and does not reflect any natural circumstance or law.

Figure 1: The normal distribution curve (Source: Dancey and Reidy, 2002, p. 89)

The standard deviation for a set of scores can therefore be used to define the boundaries of what ‘normal’ might be. Another example is that of IQ scores, which are constructed to be normally distributed with a mean of 100 and a standard deviation of 15. This means that IQ scores between 85 and 115 are considered to be ‘normal’. Scores lower than 85 are regarded as abnormally low (the bottom 16 per cent), and scores higher than 115 are seen as abnormally high (the top 16 per cent).

This seemingly simple and objective approach to defining ‘normality’ is in fact quite problematic. If deviation from statistical norms is used to define ‘abnormal’ functioning, then the following questions about measurement must be answered.

1. How are psychological characteristics (such as intelligence) quantified? Can they be measured on a continuous scale or are they better captured by discrete categories?
2. Do the relevant measures have a normal distribution? If not, mean scores and standard deviations are likely to be inappropriate reference points (Dancey and Reidy, 2002).

3. Are the assessments reliable? Tests that are going to be used for diagnostic purposes need to have extremely good internal and external reliability.
4. Are the assessments valid? To address this, we need to be clear about the purpose of measurement and consider different types of validity.
5. How is a behaviour classified as ‘abnormal’? The ‘one standard deviation away from the mean’ criterion can be a rather over-inclusive indicator of abnormality for some tasks, especially if the consequences of such an assessment would be to give that person a negative label. More extreme boundaries of 1.5 or 2 standard deviations from the mean are sometimes chosen instead. Any cut-off point for classifying people into discrete categories of ‘normal’ and ‘abnormal’ is arbitrary if the characteristic in question really is dimensional.
6. Does it matter if someone is scoring higher than the average population? On some measures very high scores may be just as worrying as very low scores (e.g. persistent over-arousal, reflecting stress or anxiety). On other measures, only one extreme of the distribution may be considered ‘abnormal’ in the sense of problematic. The statistical approach to defining normality does not make these kinds of judgements, so clearly other criteria are being applied in these situations.

1.2.2 Medical approaches to normality

What did you write for ‘normal’ eyesight? The ability to see clearly without glasses? It is unlikely that you wrote down short- or long-sightedness as an example of ‘normal’ eyesight, even though they are very common. However, they are not seen as ‘normal’ because having to wear glasses is perceived as a limitation or even a form of disability. This relates to one of several so-called ‘medical models’ of normality, which centre on the idea of uniformity of physical and psychological functioning across individuals. These models are often reductionist, proposing that disease or physical disorder of some kind can explain ‘abnormality’, although such explanations frequently acknowledge social and external factors that may trigger the physical ‘cause’ of a problem. Psychological conditions like depression can be viewed using medical approaches as the result of ‘abnormal’ functioning of the brain systems that govern mood and arousal. As a result, medical models often provide the rationale for many drug treatments (e.g. anti-depressants) aimed at correcting the presumed biochemical imbalances to restore ‘normal’ functioning. However, these simple reductionist approaches have proved unsuccessful because:

1. The identification of many psychological ‘disorders’ can be very difficult in practice, because they appear to fall on a continuum with ‘normal’ functioning, so any clear distinction between ‘normal’ and ‘abnormal’ is frequently difficult to draw.
2. Biochemical (drug) treatments often go hand-in-hand with a medical approach. However, there is still considerable uncertainty about the precise nature and origins of any biochemical abnormalities associated even with well-studied conditions like depression or schizophrenia, for which various drug treatments are in routine use. For others such as eating disorders, even less is known about possible biochemical contributions, if any exist at all.

3. It is evident that many of our most common diseases are actually **systemic** – they arise from a breakdown of many complex interacting systems, and medical approaches acknowledge this. They should not be thought of as simple or reductionist explanations for physical or psychological disorders. For example, both heart disease and cancer arise from the interaction of genetic predisposition with environmental and lifestyle factors that include both biological and sociocultural influences. There is no reason to suppose that psychological disorders are any simpler.

The sheer complexity of the many interacting systems involved in human development and functioning means that even in physical disorders, realistic medical approaches are rarely simple or reductionist. In the same way that good medical models reflect complex interactions between different factors, so too should our models of psychology.

1.2.3 Cultural approaches to normality

What is normal in terms of the simple act of waiting for a bus? In the UK it is expected that people will organise themselves into a queue, so those who have waited the longest can board the bus first. However, this is not true of all cultures. Yet, if someone from a culture that does not queue were waiting for a bus in Manchester and did not wait her turn, she would be chastised for it. So, another approach might be to define as ‘abnormal’ any behaviour that contravenes social norms, values or expectations.

Using a cultural approach, what is defined as ‘abnormal’ will depend on expectations and standards of the society, and thus on political and economic as well as social factors. The criteria used may differ between societies, over time within the same society, and between groups within the same society.

> One thing to consider is whether a ‘deficit’ or ‘abnormality’ is defined as such by context. For example ‘deficits’ in one area may be linked to ‘abnormal’ strengths in another. We shall consider this in more detail in relation to dyslexia later in the unit. Another issue is whether what is considered ‘normal’ should then also be considered as ‘natural’. Human behaviour is complex and is determined by interactions between a variety of influences, internal and external. Consequently, the idea that some behaviours are ‘natural’ because they are determined in some part by our physiology, is not a satisfactory justification on its own for considering them ‘normal’.

1.2.4 Personal distress

Another way of defining psychological ‘abnormality’ is to ask whether certain behaviours or styles of functioning cause distress to the individual concerned. Think about your response to what you consider to be ‘normal’ alcohol consumption. Perhaps you specified a maximum number of units per day or week? If so, why did you do this? Is it because of the health problems associated with excessive drinking, or because of its association with antisocial behaviour? Some of you may believe that any alcohol consumption is inappropriate, for medical, cultural or religious reasons. Alternatively, some of you might have specified an age criterion that reflects the legal age for alcohol consumption in your country. These are not trivial points. Many people see ‘excessive’ alcohol consumption, even if within cultural norms, as ‘abnormal’ because of the personal distress it will cause. They believe that heavy drinking can lead to alcohol dependency or health problems that have the potential to ruin a person's life.

An obvious difficulty with the criterion of personal distress is that in some cases, such as alcoholism or drug use, personal distress is not necessarily manifest. Whose distress are we considering? Are we really intervening in the interests of the person showing the behaviour, or in the interests of their family or society? Moreover, who makes the decision to intervene will vary depending on what the behaviour is. The degree to which individuals are pressurised to comply will also vary depending on whether it is a doctor or a friend who is trying to intervene. Clearly, this criterion raises some complex issues to do with the imposition of other people's values and the acceptability of setting limits to individual freedom.

> Tobacco use is associated with substantial health risks and social issues, but would intervention, in the form of bans on its use, infringe personal freedom? If the answer is ‘yes’, then why does this not equally apply to behaviours such as eating disorders? Is it because of sociocultural notions of what constitutes ‘normal’ behaviour? Furthermore, does the large number of people engaging in a behaviour, such as smoking, make it somehow more ‘normal’?

Box 1: Definitions

- **Dimensional** Used to refer to variables that lend themselves to measurement on a continuous scale (e.g. height is dimensional, but eye colour is not).
- **Systemic:** Belonging to or affecting the system or body as a whole. For example cardiovascular disease, with origins involving many interacting subsystems, is usually seen as systemic, whereas tuberculosis, caused by a single infectious agent, is not.

1.3 Overview of ‘normality’

Before we can specify what might be ‘abnormal’, we must first have a clear idea of what we mean by ‘normality’. However, within psychology this is much more difficult than it first appears. As our discussion has shown, psychological ‘normality’ can be defined in terms of:

- what is ‘average’ or ‘typical’ with respect to statistical frequency;
- ‘lack of disability’ – where ‘normality’ is defined by reference to an ‘ideal’ or ‘perfect’ state of functioning;
- conformity to social, cultural or historical expectations or norms;
- individual well-being or lack of personal distress.

It is important to recognise that these approaches are not mutually exclusive. Thus, ‘normality’ can be defined by calculating statistics on what is most common, as well as by trying to find valid, biologically based criteria of ‘healthy’ functioning. It can also be culturally defined, encompassing social values and expectations, as well as involving appreciation of individual differences and personal well-being. Each of these factors may carry more or less weight, depending on the circumstances and the behaviour(s) being considered. There is so much natural variation in human behaviour and psychological functioning that it is almost impossible to arrive at any universal definition of ‘normality’. This means that attempts to define ‘abnormal’ psychological functioning can be problematic and misleading unless careful consideration is given to the reasons for seeking such a definition.

> Why do we need to make a distinction between ‘normal’ and ‘not normal’ when we are acutely aware that human psychological life is so diverse? Do you think that society or the individual within it benefits from identifying some types of behaviour as ‘abnormal’?

1.4 Experiencing dyslexia

To illustrate just how problematic the idea of ‘abnormality’ is in practice, we will consider the condition of **developmental dyslexia**, *dyslexia* for short. Dyslexia is relatively common and you may have knowledge of it from friends or personal experience. The following section illustrates many of the difficulties experienced by people with dyslexia, and it also highlights more generally some of the problems that can occur if you are not, in some sense, ‘normal’.

A case study in ‘abnormality’

Alexander Faludy is severely dyslexic. Dyslexia is a condition that is primarily manifested by a difficulty in learning to read and write, although its behavioural symptoms are far more wide ranging than this. At the age of 11 Alexander was still only able to write two legible words per minute, and coped with reading by using book tapes intended for blind people, which he would listen to while following the text of the book. He was also extremely clumsy and uncoordinated. Unable to read at all for a long time, he suffered bullying at school. In these respects his story is not untypical of many people with dyslexia. However, Alexander is also ‘not normal’ in another respect – he has an extremely high IQ. By the time he was 11 he had passed GCSE and A-Level English Literature and had begun a foundation course with The Open University. To achieve all this, Alexander and his parents had to persuade schools and examination boards to change their thinking about the ways they assessed and examined dyslexic students' work. Alexander dictated his work to his parents who would copy down what he said verbatim. At 15 he won a place at Peterhouse College, Cambridge as the youngest student since Pitt the Younger, studying Theology and History of Art.

Alexander's story in his own words, aged 12

> At playschool, other children were taught to read. They tried to teach me, but I was never any good at it, and even when I did learn to read I was very slow … When I was five, an important marker in my dyslexic case history emerged. The use of my left and right hands became more

or less even, and in places, alternated, a fact that puzzled my class teacher… I was physically weak and uncoordinated. My contemporaries at school concluded that I wasn't one of them. I wasn't any good at throwing a ball, reading, or beating someone up for no apparent reason …

Despite my wide literary knowledge, I was no good at my English class, something that rather upset me. My spelling was bad, and handwriting slow and abominable. It hurt to write, because I had to write so quickly to keep up …I did badly in English and Maths and it was suggested my qualities were incompatible with the next part of the school. I was humiliatingly sent down in the period before lunch to the bottom class to be taught how to write letters properly …

Official confirmation that I had dyslexia came in 1990, when I was seven … When I was still in the pre-prep, I got my parents' Othello cassettes and fully-illustrated text, and set about reading and listening to it simultaneously (a method which was later to serve me in good stead). My parents asked me to talk about the play on tape. They then showed me more new texts and plays which expanded my mind and helped me to see that life cannot just be tackled by attacking a surface but by digging out the root …At the beginning of the spring term in 1992, when I was nine, my parents finally let out the secret to me – all the reading of Shakespeare and Donne had had a purpose: I had been doing a GCSE. I felt a sense of achievement unlike anything before.

By this time I had entered the lower school… My form teacher, who took me for Maths, gave me a 'D' at the end of term, and told me to try harder, for I was using my dyslexia as an excuse for laziness and that it wasn't the problem my parents and I were making it out to be … My handwriting got worse as I was expected to write at speed. A normally well-meaning and kind science teacher ripped out several pages of my work in front of the entire class because he thought them insufficiently neat. I felt humiliated and dejected …

I received my GCSE results during the summer. It was a very special day. Taking a GCSE had raised my standard of thinking and helped me put the concerns of my contemporaries in perspective. They would feel great sorrow if they kicked a football the wrong way, but I had learned about the real sorrows of death, love, hate, kindness, greed, treachery, avarice, power and corruption. I could learn more about life from poetry than I could by trying to kick a large spherical object between two posts.

(Faludy, 1998, p. 3)

Description

An example of Alexander's handwriting, aged 9, the same year he got his GCSE in English literature

End of description

Activity 2

Make notes on which difficulties experienced by Alexander were the result of his condition, and which were ‘constructed’ by having to fit in to ‘normal’ ways of doing things?

Discussion

Comment

In some senses dyslexia itself is a ‘construction’ because it was not identified as a difficulty until there was a societal expectation that everyone should be literate. The difficulties in learning to read and in physical coordination (including writing) experienced by Alexander are genuine problems, but the negative social and emotional consequences of them are not: they result from expectations of the level of performance he should attain and limited tolerance by others to his ‘being different’. This is evidenced not just in the bullying, but also in the way that his teachers responded to his work, as they wanted him to conform to the ‘normal’ set of skills and abilities defined as appropriate to his age and culture. Alexander's success in English using his technique of listening to book tapes and dictating his work suggests that there was limited need for such an emphasis on traditional forms of literacy to demonstrate his competence in the subject.

The comments of Alexander's mathematics teacher illustrate another aspect of having dyslexia: having a label that effectively says ‘this person is not normal’. People react to labels in different ways, sometimes positively, sometimes negatively. Labels relate to stereotypes and can result in prejudicial attitudes towards the individual concerned. The teacher here suggests such an attitude: the idea that dyslexia is used by parents as an excuse for little more than laziness on the part of their child. It also suggests that the teacher may be sceptical about dyslexia itself. This scepticism persists in some quarters because there has been debate about the nature and causes of dyslexia, whether it differs from general reading difficulties, and how. In this unit we consider the evidence that dyslexia exists as a distinct syndrome with a biological basis.

End of discussion

1.4.1 What is dyslexia?

Dyslexia involves difficulties in learning to read and write. However, this is not the only form of difficulty that people with dyslexia experience. They usually have particular difficulties with *coding*: learning and retrieving associations between verbal and visual information. The most obvious example is when we have to learn what sounds the letters of the alphabet make, but this difficulty can also affect the speed with which dyslexic people are able to learn and recall the names for objects. Generally, people with dyslexia have difficulty dealing with phonological information (speech sounds) in short-term memory, so any task that requires the processing of verbal information will prove difficult. For this reason mental arithmetic is also often difficult, and mathematics generally can suffer because of the coding that is often necessary when learning mathematical symbols and their functions. Another general area of weakness is the sequencing of information. Poor sequencing can affect the written expression of ideas, or methods of working in mathematics, but it most obviously affects information that is usually learned by rote, such as the months of the year, or multiplication tables. Directional confusions are also common, and people with dyslexia often have difficulty remembering left from right.

Box 2: Key characteristics of people with dyslexia compared to people without dyslexia

- A delay or deficit in understanding letter–sound correspondences.
- A delay in learning to read.
- Poor spelling.
- Difficulty generating written language.

- Some initial difficulty in recognising rhyme.
- Poor short-term memory.
- Poor mental arithmetic.
- Difficulty in learning labels (e.g. names for new objects).
- Difficulty naming objects and word finding.
- Difficulty learning sequences (e.g. months of the year, the order of a sequence of tasks).
- Slowness in learning text or verbal information.
- A subtle difference in form and function of some areas of the brain.

Dyslexia is relatively common, with an estimated prevalence of around 5 per cent in its severe form, and as much as 10 per cent if milder cases are included. Prevalence depends on the definition used and there are several different ways in which the identification of dyslexia can be approached. There is a wide variety of terms used to describe specific difficulties in learning to read. The original term 'word blindness' was rejected in the 1960s and replaced by the more familiar term dyslexia, which is preferred by people with dyslexia and their families. However, it is disliked by many psychologists, who believe that it implies a degree of certainty about the existence of a *distinct* syndrome. In fact, there is continued debate about the core symptoms of dyslexia and its potential causes. The terms **specific learning difficulty** or **specific reading difficulty** are preferred because they are more neutral and less suggestive of a distinct and cohesive 'medical' syndrome.

Box 3: Definitions

- **Developmental dyslexia:** Refers to a congenital condition that results in a primary difficulty in learning to read and write.
- **Specific learning difficulty:** Used to refer to specific difficulties in one area of learning such as reading or mathematics.
- **Specific reading difficulty:** Used to refer to specific difficulties in learning to read, but in no other areas of academic study.

1.5 Defining dyslexia

The ongoing debate about dyslexia is reflected in the different approaches that have been taken to formally define it. Clearly this impacts on how dyslexia is defined in practice. The next three sections summarise how definitions of dyslexia have changed as our knowledge has increased. In short, there have been three main approaches to defining dyslexia: **definition by exclusion**, **discrepancy definitions** and the identification of **positive indicators**.

1.5.1 Definition by exclusion

> A person is 'dyslexic' if no alternative explanation can be offered for their reading and writing difficulties.

In the UK, interest in children who showed a specific lack of ability in literacy grew as all children became entitled to a basic education. For the first time there was an expectation that all adults should be literate. Initially, it was proposed that specific difficulties in learning to read and write were visual in nature, and the term

congenital word blindness was used by James Hinshelwood (a Scottish eye surgeon) to refer to:

> …a congenital defect occurring in children with otherwise normal and undamaged brains characterized by a difficulty in learning to read so great that it is manifestly due to a pathological condition, and where the attempts to teach the child by ordinary methods have completely failed.
>
> (Hinshelwood, 1917, p. 40)

Notice that Hinshelwood identifies the dyslexic population by reference to two norms: the children have normally functioning brains, and that normal methods of teaching result in failure. What this quote reflects is how little was understood about the causes of reading difficulties. This lack of knowledge resulted in dyslexia being defined and diagnosed by exclusion. One example of this is the definition from Critchley:

> A disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and sociocultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin.
>
> (Critchley, 1970, p. 11)

That is, if the children's disability could not be attributed to other potential causes (i.e. the children are apparently 'normal' in key respects), then they were given the label of 'dyslexic' – diagnosis by exclusion.

Diagnosis by exclusion is problematic as it is based on assumptions about what factors might affect one's ability to learn to read. The most problematic exclusionary criterion is that of 'adequate intelligence'. While IQ tends to correlate with reading ability, a low IQ is not a barrier to learning to read. The idea that someone with a low IQ is 'expected' to fail to read is no longer socially acceptable. Dyslexia is not a set of difficulties that can only be experienced by the intelligent. Similarly, the criterion of sociocultural opportunity implies that people from households with few books, or children who are read to less by their parents, either because of financial, cultural or linguistic reasons can also be 'reasonably expected' to fail to learn to read.

> You may find that you yourself satisfy one of these criteria. Did you experience difficulties learning to read and write? How reasonable do you believe these criteria to be? Think also about what they say about our expectations of children from diverse social and cultural backgrounds, in terms of standards that are being set concerning the conditions necessary for 'normal' development.

More fundamentally, definition by exclusion is unsatisfactory on logical grounds. If dyslexia represents a particular 'abnormal' pattern of development with a biological basis, then there is no reason why it could not coincide with other factors that may also be disadvantageous to the development of literacy skills. Dyslexia can in fact be found across the whole range of intelligence, although it may be more easily recognised in a child who otherwise appears to be highly talented, and it occurs at fairly similar rates in all countries and cultures where universal literacy is demanded. Social, economic, cultural and personal factors can certainly influence the rate and extent of someone's development in literacy skills, as we shall discuss later. However, these factors may also be quite independent of the predisposition to dyslexia. The fact that they have often been used to ‘explain away’ reading failure amongst children whose background does not conform to desired standards may account for why dyslexia has been mocked as a ‘middle-class disease’.

1.5.2 Discrepancy definitions

> The label is given if there is a discrepancy between perceived potential to learn to read (as indicated by general ability) and actual level of reading achievement.

The most common way of diagnosing dyslexia is to look for a discrepancy between someone's general ability as measured by an IQ assessment and his or her performance on standardised measures of reading and spelling. However, there are many variations in the procedures for measuring a discrepancy between potential and actual reading ability, and the precise boundaries that may be chosen as ‘cut-offs’ will also vary depending on the purposes of the measurement. Different criteria may be used, for example, in research studies (where strict statistical boundaries may be needed for scientific reasons) than in educational or other settings (where diagnoses may be used to guide more personal and/or practical decisions).

> Notice that this approach to defining dyslexia reflects a psychometric perspective.

Discrepancy based definition and diagnosis of dyslexia assumes that an IQ assessment indicates a person's potential for learning to read. However, IQ is only weakly related to reading achievement, and assessment will involve some ‘measurement error’, so any predictions of ‘expected’ reading achievement will be insensitive at best. Keith Stanovich (1991) has argued for a different approach to discrepancy based diagnosis of dyslexia, where reading ability is compared to *listening comprehension* rather than IQ. Despite the academic support for such an approach, IQ based assessment remains the ‘gold standard’ method for identifying dyslexia, but educational psychologists do not simply look for a discrepancy in scores. Instead they examine a person's performance on each IQ subtest as well as overall performance. This information is combined with evidence from other sources, such as the person's case history, before dyslexia is identified.

An overall discrepancy between IQ and reading ability will identify a broad range of people with *specific reading difficulties,* but depending on the population studied, reading problems will in some cases arise entirely from social, emotional or cultural influences. This means that specific reading difficulties are not to be equated with dyslexia, as this term refers to a broader developmental syndrome proposed to have a (biological) basis.

Discrepancy definitions reflect the statistical approach to defining ‘abnormality’. Other criteria are usually required for any meaningful definition of ‘abnormal’ functioning – and the methods used for assessment, their reliability and their validity are crucial issues.

> If someone's reading improves through special help and there is no longer a discrepancy, would that make him or her less dyslexic? If we accept that dyslexia has a biological basis which impacts on skills other than literacy, then even if the reading difficulties ‘go away’ the underlying cause of the dyslexia and other associated symptoms may remain.

Box 4: Definitions

- **Definition by exclusion:** A definition that identifies a person as having a condition if there is no other known reason that can account for their symptoms.
- **Discrepancy definitions:** A definition that identifies a person as having a condition by virtue of a perceived discrepancy between potential and actual ability.
- **Positive indicators:** A symptom or characteristic that can be used to identify a condition by its presence.
- **Congenital word blindness:** The term used by Hinshelwood in 1917 to describe dyslexia-like difficulties in children.

1.6 Positive indicators for dyslexia

> Dyslexia is recognized if the person shows various core behavioural symptoms or other features associated with dyslexia.

As mentioned in the previous section, contemporary approaches also involve identifying positive indicators that signal potential dyslexia by their presence. Dyslexia involves specific weaknesses in areas that relate to written language, but because it is not associated with a general lack of ability it also often involves compensatory strengths. For example, Alexander Faludy was verbally gifted from a young age (see the Case Study in section 1.3). For this reason, in addition to assessing the discrepancy between ability and written language skills, psychologists usually take particular note of the profile of strengths and weaknesses on cognitive tests. Discrepancies between verbal and non-verbal IQ may be significant. People with dyslexia often show lower verbal than non-verbal ability, but the reverse pattern is also found, illustrating the variability within dyslexia. Particular profiles on the sub-tests of IQ assessments have been suggested as characteristic of dyslexia. One such profile emphasises deficits on Arithmetic, Coding, Information (general knowledge) and Digit Span (short-term memory capacity) sub-tests. This is called the **ACID profile** (Thomson and Grant, 1979). However, not all children diagnosed show deficits in all these areas. Bannatyne (1971) advocated grouping the sub-tests according to the kinds of abilities they tap. Studies using this procedure suggest that dyslexic people typically show a profile of above average *spatial* and *conceptual abilities*, and below average *sequential abilities* and *acquired knowledge*. However, none of these procedures results in clear diagnosis, again emphasising the variation within any dyslexic population.

Behaviours that are indicative of dyslexia include a mixture of weaknesses and strengths, with some factors related to reading and writing, and others apparently unrelated. For example, among his list of positive indicators, Tim Miles (1983) cites directional confusions, poor auditory sequential memory, problems with word repetition and other members of the family with reading or writing problems. Screening for dyslexia usually includes assessments of a wide range of skills, such as visual and auditory perception, integration of different types of sensory information, and aspects of motor function such as balance. If dyslexia really is a neurodevelopmental syndrome, it is highly implausible that this would *only* affect written language skills, and the evidence does implicate a broader range of abilities. Kinsbourne et al. (1991) assessed dyslexic and non-dyslexic adults on a wide range of neuropsychological tests. They found many differences on tasks bearing no apparent relation to reading, such as rapid alternating movements of the hands or feet, and judging which came first of two simple auditory or visual stimuli presented in quick succession.

Miles (1983) has argued that dyslexia should not be seen as a form of reading disability but as a **syndrome:** a set of symptoms with a neurological basis. Although each of these individual 'signs' (such as problems telling left from right) may also be found in some people with a 'normal' reading ability, the presence of more than a certain number of these indicators would suggest a dyslexic profile. When used together with standardised measures of reading and spelling, these kinds of screening measures can provide useful information to guide both research and educational practice.

Activity

Simple examples of assessments that focus on positive indicators rather than discrepancies are the checklists often used for initial screening before a formal dyslexia assessment takes place. Table 1 shows the one used by the British Dyslexia Association.

Table 1: British Dyslexia Association – adult dyslexia checklist (1994)

		YES	NO
1	Do you find difficulty telling left from right?		
2	Is map reading or finding your way to a strange place confusing?		
3	Do you dislike reading aloud?		
4	Do you take longer than you should to read a page of a book?		
5	Do you find it difficult to remember the sense of what you have read?		
6	Do you dislike reading long books?		
7	Is your spelling poor?		
8	Is your writing difficult to read?		
9	Do you get confused if you have to speak in public?		
10	Do you find it difficult to take messages on the telephone and pass them		

YES NO

on correctly?

11 When you have to say a long word, do you sometimes find it difficult to get all the sounds in the right order?

12 Do you find it difficult to do sums in your head without using your fingers or paper?

13 When using the telephone, do you tend to get the numbers mixed up when you dial?

14 Do you find it difficult to say the months of the year forwards in a fluent manner?

15 Do you find it difficult to say the months of the year backwards?

16 Do you mix up dates and times and miss appointments?

17 When writing cheques do you frequently find yourself making mistakes?

18 Do you find forms difficult and confusing?

19 Do you mix up bus numbers like 95 and 59?

20 Did you find it hard to learn your multiplication tables at school?

Nine or more 'yes' responses on the questionnaire could be indicative of dyslexia-type difficulties.

(Source: Vinegrad, 1994)

Discussion

Commentary

You may answer yes to several of these questions, but not have dyslexia. This is why they are termed 'indicators' and are only used for screening purposes. They cannot 'diagnose' dyslexia on their own, and must be used in conjunction with background information and a psychometric assessment.

End of discussion

The need for a balance between identifying dyslexia by a discrepancy between potential and actual achievement, and by the presence of clear symptoms is reflected in a more recent definition from the Orton Dyslexia Society, now known as the International Dyslexia Association:

> It is a specific language-based disorder of constitutional origin characterized by difficulties in single word coding, usually reflecting insufficient phonological processing abilities. These difficulties in single word coding are often unexpected in relation to age and other cognitive and academic abilities; they are not the result of generalized developmental disability or sensory impairment. Dyslexia is manifested by variable difficulty with different forms of language, often including, in addition to problems of reading, a conspicuous problem with acquiring proficiency in writing and spelling.

(Miles and Miles, 1999, p. 169)

- **ACID profile:** Refers to the observed deficit in arithmetic, coding, information (general knowledge) and digit span (short-term memory) that is associated with dyslexia by some researchers.
- **Syndrome:** A combination of symptoms which regularly occur together and may have a shared neurological basis.

1.7 Dyslexia as a distinctive condition

1.7.1 Differentiating dyslexia from other reading difficulties

The idea that dyslexia is distinctive from other forms of reading difficulty is still debated. One viewpoint is that reading ability is a simple continuum, with exceptionally gifted readers at one end and people with dyslexia at the other. However, as we have already seen, dyslexia involves more than just difficulties in reading and writing. Reading difficulties must be specific and accompanied by a variable profile of cognitive abilities. It is the presence of other characteristics unrelated to reading that makes dyslexia distinctive.

Activity 3

If dyslexia were simply part of a continuum (i.e. it was dimensional), can you suggest how we might go about identifying people with dyslexia?

Discussion

Commentary

Section 1.2 mentioned that conditions that are part of a normally distributed continuum lend themselves to identification by statistical means, perhaps using the standard deviation as a boundary between 'normal' and 'dyslexic' readers.

End of discussion

1.7.2 Differentiating within dyslexia – acquired versus developmental dyslexia and the search for subtypes

There has also been continued debate regarding the variability *within* any dyslexic population, the apparent variety of forms that dyslexia can take. Given the complexity of the skills required to develop fluent reading and spelling perhaps this is not surprising. The variability within dyslexia may simply reflect the fact that this complex process can go wrong in different ways and for different reasons.

The term 'dyslexia' was originally used to refer to the **acquired dyslexias** – specific disorders of reading or writing that can follow from brain injury in adults. The study of people with such acquired difficulties has provided invaluable insights into how written language may be processed in the brain. These people often suffer selective impairments, where some abilities are lost while others are preserved. For example, people with acquired *phonological dyslexia* may have no problem reading familiar words by sight, but they can no longer ‘sound out’ unfamiliar words, or find a pronunciation for nonsense words like ‘flad’. Conversely, some people with *surface dyslexia* may have no trouble with regularly spelt words such as ‘bat’ or pronounceable nonsense words such as ‘pux’, but they seem to have lost the ability to recognise words purely by sight (i.e. without decoding each letter). They tend to misread even familiar words like ‘pint’ – which they would pronounce to rhyme with ‘flint’. Even more bizarre are the errors made by people with *deep dyslexia*, who may misread ‘lion’ as ‘tiger’, or ‘symphony’ as ‘orchestra’. They seem to have difficulties with both the visual and phonological components of reading, and yet their errors suggest that they still have some access to the meaning of words they cannot read.

The different patterns of impairment found in the acquired dyslexias indicate that skilled reading requires the interplay of many sub-processes. It is therefore not surprising that the search for subtypes in developmental dyslexia has been modelled on the different kinds of acquired dyslexia. However, there are good reasons why comparisons between acquired and developmental reading disorders may not be appropriate. For example, there is evidence that the development of literacy skills is not an additive process (where the earliest skills are extended and elaborated upon in later stages), but may involve substitution, with later stages or processes replacing earlier ones (Morton, 1989). If so, the development of reading and writing skills may be more akin to a metamorphosis, such that the mature written language processing system bears little relation to its early components. There are likely to be important differences between a system that developed ‘normally’ but was then damaged, and one where the process of development itself was abnormal.

The search for subtypes within developmental dyslexia has engendered much research, but no clear and consistent subgroups have stood the test of time and experimental investigation. The most frequent distinction has been between auditory problems (i.e. difficulties in identifying and manipulating letter sounds within words) and visual problems (difficulties in visually recognising and remembering words). These categories broadly resemble the phonological and surface forms of acquired dyslexia. However, many people with developmental dyslexia show both types of impairment. It has even been suggested that both kinds of difficulties have a common basis, as we shall see later. The truth is that no simple picture emerges from attempts to define subgroups, and it may be more appropriate to think about several distinct but overlapping components to dyslexic type difficulties. We shall return to the issue of subtypes in Section 2 of this Unit.

1.7.3 Differentiating dyslexia from other developmental conditions

While dyslexia is distinctive, there are other developmental syndromes that often co-occur with it. Examples include:

- developmental dysphasia – specific difficulties with spoken language
- attention deficit/hyperactivity disorder – involving particular problems with concentration and/or behaviour
- developmental dyspraxia – developmental coordination disorder.

Developmental dysphasia

Developmental dysphasia involves primary problems in the development of speech and language skills. Despite abilities in other areas, some children are slow to achieve the usual milestones in the development of spoken language, such as uttering their first words, putting together meaningful sentences, and/or understanding complex verbal instructions. It is perhaps unsurprising that these children can go on to show specific difficulties in acquiring the ability to write language.

Attention deficit/hyperactivity disorder (ADHD)

This refers to persistent and age inappropriate difficulties in regulating attention and/or behaviour. This diagnosis remains somewhat controversial, but it involves specific difficulties in either or both of two distinct dimensions:

- *inattention* – difficulties maintaining concentration on the task in hand, high distractibility, working memory problems and tendencies to daydream
- *hyperactivity-impulsivity* – excessive motor restlessness, and apparent difficulties in the inhibition of impulse, leading to inappropriate and often reckless behaviour.

Children may be diagnosed with ADHD if they show either or both of these kinds of problems, so there is considerable variability within such populations.

The overlap between dyslexia and ADHD is high (between 30 and 50 per cent in both directions), but it appears to be stronger for attentional problems than it is for the purely hyperactive-impulsive form of ADHD.

Developmental dyspraxia

This broadly refers to specific difficulties in motor coordination (corresponding to the diagnosis used in the USA of ‘developmental coordination disorder’) but the term strictly refers to problems in the planning and execution of any complex, sequenced actions (including speech and writing). Dyspraxic children typically have difficulties in learning to do up buttons or tie their shoelaces, in balance and ball skills, and in copying and handwriting. Mothers often report that as babies they never went through the crawling stage, but simply got up and walked. At play or sports they appear ‘clumsy’, and they often show specific weaknesses in visual-perceptual skills and visual-motor coordination (relative to their other abilities) as well as marked attentional and organisational problems. The dyspraxia syndrome remains less widely recognised than dyslexia, but the overlap between the two appears to be very high, as around 50 per cent of dyspraxic children typically show dyslexic difficulties, and vice-versa.

In summary, there is considerable overlap between dyslexia and other abnormal developmental conditions such as dysphasia, ADHD and dyspraxia, although each syndrome can also occur in isolation. As well as their frequent co-occurrence in the same individual, these conditions also tend to associate within families, suggesting that there may be some common predisposing factors. We will return to this issue in Section 2 of this Unit.

Activity 4

Reread the case study of Alexander Faludy presented in Section 1.3. As well as dyslexia, does his account suggest features of any of the other conditions discussed here?

Box 5: Definitions

- **Acquired dyslexia:** A form of dyslexia which is acquired as the result of neurological damage.

1.8 Reflecting on definitions of 'abnormality'

The main thing to remember is that the way that 'abnormality' is defined will have consequences for the method of identification. It will also impact on people's expectations of their future development. For example, we discussed the way that dyslexia is defined in relation to a person's IQ. Does that mean that if someone has a low IQ and an even lower reading age we should adjust our expectations of what that person can achieve with help, or let IQ influence how much help is offered? Similarly, if positive indicators suggest that the problem is neurologically based, do we assume that it cannot be overcome? Moreover, do the individuals themselves believe that they cannot overcome their difficulties? Definitions can be powerful influences on people's beliefs and expectations.

Finally, it is worth reflecting on what dyslexia has told us about the way we think of people who experience disability. It is easy to assume that everyone with a particular difficulty will have highly similar characteristics but in practice these groups are much more heterogeneous than you might first expect. Again, this often reflects the difficulties associated with identifying the precise nature of a psychological difficulty and differentiating it from other types of problems. More fundamentally, individuals differ in all kinds of ways, and the key issue is that deviation from the 'norm' is not always 'abnormal' in the sense of pathological. The same characteristics that are disadvantageous in one situation can be advantageous in others. It may also be, as we saw in the sub-section on positive indicators (see Section 1.4), that lesser ability in some skills may go hand-in-hand with greater ability in others.

Meanwhile, there is increasing recognition that people should not be defined or characterised by the difficulties they experience, but rather understood as people who have been affected by them. This is why you will notice that psychological texts increasingly talk about '*people with dyslexia*', rather than '*dyslexics*', '*people with autism*' rather than '*autistics*' and so on. It shows that we realise that people do not conform to some kind of stereotype just because they experience difficulties in certain areas, and helps us to remember that they are all individuals first and foremost. However, even this terminology suggests that dyslexia and autism are clear 'entities' that people do or do not have (and they also sound like medical labels, to which many people still object). In fact, all the evidence suggests that labels such as dyslexia and autism are just that – labels. They are useful descriptions of collections of characteristics that can affect different people in different patterns to different degrees. To capture this dimensionality, it would probably be more accurate to identify people as slightly, very or not at all dyslexic (or whatever condition is under consideration), and include plenty of additional information about the precise pattern of strengths and weakness that they show in relevant situations.

> By now you might realise that during our discussion of dyslexia the different approaches discussed in Section 1.2 have been reflected in the way that dyslexia has been defined. For example, discrepancy definitions of dyslexia are based on a statistical definition of 'normality'. Definition by exclusion, in emphasising the biological basis of dyslexia, is subscribing to a medical definition of normality, as does the notion of positive indicators'. Finally, the identification of dyslexia as a problem' in itself is the result of cultural expectations of literacy being part of an adult's 'normal' repertoire of skills.

Summary of Section 1

- 'Normality' and therefore 'abnormality' may be defined in a variety of ways: in relation to statistical frequency, perceived disability, cultural expectations or personal distress. No single definition is appropriate for all purposes.
- Dyslexia is a label used to describe a condition involving, but not confined to, specific difficulties in learning to read and write. The term 'dyslexia' has been used by approaches which propose that there is a (constitutional) biological basis to those difficulties.
- Definitions of dyslexia were originally based on exclusion criteria, but are now based on the discrepancy between potential and actual literacy ability. Modern assessments also identify positive indicators of the presence of dyslexia.
- As a result of the heterogeneous nature of people with dyslexia, there have been attempts to classify different combinations of symptoms into discrete subtypes of dyslexia. These attempts have been unsuccessful because people often show the characteristics of more than one subtype.
- Dyslexia is known to co-occur with other developmental conditions.

2 Explanations of dyslexia

2.1 Behavioural, cognitive and biological perspectives

So far we have discussed what contributes to our ideas of 'abnormality' and these issues have been illustrated by examining the real-life example of dyslexia. We will now consider the different potential explanations that have been offered to account for the observed symptoms of dyslexia.

Uta Frith (1999) has provided a useful framework for thinking about the nature of developmental difficulties (see Figure 2).

Frith suggests that there are three main perspectives on any given developmental condition: a behavioural, cognitive and biological one. In addition to this there are *environmental factors* (literally referring to the environments, biological or otherwise, that we are exposed to) that can have a role in the accounts offered from these perspectives.

Figure 2: Frith's three level framework (Source: Frith, 1999, p. 193)

- *Behavioural perspectives* provide a model of the difficulty by describing the nature of the behavioural symptoms experienced, much as we have done in Section 1 above.
- *Cognitive perspectives* describe what mental processes are involved in and affected by the difficulty (e.g. memory, perception, attention). As such, these descriptions offer a cognitive 'explanation' of what may cause the types of behavioural symptoms observed.
- *Biological perspectives* offer descriptions of the behavioural difficulties in terms of their potential biological origins, which can cover genetic, biochemical and neurophysiological explanations.

Thus, biological and cognitive perspectives offer theoretical explanations that require experimental validation, whereas behavioural perspectives tend to be less debated because the behaviours can be directly observed. Cognitive perspectives describe cognitive processes that might explain how the biological and behavioural accounts map onto each other. For example, damage to one area of the brain (*biological perspective*) may result in an inability to store new long-term memories (*behavioural perspective*), because the person is no longer able to transfer information from short-term to long-term storage (*cognitive perspective*).

> Frith's framework echoes the extent to which perspectives in psychology can be seen as complementary, conflicting and co-existing. It also suggests that, when discussing explanations of 'abnormal' development, it is wrong to think that biological and cognitive perspectives are competing with each other. In fact, cognitive and biological models can be complementary rather than conflicting.

We can use this framework to think about theoretical explanations of dyslexia. As we have already provided a behavioural account of dyslexia in Section 1, we will now consider cognitive and biological explanations of what may cause these behaviours and acknowledge environmental influences on their development. After examining each explanation individually we suggest how different perspectives can be put together to offer a complete account.

2.2 Cognitive explanations of dyslexia

2.2.1 The phonological processing deficit

Recall Alexander Faludy's difficulties in learning to read and write, and the other behavioural characteristics associated with having dyslexia. You might have noticed that many features of dyslexia point to a difficulty with some aspects of memory. That is, people with dyslexia have difficulty with tasks that require short-term memory processing such as mental arithmetic, writing and learning new information. However, these tasks have an additional feature in common: they contain a phonological component. That is, they involve the processing of speech sounds in short-term memory. It is therefore possible to suggest that a deficit in phonological processing may provide an explanation of dyslexia. To understand why a phonological deficit would have an impact on reading and writing we need to understand how people typically learn to read (see Box 6).

Box 6: Learning to read (after Frith 1985)

It has been suggested that initially we adopt two strategies. One strategy, widely suggested to be the first to develop in beginning readers, is the whole word, or **logographic strategy**. This refers to the way children learn to associate a spoken word with its written form, without showing any awareness of the sounds that each of the individual letters make. This strategy is often encouraged in early years classrooms where objects are labelled with their names and teachers use 'flashcards' to teach children a core 'sight vocabulary' of common words. This technique is useful in enabling children to build a large sight vocabulary quickly, which will enable them to begin reading with some degree of fluency. However, this approach places huge demands on visual memory and does not provide children with a strategy for coping with unfamiliar words.

To address these limitations, children also need an **alphabetic decoding strategy**. This requires them to learn the sounds that each letter of the alphabet makes, and then learn how to blend those sounds together during reading to work out how to pronounce the word. Alphabetic decoding is also needed during spelling to analyse spoken words and break them down into their corresponding letter sounds.

A skilled reader is one who moves beyond letter by letter decoding and rapidly processes longer 'strings' of letters that recur across different words (an **orthographic strategy**).

> Did you notice how these strategies reflect what we know about reading processes from the acquired dyslexias?

The alphabetic decoding strategy draws heavily on phonological processing – both in the learning of **letter-sound correspondences**, and in the manipulation of those sounds during reading and spelling. People with dyslexia often find it difficult to move beyond a logographic strategy and problems with spelling usually persist into adulthood.

The severity of the phonological deficit is best demonstrated by the awareness of rhyme by children with dyslexia. Recognising that two words rhyme is a skill that most children acquire at an early age. However, studies have repeatedly shown that children with reading difficulties have trouble identifying words that rhyme (e.g. Bradley and Bryant, 1978). This is just one finding from a large literature showing that children with reading difficulties find it difficult to isolate and manipulate sounds in words.

What is still not clear is whether the phonological deficit is related to the *encoding* or *retrieval* of phonological representations in memory. While there is evidence of difficulties in processing phonological information in short-term memory, there is also speculation that the way this information is represented and stored in long-term memory could further explain the poor performance of people with dyslexia on phonological tasks.

> Much of the research into phonological awareness and reading disability has centred on English-speaking children. However, this presents a misleading picture, as letter-sound correspondences in English are complex. Often, the same sound can be spelt a number of different ways (e.g. /f/ can be spelt f and ph), and the same letter can make a variety of different sounds (consider the sound that 'a' makes in 'bat', 'part' and 'apron '). Furthermore, it is not a simple case of one letter per sound: mouse has five letters but only three sounds: /m/ /au/ /s/. The phonological awareness deficit that has been demonstrated with English speakers may not be a universal characteristic of reading disability, as many other European languages have much more predictable letter-sound correspondences. Research into phonological deficits in other languages is ongoing, but there does seem to be evidence of phonological deficits in people with dyslexia (and at risk of dyslexia) who learn to read in more regular languages (see Courcy, Béland and Pitchford, 2000; Müller, Saarenketo and Lyytinen, 2000).

> It has also been suggested that measuring the speed of performance on tests may be a more universal indicator of reading difficulties across languages.

Almost *all* types of reading difficulty appear to be characterised by a phonological processing deficit, not just dyslexia. However, this does not mean that because it appears to have the same underlying cognitive deficit as other reading difficulties, dyslexia is the same as other types of reading difficulty. While the phonological processing deficit may ‘explain’ the *reading and writing difficulties* associated with dyslexia, it cannot account for the full range of behavioural symptoms that are observed, and that make dyslexia a distinctive condition. Other cognitive accounts are needed to explain the origins of the other behavioural symptoms of dyslexia. We have already proposed in the previous section that dyslexia can be thought of as consisting of several overlapping dimensions – it seems likely that a phonological deficit may be just one of several cognitive components associated with the condition. Moreover the phonological deficit hypothesis is exactly that, a *hypothesis*. While it has a good deal of empirical support, it is a theoretical proposal – but not something that we know definitely exists.

2.2.2 ‘Visual deficit’ hypotheses

Samuel Orton was one of the earliest and most influential researchers into dyslexia, although he used the term **strephosymbolia** – literally meaning ‘twisted symbols’. He noticed that children with specific reading difficulties often wrote letters back to front, confused letters such as ‘b’ and ‘d’, and would swap the position of letters within a word during spelling (e.g. ‘was’ might be written ‘saw’). From these and other observations, he suggested that their reading difficulties might reflect some kind of visual processing impairment involving incomplete specialisation between the left and right sides of the brain. It is worth noting that the left hemisphere of the brain is specialised for processing language.

As we saw in Section 1.4, the original observations by Hinshelwood about what he called congenital word blindness also emphasised a visual-perceptual contribution. Much early research was therefore focused on trying to identify perceptual factors that could contribute to dyslexia. Visual deficit explanations fell out of favour during the 1970s and 1980s when psychologists increasingly adopted a phonological deficit model of dyslexia, arguing that reading difficulties reflect primary problems with language processing. While the phonological deficit explanation is still popular and widely researched, there has been a resurgence of interest in the idea that there may be an underlying visual deficit that could explain difficulties in learning visual-phonological correspondences (see Everatt, 1999; Whiteley and Smith, 2001).

More recently, the evidence for visual-sensory processing deficits in dyslexia has become robust. The challenge now is to determine whether these visual-perceptual problems affect the development of visual processing required for fluent and skilled reading, and if so how. Seymour (1986) has re-emphasised the obvious point that the cognitive systems specifically required for *written language* (as opposed to spoken language) are actually in the visual domain. He and others have shown that the reading performance of many dyslexic people reflects weaknesses in visual processing that can occur independently of phonological difficulties.

It has been claimed that phonological deficits are more common than visual deficits in dyslexia, and the fact that many dyslexic people show superior visual-spatial abilities is cited as supporting evidence. The trouble with this argument is that the psychological tests used to assess visuo-spatial abilities do not actually measure the same kinds of visual processing that Seymour refers to, which is more perceptual in nature. In fact, mild visual disturbances are consistently found in up to 70 per cent of people with dyslexia, and more importantly, these typically co-occur with phonological problems (Lovegrove, 1991). It has even been suggested that both types of problem might have a common cause.

As we have already seen, it is misleading to think either that visual-perceptual and phonological problems must be mutually exclusive, or that all people with specific reading difficulties are the same. What is more, variation in the ‘clinical’ picture of dyslexia (at either the behavioural or the cognitive level of Frith's model) does not in fact rule out some common underlying ‘cause’ at the biological level. The complex interactions between biology and environment mean that the same biological ‘problem’ can result in different cognitive and behavioural consequences for different people.

‘Automaticity’ and ‘rate of processing’ hypotheses

A proposal that attempts to address the broader picture of dyslexic functioning is that dyslexia may be caused by problems in the **automatisation** of skills. The concept of automatisation refers to the gradual reduction in the need for *conscious* control as a new skill is learned. This leads to greater speed and efficiency and a decreased likelihood of breakdown of performance under stress, as well as the ability to perform a second task at the same time with minimal disruption to either behaviour. Nicolson and Fawcett (1990, 1994) have pointed out that even highly competent dyslexic readers show a distinct lack of fluency in written language skills: their reading and writing is more laboured, more prone to error, and more susceptible to interference from other tasks. They also suggest that ‘incomplete mastery’ characterises many other features of dyslexic performance, such as problems learning to ride a bicycle or tie shoelaces. However, a general ‘automatisation deficit’ would be most evident during complex, highly demanding, multi-sensory tasks such as learning to read and write.

One way of assessing the presence of an automaticity deficit is through the use of a **rapid automatised naming task** (RAN). For example, individuals may be presented with a set of 50 stimuli consisting of five rows of 10 pictures of a given type in a random order and asked to name each picture as quickly as possible (see Figure 3). People with dyslexia typically show a deficit in speed on this type of task.

Figure 3: An example of a RAN task for pictures

These results have been interpreted as further support for a phonological deficit in reading, as the task does require some phonological processing during the retrieval of the picture names. However, more recently Wolf and Bowers (1999) have suggested that difficulties in rapid naming are a separate, additional deficit to phonological difficulties, and that such a deficit is sufficient to explain reading difficulties even if the person has good phonological awareness. They suggest that people with reading difficulties fall into one of three subtypes, depending on the underlying cause of their problem:

- phonology group: shows a phonological deficit, but no real problems on the RAN task
- (slow naming) rate group: shows a RAN task time deficit, but no phonological problems
- double deficit group: shows signs of a deficit in both phonology and naming rate and therefore has the greatest reading difficulties.

Because the most common form of treatment recommended for reading difficulties in children focuses on improving phonological awareness, evidence for different forms of cognitive deficit in dyslexia is important. If visual processing deficits do play an important role, or if there are rate and double deficit subtypes as described above, then training in phonological awareness alone would be unlikely to address all reading difficulties.

However, it is always important to look carefully at the nature of tests used to diagnose reading difficulties. RAN tasks come in two forms: **serial presentation** where the person is timed from start to finish, and **discrete presentation** where the symbols are presented one at a time and a reaction time for each item is recorded. Only serial presentation procedures are consistently associated with reading difficulties. This may be because serial tasks usually require more sustained concentration in comparison to discrete presentation tasks (where there is no need to follow a line of text or keep one's place in the grid of symbols). In other words, the apparent difference between 'normal' and dyslexic readers on tasks of this kind could be due to perceptual, attentional or fatigue effects rather than differences in RAN ability. This would undermine the case for a separate 'RAN deficit'. However, it also raises a different, interesting question: why should dyslexic people be particularly susceptible to these kinds of effects? It would certainly be difficult to explain this fully in terms of a pure 'phonological deficit' hypothesis.

We can see how the cognitive accounts 'explain' many of the behavioural symptoms of dyslexia. However, even when taken together, they cannot explain dyslexia fully, nor its variability between individuals. As Frith suggests, cognitive accounts taken in isolation are incomplete: we also need to consider biological explanations.

Box 7: Definitions

- **Logographic strategy:** A holistic approach to identifying written words via their overall visual appearance, sometimes also referred to as 'sight word reading'.
- **Orthographic strategy:** The approach skilled readers use to identify written words, employing both alphabetic and logographic strategies as well as their existing knowledge of grammatical forms and similar words.
- **Letter-sound correspondences:** The associations between individual letters, and the sounds that those letters can make in a given language.
- **Strephosymbolia:** The term coined by Orton to describe dyslexic-like symptoms (literally – 'twisted symbols').
- **Automatisation:** The process of making a skill 'automatic', so that performance no longer needs conscious monitoring. (If fully automatised, a task can be carried out with no interference to another task being performed simultaneously.)
- **Rapid automatised naming task:** A task requiring rapid naming of a series of letters, numbers, colours or common objects, which should involve automatic processes owing to the familiarity of the stimuli.
- **Serial presentation:** The presentation of test items one after the other in the form of a list (or grid) that the participant has to work through in a systematic fashion.
- **Discrete presentation:** The presentation of test items one at a time. None of the other test stimuli are visible at the same time.

2.3 Biological explanations of dyslexia

Some physical characteristics appear to be ‘typical’ of people with reading difficulties, although their relevance is debated. These include being male, tendencies towards left-handedness or mixed-handedness (i.e. *inconsistency* of hand preference across different tasks), and a variety of neurological **'soft’ signs** and minor physical anomalies. We will consider each of these in detail in the sections that follow. There is also some evidence that people with dyslexia (and their relatives) may show higher rates of allergic conditions such as asthma and eczema as well as other autoimmune disorders. On the surface these factors may appear to have little to do with dyslexia. However, by relating these physical characteristics to the observed behavioural symptoms of dyslexia we may identify clues to the possible biological mechanisms underlying the condition.

2.3.1 Sex differences

An intriguing aspect of dyslexia is the apparent excess of males who are affected. This could simply reflect **referral bias** – a tendency for boys to be *identified* as dyslexic more readily than girls. In the past, society's expectations of boys and girls were very different with respect to educational achievement. There is now much less overt stereotyping of this kind, but there may still be other reasons why dyslexia might be more readily identified in boys. For example, evidence suggests that in mixed-sex classes, boys often dominate classroom interactions. This might bring their general ability to the attention of teachers, who could fail to notice the abilities of some quieter girls whose reading attainment is equally discrepant. Another possibility is that boys and girls may respond differently to the experience of reading failure, with boys perhaps more likely to ‘externalise’ their frustrations over their reading difficulties than girls. Even awareness that dyslexia is more common in boys could serve to influence the expectations of parents, teachers and others, thereby creating something of a ‘self-fulfilling prophecy’.

Nevertheless, the evidence does suggest that as many as three or four males may be affected for every female (James, 1992). This apparent sex difference still awaits adequate explanation, especially given evidence from a recent twin study that found no gender difference in heritability of reading difficulties (Wadsworth et al., 2000). In some respects, the excess of males with dyslexia appears to be an exaggeration of the usual slight advantage that females, on average, tend to show for language-related skills. Boys appear to show greater visual-spatial awareness than girls do, and you may wonder why these skills do not offer any advantage for processing written language. However, as we have already observed, visual-*spatial* awareness does not prohibit the development of visual-*perceptual* difficulties that are associated with dyslexia. Males are over-represented to varying degrees across a whole range of developmental disorders. These include not only dyslexia, but also dysphasia, dyspraxia, ADHD and the autistic spectrum of disorders. What is more, all of these conditions tend to run in families, suggesting that they might share at least some common elements at the level of biological predisposition.

2.3.2 Why are boys more vulnerable to some conditions?

In some conditions that affect more males than females (such as colourblindness), the explanation has been found to lie in genes on the X chromosome. Most females have two X chromosomes (one inherited from each parent) while most males have an XY combination. This means that if someone should inherit an X-linked gene predisposing to a particular condition, compensation for this will be easier for a female (whose other X chromosome may have a ‘normal’ copy of the gene) than for a male. However, as yet no X-linked genes have been identified in connection with dyslexia, dyspraxia, ADHD or autism. As we shall see later, a combination of many different genes is probably involved in the predisposition to these conditions, and environmental factors are also crucial, because genes alone do not dictate outcome. What the evidence from family studies does suggest is that females may need a higher ‘genetic loading’ (i.e. a stronger ‘family history’) than males for these conditions to be ‘expressed’. Some protective factors therefore seem to be operating in females, but we do not yet know what these are.

2.3.4 Lateralisation

It has long been suspected that unusual patterns of **cerebral lateralisation** (i.e. the ‘division of labour’ between left and right hemispheres of the brain) may have some connection with dyslexia. Early researchers noticed an apparent excess of left-handedness in children with specific reading difficulties (and their relatives). However, most dyslexic people are in fact right-handed, and most left-handed people are not dyslexic. Nonetheless, large-scale analyses of the research findings have shown that mixed-handedness is more common than usual in dyslexic people (Eglington and Annett, 1994). You will recall how Alexander Faludy used his left and right hands interchangeably. Although the relationship between handedness and other aspects of cerebral lateralisation is far from clear-cut, these findings are consistent with Orton's original proposal that dyslexia may involve a relative lack of specialisation between the hemispheres.

Neuroanatomical studies, in which brain structure is studied either from postmortem samples or via brain imaging techniques such as magnetic resonance imaging (MRI) in live participants, also provide some support for this view. The typical human brain has a number of well-known structural asymmetries, which are more often reduced or reversed in dyslexic people (Hynd and Semrud-Clikeman, 1989). In particular, brains of people with dyslexia often show an unusual symmetry across hemispheres of a region called the *planum temporale* (see Figure 4), which is typically larger in the left hemisphere. This finding has attracted considerable attention because this area is involved in auditory and language processing. This planum symmetry appears to distinguish dyslexic from ADHD children (Hynd et al., 1990) and there is some evidence that it may relate to poor phonological skills (Larsen et al., 1990).

Figure 4: A cross-section of a ‘normal’ brain showing asymmetry of the planum temporale region across hemispheres

(Source: adapted from Kalat, 2001, Figure 14.8, p. 402)

So could this reduced brain lateralisation be a ‘biological marker’ for dyslexia? And could it be considered ‘abnormal’ in the ‘medical’ sense that we discussed in Section 1? It would seem not. Firstly, general population studies have shown that this ‘abnormal’ pattern of planum temporale symmetry is shared by up to one person in every four (Galaburda et al., 1987). This means that it cannot be a feature that is *specific* to dyslexia (but it could perhaps be one ‘risk factor’ among others). Secondly, the degree of planum temporale asymmetry in the general population is normally distributed on a continuum. If you recall our discussion in Section 1 about defining ‘abnormality’, you will remember that for dimensional traits, any cut-off chosen to distinguish ‘normal’ and ‘abnormal’ is essentially arbitrary. Another interesting point is that the ‘normal’ asymmetric pattern involves a large planum temporale on the left, and a smaller one on the right – in keeping with the usual left hemispheric specialisation for language processing. However, the symmetry associated with dyslexia appears to reflect two large regions (rather than two small ones): the total area of these brain regions may actually be *greater* in people with dyslexia (and others who share this symmetrical pattern). This might possibly help to explain the very *superior* language abilities shown by some people like Alexander Faludy.

Box 8: Definitions

- **'Soft' sign** Any behaviour or response that may be linked to an underlying cause (like brain damage) but which is difficult to establish or open to interpretation.
- **Referral bias** Any influence on the composition of a study sample that arises from the particular method or source by which participants are recruited.
- **Cerebral lateralisation** Refers to the asymmetries found in many brain structures and functions, and/or the developmental processes by which these differences between the left and right sides of the brain usually emerge.

2.4 Differences in brain architecture

2.4.1 Organisation of brain cells

Some findings that do appear to be more specific to dyslexia are various microscopic anomalies in the actual organisation of brain cells, reported from post-mortem studies (Galaburda et al., 1985). These include collections of slightly 'misplaced' cells (called **ectopias**) and some minor disordering of the regular layering of cells in the cortex. They are often particularly concentrated in left hemisphere regions involved in language processing, although their distribution varies considerably between individual cases. Another interesting feature of these ectopias is that they are typically accompanied by an unusually rich and diverse pattern of connections to other brain regions, which may account for the apparent increased creativity that is sometimes observed in people with dyslexia.

These minor disturbances of brain architecture are known to arise during prenatal development, and although the reasons for their origin are still unclear, it is thought that they could reflect unusual immune system effects on the developing brain. Research into their significance for brain function suggests that they could interfere with the coding of rapidly changing auditory stimuli, like sounds in speech. If so, this could be relevant to the phonological deficits already discussed. However, it is particularly interesting to note that these anomalies have so far only been associated with auditory processing problems in males (Herman et al., 1997).

The discovery of minor structural differences in the brains of people with and without dyslexia would support the idea that the predisposition to dyslexia is constitutional, particularly if these differences are present before birth. However, a major difficulty is that these differences can only be observed post-mortem, so only a limited number of brains have so far been studied in this way. This means that we should be very cautious about generalising these findings to all people with dyslexia.

If these anomalies do have any causal significance for dyslexia, then the fact that their regional distribution varies so much between individuals could help to explain some of the variation observed in behavioural symptoms. For example, if this unusual brain micro-architecture were to occur in left hemisphere areas important for auditory or language processing, would we expect a more 'phonological' form of dyslexia than if it occurred in right hemisphere areas important for rapid visual processing?

Finally, some speculation can also be offered regarding these apparent differences in the 'hardware' of the dyslexic brain. Two points seem particularly relevant:

- the brain symmetry associated with dyslexia may reflect an increase in the total number of neurons
- the microscopic disturbances of cellular organisation are associated with greater connectivity between different regions.

There is evidence from the study of artificial 'neural networks' that this kind of arrangement (i.e. one with more cells and more interconnections) may be disadvantageous for some tasks – such as learning associative 'rules' – but it may actually be *more efficient* at tasks which require less automatisation and more creativity.

2.4.2 Differences in sensory, perceptual and motor function

As we saw in our discussion of cognitive explanations, there has been longstanding debate over the possible contribution of perceptual problems to dyslexia. Subjectively, many children and adults with dyslexic difficulties do report 'visual symptoms' when trying to read. These include letters and words appearing to move or 'blur' on the page, particular difficulties with small, crowded print, and complaints of 'glare' or other kinds of visual discomfort (see Figure 5).

Figure 5: Examples of visual disturbances experienced by some peolple with dyslexia

Experimental studies now provide evidence of some perceptual difficulties in dyslexia for tasks involving the processing of rapidly changing information, such as the perception of flicker or motion (Stein, 1994). Such difficulties in processing rapid visual information implicate the **magnocellular visual system** (Stein and Walsh, 1997). Furthermore, neuroanatomical abnormalities relating to this visual pathway have been reported in the brains of dyslexic people post-mortem (Livingstone et al., 1991). The magnocellular system is particularly important for the control of eye movements and visual attention.

Similar difficulties in processing rapidly presented auditory information have also been observed in people with dyslexia. Some have argued that this is evidence of general difficulties with rapid auditory perception, which would account for the difficulties in acquiring phonological awareness in dyslexia (Tallal et al., 1997). However, an alternative explanation that has increasing support suggests that the phonological awareness deficit is the result of a specific problem with speech sounds only, perhaps associated with difficulties in speech perception (Mody et al., 1997).

Attention has also turned to the possible role of the **cerebellum** in dyslexia. This brain structure is important for motor coordination and planning, but is now recognised to play an important role in cognitive development, particularly in the automatisation of skills and ‘rote’ learning (i.e. learning facts ‘off by heart’, like multiplication tables). Brain imaging studies using positron emission tomography (PET) have shown differences in the activity of the cerebellum in dyslexic versus non-dyslexic adults during motor learning tasks (Nicholson et at, 1999). In our discussion of cognitive explanations we noted that an ‘automatisation’ deficit could help to explain a wide range of features of dyslexic functioning, including (but not confined to) phonological deficits. Furthermore, because the cerebellum is known to act as a ‘timing’ device, a ‘cerebellar deficit’ theory is also highly compatible with the idea of problems in very rapid sensory processing (the ‘magnocellular’ hypothesis).

If you recall our discussion of Frith's model (see Figure 2), we emphasised that variability at the behavioural or the cognitive level (e.g. phonological or visual problems) need not rule out some single underlying cause at the biological level. It is perfectly possible that microscopic differences in brain architecture could have different effects according to the particular brain areas affected.

Figure 6: The cerebellum

(Source: adapted from Martini et al., 2000, Figure 15–9 (a), p.395)

Box 9: Definitions

- **Ectopia:** A collection of misplaced cells.
- **Cerebellum:** A part of the brain (situated underneath the rear cerebral cortex) involved with motor and balance functions, and recently shown to be involved in the automatisation of many cognitive skills.
- **Magnocellular visual system:** A visual sub-system specialised for processing information that changes very rapidly over time, characterised by large cells with fast responses. (Strictly, this refers to a specific sub-cortical pathway from retina to primary visual cortex, but it can also include further cortical areas to which these cells project.)

2.5 Biochemical factors

2.5.1 Highly unsaturated fatty acids

As we saw in Section 1, 'medical' approaches to some psychological conditions have focused on biochemistry and the use of corresponding drug treatments. Very little research of this kind has been applied to dyslexia. However, emerging evidence suggests that there may be a biochemical contribution involving abnormal metabolism of **highly unsaturated fatty acids** (HUFA) – essential substances that play a key role in brain development and the maintenance of normal brain function. In fact, just two fatty acids make up 20 per cent of the brain's dry mass, as they are essential components of the membranes surrounding every cell (and structures within each cell). HUFA are also needed to produce other substances that are crucial for regulating a very wide range of brain and body functions including cell signalling, immune system responses and cardiovascular function.

These essential fatty acids – from the so-called omega-6 and omega-3 series – are found in a wide range of natural foods. However, they are often seriously lacking from modern diets, especially if these are high in saturated fats or processed foods with a high level of artificial fats. In fact, only fish and seafood provide significant quantities of the crucial omega-3 fatty acids. Most of us therefore rely on being able to build our own HUFA from simpler compounds. However, this conversion process may be inefficient in some people, who would therefore have a higher dietary requirement. There is some evidence that this (and/or other inefficiencies in fatty acid metabolism) may be a factor in the biological predisposition to dyslexia, as well as related conditions such as ADHD and dyspraxia (Richardson et al., 1999; Richardson and Ross, 2000).

Fatty acid deficiency leads to minor physical symptoms such as excessive thirst, frequent urination, rough dry skin and hair, and soft or brittle nails. Research has shown that these characteristics are common in children with ADHD, and adults and children with dyslexia. Magnetic resonance (MR) imaging is a safe and non-invasive technique involving the use of radiowaves within a very strong magnetic field. It can be used to obtain either structural images (the well-known MRI) or information on the chemical composition of tissues (magnetic resonance spectroscopy, or MRS). MR brain imaging has also revealed differences in lipid metabolism in dyslexic versus non-dyslexic adults that are consistent with HUFA deficiency, and increased levels of an enzyme that removes HUFA from cell membranes have been reported from blood biochemical studies of dyslexia. If some features of dyslexia and related conditions like ADHD reflect fatty acid deficiency, then supplementing the diet with these fatty acids could be helpful in the management of these conditions. We will return to this in Section 3.

2.5.2 Genetic explanations

Earliest investigators noted that dyslexia tends to run in families, and studies involving extended families or twins have confirmed this. The heritability of dyslexia is estimated at around 50 per cent 'about half of the variability in dyslexic traits found in the general population could be attributable to genetic variation'. However, the mode of inheritance is not known, and as with most behaviourally defined conditions, genetic studies of dyslexia are complicated by a number of factors. The most obvious of these is the difficulty in arriving at a satisfactory definition of dyslexia, as we have seen in Section 1. Another complication arises when individuals with the genetic tendency for dyslexia fail to develop the condition, or when individuals without the genetic predisposition show problems that resemble dyslexia. Moreover, the same condition in different people may each be 'caused' by a different gene. All these factors can make heritability estimates unreliable. It is most likely that a combination of different genes are involved in dyslexia.

Why there can be no such thing as 'a gene for dyslexia'?

In terms of human evolution, reading is a recent acquisition. The demand for literacy has largely arisen within the last 100 years, and is still confined to 'developed' societies. We can therefore be confident that no specific neural mechanism can have evolved for dealing with written language. Skilled reading is also a highly complex process, drawing on a wide range of abilities and requiring integration across many different domains of perception and cognition. Whatever genes are involved, they may include those associated with the structures necessary for language development in general, certain aspects of visual perception and cross-modal integration. Given the wide range of component processes involved, it seems evident that variation in reading ability (to the extent that this is genetically determined at all) will depend on interactions between many different genes. At most, what is inherited is a predisposition towards reading difficulties, but to explore this further we need to understand much more about the actual brain processes involved in such difficulties.

Box 10: Definitions

- **Highly unsaturated fatty acids:** Lipid molecules which make up 20 per cent of the brain's dry weight, and are crucial for normal brain development and function.

2.6 Environmental explanations of dyslexia?

‘Environment’ is often used to refer to only social or non-biological influences. However, it actually also refers to the biological, cognitive and behavioural environments that we may be exposed to. If you refer back to Frith's framework (see Figure 2) you will remember that the environment can be heavily involved in each perspective. An example of a biological environmental influence is a dietary deficiency such as insufficient consumption of fatty acids. The idea that dyslexia has a non-biological environmental explanation has been excluded: you may recall that external environmental factors were explicitly rejected in exclusion based definitions of dyslexia. However, Spear-Swerling and Sternberg (1998) believe that there is some evidence to suggest that while such factors may not explain dyslexia, they can dramatically affect the nature and extent of the difficulties experienced. For example, Adams (1990) has suggested that reading aloud to preschool children results in real benefits in later reading development. Snow (1991) found that children who have a ‘literate home environment’ were more likely to progress in reading than peers who were exposed to less ‘literate’ contexts. MacLean et al. (1987) have also shown that children's knowledge of nursery rhymes can predict both reading performance and phonological awareness.

Just as the home environment can influence reading development, so too can school environments. For example, children are exposed to different methods of reading instruction and it has been argued that some instructional methods can effectively prevent reading difficulties (Clay, 1990). Similarly, the overemphasis on either phonic (alphabetic) or whole word (logographic) approaches to reading can exacerbate existing reading difficulties, because of the need for both skills to compensate for the relative weaknesses of each approach (Chall, 1996). Anderson et al. (1985) have also found evidence that children who are ‘streamed’ into low ability groups receive less effective instruction due to lower expectations of what they can be expected to achieve. There is also often a higher incidence of behavioural difficulties in such groups, which can disrupt opportunities for learning.

> … we cannot blame reading failure – especially extreme disability – on either the child or the initial method alone. Severe disability seems to result when a child has a predisposition (a set of characteristics that make it difficult for him to associate printed symbols with their spoken counterparts) and is exposed to an initial method that ignores this predisposition.
>
> (Chall, 1996, p. 175)

2.7 Reflecting on explanations of ‘abnormal’ development: the case of dyslexia

We can draw the following general conclusions about cognitive and biological explanations of abnormality from the material presented above.

- Both cognitive and biological accounts of dyslexia are offered as theories which explain the behavioural difficulties that are observed. While some theories may dominate accounts of a given condition (e.g. the phonological deficit hypothesis), and may result in influencing the nature of interventions, they are still only theories and always need to be validated by consistent empirical evidence.

- Any single level of description, taken in isolation, will provide an incomplete account of what may cause the behavioural symptoms. Evidence and theories from different levels of description give a fuller account of a condition and better reflect the systemic nature of dyslexia.
- Research evidence provided at one level of description can support a theoretical idea offered at a different level. For example, the evidence suggesting that people with dyslexia show neurological abnormalities in the magnocellular visual pathway (biological evidence) lends support to the visual deficit hypothesis (cognitive explanation).
- The case of dyslexia illustrates a general finding that few conditions are caused by a single biological problem, which affects a single cognitive process, which in turn results in a consistent set of behavioural symptoms. Within most conditions there will be a good deal of potential variability in the symptoms manifested, the cognitive processes affected and the biological factors proposed to explain them. This is because human behaviour is the product of the complex interplay between cognitive and other processes, influenced by a whole range of interconnected and modifiable biological systems. Our 'environment' (physical, psychological and biological) can impact on all these levels and either exacerbate or temper the severity of the condition as a result.

Summary of Section 2

- Theoretical explanations of 'abnormal' development conditions need to take into account behavioural, biological, cognitive and environmental evidence.
- Cognitive explanations of dyslexia include deficits in phonological awareness, visual perception and automatisation of skills.
- Biological explanations of dyslexia refer to observed abnormalities in brain architecture, perceptual pathways and biochemistry.
- *External* environmental explanations are specifically excluded from current definitions of dyslexia. However, evidence suggests that certain home and school environments can contribute to successful reading development.

3 Treatment and management

3.1 Thinking about intervention

So far we have looked at issues relating to how we define 'abnormal' behaviour, and how we think about explanations. Now we will consider the more practical issue of how to approach the treatment of such difficulties. As in the previous section, we will discuss behavioural, cognitive and biological perspectives on treatment and consider specific techniques from each perspective that are applicable to the management of dyslexia.

3.1.1 Treatment or management?

In the preceding paragraph you will notice that we talked generally about the treatment of conditions, but referred to 'managing' dyslexia. Why did we do this? It relates to the following important general issues:

Is treatment (i.e. intervention) warranted? We mentioned this issue when we were discussing sociocultural or personal distress based definitions of abnormality. Intervention is not always desirable or sought by the individual, who may feel that what other people perceive as 'abnormal' is little more than an individual difference that simply requires increased awareness on the part of other people. For example, some people with hearing impairment do not use hearing aids, which they find unnecessary or distracting. A hearing aid may make life easier for hearing individuals speaking to someone with a hearing impairment because it means that they do not have to adjust their own behaviour to accommodate the other person's difficulties. But it may not make life easier for the hearing impaired person. From this perspective, such an intervention is just as unnecessary as it would be if all hearing people were required to communicate in sign language. Alexander Faludy's case study provides a good illustration of someone who has found a way of managing his difficulties, most of which are only perceived as 'difficulties' because of the constraints and expectations that he is expected to work within.

Are all conditions 'curable'? In many cases it is simply not possible to treat the condition in the sense of 'curing' it, and so the individual often has no choice other than to find a way of managing his or her symptoms. As already noted, few psychological conditions have a single cause that would respond to appropriate treatment and disappear, because of the complex interaction of different factors and the difficulty in altering some types of biological difference. Moreover, it is worth considering what might be lost as well as gained if some types of psychological functioning were 'corrected'. Dyslexia is often associated with compensatory strengths (as described in the Case Study in Section 1.3). If all children could be inoculated against developing dyslexia, then these strengths may also fail to develop. A crucial point to consider is whether the gains of any intervention might outweigh the potential losses.

What caused it? Choice of intervention is often influenced by what is believed to cause the condition. For example, if the primary difficulty is believed to be cognitive then the strategy for intervention may also centre on addressing cognitive rather than biological or social aspects of the situation. As we shall see, dyslexia is a good example of a condition where intervention strategies have been largely cognitive in nature, but increased understanding of its biological basis is leading to new possibilities. In contrast, children with ADHD are already offered drug-based treatments simply because these appear to calm their disruptive behaviour, despite the lack of any clear evidence for corresponding biological theories of what causes this 'syndrome'. However, the idea of prescribing such drugs to young children has proved controversial in the UK and raises issues to do with the appropriateness of some treatments. Do the ends really justify the means? As we have seen, most 'problem' behaviours are usually sustained by many influences operating at different levels. This means that in some circumstances any intervention that helps to break what is sometimes a vicious cycle may be beneficial. Although it is helpful if a clear 'primary cause' can be identified and tackled, this is not always necessary for treatment or management strategies to be effective.

3.2 Behavioural approaches

Behavioural therapies are based on principles of classical conditioning and operant conditioning (the latter being more properly referred to as behaviour modification therapy). Operant conditioning is about the presentation of a reinforcement being dependent (*contingent*) on the appearance of a given behaviour. Based on this idea, Skinner (1953) suggested that sometimes 'abnormal' behaviour is the result of bad **contingency management**, where inappropriate behaviours have been reinforced. He suggested that such behaviours could be modified by a process of more appropriate contingency management to become 'normal'. A simple form of this is the so-called 'token economy', often used by schools in the UK to encourage children to engage in good work or behaviour, for which they receive awards such as gold stars. Behavioural therapies are also well suited to the treatment of conditions such as phobias where unwanted emotional reactions can sometimes be extinguished by behavioural means (see Box 11).

Box 11: The three stages of a contingency management programme (Klein, 1996)

1. Observations are made of the client, and the frequency of the inappropriate behaviour is noted along with the characteristics of the situations that it occurs in. From this it is possible to generate hypotheses about what is reinforcing these behaviours inappropriately.
2. Based on the data from stage one, an intervention is designed which seeks to establish new contingent relationships between desirable behaviours and suitable reinforcement.
3. The situation is monitored as in stage one to ascertain whether the new relationships are having the desired effect. Changes to the contingent relationships are made if necessary.

There are emotional consequences of dyslexia which can also be treated using a programme of this kind. Although there has been little research in this area, the studies that have been conducted do show that poor self-esteem and high levels of stress are real problems (Riddick 1996; Riddick et al., 1999). If this is the case, remediation programmes need to address both the direct symptoms of dyslexia and the emotional difficulties that people with dyslexia often experience. One example of a study that has done this was the summer camp programme devised by Westervelt et al. (1998) outlined in Box 12 below.

Box 12: The Westervelt et al. (1998) summer camp study

Over a six-week residential summer camp in the USA, 48 dyslexic students aged between 9 and 14 years received daily tuition in phonics using the Orton-Gillingham multisensory method (see Section 3.3) and oral reading. Student progress was monitored and individual achievements were shared in a weekly newsletter. Psychosocial difficulties were addressed by praising the children, encouraging them to praise and support each other and by creating opportunities for each child to demonstrate success and receive recognition for it. Awards were presented daily to children who had shown progress in socialising. At the end of the summer camp the children showed significant gains in phonetic reading, spelling skills and self-esteem. However, it was noted that children who also had ADHD showed little gain in self-esteem, despite showing the same degree of improvement on the literacy measures. It would seem that the additional difficulties experienced by these children prevented them from receiving praise as readily as the other children with dyslexia did.

You will notice that this programme of intervention has a behavioural element to it. It was observed that much of the children's low self-esteem was associated with failed attempts at reading and writing, and with socialising with other children who might judge them. The researchers attempted to break this cycle by praising the children when they worked hard, rather than criticising them for their errors, and by rewarding the children with awards when they started to engage socially with other children. While this benefited many children, the ADHD/dyslexic children were not benefiting emotionally from the programme, and so some modification to the contingency management programme would be needed for these children in future.

Can you think of any modifications that might increase opportunities for praise for the children with ADHD/dyslexia?

Box 13: Definitions

- **Contingency management:** An alternative term to 'behaviour modification therapy', used to describe a behavioural intervention that is based on principles of operant conditioning.
- **Cognitive therapy:** Involves working with a therapist who highlights maladaptive beliefs that an individual may have about their situation. The individual is retrained to monitor their own thoughts, recognise when their thoughts are based on emotion rather than reality, reject biased cognitions and learn to change whatever beliefs have caused them to distort their interpretation of reality.

3.3 Cognitive approaches

Cognitive approaches to therapy involve interventions that focus on addressing aspects of cognitive processing. For example, **cognitive therapy** is frequently used to treat stress, depression or phobia, and involves working with a therapist who highlights maladaptive beliefs that an individual may have about their situation. The individual is retrained to monitor their own thoughts, recognise when their thoughts are based on emotion rather than reality, reject biased cognitions and learn to change whatever beliefs have caused them to distort their interpretation of reality. Another approach, referred to as **cognitive behaviour therapy** (CBT) involves observing the therapist 'modelling' the desired behavioural response to a situation, and the individual trying to copy that response and receiving feedback on their attempt. This behavioural rehearsal is repeated until the behaviour has been mastered. It is claimed that this process, whereby the person realises that they can now do something that they had previously been unable to, leads to the development of a sense of self-efficacy, will also encourage the person to cope with new situations.

Interventions that directly address the cognitive deficits of a condition (i.e. rather than emotional difficulties) through training may also be thought of as 'cognitive therapy'. As the primary difficulty for people with dyslexia is with acquiring literacy, the most common approach to remediation is to develop programmes that teach reading and writing in a way that addresses the cognitive deficits associated with dyslexia. The difficulty shown in acquiring alphabetic and phonological awareness has led to the development of phonic teaching programmes. **Phonic approaches** to reading teach students how to break words down into their composite sounds, e.g. "cat"=/k/ /a/ /t/ (phonic analysis) and how to blend individual sounds together to form words (phonic synthesis).

At the time of writing, all English and Welsh children are routinely taught phonic strategies as part of the National Literacy Strategy. Phonic strategies are also included in reading programmes in other countries in Europe and in America. Earlier we noted that phonic strategies should not be taught to the exclusion of other approaches if they are to be successful, and they rarely are although they are an especially important technique for children with dyslexia to focus on due to their difficulties in achieving 'alphabetic' reading. Moreover, phonic strategies alone are not enough to improve dyslexic symptoms if they are taught in normal classroom contexts – so the *way* that they are taught to students with dyslexia is an important feature of remedial programmes. One approach known as the **Reading Recovery System**, developed by Marie Clay in New Zealand, emphasises the need for regular periods of one-to-one tuition that focuses on the types of error each child typically makes. There is evidence that this level of individual support is effective in bringing poor readers up to age-appropriate levels of performance, especially when combined with tuition in phonics (see Iversen and Tunmer, 1993), but such programmes are expensive to maintain. They also lack thorough evaluation of the long-term performance of children after the intervention period has finished. Other projects have found that parental tuition and peer-support (where more able friends teach struggling readers) can also be effective, although specific guidance on how to support the student must be given to the tutors.

Clearly, one-to-one tuition is not always a practical option. The more common approach to teaching phonics is known as **multisensory teaching**. The origins of this idea appear to be with Hinshelwood (1917) who recommended that when teaching reading to dyslexic children, the teacher should simultaneously provide input to verbal, visual, motor and tactile memory centres. This sensory integration is intended to maximise the child's ability to make associations between visual and verbal information by linking them via the other available senses. However, this idea is more widely credited to Samuel Orton who, along with Anna Gillingham, developed the **Orton-Gillingham Technique**. This involved '… the constant use of associations of all of the following: how a letter or word looks, how it sounds and how the speech organs or the hand in writing feels when producing it' (Gillingham and Stillman, 1956, p. 17).

A wide variety of multisensory teaching strategies have been developed based on this principle (e.g. the *Hickey Multisensory Language Course* in the UK, or the *Wilson Reading System* in the US). Studies have shown the multisensory technique to be especially effective in helping students with dyslexia and it has also been applied to the teaching of mathematics (Kibel, 1992).

3.3.1 Multisensory teaching for students

Guyer et al. (1993) tested the effectiveness of the Wilson Reading System for improving spelling in higher education students with dyslexia. They compared this technique to a non-phonic approach that teaches visual memory techniques to help students to remember frequently misspelled words. A control group of students with dyslexia but who had specifically requested no intervention formed the control group. Both intervention groups were tutored in the given technique for two, one-hour sessions per week, for 16 weeks. Only the multisensory group showed a significant improvement in spelling ability at the end of this period.

Activity 5

What is significant about the students in the control group regarding (1) the ethics of conducting intervention studies of this kind and (2) the interpretation of the study's results?

There are normally ethical problems in excluding people from an intervention in order to form a control group. When this happens it is normally necessary to offer the treatment to the control group after the study has concluded to make sure that they have not been unfairly disadvantaged. However, Guyer et al. (1993) avoided this problem by using people who did not want any help for their dyslexia as his control group. However, this does raise some issues regarding the interpretation of their results because we do not know the reasons why this group did not want support. For example, the control group may have achieved less because they were less motivated to improve, or because their primariy difficulties had been successfully addressed elsewhere. In other words, an important factor to consider when designing an intervention is to use a closely **matched control group**.

As we have already mentioned, phonic approaches do not address the wider difficulties of visual or attentional processing, physical coordination or automatisation associated with dyslexia. There may be some individuals with no primary problems in phonological awareness who need programmes specifically tailored to address their particular difficulties.

Box 14: Definitions

- **Cognitive behaviour therapy:** Involves observing the therapist 'modelling' the desired behavioural response to a situation, and the individual trying to copy that response and receiving feedback on their attempt. This *behavioural rehearsal* is repeated until the behaviour has been mastered.

- **Phonic approaches:** An approach to teaching reading that emphasises the relationships between letters (graphemes) and their corresponding sounds (phonemes).
- **Reading Recovery System:** An intensive individualised technique for teaching reading devised by Marie Clay.
- **Multisensory teaching:** A technique that involves teaching children via the simultaneous stimulation of as many senses as possible.
- **Orton-Gillingham technique:** A specific multisensory technique for teaching reading.
- **Matched control group:** A control group that has been matched to the participants in the experimental group on various key characteristics.

3.4 Biological approaches

Certain kinds of psychological disturbances may be seen as 'malfunctions' of the brain. If a psychological problem has an obvious biological explanation, then it may be possible to direct therapeutic approaches at this level. However, as we have seen, it is difficult to identify precise biological causes for complex psychological phenomena. Even if this were possible, it would not always be practicable to use treatments to change the underlying biological factors. Genetic 'explanations' provide the most obvious example of this problem. As we have seen, the genetic factors underlying complex patterns of behaviour are rarely simple, usually involving many different genes. Even if a single malfunctioning gene *could* be identified, the likelihood of successful 'gene therapies' remains highly theoretical and would be fraught with both ethical and practical difficulties.

The most common medical method of treating psychological problems is through biochemistry. Numerous pharmacological (drug) treatments are already in use for conditions such as anxiety, depression, schizophrenia and ADHD. However, prescription of these kinds of treatments lies in the province of psychiatry, not psychology, because their safe use requires specialised medical knowledge and training. Nutritional treatments offer a possible alternative to drugs for correcting biochemical imbalances that contribute to psychological problems. It is easy to forget that what we consume can have powerful effects on brain function, both in the short-term (e.g. the way that coffee or sugary foods provide a temporary 'lift' in energy) and in the long term, because our diet provides the substances we need to fuel, maintain and repair our brain and body.

3.4.1 Pharmaceuticals or nutraceuticals?

Nutraceuticals refers to the use of food supplements or herbal remedies for health purposes. For example, certain ingredients of the herb St John's Wort can be as effective in managing depression as conventional anti-depressants, with fewer negative side effects (Greeson et al., 2001). However, research also shows that this supplement can interact negatively with some commonly prescribed drugs, such as the contraceptive pill. This highlights the need for:

- proper research into food supplements and herbal remedies;

- consulting a medical practitioner before taking any of the supplements.

Similarly, doctors sometimes ‘prescribe’ vitamins and minerals (e.g. vitamin B6 for depression, poor concentration or memory problems). Evidence has also emerged that supplements of fish oil, which contains certain highly unsaturated omega-3 fatty acids, may help to reduce the symptoms of serious mood disorders (Stoll et al., 1999). As discussed earlier, deficiencies in highly unsaturated fatty acids are also suspected of playing a part in behavioural and learning problems like ADHD, dyslexia and dyspraxia.

> Even apparent evidence of benefits does not mean that the treatment is really addressing the underlying problem. For example, sleeping pills may render someone unconscious, but can we really say that this is addressing the underlying problem? You may ask: ‘does it matter if we don't know how something works, as long as it works?’ The answer depends on a careful evaluation of both the costs and the benefits associated with a particular treatment. However, even if a treatment appears to ‘work’, it can still be difficult or impossible to know whether the benefits observed result from the treatment. The problem of evaluating interventions, be they biological, cognitive or behavioural, is discussed in Section 3.5.

As we saw in Section 2, we still know comparatively little about the physical brain differences that may contribute to developmental dyslexia, and what we do know suggests limited scope for direct biological interventions. Related conditions such as ADHD are often treated using drugs, but there has been little investigation of possible biochemical contributions to dyslexia. However, as discussed, there is some evidence of deficiencies in certain highly unsaturated fatty acids, and case studies suggest that nutritional therapy may be helpful in some cases (see Box 15). Large-scale double-blind trials should soon reveal whether dietary supplementation may be of more general benefit in the management of dyslexia.

Box 15: A biochemical approach to dyslexia (Baker, 1985)

This report describes the case of a boy diagnosed with dyslexia, for whom biochemical testing revealed various imbalances. Correcting these with nutritional supplements led to clear improvements in his schoolwork. His story illustrates the importance of treating the individual child rather than the apparent problem of his dyslexia (which had not responded to conventional remedial teaching methods).

Deficiencies in certain fatty acids were considered the single most important factor in this case, but some vitamins and minerals were also lacking. Furthermore, to anyone familiar with the signs, this child's fatty acid deficiency was evident from simple observation (although biochemical testing was needed to confirm it).

> Michael had very dry, patchy, dull skin. Like a matte finish on a photograph, his skin, as well as his hair, failed to reflect light with a normal lustre. His hair was easily tousled and when pulled between the fingers it had a straw-like texture rather than a normal silky feel. He

> had dandruff. The skin on the backs of his arms was raised in tiny closed bumps like chicken skin. His fingernails were soft and frayed at the ends. All of these findings point to an imbalance of fatty acids.
>
> (Baker, 1985, p. 583)

This biochemical approach apparently angered some specialists, who took the view that ‘Nutrition has nothing to do with dyslexia’. However, as the author notes:

> Improvement in Michael's school work coincided with the return of normal lustre and texture to his skin and hair. If he had been a cocker spaniel his family would have accepted the connection between his ‘glossier coat’ and better disposition more readily. The timing was convincing. Although it is never enough to establish ‘proof’ in a given person, Michael was convinced. He saw and felt the changes together, and he understood the idea behind the work we did with him. With a twinkle in his eye, he told his grandmother that dandruff had been the cause of his dyslexia.
>
> (Baker, 1985, p. 583)

The doctor emphasised that he was simply treating the individual child, and did not regard dyslexia as any kind of ‘disease’. Instead it was the non-medical specialists who seemed pre-occupied with the ‘dyslexia’ label. Recall too our discussion of ‘explanations’, where we saw that a proper understanding of any psychological problem requires an appreciation of three levels – behavioural, cognitive and biological, as well as the way that environment (in this case diet) can impact on each of these. This report also shows the value of a well-documented single-case study, although randomised controlled trials are necessary to provide unequivocal evidence of benefits from biochemical treatments.

Some visual treatments, such as covering one eye when reading, have shown benefits in double-blind trials (Stein et al., 2000). However, this kind of specialist treatment is only appropriate for children who have particular visual deficits, and it requires proper professional supervision. Others, such as using coloured lenses or overlays for reading, are popular amongst some people with dyslexia and lead to improvements in reading ability in open studies (Sawyer et al., 1994), but as yet there is limited evidence from **placebo**-controlled studies to suggest that they are effective (Francis et al., 1992). A few other unconventional treatments for dyslexia are widely advertised by private clinics as ‘based’ on biological evidence, but have no reliable evidence of their efficacy. One unorthodox approach that has support from randomised, double-blind, placebo-controlled trials involves special physical exercises designed to improve aspects of motor coordination thought to reflect neurological immaturities in dyslexia (McPhillips et al., 2000). Benefits to physical coordination, reading and attention were reported.

Box 16: Definitions

- **Placebo:** Any therapy that is used for a specific symptom or disease, but which is actually thought to be ineffective for that purpose. A placebo is usually employed in clinical trials for comparison with the 'active' treatment under study. A study with no placebo is an 'open study'.

3.5 Evaluating intervention studies

3.5.1 Expectancy versus effect

One of the biggest problems in evaluating psychological interventions is that even if a treatment appears to 'work' it can still be difficult to ascertain whether the results were a consequence of the treatment itself. The improvement might have occurred anyway, with or without the treatment, or the apparent benefits might have resulted from other factors, such as being able to discuss the difficulties with a professional who understands. *Any treatment* can lead to expectations of improvement that can be self-fulfilling. Even a treatment with absolutely no benefits for the condition in question can be followed by substantial improvements if the person *believes* that it will help. This is the so-called placebo effect.

For biochemical interventions, professionals evaluate treatments via randomised, double-blind, placebo-controlled trials (see Box 17). This kind of trial remains the benchmark of 'evidence-based medicine', as the most objective way to find out whether a treatment is effective. It can also be used to evaluate other types of intervention strategy where it is possible to develop a suitable placebo.

Box 17: Randomised, double-blind, placebo-controlled trials – some definitions

Placebo-controlled – the treatment being tested (known as the 'active' treatment) is compared with another treatment (the 'placebo') that is believed to be neutral with regard to the underlying specific basis of the condition in question, but is otherwise indistinguishable from the active treatment. Studies with no placebo are known as *open treatment* studies.

Double-blind – to eliminate as much bias as possible, it is crucial that neither the participants nor those carrying out the study know which people are receiving the 'active' treatment and which the placebo (i.e. everyone involved in the study must be 'blind' to treatment status until all data have been collected and analysed). Sometimes it is not possible to achieve this owing to the nature of the treatment, in which case the next best option is the *single-blind* study, in which the participant does not know what kind of treatment they are receiving but those carrying out the trial do.

Randomised – the kind of treatment that each participant receives must be determined by pure chance, otherwise there is an opportunity for bias (conscious or unconscious) in the allocation of treatments that could influence the results.

Proof of efficacy is required before any new drugs are licensed for prescription, but inevitably this evidence is often obtained under rather limited conditions. Individual differences in the metabolism of many drugs can mean that not everyone reacts biochemically in the same way to a given dosage. For ethical or other reasons, clinical research trials often do not include particular groups such as children or women. Many drug-based interventions also have undesirable side-effects that have to be weighed against the possible benefits. Since psychological problems usually have a wide range of possible interacting causes, in many cases drugs may not be the primary treatment option.

There are difficulties inherent in carrying out placebo-controlled trials, particularly for non-pharmacological treatments, including:

- deception – can it be justified?
- double-blind trial – can this be achieved when the experimenter is administering a cognitive or behavioural ‘placebo’ therapy?
- homogeneity – for some medical problems it may be possible to ensure close similarity of symptoms experienced across all participants. However, for many complex psychological conditions this is much more difficult.

3.5.2 Pre-post test studies

Another method for evaluating the effectiveness of a therapy is to use a **pre-post test design**. This is where a group of people is assessed before and after a programme of intervention. Ideally, these people would be matched to a control group who are also tested twice, but do not receive the same (or any) intervention during that period. However, as with randomised controlled trials, there are ethical issues if it becomes clear that the intervention is having an adverse affect on the experimental group. Even if the intervention is successful, there may be ethical issues as the control group could be seen as ‘disadvantaged’ by not receiving the intervention. Finally, it is always important to assess the long-term effects of any intervention programme to see if the apparent benefits are sustained long after the study has concluded.

3.5.3 Single participant interventions

A single participant intervention study, studies the effects of an intervention in the case of one person, with the aim of establishing those elements of the intervention which would work with the majority of people. This is because the method assumes that in all important respects, all human beings are the same, and the effects of the intervention in one case should be the same in all cases. It is a method that belongs to objectivity.

Box 18: Featured method

Single participant experimental designs

Single participant experimental designs are used to assess the effectiveness of an intervention on a case by case basis. What may be effective for some people may not work well for others, and given the heterogeneous nature of people with reading difficulties it would seem appropriate to adopt a single case strategy to the design and assessment of interventions for this and similarly varied samples. This approach is also used in other areas of psychological intervention such as psychotherapy and psychoanalysis.

There are a variety of designs that are used within this method, one of them being the ABAB Design (see Figure 7).

A baseline measure is taken several times before the intervention is introduced (A), and then during the intervention itself (B). The intervention is then withdrawn for a sustained period (A) and reintroduced (B). This alternating pattern enables the researcher to see if the intervention has any genuine effect on the individual, whether the benefit is reliable (i.e. is it reproduced the second time the intervention is applied), and whether it has a continued benefit after the intervention is withdrawn. The participant also acts as his or her own ‘control’ in a design of this nature. This design gives a richer picture of what is going on than a simple pre-post test design would.

Figure 7: ABAB Design

3.6 Reflecting on dyslexia

Throughout this unit, dyslexia has been evaluated as an example of 'abnormality', a difficulty, a problem in need of an intervention. However, research has shown that some adults with dyslexia are distinctive, not just in their difficulties, but also in their increased levels of creative reasoning compared to 'normal' people (Everatt 1997). West (1997) reports that Nicholas Negroponte, the founding member of the Media Lab at the world renowned *Massachusetts Institute of Technology* has joked that dyslexia is 'the MIT disease', because so many of the individuals at the forefront of their fields have dyslexia.

The following are some of the strengths associated with dyslexia (Reid and Kirk, 2001):

- Good visual and spatial skills in areas such as engineering and the physical sciences.
- Ability to recognise patterns of information and represent three-dimensional images.
- A facility for mentally rearranging designs and information.
- A holistic way of viewing the world, which aids the discovery of problem solutions.
- Rich colour memory and ability to use fast multisensory combinations.
- Creativity.
- Critical thinking skills.

What is problematic in one situation can be advantageous in another. In Section 2.3 we saw that the brain anomalies associated with dyslexia can result in rich neural connections, and that computer models with similar patterns of connectivity are more efficient at tasks that require creativity but not automaticity. Similarly, the ease with which people with dyslexia transpose letters like *b, d, p* and *q*, reflects an ability to manipulate and match images that can be helpful in engineering. Rather than viewing it as a deficiency or abnormality, it has been proposed that dyslexia can be thought of as a unique cognitive style that favours parallel/holistic reasoning over sequential processing of information (Aaron et al., 1993).

Remember what we discussed at the beginning of the unit about social or historical factors constructing 'normality'? Dyslexia was not recognised as a problem until there was a social expectation of and need for literacy, even though the condition probably did exist before then and affected people's lives in other ways (e.g. poor memory). Written language is a technology, but technologies change – as we become more dependent on one, we will become less dependent on others. The increase in new technologies is prompting a re-examination of the sorts of skills society needs. This might highlight a need for the creative thinking that computers are unable to do, but which many dyslexic people are skilled in.

> As a final postscript, not just to the ideas we have examined to do with dyslexia, but with 'normality' generally, consider once more the case of Alexander Faludy (see the Case Study in Section 1.3). His story is worth reflecting on in terms of what it tells us about 'normality' and 'abnormality' and the way that society responds to individuals who are exactly that – individual.

Summary of Section 3

- There are important distinctions between ‘treating’ and ‘managing’ a condition.
- Therapies can be directed at behavioural, cognitive and biological levels.
- Interventions require effective evaluation.
- Successful approaches to managing dyslexia include multisensory teaching of phonics, the promotion of self-esteem through rewards, and addressing nutritional deficiencies through dietary supplementation.

4 Concluding remarks

This unit has been about understanding the idea of psychological abnormality and its implications. What we have learned is that ‘normality’ is defined in a variety of ways, and it is important to ask what model of ‘normality’ is being subscribed to when looking at ‘abnormal’ populations. Are we judging someone's behaviour according to medical, statistical or social definitions of ‘normality’? The point of giving a detailed example like that of dyslexia is to show that in practice there are difficulties in applying any one model of ‘normality’, and that they all have implications for defining a condition, which in turn will have implications for diagnosis and management. Our discussion has shown that it is important to integrate the different psychological accounts of the condition in order to provide a full explanation of potential causes and strategies for remediation. Moreover, it is important to consider what can and should be addressed during remediation and which behaviours, however ‘abnormal’, are valuable and even desirable in particular contexts.

> If you believe that you may suffer from dyslexia, we advise you to contact a national charity that will be able to offer assistance and guidance in the first instance. If you are based in the UK, you may wish to contact the British Dyslexia Association, the Dyslexia Institute or the Adult Dyslexic Association.

5 Further reading

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A classic text on ‘abnormal’ psychology.

Faludy, T. and Faludy, A. (1996) *A Little Edge of Darkness: A Boy's Triumph Over Dyslexia*, London, Jessica Kingsley.

This is the personal account written by Alexander Faludy and his mother, Tanya, of their experiences of understanding and managing Alexander's dyslexia.

Miles, T.R. and Miles, E. (1999) *Dyslexia: A Hundred Years On* (2nd edn), Buckingham, Open University Press.

A good introduction to the history, issues and research that relates to developmental dyslexia.

Do this

- Create a Knowledge Map to summarise this topic.

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Acknowledgements

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Texts

Section 1.3 Case Study: extracted from Faludy, T. and Faludy, A. (1996) *A Little Edge of Darkness*, Jessica Kingsley Publishers.

Figures

Figure 1: Dancey, C.P. and Reidy, J. (2002) *Statistics Without Maths for Psychology: Using SPSS for Windows*™, 2nd edn, Pearson Education Limited. Copyright © Pearson Education Limited 2002, reprinted by permission of Pearson Education Limited; Figure 2: Frith, U. (1999) 'Paradoxes in the definition of dyslexia', *Dyslexia*, vol.5, no.4, December 1999. Copyright © 1999 John Wiley & Sons, Ltd. Reproduced by permission of John Wiley & Sons, Ltd; Figure 4: Reprinted with permission from 'Human brain: left-right asymmetries in temporal speech region' by N. Geschwind and W. Levitsky, *Science*, 161 pp. 186–7. Copyright © 1968 by American Association for the Advancement in Science.

Tables

Table 1: *A03. Adult Dyslexia Checklist*, 1994 http://www.bdadyslexia.org.uk [accessed 18 October 2006], British Dyslexia Association.