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AN ASPECT OF THE JAPANESE LANGUAGE IN RELATION TO DYSLEXIA

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ABSTRACT

These studies were conducted to examine the processing of two kinds of Japanese orthography, namely, kanji and hiragana by a group of dyslexic Subjects and Subjects in a control group of similar age, in order to ascertain the effectiveness of hemispheric specialization. An analysis of variance showed that in visual-learning there was a significant main effect for script type for both groups, $F(1,36), = 28.125, p < .001$. There was also significance for the dyslexic group in verbal-recall, $F(1,36), = 13.15, p < .001$. There was a significant interaction between group and script for direction-orientation with kanji showing higher correct responses, $F(1,36), = 4.142, p < .05$. These results confirmed expectations based on research and also identified left brain (Right Hemisphere) strengths. Thus it seems that a much closer examination of learning styles and modes of learning is crucial for the dyslexic group. Japanese brain lateralization, seen to differ from Western lateralization, appears to be linked with environment which is closely related to language type. This study is an investigation from a culture-specific perspective with a consideration of neurolinguistics in cerebral hemispheric lateralization. This is considered in view of the existence of certain difficulties with regard to reading and the possible influence of life-style and familial career selections to which those difficulties might accrue.

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INTRODUCTION

Despite the volumes of investigation and literary contributions made in the field of reading difficulties, it has only been in the past two decades that studies in this field have become considerably more specific. In this context Berk (1984) asserts the need for a theoretical definition for a learning difficulty and it must of necessity be constitutionally meaningful for it to be used scientifically.

A universal definition has not been easy to find, but Critchley (Pavlidis & Miles, 1981) gives us an up-to-date version which is adequately comprehensive to be useful. It was accepted by the World Federation of Neurology: Specific Developmental Dyslexia, in 1968, as follows:

"Specific Developmental Dyslexia is a learning disability which initially shows itself by a difficulty in learning to read, and later by erratic spelling and by lack of facility in manipulating written, as opposed to spoken, words. The condition is cognitive in essence, and usually genetically determined. It is not due to intellectual inadequacy or to lack of socio-cultural opportunity or to failure in the technique of teaching, or to emotional factors, or to any known structural brain lesion. It probably represents a specific maturational defect which tends to lessen as the child grows older and is capable of considerable improvement, especially when appropriate remedial help is offered at the earliest opportunity" (p.103).

It is termed specific to differentiate it from any notion of a lack of intellectual capacity or deficiency in opportunities for education. It relates directly to reading.

Depending on the country as well as the opinion of reading disability specialists in different professions, the terminology varies.

Rabinovitch et al., (1954) explain that "many alternative terms have been coined, such as congenital symbolamblyopia, congenital typhlexia, congenital alexia, amnesia visualis verbalis, analfabetia partialis and bradylexia" (Naidoo, 1972:8). These terms were cast aside almost

immediately, though strephosymbolia of Orton's derivation sometimes still appears. It means twisting of symbols (Money, 1962:91). Tarnopol (1981) enumerates terminology as "dyslexia, specific language disabilities, perceptual disorders, minimal brain dysfunction, word blindness, minimal cerebral damage, instrumental disabilities, brain damage, educational handicap, learning difficulties, neurological handicap, learning disabilities," (p.6) etcetera. Each name presented possesses slightly different characteristics and philosophies of cause.

The study of dyslexia and its concomitant difficulties is necessarily a long-term one and it is unrealistic to attempt to obtain extensive data in a short period of time. This particular study purposes to look at certain aspects of dyslexia as a syndrome and to investigate the processing facility of two types of Japanese script, namely, kanji and hiragana, by a group of Subjects with dyslexia in comparison with a control group of normal reading ability Subjects matched for age. The present study will investigate whether or not there is any significant difference between groups in their perceptual ability to memorise and recall these two types of orthography accurately. Hopefully the findings will contribute in some small measure to the broad spectrum of investigation that has already been undertaken to achieve an understanding of dyslexia and the functions of the brain.

For a glossary of terms used in the literature concerned with dyslexia and throughout this study, see Appendix I.

LITERATURE REVIEW

1.0 Historical Overview

In 1861, a Frenchman, Paul Broca, noted the occurrence of disturbed articulation in a patient after a specific portion of the brain was damaged (Geschwind, 1972). Thirteen years later, a German neurologist, Carl Wernicke (Ellis, 1984) localised another area in the brain where reading and writing depend on visuo-perceptive skills, often including comprehension and auditory perception. The loss of these abilities is now known as dysphasia and in the case of writing, dysgraphia. These profound discoveries of brain lateralization and their relatedness to language were the harbinger of a retinue of research that has since been performed. There has been a search to find keys for the uniqueness of human learning, attributed to a highly organised brain and a very complex nervous system (Geschwind, 1984; Lerner, 1985).

A German physician by the name of Kussmaul, in 1877, invented the initial term word-blind when he discovered different types of problems among his patients caused by cerebral vascular injury, through which the ability to read was lost, but sight, intellect and speech remained unimpaired. In 1895, a Glasgow ophthalmologist, James Hinshelwood, published a paper on the subject (Naidoo, 1972). British doctors, James Kerr and Pringle Morgan, both independently also became aware of the condition and spoke publicly on the subject. Hinshelwood's studies continued and his publications in 1900 and 1917, drew the attention of other doctors whose patients with similar problems provided data for early research (Ellis, 1984). Out of this early investigation by Hinshelwood and Morgan (1896) emerged a condition termed congenital word-blindness (Vellutino, 1979), attributed to a maldevelopment in a region of the angular gyrus. This term, congenital word-blindness, was founded on the notion that an individual has no ability to perceive and store images of words or, of course, recall them. Geschwind (1982) notes that medical autopsies performed on dyslexics who had died in accidents had brain cell abnormalities identical with those of aphasic

patients. The visual centres of the brain were not able to interpret what was set down in written language (Lerner, 1985; Howes,¹ 1962). This was a pathological diagnosis.

There was little research published about reading difficulties during the first quarter of the twentieth century (Vellutino, 1979).

Pavlidis claims that the term dyslexia was conceived by Berlin in 1887. Orton, an American psychiatrist and neurologist, used this term in literature in 1925 and 1937. Orton directed his studies to "reversals, directional confusion and difficulties with orientation...the hallmark of specific reading disability or strephosymbolia...a failure in recognition of a printed word even after it has been encountered many times" (Pavlidis & Miles, 1981).

For a number of years there was disagreement over characteristics and causes and it took time for the syndrome to become accepted as a specific area of learning disability (Simpson, 1979).

In the search for identification of specific reading difficulties and etiology, Rabinovitch (1968) distinguished between reading retardation from 1) primary deficit in which the disorientation of letter and word symbols reflect a neural disturbance, 2) secondary to brain injury, 3) secondary to environmental factors and specific developmental dyslexia (Naidoo, 1972). Ingram (1964) made the distinction between specific developmental dyslexia and acquired dyslexia, exhibited as a result of minimal brain dysfunction. Concepts of genetic transmission became evident in studies performed by Edith Norrie in Copenhagen and Hallgren and Hermann, in particular, through working with twins (Naidoo, 1972). Since then, a wide variety of studies has been taken up on aspects such

¹Cited in J. Money, (Ed.). (1962). Reading Disability, Progress and Research Needs in Dyslexia.

as genetic factors, maturational lag, neurological dysfunction, cognitive processes, sensory-motor and perceptuo-motor abnormalities, patterns of cerebral dominance and lateralization functions involving switching hemispheric mechanisms, depending on aetiology.

Orton first raised the question of "cause and effect" (Goldberg & Schiffman, 1972), the role of cerebral dominance and subsequent delays and confusion in language with reference to an unestablished preferential laterality (Vellutino 1979). This proposal was taken up by a leading neurologist, Lord Russell Brain, who contended that the failure to establish laterality results in difficulties rather than being the cause of them. Professor O.L. Zangwill, another authority, agrees that "a certain proportion of children with ill-defined laterality have, in addition, a slowness in maturation" (ibid., 1971:132). These authors propose that difficulties in learning and confusion of laterality are the result of cerebral immaturity.

Many have taken up the concept of laterality to examine preferences in eye, ear, hand and foot. According to Goldberg and Schiffman (1972), the outcome of this particular series of investigations is that statistically, there is no significant difference between those who display a crossed dominance and those with an established lateralization for eye, ear, hand and foot. It is maintained that "the anomaly of handedness is a corollary and not a cause of dyslexia" (p.131-132).

In Japan, according to Nakano and Suzuki (1981), learning disabilities within the field of reading and writing have gone almost unnoticed. Much of the Japanese research is based on theories of neurological disorders and minimal brain damage.

In 1968, Makita indicated that about 1% of school-age children in Japan have reading problems. This, he estimates to be about one tenth of the incidence in countries where English is the first language. But later research seriously questions this prognosis. Hirose and Hatta (1985)

maintain that precise and adequate testing has not been possible because of a lack of Japanese standardised diagnostic tests and methods and that the area of specific reading disabilities is still in its experimental stages.

Tsunoda (1985) postulates a theory that Japanese patterns of the cerebral hemispheres are different from Western patterns. He suggests that the major difference is in the lateralization of vowel sounds. Tsunoda contends that there is a subcortical switching mechanism which is related to language and culture. His investigations deal with both conscious and subconscious systems. His theories have been contrasted with those of Liberman of the Haskins Laboratories in the United States (1971), who has demonstrated that hemispheric lateralization does fluctuate. The studies of Albert and Obler (1978) in bilingualism substantiate this.

Tsunoda (1985) in more recent studies, however, asserts that there is a critical age for dominance patterns to emerge and that this is associated with a mother tongue and culture. His studies conclude that dominance is effected in the first eight years of a child's life and that the critical period determining lateralization is most significant between the age of six and almost nine years of age. Tsunoda maintains that the learning of a foreign language is, therefore, more effective after this crucial period of development.

Hatta's (1986) research on cerebral hemispheres also shows that there is an integrated interaction of both hemispheres for Japanese. As well, he observed differences in hemispheric organization between Japanese, Israelis, and British. He claims that this is due to cultural effects on language attributed to unique styles in writing systems.

Etymology

The term dyslexia is derived from its Greek roots dys and lexis which translate into faulty and speech, "cognate with the Latin legere (to read" (Simpson, 1979:431). By definition these roots equate with a common experience of all dyslexics, that is, a difficulty in the use of words (Pavlidis & Miles, 1981; Howells & Osborne, 1984). Hornsby (1984) emphasises the fact that often there can be confusion concerning the term because there are so many differing characteristics. Furneaux (1969) contends that because most factors are found only in a small percentage of the population, the incidence of difficulties is not any more significant than in a normal population. This was based on the premise that characteristics "do not group together in any significant way" (ibid., 251). It is true in fact, that those with dyslexia vary greatly except that they seem to have specific difficulty with written forms of language. Because the problem has been ill-defined, the specific has been incorporated in the general term learning disability. This reference in generic terms has been applied to all children educationally handicapped no matter what the reason (Telford & Sawrey, 1972).

Dyslexia refers to a subgroup of reading disabilities. Descriptions of dyslexia strongly emphasise that it is a complex syndrome and the central characteristic is the difficulty experienced in the use of words, coding and encoding in any written form. Criteria for inclusion in the category of dyslexia are that the subjects have average or above average intelligence and are at least two years below the normal reading level for their age group (Thakurdas & Thakurdas, 1979; Miles & Miles, 1983). Low intelligence, cultural deprivation, minimal brain damage, or emotional disturbance are not included in the definition (Naidoo, 1972).

Young and Tyre (1983) rather vociferously criticise the use of the term dyslexia and its introduction into common parlance as a label for those experiencing specific reading difficulties. They contend that rather

than labelling individuals it is more important to discriminate their problem area and to meet these needs individually. This view is also stressed by Wedell (1973) who states that classifications should not exceed analysis. Tansley and Panckhurst (1981) state that in the United Kingdom, the term specific reading difficulty is preferred.

Conversely, Miles and Miles (1983) state that they prefer to see dyslexics separated into a separate category from the all-inclusive spectrum of reading difficulties, because this alerts a specific educational need that ought to be recognised and assisted on an individual basis. Critchley's (1970) view is that the rejection of a term is tantamount to denial of the condition. Bannatyne (1971) also supports the classification system on the grounds that when cases exist, they will not be misdiagnosed or given the wrong remediation.

Basically, both arguments attempt to narrow down a complex syndrome and seek to know possible causes. Caution is necessary so that labelling does not cover up differences that are important. For practical purposes this study will use both terms.

Characteristics of Dyslexia

2.0 Symptoms

Dyslexia is a specific disability which is quite distinct from a mental deficiency. In the event of a child experiencing difficulties in learning to read, it could be for one of several reasons, such as poor vision or hearing; an inefficient teacher or one who employs a faulty methodology; incompatible classroom environment; emotional stress or because English is a second language. Beyond these reasons, characteristics of the reading difficulty then become critically important and require informed diagnosis.

A person who is dyslexic has great difficulty in acquiring a working knowledge of systems of sequential symbolism. A child may have poor visual memory; visual or auditory imperception; confusion of letters with reversals in letters or words; mirror-writing; uncertainty of order, or left/right orientation which might result in a tendency for some letters and words to be read or written backwards, inverted or rotated; late speech development; directional confusion; hyperactivity; motion sickness; perseveration, that is, continuing an action such as a temper tantrum or stammering longer than usual; or general clumsiness and poor coordination (Telford & Sawrey, 1972). Naidoo's (1972) studies with dyslexic boys reveal that poor voluntary motor control is evident quite early. Any of these characteristics are possible in part or whole (Kirk & Kirk, 1974).

An awareness of any of these symptoms needs close observation and identification so that support, encouragement, and remediation can be given.

2.1 Giftedness

Although signs of giftedness may not be manifested in a classroom, scoring is frequently high when aptitude tests are administered (Tarnopol & Tarnopol, 1981; Hornsby 1984). There are instances when intellectual giftedness of a very high calibre becomes apparent in dyslexic subjects (Lerner, 1985; Goldberg & Schiffman, 1972).

In spite of the tremendous effort required to overcome problems of learning to read and write, some dyslexics have risen to eminence in a wide spectrum of fields. From an anecdotal aspect, for example, Leonardo da Vinci wrote his notes in mirror-writing. Examples of this may be viewed in the British Museum in London. The manuscripts of the prolific Danish author, Hans Christian Andersen have revealed that he was almost certainly dyslexic. The French Sculptor, Auguste Rodin was deemed ineducable by his family, though at the mature age of 67 he had an honorary doctorate conferred on him at Oxford University. Albert Einstein did not talk until he was four years old, and at school he failed in mathematics (Raymond, 1976). The American inventor, Thomas Edison had constant problems with reading, writing and mathematics skills, yet gave to the world such things as the telephone, microphone, and phonograph as well as electric light bulbs. The twenty-eighth American President, Woodrow Wilson, had a poor school record, was read to by his family until the age of eleven, but he excelled at debating (Lerner, 1985). The outstanding brain surgeon, Harvey Cushing, a scholar of Harvard and Yale Universities, could not spell, yet despite this became an author and recipient of the renowned Pulitzer prize in literature (Hornsby, 1984). Virginia Woolf's writing drafts were always checked for spelling and punctuation by her husband because her efforts were so erratic. Likewise Agatha Christie found writing and spelling extremely difficult, and was looked on by the family as the "slow one". Yet, she wrote some 68 novels and 100 short stories as well as 17 plays (Simpson 1979).

Patient perseverance has brought its rewards to each of these individuals with characteristics of dyslexia.

Incidence of Dyslexia

3.0 Ratios

It is said that among the population of the West, between 7% and 10% of children are victims of different forms and degrees of dyslexia.

Critchley (1964) states that,

"there is a greater or lesser ratio of boys to girls, depending on the cut-off point in terms of severity of dyslexia. If the cut-off point is in the mild dyslexic area, the ratio of boys to girls may be 3:1 or 4:1, but in the very severe cases, the ratio may rise to 10:1" (Bannatyne 1971:15, 376; Vellutino, 1979; Young & Tyre, 1983).

Naidoo, (1972) states that the ratio of boys to girls at the Word Blind Centre in London is consistently 5:1.

A survey of twenty-six countries made by Tarnopol and Tarnopol (1981) failed to identify accurate percentages of those who experience problems, due to the non-existence of standardized tests for reading, and due to the lack of an internationally recognised definition.

3.1 Sex Differences

Maccoby (1966) is quoted by Bannatyne (1971) as also stating that the verbal performance of girls exceeds that of boys to preschool age then it gradually levels out until by approximately age 10 boys accelerate to the level of girls with reading skills. Boys seem to be consistently stronger in mathematical reasoning and visual-spatial skills (Bannatyne, 1971).

Morley's research (Bannatyne, 1971) reiterates this by stating that defects of oral speech were found to be three times greater in boys than in girls at the age of five. Bannatyne supports these findings of female verbal superiority. He states that sequential fluency, such as

spelling, semantics and grammar, often continues throughout life, whereas males predominantly show strength in information type testing.

Other literature also affirms that typical characteristics of dyslexia are found primarily in boys (Pavlidis & Miles 1981; Wilson 1967; Goldberg & Schiffman, 1979; Bannatyne, 1971). Under test conditions utilising delayed auditory feedback, Bachrach (1964) observed that there was also a tendency for males to stutter. Females did not do so.

Aetiology

Developmental psychology seeks to unravel and discover principles of human growth, behaviour, and development throughout the life span. There seems to be specific time periods when maturation takes place if an individual is to experience normal development. According to Turner and Helms (1979) different areas of the cortex all develop at a different rate. Likewise, there are critical periods during the course of growth when the effect of what is happening in the environment has an optimum impact on development (Turner & Helms, 1979).

Research has probed many related areas but through lack of understanding and, therefore, lack of recognition, the dyslexic reader's poor progress is still not fully understood. This problem has often been considered a moral issue by attributing failure to laziness (Tarnopol, 1971; Newton & Thomson, 1975).

In considering some causes and conditions of developmental dyslexia, various aspects require comment, as follows:

4.0 Cerebral Dominance

In 1861, Broca observed a close link between aphasia and certain conditions in the left frontal lobe. Then in 1865 the notion was put forward that reading difficulties were related to a dysfunction of the left hemisphere. Approximately one hundred years later, by sectioning the corpus callosum through which intercommunication between the cerebral hemispheres normally takes place, research showed that this intercommunication could be prevented (Myers, 1962). Both sides of the brain share memory traces contralaterally, but under certain conditions there may only be traces or engrams laid in one hemisphere, ipsilaterally. Where there is a dominant hemisphere, the single engram tends to be dominant particularly in language learning functions.

It has been found in stroke victims where right side paralysis develops, that the left hemisphere of the brain is usually affected. Conversely, with left-side paralysis the right hemisphere is affected. If the temporal parietal area is injured on the right side there is a "loss of spatial perception, loss of awareness of body scheme, and loss of spatial relationships" (Goldberg & Schiffman, 1972:127). In the event of a similar injury on the left side of the brain, it has "the effect of producing the most severe disruption of language and its associated thought processes" (ibid.).

This is consistent with Sperry's studies which discovered that while language and serial processing is carried out in the left hemisphere, spatial and picture perception as well as holistic processing is carried out in the right hemisphere (Farnham-Diggory, 1979).

Goldberg and Schiffman's (1972) studies verify Sperry's brain dominance theories, especially the particular functions of each hemisphere as well as the potential of a non-dominant hemisphere to take over if injury or incapacitation should take place in the dominant side. This raises the proposition that at times, because of its very structure, a normal brain could possibly experience occasions of conflict. From this we can possibly assume that the right hemisphere is dominant for spatial relationships and the left hemisphere is dominant for temporal relationships (Bannatyne, 1972). If temporal relationships play a vital role in language activity then it can be assumed that language performance develops in the left hemisphere.

Orton's long-standing hypothesis, suggested in 1937, promulgated that much of the retardation of language development is the result of "a deviation in the process of establishing unilateral brain superiority" (Goldberg & Schiffman, 1972:131). It seems that left-handedness is frequently found among dyslexics and deviant dominance seems a plausible explanation. However, Brain² postulated that a non-establishment of

cerebral dominance is more likely to be the result of a congenital abnormality than the cause of it, showing up in speech, reading and writing disabilities.

Zangwill (1962) states that for some there is a slowness in maturation, and this is often accompanied by delayed lateralization or other corollaries such as left-handedness, slow speech development and in some cases weaknesses in drawing, copying, spatial orientation and directional discrimination, reemphasising the fact that these are the result and not the cause of lack of cerebral dominance. This brings into question whether the disability is genetic and, therefore, a developmental problem or whether it is acquired dyslexia through minimal brain damage either at birth or through some other injury.

Goldberg and Schiffman (1972) also state that this is so in the case of the inconsistent dominance of eye, hand, and foot. Environmental factors can affect these preferences greatly. For example, a teacher insisting that a naturally left-handed child uses the right hand for written expression.

Vernon (1984) states that in a normal foetus some anatomical assymetry is evident in the left temporal lobe where Wernicke's area for language is located and that this is larger than the right.

Brown (1976) also suggested in earlier studies that hemispheric assymetry in newborn babies indicates a "physiological bias of language to the left hemisphere" (ibid., p. 183), which is highly predictive of left-hemispheric lateralization in due time. Some studies in dichotic listening estimate that dominance is established by six years. Vernon (1984) states that this is determined between the fifth and tenth year, "when all the nerves to the corpus callosum become myelinated".

²Cited in Goldberg & Schiffman, 1972:131.

Tsunoda's (1985) studies over a period of time indicate that the establishment of language dominance is between six to nine years of age. Naturally there will be early and late developers over this approximate age-range.

It appears that different types of aphasia may be age specific (Brown & Jaffe, 1975). Brown and Hecaen (1976), for example, state that there is a tendency in young aphasic children to mutism or agrammatism and in late childhood, anomia and verbal paraphasia. This tends to substantiate an argument for "continuing lateralization".

Brown (1976) also observed that there has been some evidence that left- and right-handed individuals organise language differently, though the nature of this process is not yet known. This has been suggested by the fact that three-fourths of aphasics who are left-handed have a lesion in the left hemisphere and one fourth, a right hemispheric lesion (Brown, 1977).

Doreen Kimura (Brown, 1977) has researched conscious mental processes carried out in the cerebral cortex by means of dichotic listening tests which she adapted. Her test "is designed to detect different activities of the right and left hemispheres by presenting different auditory stimuli to the ears" (p.14). These tests can measure the establishment of a dominant hemisphere but not continuing lateralization other than an ear preference (p.53).

Witelson (1977) found evidence through the administration of a battery of tests that among dyslexics there exists bilateral representation of spatial functions. Her finding suggests that this dual imagery process affects cognition due to excessive loading of the left hemisphere so that there is an interference with other functions. Consequently, linguistic tasks are under stress and poor performance is the result. Witelson's research addressed itself to the question of whether or not a dyslexic's linguistic processing is performed in the left hemisphere

(Tansley & Panckhurst, 1981). She also investigated as to whether or not the right hemisphere specializes in spatial processing and followed this up with tests on the two hemispheres in a way that revealed the correlative participation of the specialised functions of each. This required a performance of the two cognitive processes. It is particularly interesting to note that the results showed that although spatial functions operate in the right hemisphere normally, in dyslexics these are represented in both hemispheres. Although dyslexics show left-hemisphere representation mediation there appears to be some deficiency. This deficit in cognitive patterns seems to be specifically in the sequencing and analysing processes of linguistic tasks, while the functions for spatial and holistic modes are unimpaired and may even be developed in excess, thus taking over a predominant role.

Tsunoda's (1985) studies over fifteen-twenty years suggest some interesting facts, connecting cerebral dominance with culture. Kimura's (1977) dichotic listening tests also recognised the relevance of culture. Tsunoda furthered the studies with a more penetrating method known as the key tapping technique which is able to "discriminate and distribute external auditory stimuli to the one or the other cerebral hemisphere" (ibid., p.7) automatically.

It has also been confirmed that the left temporal plane, which Wernicke established as the brain's language centre, is larger than the right area among children before they learn to speak (Geschwind & Levitzky, 1968)³. Wada, a Japanese neurosurgeon, claimed that the lateralization of the left brain for language was determined from birth, but Tsunoda points out that this view ignores the impact of environmental factors. His research reveals that a particular tongue in its own culture can

³Cited in N. Geschwind (1984). Cerebral dominance in biological perspective. Neuropsychologia 22, 6:675-683.

cause a variation from usual patterns. This will, therefore, make an acquired difference.

Tsunoda began testing second and third generation Japanese living in the United States of America, Brazil, Portugal and Peru to discover whether cerebral dominance patterns were the same in these subjects as for other Westerners. He found the same patterns of dominance in these overseas Japanese as in other Westerners.

Likewise, foreign children raised in Japan who learn to speak Japanese fluently before the age of eight years show Japanese patterns. These children are usually bilingual, but there has been some evidence that they have difficulty in learning to read English and they not uncommonly tend to calculate mathematics back-to-front as well as twist prefix sequences, diphthongs or suffixes.

Another interesting discovery was made by Dr. Tsunoda when a group of Maori, East Samoan and Rarotongan musicians visited Japan. Tests showed that those who normally lived in cities and towns in New Zealand and spoke English showed Western patterns of dominance with a probable loss of their own culture as well, while those brought up in comparatively isolated areas speaking their own national language, at least until they were eight years of age, displayed a Japanese-type of lateralized pattern. From this Tsunoda concluded that the linguistic factor was the crucial influence and not race. The environment in which one is raised, Tsunoda hypothesises, tends to determine the cerebral dominance pattern.

4.1 Genetic Transmission

It is said that many instances of dyslexia are genetic or inherited (Lerner, 1985) and that it is often apparent in other family members (Naidoo, 1972). Vellutino (1979) also raises the significance of the incidence of familial links. Naidoo (1972) reports Hallgren's (1950) study of 276 children in which there was "a history of early and

prolonged reading difficulty" (p.11). Genetic transmission is strongly suspected as over three-quarters of the immediate family members also experienced reading difficulties. More conclusive evidence surfaces in Hermann's (1959) research on monozygotic and dizygotic twins. Similarities and differences provide conclusive evidence for hereditary components, although test subjects were limited (Tansley & Panckhurst, 1981). Bannatyne (1971) also reports similar findings.

Bannatyne's (1971) studies also show a strong correlation between genetic dyslexia and occupations in which the fathers are involved in highly spatial tasks such as surgeons, chemists, mechanics, dentists, architects, engineers, artists, factory workers, transport drivers, pilots, and farmers. He adds that the female linguistic abilities in such families may be superior, but these females will possess some symptoms of dyslexia, in particular, a possible deficiency in ability to learn a foreign language, because of the rote memorization skills needed.

4.2 Handedness

Left-handedness or ambilaterality which is mixed handedness (cross-laterality) is also common among dyslexics. Cross-laterality indicates a lack of correspondence between the dominant hand and eye. Naidoo (1972) points out that the dominant use of a hand may be the result of social pressures, for example, a teacher insisting that the right hand be used for writing. She also found that among reading retardates, left-handedness and ambilaterality showed a higher incidence. However, there was a higher "eye-preference, cross-laterality and hand-eye-foot correspondence for spelling retardates" (ibid., p.89). Her findings tend to show that rather than speech and language deficits being due to low intelligence or environmental factors, they seem to be constitutional because of "neurodevelopmental delays and anomalies" (ibid.).

Linksz (1973) observes that many of the children who have reading difficulties are left-handed. Geschwind's (1972) comments should be noted; just as sinistrals have language lateralized in the left cerebral hemisphere as do dextrals, when there is damage to the speech region their disorders tend to be milder than the dextrals. He also states that those dextrals who have a left-handed family history are observed to have a better recovery of speech than if left-handed familial links do not exist.

Young and Tyre (1983), however, have found a closer association between "ambidexterity and reading difficulties" (p.85-86). This would tend to signify undetermined lateralization (Orton, 1925).⁴ "Lateralization is a result of specialization within the language zone of the dominant hemisphere." (Brown, 1977:53).

Vernon (1984) states that there is less homogeneity among left-handers than among the right-handed. The observation of hand preference may be unreliable in view of pressures that can be brought to bear on an individual to use the right hand, such as in Japan for the purpose of writing logographs or even in early training of movements. However, in spite of cultural norms, Vernon links left-handedness with a strong genetic component:

"Only 2% of children of two right-handed parents are left-handed; 17% of those with one left-handed parent, and nearly 50% of children with both parents left-handed. Newborn children already show some right or left preference in turning, which correlates quite highly with eventual handedness." (p.446)

⁴Cited in R.L. Masland, (1981). Neurological aspects of dyslexia. In G.Th. Pavlidis & T.R. Miles, (Eds.). Dyslexia Research and its Applications to Education. N.Y.: John Wiley

Gesell and Ames (1947) suggest that until a child is around six years of age, in most cases, handedness is not stabilized.⁵

4.3 Aspects of Reading

Learning to read is a mental process requiring the development of skills of association and discrimination, applying logical conventions systematically, utilising memory recall and developing the ability to draw on clues from context and grammar in order to anticipate conclusive information. Ryan⁶ (1980) states it as "an active and skilful quest for meaning" (p.106).

Most children will learn how to read, spell, and write without great hardship, but in all of these areas dyslexic children lag behind their classmates increasingly through to the junior high school years (Pavlidis & Miles, 1981). Naidoo (1972) adds that those who are gifted in intelligence show a spontaneous improvement at puberty.

a) The Retarded Reader

Goldberg and Schiffman (1972) distinguish between two types of persons experiencing reading difficulties: the slow reader and the retarded reader. They say, "the slow reader is one who reads below his grade level but whose level of reading is consistent with his intelligence level. On the other hand, a retarded reader is one who reads below his grade level but who may be of higher-than-average intelligence" (p.18). This second type is pertinent to this study.

⁵Cited in Kraft, R.H. (1984). Lateral specialization and verbal/spatial ability in preschool children: age, sex and familial handedness differences. *Neuropsychologia* 22, 3:333.

⁶Cited in J.F. Kavanagh & R.L. Venetzky, (Eds.). (1980:106). Orthography, Reading and Dyslexia. Baltimore: University Park Press.

To children commencing school, a match between expressive language development and the three R's is crucial. It is too readily assumed that upon school entry, children are linguistically experienced enough to follow directions and begin reading textbooks graded according to developmental norms. It is essential that students are able to integrate new experiences with past learning and knowledge. A child needs to enter into all kinds of activities to gain multimodal sensorimotor information. These enable a child to build up rich forms of internalised imagery and symbolic representation (Chappell, 1977). An holistic approach would integrate an individual's experience with reading matter so that prior knowledge can relate to the reading text. This should then improve comprehension. This was Ashton-Warner's (1963) far cry, that school reading texts should have an harmonious flow of imagery at the level of the child so that this would unlock the mind. Ashton-Warner (1972) stressed that the vocabulary should arise from a child's dominant relationships expressing meaningful emotion. The tears, love, fears, and other implications of a culture should emerge to link the content of a mind with its reading text (1972).

Thompson⁷ (1974) also raises the same holistic issue when deliberating on whether or not "Maori and other Polynesian children require different teaching methods and programmes from those required by their European counterparts" (p.85). Thompson's reference to the holistic encounter encapsulates the life-style in which an individual is raised. A communal, extended family system might often engender different norms and expectations from those relating to the classroom. As well, there is the matter of a standard of values presented in a school and desired behaviour and speech that is referred to as the "hidden curriculum" which belongs to the system (Turner, 1985). Acceptance is dependent on being able to learn implicitly these hidden rules that accompany

⁷Cited in Polynesian and Pakeha in New Zealand Education, Bray & Hill (Ed.) 1974:85-87.

curriculum content so that the presentation of knowledge is pleasing to educators (Hamilton, 1984). When a child struggles with a specific learning disability, this is seen as an irregularity which cannot flow in consonance with the norm. The result is, more than likely, criticism, disapproval, and general negativity leading to discouragement and frustration. This can easily result in aggression and defiance of the school environment. The integration of a child's home, social, cultural and school experiences will influence how a student learns. Holistic learning becomes a syndrome of a very complex survival strategy.

b) Visual and Auditory Perception

The human brain is complex in its neurological capacities. Each individual is different and so there can be unconscious brain dysfunctions which may be termed idiosyncratic. For example, some have an inferior sense of direction or poor colour sense, lack sound or rhythm perception, have colour blindness, in varying degrees.

With dyslexia, dysfunctions are commonly concerned with the impairment of visual and auditory perception. Visual perception is the recognition of shapes and forms and the ability to differentiate between them. If normal visual perception is lacking a child may have difficulty distinguishing between the small differences in the shapes of letters and numbers. Vellutino (1979) states that "visual dyslexia" comprises deficiencies of visual perception and memory. A child thus afflicted is often seen to make errors in orientation and sequencing. These individuals have been known to succeed by learning through an auditory mode as a compensatory alternative.

"Auditory dyslexia", on the other hand, afflicts a child by rendering him unable to discriminate "speech sounds, sound blending, labelling, naming, and in auditory sequencing" (p.48).

In regard to auditory symptoms, Bannatyne (1972) points out that perception of musical sounds and general music ability appears to be located in the right temporal lobe whereas speech perception is in the left area. A common characteristic of dyslexic children is an inability to distinguish melodies. It seems that this disability could also be apparent in relation to the perception of sound sequences. Poor listening skills and slow speech development may be on this account.

Dyslexics show a deficit in auditory closure and sound blending. This means that sounds are not heard as they are meant to be. The auditory/vocal experience is not functioning.

In reading and spelling, phoneme-to-grapheme correspondences are equally difficult to grasp. Memory sequences cannot be remembered. Thus, the mechanics of reading, spelling and writing become confused. However, Bannatyne also contends that rather than the problem being concerned with spatial and sequential errors and the distortions of visual-spatial factors, it is linked with errors of linguistic intrusion. There is an apparent inability to name letters and words and thus they are reversed.

Because this is a central auditory processing deficiency, it does not mean that an individual does not possess normal hearing sensitivity. Background noise obstructs the process of sorting out important information.

Cohn and Stricker (1978) argue that, for children who make reversals, the problem is often not so much a perceptual reversal as not knowing a letter name well and realising that it has different sounds according to its different positions in space. Visual discrimination abilities develop with maturation and this is consistent with Jean Piaget's educational principles as exemplified in his notion of conservation (Cohn & Stricker, 1978; Vellutino, 1979). A six year old will focus attention on one noticeable characteristic of an object and disregard

any other part, thus displaying inadequate awareness (Vellutino, 1979). The ability to perform this concrete operational task could well be a determining factor for predicting success in learning to read. The notion also carries over into letter or character recognition.

Maccoby's (Bannatyne, 1971) research indicates that there seems to be considerable competence amongst dyslexics in terms of visuo-spatial ability particularly amongst boys. Where perceptual-motor skills are involved it appears that girls are superior.

In intellectual and conceptualising abilities, it is certainly possible for a dyslexic to gain higher education, though as Bannatyne (1971) states, there might be some of the following characteristics:

"somewhat slow speech development in early childhood, difficulty with auditory sequencing, closure and blending, difficulty in learning to read initially and a residual problem in spelling which usually persists into adulthood" (p.378).

The majority of men with such patterns might have very scientific minds, be able to think clearly and logically, and be competent in organising and developing materials that call for visual-spatial processes. Manipulating objects in multidimensional, intelligent interrelationships is not a problem to them.

The reading process is a gradual coming to terms with a text in its visual form. To do this, a child relies on his own language processing just as in the auditory language. The more mature or extended the resources, the greater the comprehension of a variety of texts. However, the verbal and visual do not always correspond so well. Sometimes there is a mismatch between speech and the writing system (Gurney, 1976).

To build words into a visual text in English, twenty-six letters of the alphabet are used. There are less than fifty of the smallest linguistic

units, called phonemes, which carry meaningful distinctions. In this way there are insufficient letters to match all the significant distinctions in speech sounds. Thus the basic substance of text as sound and writing does not always equate. For example: 'th' and 'wh' are two actual classes of sound, although one letter is common to both.

The historical origins of languages, each with social and environmental influences, also promote peculiar difficulties. As well, there are often subsystems of mutually related words with conflicting spelling rules. Hence mastering an inconsistent system of spelling becomes an additional hurdle. As well as this, there is the confusion of silent letters as in "knee", "knob", "numb". Stress, pitch, and pauses are not recorded and so the recovery of this depends on the linguistic ability of the reader.

The written text also establishes its context to the reader and this is as effective to the degree in which it can be understood by the reader.

Each language has its own set of sound units or phonemes with different combinations of these sounds. Linguistically, each function is unique. These small units combine to make larger units representing morphemes. Many of these can be recombined to form words. Politzer (1965) likens these units to sets of "building stones" with constructions built from words "according to definite construction patterns or blueprints" (Pp.6-7). Children require time to be maturationally ready to build these constructions. With plenty of learning opportunities there should be reasonable success except for the small minority who really do have distorted perception. In the English language this is quite an imposing task. Letters are quite similar so reversals are common. As a consequence, spelling can easily become bizarre through sheer confusion. Where intrinsic deficiencies exist, these must be delineated and teaching adapted to the need. Not only an analysis of the child but also an analysis of what is to be taught is necessary. This will mean a personal, individualised, interdisciplinary approach to the reading

process, based on physical, emotional, and social needs as well as reading deficits and learning style (Devereux, 1982).

c) Ineffective Strategies

Reading difficulties can be closely related to ineffective strategies applied to a given task. Torgesen and Licht (1983) note that the matter of inappropriate processing strategies for hyperactive and impulsive children has been under scrutiny since the 1970's. The performance of impulsive children is marred because of haste and by not taking enough time to ponder over their work.

Lerner (1971) proposes that both children and adults have individual styles of learning. For some an "auditory modality" is efficient, whereas for others it might be a "visual modality". Still others learn best by a "tactile modality" and yet others by a "kinaesthetic modality" (p.118), or cross-modalities. Perception and memory include all of these experiences. Cognition involves all thought processes including reading. Motor skills embrace all the small and large muscle functions including those involved with eye and speech ability. Deficits in any of these areas will affect an individual's performance (Tarnopol, 1981).

d) Maturational Lag

Brain, Zangwill (Goldberg & Schiffman, 1972) and Critchley also consider maturational lag which they maintain can be augmented given appropriate remedial assistance (Pavlidis & Miles, 1981).

Because these children appear to be normal their problem is hard to detect. Crosby and Liston (1978) define reading from a neurological viewpoint as "translating graphic symbols into sound according to a recognised system". They further comment that, at school entrance age, a child has an oral vocabulary ranging between 2,500 and 20,000 words, depending on maturity and environmental exposure. The transition from oral to written and reading skills should be a fairly natural one,

merely translating existing verbal ideas and patterns into a sight dimension.

Reading achievement can be closely related to the degree of independence of concentration on a given task, and of how efficiently a child can follow instructions. Research quoted by Torgesen and Licht (1985) states that learning disability children develop at a slower rate than normal children in the "mnemonic strategy of verbal rehearsal" (ibid., p.5). There is probably a high correlation between this and ineffective strategies applied to a given task.

Clay⁸ emphasises that if the language competency and the linguistic environment of the school beginner does not match with the school new entrant programme, the opportunity for failure will be increased. This is particularly the case when the notion of passive and active bilingualism is contemplated. By passive bilingualism is meant the ability to hear and understand a second language without being able to generate those language patterns vocally as an active speaker would do. This, of course, hints at certain aspects of socio-linguistics but it can also be a crucial factor if Tsunoda's theory of cerebral lateralization and culture is indeed relevant. A mismatch in linguistic background would certainly germinate specific problems for some.

It is recognised that there are some children who have problems that are specifically related to processing skills that do not come under conscious control. Delayed development of skills and subskills will induce a "developmental lag" in strategic behavioral growth (Torgesen and Licht, 1983). Alternately, there is the possibility that reflective processes function differently for dyslexic persons. Here, the question arises of home environment and whether there has been much stimulation for intellectual development thus affecting the preparation

⁸Cited in Bray & Hill, 1974:83.

needed for school entrance (Thompson, 1966). The way a child is affected in those early school experiences when confronted with academia for the first time is very relevant (Turner, 1985). The switch is in the difference between incidental learning and conscious application to learn many facts. Some cannot assume the new role as a self-conscious learner because some parents do not allow their children to become self-directed and self-regulated in task situations. How a child is raised may even foster avoidance behaviour that will impede the learning process.

The type of life-style of the ethnic community in which a child is raised can also contribute to the sets of values and behaviour that moulds and lays foundations for intellectual and emotional development. If these are not congruent with a school system of learning, the mismatch might be quite shattering.

Early identification in any area of dysfunction is a primary necessity and then teaching methodology becomes important so that helpful remedial assistance can be given (Devereux, 1982). This represents individual needs because all may not suffer with the same contributing factors and so differing remedial methods may be necessary (Vernon, 1966).

4.4 Memory Systems

Earlier research on the memory system makes a distinction between 1) its structure and 2) the voluntary activities that can control it, such as organization and ways to maintain that which is to be remembered.

Yet further research has looked at two distinct memory systems, known as short-term and long-term memory (Torgesen & Licht, 1983). Depending on the quantity and nature of matter to be retained, the processing procedure can differ. Short-term memory is that which has a retention capacity of, at most, a few minutes' or at least a few seconds' duration, and is limited in amount unless reinforcement follows. A process of recoding and organising stimulus matter is carried on so that

it can enter a long-term memory storage and retrieval system. Long-term memory refers to the great bulk of stored facts and experiences committed to it both intentionally and incidentally. It stretches over hours, days, and years.

There are also two processes of operation known as recall and recognition. Bannatyne (1971) identifies them this way:

"Recall...can be defined as remembering criterion response in its original form and reproducing it accurately on demand in the absence of the original stimulus.

Recognition...can be defined as remembering a criterion response to the performance level of being able to identify the original stimulus accurately in re-presentation, as having been experienced before in exactly that form." (P.246).

Normally, it is possible to recognise with complete accuracy materials re-presented immediately, but a considerable time lapse shows a decrease in efficiency.

Frith and Frith⁹ (1980) found that different modes function depending on the encoding task. Any sequential encoding, as in spelling, largely depends on auditory coding whereas items of spatial orientation are facilitated by visual coding.

4.5 Spelling

Miles's (1981) studies make reference to a very noticeable characteristic in the written work of dyslexic children. The type of spelling that is produced is termed bizarre (Miles, 1981). She states that this should be differentiated from poor spelling. Miles found that poor spellers simply get some letters in the wrong place which is often plausible on account of associative patterns. Even for the non-dyslexic

⁹Cited in J.F. Kavanagh & R.L. Venetzky, (Eds.). (1980:290-291). Orthography, Reading and Dyslexia. Baltimore: University Park Press.

a recognisable pattern appears in their mistakes. A dyslexic's spelling shows confusion and distortion in letter placement as well as in their formation, reversals, and word substitutions. Tarnopol & Tarnopol (1981) state that dyslexics particularly find homophones difficult to differentiate (Ellis, 1984).

Anna Gillingham and Bessie Stillman associated with Orton, devised what was originally known as the "alphabet method" (Crosby & Liston, 1968:215). Gradually this has been modified into a visual-auditory-kinaesthetic approach to spelling which teaches phonic-grapheme associations through a multi-modal approach and helps those with dyslexia to be encouraged to translate sound into symbol in an active, decoding way.

Johnson and Myklebust (1967) term this as visual dyslexia. By this is meant, "strong auditory skills and visual processing problems" (Faas, 1979:185). Through one approach a student can then learn how to process information through another mode.

Usually, dyslexics cannot handle the "look-and-say" method of learning to read. Hornsby (1984) reminds us that our speech is composed of 250 key words and it is expected that children will learn these by sight with the aid of a picture in association with the word. When needed, initial letter sounds are taught, though this is only really helpful if there is regularity between the letters and sounds involved. However, Johnson and Myklebust (1967) state that for auditory dyslexics who have real problems associating sound-letter correspondences, the sight-word approach is often more successful initially. They are more able to build up sight-word vocabularies.

Some children enter school knowing the alphabet by its letter names and upon school entry they are required to learn the sound names. Most children can accomplish this but for many dyslexics it is an onerous, if not impossible, task. A more logical, systematic, ciphering link

between the spoken and printed form is necessary. Learning individual letters and encoding sound segments or phonemes through more than one medium or mode is essential (Nicholson, 1986).

4.6 Handwriting

Penmanship involves patterns made by hand and arm movements. To make these patterns demands select visual perception and motor control that can produce such elements as strokes, curves and size. The accomplishment of this may depend on components of sensory organization. It is important to utilise kinaesthetic memory; to feel the movements that need to be made.

Wedell and Horne (1969) investigated handwriting from the aspect of sensory and motor organization. Subjects with motor difficulties were found to have the worst performance and visual discrimination was not the main dysfunction (Wedell, 1973).

Bannatyne (1971) states that as a result of research performed with reading difficulty cases, Bryant (1964) discovered that only one third of the subjects tested had normal motor function on the Lincoln-Oseretsky Scale. Bannatyne's own studies supported this finding (ibid.). This evidence suggests that in a small group of dyslexics motor performance is either average or above average, although the majority of dyslexic cases display great awkwardness and very irregular attempts at writing (Lerner, 1985).

Benton¹⁰ discusses dysgraphia from two aspects of acquired dyslexia. Parietal disturbance affects all aspects of writing. It also impairs mathematical calculation, drawing, bodily orientation, design and construction as these are all spatial tasks. In spite of this, Benton

¹⁰Cited in J. Money (Ed.), Reading Disability, 1962:84-5.

says although there may be a combination of higher-level perceptual and conceptual deficits, there may be no particular dyslexia manifested.

He claims that Occipital dyslexia will still allow for spontaneous writing though with some small discrepancies. Copying is difficult. Although oral language may be unimpaired, making classifications is difficult. It must be remembered, however, that individual cases vary greatly in the amount and degree of deficit.

4.7 Psychological Factors

A child's perception of his own abilities or lack of them will often accrue from parental attitudes. Kronick¹¹ emphasises the importance of parents accepting apparent strengths and weaknesses and of coming to terms with this. A child will then tend to live and work within the parameters of realistic goals. This, in turn, should alleviate tension and frustration to some extent.

Ambition and aggression on the part of parents can also be very detrimental. The high expectations of parents demanding superior performance, irrespective of whether a child is capable of such standards, can lead to confusion, intense apprehension, and often failure. Together with this, there is a loss of self-esteem, an ensuing inferiority complex, and a block in the emotions which can break out in aggressiveness. This behaviour could well be an attempt to destroy the learning situation which has become such a frustration.

Emotional stress might become apparent in the form of feelings of inadequacy, guilt, stupidity, abject failure, and rejection. Secondary behavioural and emotional problems are the frequent result (Naidoo, 1972).

¹¹Cited in Faas, L.A. 1979:95.

In their percepts of children with specific difficulties, Shore and Riegel (1979) add that older children may resist learning to read because they are convinced that it is an impossible task. For younger children there may be denial of failure and use of avoidance tactics. It is for this reason that Frostig (1979) asserts the importance of a methodology of learning that will foster success and positive attitudes.

Loneliness is often experienced by those suffering from dyslexia. Because there is a struggle involved in deciphering words, there is also a hatred of reading aloud, a stigma that accumulates as a result of teachers being unable to relate to the problem or to assist the child to overcome it, and classmates' often derogatory attitudes toward low achievers (Hornsby, 1984).

In many cases a person with dyslexia is very intelligent, is good at sport, and is a fine communicator. Hence the dyslexic has friends but still faces failure in the mechanics of learning to read and this can be very enervating. There is the earnest desire to read but the ability to accomplish this is not apparent. Facing academic failure among peers can result in severe psychological stress because of frustration, ridicule, and embarrassment. As an educational casualty, an individual is tagged "untaught" and loses out on the benefits that accrue to the literate.

Consequently, conflicts arise not only with authority figures (parents and teachers) but also with peers. Goldberg and Schiffman (1972) point out that in order to express or to control such emotions, a variety of defense mechanisms directly related to failure and conflict are learned. If this stress begins at an early age, the psychiatric factors compound the stress with which he has to cope. Spielberger (1966) published a study of high and low-anxiety students. Failures in the high-anxiety group were 20.2% while the rate for the low-anxiety group was 5.8% This supports earlier studies of children in psychiatric institutions where tension and performance were measured under certain conditions for

learning. The conclusion was that apprehension leading to tension is a factor in failure.

When, despite honest effort to learn, a person finds reading confusing the results can be devastatingly serious. This is especially so for those children whose IQ is well above average but whose reading ability is well below grade level. There is always the possibility that a person will not be academically oriented. In this case goals should be realistically set, as much as possible differentiating between apparent native abilities so that success can be tasted where there is an area of interest. Some do better academically while others excel in manual pursuits but this is outside the parameters set for this present study. Suffice it to say that answers need to be found to the question of why some with above-average intelligence who do have the motivation toward academic pursuits cannot succeed in reading and writing skills. Negative attitudes, if they exist in parents or child, need to be dealt with first so that suitable remediation can take place.

Recognition and acknowledgment of a problem is the first step to remediation, followed by a discovery of strengths and an alternative learning style that will contribute toward successful experiences. These are positive approaches to a problem.

4.8 Bilingual Factors

Myklebust (1973) emphasises that the culture of a nationality influences the way communication takes place, the way things are categorised and the way abstract thoughts develop. This determines mental processes for the way in which forms of language are acquired.

Turner and Helms (1979) state that language development will be affected by "socioeconomic influences, the intelligence level and sex of the child, bilingualism and whether or not the child is a singleton or twin" (ibid., Pp.150-151). It is said that socioeconomic influences and the familial setting affect the individual markedly. In particular, the

bilingual home proves to be an interesting setting. In a foreign setting, as well as the language learning of the mother tongue, there is the cultural conflict related to the second language. Research, cited in Turner and Helms, indicates that subjects in a longitudinal study, conducted over a period of seven years, showed no decrease in language ability despite working in two languages. Rather, the bilinguals tended to score highly on creativity tests.

Albert and Obler (1978) state that the auditory language skills of bilinguals are more developed than monolinguals. They also suggest that "the perceptual capacity of the bilingual is different" (ibid., p.204). It appears that on a variety of cognitive tasks there is considerable difference (Hatta & Dimond, 1981). This is possibly due to differences in language organization of the brain and to bilaterality in language function. Where there is efficiency in both languages, processing strategies are better controlled by bilinguals. Young children exposed to a second language have a precociously developed capacity to express themselves semantically (Albert and Obler 1978). In cases where there is less control of the second language, there can be cross-language semantic and accent interference from the mother tongue. Each language has its own composition and set of "higher-level rules" and interference "may obtain for perception as well as for production" (ibid., p.249). Age, manner and mode of acquiring the second language must be taken into consideration.

Further, Albert and Obler (1978) assert that the brain has plasticity and can alter language patterns of hemispheric organizations in a switching mechanism depending on the nature and content of a language and the age at which it is learned. Especially, they maintain that "the productive phonological systems have a measure of dual organization" (ibid., p.246). For the bilingual, each different language may utilise different patterns of cerebral dominance. Hatta and Dimond (1981) concur that, particularly in the processing of the Japanese language, a

blending of both hemispheric functions is required to a greater degree than in English.

Using his key tapping technique, Tsunoda (1985) hypothesised that possible variations exist between Japanese and Western brain patterns. Auditory patterns reveal that the Western brain processes "linguistic and logical functions" in the left hemisphere "while all other auditory information and functions are handled in the right brain" (ibid., p.77). The left hemisphere in the Japanese brain "handles logical processes, emotional functions, and even perceptual affinity with nature" (ibid., p.76). However, it is to be noted that Hatta and Dimond's (1981) studies on environmental interference effects showed a right hemispheric predominance for sounds of nature, though they state that their interpretation is tentative, pending further evidence to substantiate this finding. The findings of Kikuchi (1985) cited in Tsunoda (1985), on the other hand, verify the key tapping research, as does the work of Ichihashi (1983, cited in Tsunoda 1985).

According to Tsunoda (1985), all vowel processing in Japanese is done in the left hemisphere as a verbal sound, whereas for Westerners it is a nonverbal processing function in the right hemisphere. So the major difference lies in the lateralization of vowel functions (Shankweiler & Studdert-Kennedy, 1967).

Tsunoda's tests were performed on Westerners living in Tokyo. When tests were done on second and third generation Japanese living in foreign countries, Western dominance patterns were observed, reinforcing Tsunoda's theory that the first eight years of absorption in one language determines lateralization. Fromkin and Rodman (1978) and Vernon's (1984) research concurs with this.

Among many other nationalities, Tsunoda also ran tests on East Samoans and New Zealand Maoris. It was found that those speaking their native tongue as a first language displayed Japanese cerebral hemispheric

patterns whereas if English was the dominant language, Western patterns were evident. Under emotional stress, Japanese patterns also switched to Western ones. Among the many languages that Tsunoda tested, these Polynesian languages were the only ones that he found to resemble Japanese. He concludes that this is because of the heavy predominance of vowels in these languages. It is noteworthy that Ahern and Schwartz (1985) also record different patterns of lateralization of emotions depending on whether the emotion is negative or positive.

Tsunoda (1985) propounds two types of subcortical switching mechanisms, namely, a) those concerned with an abundance of vowels in a language and, b) those languages with a heavy weighting of consonants. He postulates that Japanese and Polynesian languages process human emotions and sounds of nature in a way that is consonant with verbal sounds. Western languages, with an abundance of consonants, process emotions, vowels and natural sounds as nonverbal sounds in the right hemisphere. Interestingly, where Western subjects show a dominance in the right hemisphere for the five vowel sounds, when these vowels are joined to a preceding consonant and form syllables, they are then processed in the left hemisphere. Continuous background sounds can also cause a shift of dominance for vowels. This could have an important bearing on why research investigating cerebral dominance for vowel sounds shows inconsistency and is said to be inconclusive. The type of research method and procedure is crucial in order to reach conclusive evidence.

According to Tsunoda (1985), hemispheric dominance is not affected by writing, but only by the spoken language. This finding was confirmed through blind subjects being tested through the medium of the braille system when they knew neither kanji nor hiragana. They also indicated identical responses as normal sighted Japanese for both verbal and nonverbal sounds in the voluntary and involuntary areas of the nervous system.

4.9 Orthographies

It has been suggested that there are many ways in which meaning can be represented in print. Hence, between the various processes involved in learning to read, different types of orthographies require different strategies and skills to process them (Tzeng & Hung¹²).

According to Sperry's (1969) research, both written and oral English is processed in the left hemisphere. He also found that the right hemisphere showed superiority for the performance of visual as well as spatial tasks. However, because this research was done with materials pertaining to an alphabet, it cannot be said that the same will apply to nonalphabet materials such as logographic symbols. Because of the concrete nature of these symbols, such as Chinese/Japanese characters, the task is to recognise patterns rather than to recode. It is presumed that this is carried out in the right hemisphere (Kavanagh & Venezky, 1980).

It is commonly affirmed that verbal language is centred in the left hemisphere of the brain. As opposed to the phonetic verbal system of the West, a logographic system such as is used in the East is likely to lead to different psycho-neurological approaches to learning. Myklebust (1973) reasons that "because ideograms are pictographic and nonverbal, it appears that the right hemisphere has major responsibility for the acquisition of this form of written expression" (1973:45-46).

Hatta (1985) draws attention to writing systems used in Japanese and the ways in which these might be processed. In the Japanese language, the phonetic syllabary used is called kana. This is a combination of a flowing style known as hiragana and a stiff style used for loan words from other languages and for official purposes, called katakana.

¹²Cited in J.F. Kavanagh & R.L. Venezky, (Eds.). (1980). Orthography, Reading and Dyslexia. Baltimore: University Park Press.

Symbols made with these systems are said to be phonographic. Each character in kana represents a single syllable in Japanese, the smallest unit of sound or mora (haku in Japanese). "They are short sounds spoken one after another for approximately equal lengths of time" (Sakamoto, 1980) to make up words. All consonants are followed by a vowel except in the case of the sound 'n' which will occur either in the middle or at the end of a word. It is an independent mora. Vowels on their own can also form meaningful monosyllabic words, for example, "/a/ (mute, quasi), /i/ (stomach, medicine), /u/ (cormorant), /e/ (picture, food, handle), /o/ (tail, cord)" Hatta and Dimond (1981:248). Thus, there is a heavy predominance of vowel representation in the Japanese language.

As well there are Chinese logographs termed kanji. These work on the "one-to-one symbol principle" (Ellis, 1984:3), though there can be more than one pronunciation in Japanese. As Yamadori (1975) explains, "A Kanji character symbolizing mountain may be pronounced YA-MA, which is its KUN-YOMI" (reading from a Japanese derivation) or it may be pronounced SA-N, which is "a rough phonological approximation to the original Chinese name for it at the time of importation in the sixth century. This is called ON-YOMI" (p.231). Sometimes the KUN-YOMI might be difficult for a dyslexic to read in cases where there is an inadequate capacity for grammatical analysis, because the pronunciation of a particular character may be conditioned by the part of speech which precedes it.

Hatta (1985) suggests that the brain does not process these systems in an identical way, a proposal that Yamadori (1975) had earlier hypothesised. The work of Hayashi et al. (1985) also verifies this. They assume that "kanji words achieve access to the semantic lexicon via the orthographic lexicon before they access phonological lexicon", (p.294), whereas, they suggest, "the majority of kana words go through phonological processing prior to their access to semantic lexicon" (ibid., 294). In this way, Tzeng and Hung (1980) suggest that those who are learning to read for the first time have a predilection to a concrete approach when working

with Chinese/Japanese characters in comparison to those attempting to learn through the alphabet system.

Makita (1968) claims a rarity of reading difficulties in Japan and attributes this to the phonographic and logographic writing systems in use. Hatta (1984) questions the validity of Makita's findings which were derived from questionnaires (Tarnopol & Tarnopol, 1981). Hatta and Hirose (1985) contend that this type of investigation is based on very subjective judgments. Subsequently, Kitao (1984) formulated a reading ability test for Japanese students and this was published in 1984. Results on the use of this test show a close correlation between the existence of reading difficulties in the West and in Japan. Tarnopol and Tarnopol (1981) enumerate other tests, such as Japanese editions of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), WISC-R, and Draw-a-Person Test, published in Tokyo, which are also now in use.

Sasanuma's (1980) earlier investigations also recognised that orthographical problems are basically universal in neuropsychological terms, though there are apparently specific differences with regard to Japanese. She points out that kanji will relate to semantic errors, while kana will have phonological errors associated with it. This indicates differing linguistic functions, borne out by the neuropsychological and pathological findings of Takahashi et al. (1982).

A Learning Theory

5.0 Language Acquisition

Bannatyne (1971) points out that language, regardless of culture, is a phenomenon that is learned universally from an early age. Young children learn to speak spontaneously with no formal tuition, just as crawling and walking are analogous motor functions. Piaget notes that a child less than four years of age is not likely to be able to deduce random rules of a language in order to compose it. Fromkin and Rodman (1978) state that by the time a child is five years old, all the grammar basic to a language is learned.

Three theories of language development are proposed by Turner and Helms (1979):

5.1 (i) Innate Theory

Noam Chomsky (Fromkin & Rodman, 1978) propounds that individuals have an innate deep structure that is universal among all languages, programmed to create and to understand language. This system is known as the Language Acquisition Device which is reliant on the maturation of cerebral cortex cells. In this theory, a child makes correct transformations from kernel words. Chomsky asserts that by listening to others, children are innately able to apply the same phoneme-grapheme, syntactic associations and structures heard in their environment. Whether this innate transformational grammar is an hierarchical universal or not is not known and the theory itself still remains a controversy.

5.2 (ii) Reinforcement Theory

B.F. Skinner (1957) applies a behaviourist theory to language learning by examining the effects of operant conditioning. According to this theory of language acquisition, new vocabulary is gained in response to fulfilling a child's needs. It narrows down to intrinsic versus extrinsic rewards and sets of values (Devereux, 1982). For example, a

child might enjoy doing a task for the reward of praise. Devereux also points out that, with growth, children are gradually able to apply standards for judging their own performance.

Positive reinforcement rewards appropriate words or grammar. This method, however, does not contribute to disclosing the nature of language development. It tends to focus on the factual correctness of speech patterns rather than on grammatical correctness (Brown & Hanlon, 1970).

5.3 (iii) Social Learning Theory

Social learning theorists postulate that children acquire language by observation and imitation (Bandura, 1977). For example, a child observes adults and copies their modelling. It is to do with self-efficacy. In other words, what a person thinks will determine whether that person will initiate coping behaviour in a given situation, how much effort will be exerted and what the duration of that effort will be when faced with challenging factors. Response information, or feedback, is a major determining factor in motivation and performance. This may come through actual participation in a task, or by observing others model behaviour. As consequences of action are recognised as either good or bad, so a person will improve in predicting how personal effectiveness will bring about certain outcomes. This can be linked to long-term pattern processing as well as to immediate consequences. In acquiring and retaining new behaviour patterns, cognitive processes play an important role.

There is no doubt that social learning theory can also have its place in producing autonomy in individuals. However, this notion of language acquisition while valid in some respects, raises questions due to the fact that children seem to transform sentences into their own patterns. This would tend to indicate the relevance of the maturation theory and the emphasis on a child's readiness to be able to make new grammatical formulations.

No theory in its pure form can provide a complete reason for successful language acquisition. The notion of a mixture of theories seems to be more valid.

Cognitive Theory

Tamburrini¹³ (1974) delineates effective ways in which children learn by observing two major Piagetian principles:

- 1) A teacher should begin where the pupil is.
- 2) Knowledge is a construct of reality and not a copy of it.

A child does not enter the classroom with the empiricist notion that the mind is a clean slate on which the teacher writes. Central to Piaget's (Turner & Helms, 1979) theoretical position is the notion of schemes which consists of the psychological organization of past experiences. What is an external reality in terms of what already exists in the schema becomes assimilated into that scheme. Any modification of this is called accommodation. What is accommodated depends on what has been assimilated. Situations where conceptualisation is facilitated will provide a wide base for assimilatory experiences. This means that development will not only be due to maturation; one's environment may also facilitate cognitive development. This does not imply a laissez faire approach to learning. It means that knowledge will be constructed by the learner. Piaget stresses that the crucial factor in intellectual education is the development of logic and the ability to think (Piaget, 1971).

Jean Piaget is best known for his theory of cognitive development. He recognises that there is a process for the development of mental capacities. The assimilation of all raw material is not an invariable process at all ages. Environment can play a crucial and decisive part in the development of the mind and, in different environments, the needs and interests of individuals vary. There is no immutable fixation of

¹³Referring to her article, Implications of Piaget's Theory for In-Service Education, adapted from a lecture given at the First American Conference on Teachers' Centre, in Mathematics Education in St. Louis, April, 1974.

thought content at any one age-stage. As logical structures become mature and more effective, so the development of language is helped forward. It is not language which promotes logical structures. It follows that a child passing from the concrete operational to the formal operational stage requires certain development to take place in order for language to continue to progress (Lerner, 1976). Piaget's argument in relation to reading and writing, then, is that a child needs to be encouraged to think so that he can learn to verbalise intelligently. Thus, an environment for intellectual growth needs to be provided. Tamburrini (1974) cautions that care needs to be taken that it is not thought that mere exposure to materials and environment automatically transmits concepts to a child. When a child in himself is ready maturationally, the process of learning to read can be encouraged but not imposed. In this way, the academic activity becomes genuine. Once cognitive structures are built, sound teaching methods can increase the efficiency of a student. Even postponement should have no serious effect on the eventual reading capacity of an individual.

Learning modes may either encompass a competitive approach which is largely individualistic and where comparisons are continually being made. Or, a learning approach which is facilitated by cooperative incentives, with individuals helping each other or supporting each other in groups. Tamburrini suggests that teachers need an on-going system by which they can diagnose progress in order to know what is drawing the attention of an individual. The educational implication is that a teacher needs to begin with what a student already knows and not what he does not know. There will be a great range of qualitative and quantitative differences amongst individuals and all will not be able to be patterned in the same way for linear seriation. It has been an educational principle of learning that readiness for certain steps be recognised and appropriately facilitated. However, this is not always considered seriously and hence impositions are placed on children. A premature approach or unwise presentation could lead to failure. A lack

of reading readiness seems to be a continuing problem for dyslexics, although gradually maturation will help alleviate it.

Because people do not have an equal response to opportunities, it is also true that rates, styles, and amounts of learning vary greatly from individual to individual. In the maturational continuum there are basic functions which a child can master unaided, such as reaching, grasping, sitting, standing, walking, running, etcetera. Communication is also successful at an early stage as information is passed on by means of intonation, gestures, facial expressions, and what we do with our bodies (Schell, 1975).

Thomas (1973) reports research concerning thirty-three families attending a dyslexia clinic. He found that where children are raised either in an environment of habitual laxity or else with very strict standards for all or for certain areas of cognitive growth, such as in reading or writing, this excess has effects that are deleterious.

In their first four years, most children generally master the basic grammar of a language, a remarkable feat considering the complex structures involved. As a result,

"all children exposed to one language or dialect of that language learn to understand other speakers of that language and end up using the same pronunciation, grammar, and vocabulary as the other members of their speech community. This means that each child in a speech community arrives at the same basic linguistic rules. This process appears to be a result of the child's ability to figure out the underlying structure of human language" (Fromkin & Rodman, 1978).

This appears to be consonant with Jean Piaget's theory that "intellectual development proceeds in an orderly sequence that is characterised by specific growth stages...that these stages enable the child to attain certain basic concepts necessary for intellectual maturity" (Turner & Helms, 1979).

Therefore, it is essential for educational programming and management to consider ontogenetic aspects. In this way, types of disability and variations can be remediated effectively for the well-being of those who suffer with specific reading difficulties.

The following Case Study was prepared from a taped interview and is reproduced by permission of the Subject.

CASE STUDY

Raewyn was raised in a remote country area with a predominantly Maori population in the central part of the North Island of New Zealand. Her father is a farmer and her mother spent much of her time ill. She attended a smallish country school.

The initial years of school life for Raewyn were extremely frustrating and so she frequently lost her temper. From the outset she found learning to read very taxing and was relegated to the lower stream of her class along with all the Maori children. The official text in use was the Janet and John series which she found very boring. Reading was taught through a whole word approach and by making inferences through contextual pictures. Raewyn disliked it intensely.

There was little phonic content in her reading programme until she reached intermediate school age. This was recognised by a substitute teacher of an older generation who then began inculcating phonic sounds for the six months that she was in the school; but this was grossly inadequate. The only children who knew their phonics were the top stream students whose parents were actually teachers.

For her secondary education Raewyn went to Rotorua. When Raewyn first had contact with books in order to read for herself, she was in her first year of high school. Previously, books had been for the bright students and books at home belonged to her sister who did not allow her to touch them. Now at school her teachers showed an interest in the whole class, encouraged them and communicated expectations of success to them. The English teacher was especially helpful, giving the class interesting books to read. For written work, Raewyn's teacher ignored spelling errors and looked for creativity and content. This showed her that the teacher at least attempted to understand what she had written

down on paper, albeit in bizarre spelling. The whole class felt the impact of this.

Though recommended for a general course, Raewyn managed to remain in a commercial course. She insisted on remaining in the commercial course knowing that she did not have English strengths to do History papers and so Raewyn learned typewriting. This brought a tactile modality into her learning style. Her ability to memorise was very good and by repetition and constant use she learned the order of the keys on the typewriter. She memorised words by their patterns and, again, by repetition, she learned how to spell them. Raewyn declared that this was what actually enabled her to pass her National School Certificate examination. Even now, years later, she still decodes unfamiliar words by recognising patterns.

Regarding handedness, Raewyn was made to use her right hand at school though for most things she maintains that she is ambidextrous. For the telephone she uses both ears. Her eyesight is very good and she possesses a good sense of direction. Her biggest problem is in sequencing certain numbers, for example, 2's and 3's, and 6's, 7's and 8's and reversing letters. By this is meant that they are written in the wrong cardinal position. She finds dialling telephone numbers difficult if they entail the above order.

In spelling, errors occur because of the way Raewyn hears sounds and it seems to be a phonetic way in which she interprets them. For example, determined = deturman; heavy = heave; wheel = weel; fright = frite; corridor = corerdoor. Homophones often get exchanged for the wrong one.

As a child Raewyn had difficulties with not being able to speak properly. For a dyslexic, reading aloud or speaking in front of a group is a taxing, fear-fraught, embarrassing experience. She recounts how the children in her class were cuffed over the ears, most times with a ruler, if they did not respond correctly. Under this type of pressure, often nervously, she made statements, and even whole sentences, backwards which induced further ridicule from her teacher. Due to these

sorts of experiences, Raewyn developed survival bluff techniques, such as never volunteering information, until high school. She reasoned that, by keeping quiet, noone knows what you know (or do not know). During this high school period, Raewyn made the decision to exert herself and try to achieve success for her own sake.

Other family members had similar problems of dyslexia. Raewyn's only brother was worse than she was. He entered the plumbing trade, doubtless because it suited his spatially oriented abilities. Her only sister, an artist, gained favourable attention through school on the merit of her art ability. Again, this shows evidence of spatial abilities.

Raewyn was determined to learn. By absorbing herself in study she gradually learned to forget her past unfortunate experiences and to be excited about participating in study even though it required at least twice the amount of effort of a normal person. Her enthusiasm gradually overcame the fear of reading. However, at school she refused to enter into sports because of its competitive element. Like others coping with dyslexia, Raewyn disliked competition.

Raewyn went to Japan where she received instruction in Aikido. At this time she was immersed in Japanese culture and language and began to absorb it. Her teachers and friends were all Japanese and were very patient and encouraging. This positive input gave tremendous impetus to her motivation to learn. She found that she began to absorb the Japanese language quite readily. The phonetic approach to language learning suited her.

Being an organised and energetic person by nature, Raewyn exerted herself in the study of Aikido and enjoyed the flow of its movements. However, it is interesting to note that she disliked teaching self-defence, compared with Aikido, because it reflected an unflowing element. But being in the Aikido circle meant she was a part of a group with similar aims and objectives. Also she knew acceptance. Indeed, this reflects the basic philosophy of Maori community life in which

Raewyn grew up. She has now successfully studied the art of Aikido for five years. This has helped her to gain confidence in her own abilities and she carries this confidence into her formal university learning.

The same "flow" found in Aikido movement, Raewyn experienced in writing hiragana. Hiragana she finds is beautiful and flowing. She dislikes the stiff katakana style and finds this very difficult to remember.

Raewyn's approach to the Japanese language through sounds and the logic of the phonetic system made much more sense to her than the often arbitrary principles of the English language. Through learning Japanese, Raewyn actually learned more about the sounds in English. Now, more mature, Raewyn is in the position to make comparisons which are helpful to her.

Raewyn learns kanji through their patterns. Common amongst those with dyslexia is good spatial ability and Raewyn is no exception. She has an affinity with patterns and often remembers kanji together with rhymes that go with the patterns. This kind of calligraphy is an art which is a Gestalt experience. The logographs are sensed and produced kinetically. As Chen¹ (1973) claims, they are "melodies" which are ordered in time and space. There are often intralogograph stories accompanying the formulation of the sometimes complex logograph which follow a pattern from left to right. The individual strokes must follow in an order that is temporal as much as spatial. Chinese characters must be learned by manual flow and not just by the eye alone. Chen propounds that logographs do not conform to static look-and-see pictures, seen and instantaneously understood. A directionalised scanning process is involved. For example, consider the way the following character is put together to give the meaning of "rest":

¹Cited in Links, A. (1973). On Writing, Reading and Dyslexia. N.Y.: Grune & Stratton.

1) A person = 人 2) a tree = 木 3) a person leaning against a tree = 休.
It has the meaning of "taking a rest; to have a break".

Access to reading Japanese through a mix of direct visual logographs and phonetic hiragana opened a system of reading that operates through both visual and regular auditory-oral skills. Combined with this is the kinaesthetic quality that arises through a Gestalt writing method. One mode assists another. This is essential if a dyslexic, such as Raewyn, labouring with a lack of one mode, namely, visual-auditory perception, is to sustain semantic meaning.

Raewyn has now successfully completed two years of university study of the Japanese language, even though she has had to work twice as hard as a student who does not have dyslexia and often feels discouraged because she is not rewarded with grades that are commensurate with the effort expended.

The following edited poem was written by Raewyn in her second year of high school:

Loneliness

It's empty,
It's long,
It's space;
Miles and miles of corridorred space,
Reaching far, far into the mind.
It's loneliness.

It's a cloud,
A cloud of cotton wool,
Floating about in space;
Lots of nothing,
But space.
It's loneliness.

It's a lonely hill,
Standing erect,
Reaching,
Reaching into nothing
But space.
It's loneliness.

Noone there,
Nothing here,
Nothing to love,
Or hate.
It's loneliness.

It's a feeling,
Not of joy,
But of nothing.
It's loneliness.

The mind is empty,
The heart is full,
So full
Of nothing.
It's loneliness.

Why?
Why this feeling
Of nothing,
Of noone?
Why?
It's loneliness.

This reflects Raewyn's outlook through the confinement of her reading problem.

THE PRESENT STUDY

In recent years there has been increasing interest shown in contrasted studies in reference to alternative procedures of learning. Related to this, neurologists and psycholinguists have been analysing brain mechanisms and the distinctive functions of the right and left cerebral hemispheres. It is commonly believed that language specialization takes place in the left hemisphere of the brain. When lateralization or cerebral dominance is spoken of, it refers to the degree of specialization that occurs within the dominant hemisphere.

According to research undertaken by Hatta (1977, 1985), it was proposed that there is a possible difference in hemispheric function in the task of processing two Japanese writing systems, namely, kanji (Chinese/Japanese characters) and hiragana (Japanese phonetic running script), c.f., Sasanuma (1974), Yamadori (1975) in working with aphasic patients; and Hatta (1977, 1978), Sasanuma, Itoh, Mori and Kobayashi (1977), and Tzeng, Hung, Cotton and Wang (1979) in normal people.

Therefore, the present study was undertaken to examine the memory processing of these two Japanese writing systems. The design was formulated to measure visuo-perceptual ability in word recognition through the medium of these two Japanese orthographies. The test examined visual-learning and verbal-recall of stimuli as well as a subset for direction-orientation in which Subjects matched scripts with appropriate signs. Visual perception and memory tasks were required to achieve explicit recall. Basically, this is a recognition memory experiment (Gearheart, 1985).

It is commonly recognised that dyslexics show strength in spatial abilities and, in acting on the notion that Chinese/Japanese characters are processed in the left visual field (right hemisphere), a design was formulated to test this in apposition to the phonetic hiragana script processed in the right visual field (left hemisphere) (Hatta, 1977; Ogden, 1984). The kanji script is comprised of characters which may symbolize a whole word without indicating any information about

pronunciation while the hiragana is composed of syllables of the spoken language, for example, ka, ki, ku, ke, ko; sa, shi, tsu, se, so; ma, mi, mu, me, mo and so on through the Japanese alphabet. Tsunoda (1985) postulates that consonant-vowel syllables, such as these, are processed in the left hemisphere.

Chinese/Japanese characters contribute a complex composition to language through immediate visual-lexical entry that is unique. For this reason, the present study was undertaken to investigate the two scripts in reference to locus of hemispheric specialization and dyslexia.

It is predicted that the dyslexic Subjects will not perform any better than the control group in the visual or verbal memory for recall tasks. It is also expected that the dyslexic group will be able to process the kanji script more readily than the hiragana script.

METHOD

6.0 Design

A 2x2 factorial design was used with two groups of Subjects (dyslexia and control) and two types of Japanese script (kanji and hiragana). All Subjects participated in three experimental sessions in succession.

6.1 Subjects and Sampling

The present study was undertaken with two independent groups of ten intermediate school age pupils enrolled in an urban intermediate public school. One group of Subjects had been educationally diagnosed as dyslexic and referred to a special remedial reading programme. From the same school a control group of ten Subjects with normal reading ability was also chosen, thus minimising racial, ethnic, and socioeconomic factors. Both the group and the control group composing the test population were matched for age (subjects were between 11-13 years of age). Each group of ten consisted of eight boys and two girls. The criterion for this selection was based on the fact that the incidence of reading difficulties seems to be proportionally greater in the male population than in the female (Bannatyne, 1971; Critchley, 1970, 1981; Naidoo, 1972; Pavlidis & Miles, 1981; Wilson, 1967).

A further criterion for selection for the experiment was that the dyslexic group's reading achievement level was estimated to be at least two grades below the norm of the control group. This stipulation is consistent with other research examining dyslexia in relation to normal reading ability, c.f., Naidoo, 1972; Myklebust, 1973; Pavlidis & Miles, 1981; Tansley & Panckhurst, 1981. All Subjects had normal vision and hearing, did not lack educational opportunity, English was their first language, and there were no diagnosed neurological disorders nor physical disabilities. These Subjects differed from controls only in terms of exceptional difficulty in reading, spelling and writing.

In order to build a profile of strengths and weaknesses for the purpose of remedial reading selection, the Burt reading test and the Progressive Achievement Tests were applied. These scores may be seen in Appendices XIII and XIV respectively.

6.2 Pilot Study One

In preparation for the present study, a pilot study was administered in order to establish a satisfactory presentation strategy, to evaluate the timing procedure, and to make any necessary adjustments.

Nine Subjects were tested individually. Initially, 50 cards were displayed in five rows of 10 for each Subject as follows:

Row one	English words
Row two	Stimulus pictures
Row three	Romanized script
Row four	<u>Hiragana</u> script
Row five	<u>Kanji</u> script

A ten minute time constraint was given as a processing allowance. The row of English words proved to be redundant as did also the romanized script. By eliminating the five rows of displayed stimuli to three and reducing the number of cards to 30, (20 in use at one time i.e., picture stimulus plus the hiragana script followed by the picture stimulus plus the kanji script) the amount seemed reasonable to indicate any significant differences in processing facility. However, this time limit also seemed to be too generous, allowing for ceiling effects. For the results of this pilot study see Appendix III.

6.3 Pilot Study Two

A further pilot study was performed in order to establish a more satisfactory time limit with four boys, 10 years of age, attending a primary school. These Subjects were given an allowance of three minutes to memorize the relevant cards and three minutes to recall and rearrange the cards. This appeared to be a too stringent time limit for the memorization task. For results see Appendix IV.

On the basis of this pilot study, it was decided that a selection of Subjects from the 11-13 age range would be strategically suited to the test in hand in that cognitive development should be at the transition stage for formal operations. The time constraint was altered to allow for four minutes' processing and for three minutes' recall.

MATERIALS

7.0 Test One

Three sets of ten cards were prepared. Ten stimulus cards of high-frequency noun pictures were constructed. Ten kanji cards representing the stimulus word equivalents were then constructed. In addition, ten cards written in hiragana script for the stimulus pictures were prepared. Short, two-syllable words were selected to avoid any possibility of interference effect between adjacent letters that would possibly occur if long words were employed. In order to avoid any effect of frequency of script in writing, no single syllable was repeated in the hiragana script. For examples of these three sets of cards see Appendix II(a).

7.1 Test Two

Five cards from each separate orthography, randomly selected from those successfully recalled in Test One, served as test stimuli. Correct naming of each appropriate noun was required in English.

7.2 Test Three

A subtest for directional confusion which has been noted to be associated with dyslexia (Naidoo, 1972) was administered. A set of four cards with arrows drawn on them was prepared as well as their equivalent readings in both kanji and in hiragana scripts. These four stimulus cards represented four directions, namely, 'up', 'down', 'left', and 'right'. Each orthography card corresponded with an appropriate arrow. For examples of these stimulus cards see Appendix II(a). Contrary to Test One, Test Three employed both the kanji characters and hiragana script simultaneously.

PROCEDURE

8.0 Test One (a) kanji, and Test One (b) hiragana.

There were 20 items for each test. The tests described above were administered to each Subject individually. In order to control for order effects, half of the group worked on kanji cards first and the other half of the group worked initially on hiragana cards. Testing was administered in a quiet room with each Subject seated at a separate table during which time there were neither interruptions nor distractions. The Subjects were instructed to examine the ten stimulus cards set out in a straight row before them and to memorise the kanji card that corresponded to each stimulus card. (For verbatim instructions to the Subjects see Appendix II(b)). The order of each stimulus card presented was the same for each Subject. A time constraint of four minutes was placed on this exercise.

An interval of five minutes followed the initial four minute test during which time the Subjects were required to participate in a distracting task so that they were not rehearsing the scripts.

In preparation for the second phase of the test, the stimulus cards were rearranged in a different order by the Subjects. The instructions were identical for each Subject. The kanji cards were shuffled, then checked to ensure that the logographs were all facing the correct way in one pile before each Subject. Each Subject, again, had the cards placed in identical order. A further time constraint of three minutes was granted to sort the cards and recall the correct match, one-to-one, of each kanji card with its equivalent stimulus card. On completion, the number correct was noted and recorded on a chart for each Subject.

This procedure was repeated using the hiragana script in the same way.

8.1 Test Two

From the list of correct responses made in Test One, five cards each were selected from both the kanji and hiragana scripts. These cards were presented randomly to each Subject individually and answers noted on a chart.

8.2 Test Three

Twelve cards were presented to each Subject in the following order:

Row one	<u>Kanji</u> script cards
Row two	Cards with symbols for directions
Row three	<u>Hiragana</u> script cards

Each card corresponded with its equivalent. Subjects were permitted one minute for memorising the cards. After a break of five minutes working on a distracting task, each Subject was given a time constraint of 30 seconds to set the cards out again in correct order. No verbal test was administered on this experiment.

RESULTS

9.0 Data Analysis

Results were analysed by a two-way analysis of variance (treatment-by-levels design). Planned comparisons using the t-test for related samples were also used to clarify differences of particular interest.

9.1 Test One Visual-Learning

A two-way analysis of variance was used between two groups of Subjects (dyslexia vs control) in the task of memorising two modes of script presentation (kanji and hiragana). Raw scores for visual-learning are presented in Appendix VI. These results are graphically presented in Figure I.

Results from a two-way analysis of variance show that there was a significant main effect for script type $F(1,36) = 28.125$, $p < .001$. There was also a significant main effect for group. $F(a,36) = 15.12$ $p < .001$. Interaction effects between group and script did not reach significance. (For Summary Table see Appendix VII.)

Mean correct responses

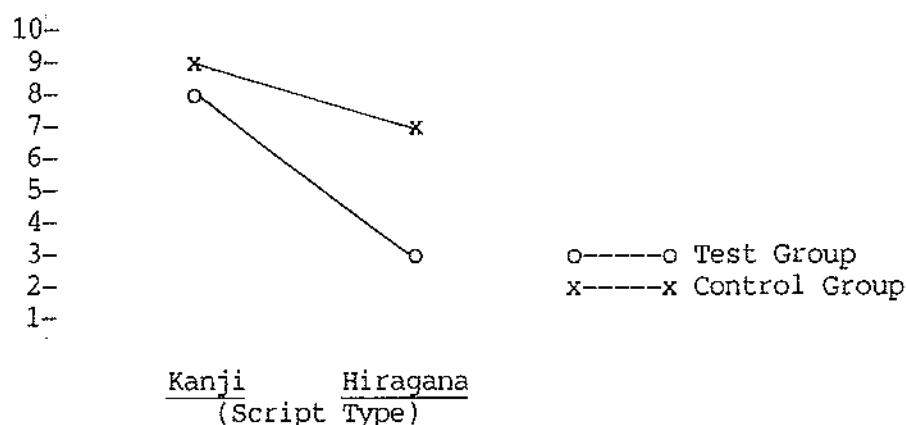


Figure I—Mean correct responses for two groups of Subjects for items presented for visual-learning in two Japanese script types.

These results indicate that, for both groups, kanji script was more readily learned (i.e., more correct responses) than the hiragana script.

The significant group effect illustrates that control Subjects gave a higher number of correct responses for both types of script than the dyslexic Subjects.

Distribution of the mean frequency of word recognition for Test One is as follows in Table 1:

Table 1

A comparison of the number of correct responses in kanji and hiragana script stimulus cards:

<u>Kanji</u>	dog	flower	boat	river	mouth	horse	rain	book	bird	moon
Test Group	8	7	5	8	9	9	7	5	8	7
Cont. Grp.	8	7	8	10	10	8	8	8	6	8
<u>Hiragana</u>										
Test Group	3	3	3	2	8	3	2	4	4	2
Cont. Grp.	5	7	6	6	7	5	6	7	6	7

Table 1 shows that both the dyslexic group and the control group were able to recall kanji much more efficiently than hiragana. The dyslexic group's performance on the kanji recall was almost as accurate as that of the control group and, in two categories, namely, "horse" and "bird", it was superior. The recall of two categories, "horse" and "bird", involved logographs that are similar in appearance and thus require greater attention to detail for a successful response.

9.2 Test Two Verbal Recall

Results from a two-way analysis of variance show that there was a significant main effect for script type $F(1,36) = 13.15, p < .001$.

Main effects for group were non-significant. There was a significant interaction between group and script $F(1,36) = 7.51, p < .01$. The experimental group gave a greater mean of correct responses on kanji than controls and a lower mean on correct responses on hiragana. (For Summary Table see Appendix IX.)

Raw scores for verbal-recall are presented in Appendix VIII. These results are graphically presented in Figure II.

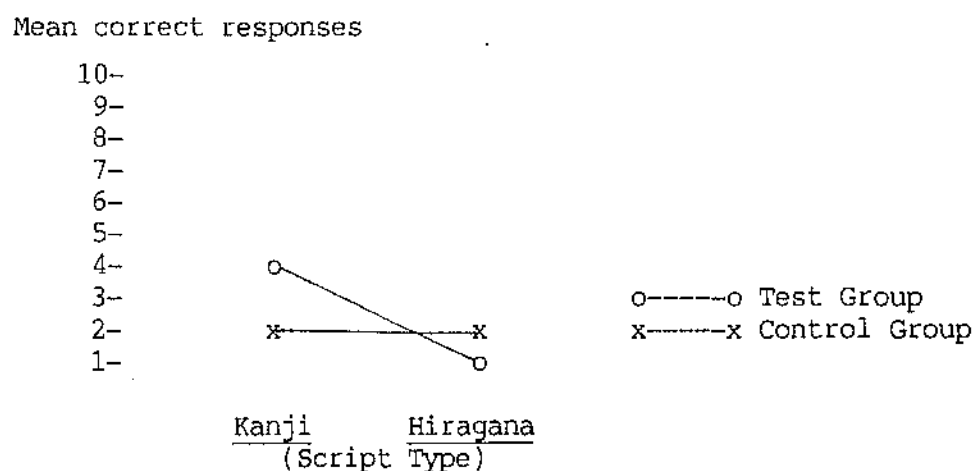


Figure II—Mean correct responses for two groups of Subjects on verbal-recall presented in two Japanese script types.

A t-test for related samples showed that for the dyslexic group, verbal recall for kanji script was stronger than it was for hiragana. These differences reached significance (t (df = 9) = 5.750, $p < .001$). Differences between recall for kanji and hiragana did not reach significance for the control group (t -(df = 9) = 2.250, $p > .05$).

9.3 Test Three Direction Orientation

There is a significant interaction ($p < .05$) between group and script ($F(1,36) = 4.142$).

Subjects in the dyslexic group tend to show higher correct responses for kanji than Control Subjects and lower correct responses than the Control group Subjects for the hiragana script.

The main effects for script did not reach significance.

The main effects for group did not reach significance either.

(For Summary Table see Appendix XI.)

Mean correct responses

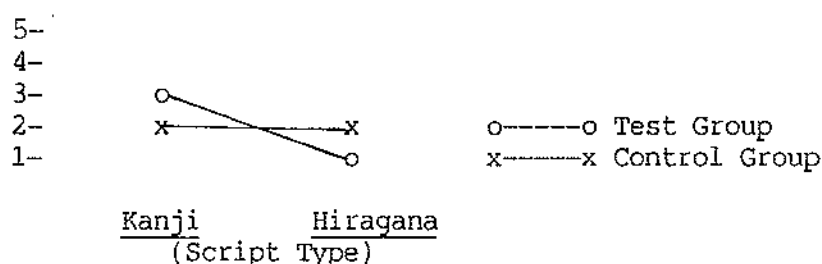


Figure III—Mean correct responses for two groups of Subjects on direction-orientation presented in two Japanese script types.

Planned comparisons using a repeated measures t-test for related groups were performed. (Raw data may be seen in Appendix X). Results for this analysis were:

Test Group $t = 2.8485$, $df = 9$, $p = < .02$ This difference reached significance.

Control Group $t = 0.5024$, $df = 9$, $p = > .20$ NS

Responses from Control Subjects show that script type was not an important factor in their ability to process directional information; performance on directional information for the dyslexic group was clearly influenced by script type.

DISCUSSION

The major aim of this present study is to examine the syndrome of dyslexia as to its characteristics and possible causes through an historical perspective, culminating in where some recent research emphases lie in relation to the learning of the Japanese language and its concomitant effects.

Among studies of dyslexia there is a tendency for some to equate the problem with dysfunction and anything that cannot be explained is referred to as minimal brain damage (Ross, 1977). Because there appears to be a greater number of boys who are dyslexic, it could be interpreted that they are more susceptible to deficits either developmentally or neonatally (Masland, 1981). Orton's (1925) thesis that dyslexia could be attributed to the way the brain is organized leads to the conjecture that there is a certain amount of ambivalence until cerebral dominance is established (Davidson, 1984 cited in Leventhal & Tomarken, 1986). Results of the present study reflect several pertinent areas.

10.0 Lateralization

This present study shows a significant ability among the dyslexic group to process left visual field stimuli (RH) which includes kanji and a significantly lesser ability to cope with right visual field (LH) stimuli which is represented in hiragana. These findings correlate with Zaidel's (1976; 1978 cited in Masland, 1981) report of cases where the sectioning of the corpus callosum has indicated a retention of considerable reading ability as long as it was not founded on a phonetic pattern to be processed visually. This points to the right visual field (LH) lateralization of consonant-vowel patterns, thus correlating with Tsunoda's (1985) findings, and born out in this present study. Visual spatial processing is superior in the right hemisphere whereas it seems the phonologic processing of graphemic symbols in the left hemisphere require an auditory accompaniment to become effective. Masland (1981) says that this will depend on the establishment of a stable association between what is visualised in the right hemisphere and its sequential

auditory patterns in the left hemisphere. Bakker (1978) indicates that this may vary according to people and circumstances.

Lateralization for language in the bilingual is a flexible, dynamic process that is prone to absorbing environmental sensitivities and influences. Perceptual strategies and cerebral organization is different from the person exposed to only one language. Albert and Obler (1978) maintain that though it is commonly accepted that the left hemisphere is dominant for language, the right hemisphere might be equally capable of acquiring language. This adheres to Tsunoda's theory (1985).

In his own case, when visiting foreign (Indo-European speaking) countries, Tsunoda also noted "a loss in sense of direction and geographical orientation as well as a slight headache" (Pp.99-101). Tests showed that this was not due to jet lag but, rather, to the influence of a foreign language and the shifted dominance did not normalize for approximately a week on return to his usual environment.

The implication here is that a shift in dominance patterns produced by switches in the mechanical processes of two quite different languages could impose an increased work load and a scrambling effect on cerebral hemispheres.

Culturally specific approaches to education need to be created to meet the needs of those whose backgrounds vary from what has been regarded as "universal". This might require the compilation of additional batteries of tests in order to reflect the attributes of non-Western cultures.

Albert and Obler suggest that this knowledge could be put 1) to therapeutic use and 2) to educational advantage. Therapeutically, an emphasis on right hemispheric activities could serve as a "deblocking technique to facilitate recovery of a patient's usual language" (p.254) and educationally, visuo-spatial modes of learning could develop language skills more readily if traditional approaches failed to attain their goal.

Simpson (1979) denotes that it is commonly believed that dyslexics cannot learn a second language but testifies to the fact that within two years' hard work she could speak French. However, she could not read it. The Subject in the biographical Case Study is also proving that she can learn a foreign language, namely, Japanese, (both orally and written) with lots of perseverance and hard work.

10.1 Heredity or Environment

The controversial question of whether dyslexia is attributable to heredity or environmental causes is also of significant interest. From the viewpoint of heredity, Bannatyne, (1971); Naidoo, (1972); Vellutino, (1979); Lerner, (1985) and others all indicate strong evidence toward familial links in the majority of cases of dyslexia. Exceptions will be in those areas clearly identified as dysfunction due to some type of brain injury. An interesting facet of this considerable research is the contribution made by Bannatyne (1971) which correlates paternal occupations with the incidence of dyslexia. Those fathers whose dominant interests and careers encapsulate tasks that highly develop spatial skills could well encourage nonverbal creativity and insights that develop the right hemisphere to the impoverishment of the left. In the present study, paternal occupations all involve spatially oriented skills. With the greater number of males who have problems of dyslexia this raises the notion that factors relating to sex seem to be relevant to conditions that are contributive to anomalous cerebral dominance. Long-term case studies would be beneficial in this area.

Linked with this notion is the impact of environment between the crucial age of 6-8 years, postulated by Tsunoda (1985). Piaget (1971) and Havighurst (1972) both propound the importance of age-stages to determine functions that should be performed before other growth and development takes place. Depending on environment, developmental lag could well be a relevant issue if appropriate maturation has not occurred, for learning depends on maturation (Turner & Helms, 1979). Life-style can be seen as a crucial link here. If, for instance, the

New Zealand Polynesian community displays a similar cerebral dominance pattern as Japanese, the factors contributing toward this could well be examined. Briefly, several pointers become apparent:

1) There is a difference between the East and West in teaching and learning styles. The East has a tendency to discuss issues and then make a decision about how to proceed.

2) In the West, programmes are predominant whereas in the East relationships are also important. The crucial factor is to differentiate between being goal-oriented or people-oriented.

3) In the West, the concept of achievement is the driving force. It is a competitive world. For the Easterner, though there is still competition, harmony is adhered to. Life is group-oriented and consensus with concord is all-important.

4) The West was fed from early times on Greek philosophy and abstract ideas that are theorised. In the East, while China had its great philosophers such as Confucius and Mencius, Chinese and Japanese people have more easily grasped concrete concepts and realistic ideals that could be worked out in practice.

5) The West is composed of an individualistic, splintered society, whereas in the East, it is the family and the group that is central.

If the above habits and strategies are inculcated during the early formative years, then there will be major adjustments upon school entrance, for this engages a totally different system and new entrants will be ill-prepared for it. Influences brought to bear upon cerebral dominance patterns will be such that will cause a child considerable confusion and frustration, particularly if these patterns have become lateralized during crucial early years through the influences of a mother tongue and culture.

Essentially this is in agreement with Erikson's (1959, cited in Lerner, 1976) maturational theory that postulates critical periods of development. In ontogeny, Erikson maintains that maturation has a critical time limit for development. If certain prescribed growth in an individual does not take place at a certain time, the rest of that

individual's development will be altered unfavourably (Lerner, 1976; Turner & Helms, 1979).

Supposing that hemispheric specialization takes place in one context during the critical period propounded by Tsunoda (1985), in accordance with Erikson's maturational theory, it could well follow that a new context will make some challenging demands which, for some, might prove very unsuccessful.

The Caucasian Case Study included in this present research is one such example of this. Raised in a Maori community and predominantly speaking the Maori language, lateralization in a pattern different from what was required to learn in the Western situation would only mitigate against the learning task. Without a teacher cognisant of the problem, impaired reading attempts would tend to become aggravated with a record of unsatisfactory progress and considerable frustration.

It seems that the primary source of difficulty for dyslexics in the reading task might be in phonological recoding. It was in this respect that the Subject in the Case Study found new facility in learning Japanese, because the process of seeing and hearing consonant-vowel mora was so regular. This could possibly have been a benefit in her approach to learning written skills in English had it been applied over an extended time, particularly throughout her primary school days.

The mixture of phonographic and logographic scripts in the Japanese language system provides an opportunity to examine the facilitation of each type of script in memorization tasks. A study of these can also give valuable leads to understanding processing skills of those with dyslexia.

10.2 Ontogenetic Aspects

Rodman and Fromkin's (1978) findings are seen to agree with those of Tsunoda on the point that language acquisition coincides with a critical age-stage, although they suggest that lateralization is complete by

approximately five years of age. It is not the concept of age-stage that is questionable here, however, so much as the continuity-discontinuity controversy. Rodman and Fromkin (1978) agree that language learning accompanies lateralization, but what conditions lateralization seems to be the point in question. If the Japanese language and Polynesian languages cause differing specialisation in the cerebral hemispheres, then are certain aspects of "pre-programmed" hemispheric language-learning theories in question? Research needs to consider wider national biases as well as regional biases in order to note the effects of differing environments and value systems upon neurolinguistic development.

10.3 Culture, Language and Emotions

A general consensus amongst researchers seems to be "that the perceptual processing of emotional stimuli is primarily under the control of the right hemisphere" (Leventhal & Tomarken, 1986:583). Concerning this distinct area of research, Tsunoda (1985) agrees that this is so for those who speak an Indo-European language as a mother tongue. He places the Polynesian languages and the Japanese language into a different category because of the predominant characteristic of vowel affluence. However, an area needing qualification concerns cognitive processes that occur under the influence of specific stimuli (Leventhal & Tomarken, 1986). Tsunoda's (1985) hypothesis that culture, language processing and cerebral lateralization are all interrelated is of particular interest in relation to the present study.

Rossi's (1967) studies among Italians showed a converse finding for emotions to those found by Tsunoda. This led Tsunoda to continue experimentations using the Wada technique. In this method, amytal (or myntal) was injected through the ipsilateral carotid artery temporarily anaesthetising a cerebral hemisphere. As a result, he confirmed his earlier findings that, for Japanese subjects, the sounds of nature and human emotional sounds and sounds of Japanese instruments are lateralized in the verbal hemisphere. For Japanese the lateralization of Western music and noise also is in the left hemisphere. His research

with subjects from among many nationalities confirms that these emotional functions are lateralized in the right hemisphere in Westerners. A shift effect in dominance was found to take place when a subject was projected into a Western situation.

Leventhal and Tomarken (1986) signify that Western studies have now found that both hemispheres respond to emotional states. Negative responses affect the right hemisphere while positive affects are registered in the left hemisphere. However, this is possibly a broad over-simplification of what is the actual intracortical organization. So much still needs specific research, drawing on a broader spectrum of nationalities. This could also bring valuable links to understanding specific learning difficulties and in helping to alleviate them.

10.4 Script Type

Vellutino (1977) denotes that dyslexics barely have any deficiency in the processing of visual tasks where overt or silent speech recoding is not essential. In the present study, this was also apparent in processing kanji as shown in the ANOVA results where a significant main effect for script type was found, whereas the processing of hiragana showed considerably less facility. Where letter and word recognition is involved, dyslexics are seen to take longer to process them.

Sasanuma (1980) contrasted these two orthographical systems where students had prior knowledge of the scripts. In the present study, there was no prior knowledge, yet, in accordance with Sasanuma's findings, Subjects still found kanji processing much easier than hiragana. The notion that kanji is a visual-lexical type of script is doubtless the reason for this. Consequently, this can be processed through visual-spatial patterns. Hiragana, on the other hand, fits into a phonological system and does not make any lexical sense outside of this process but, additionally, visual errors can also occur where symbols appear to be similar, for example, わ, ね, ぬ, ぬ.

The Subject in the current Case Study has certainly used strategies which utilised patterns and rhythm.

10.5 Memory

The present study gave evidence that, contrary to the prediction that the dyslexic group would not be able to recall the script types any better than the control group, the performance of the dyslexic group was significantly better in visual memory for recall, when kanji were used as stimuli and presented simultaneously as in Test One.

In Test Two, where there was a sequential presentation of script types, contrary to Frick's (1985) findings, in testing specific categories of "time" and "space", there was no difference between a method that represented "temporal order" and "spatial order" when processing the kanji script. The area where extreme patterns of memory recall performance did occur was, as predicted, concerned with the hiragana script.

An eleven year old Subject in one of the pilot studies was said to have no short-term memory and was dismissed as never being able to learn to read. Upon doing the kanji test, it was seen that, not only could he remember logographs very well (100% correct), he was also very quick in processing them by memory for recall. He worked more quickly and accurately than some high school and university Subjects were seen to do, despite their good concentration and strategies.

A sixteen year old confirmed dyslexic girl involved with the pilot study also indicated a very superior performance on both kanji and hiragana (100% accuracy and very quick to recall). Normally her performance with reading and the English writing system is slow and she requires extra time to complete work. She really surprised herself on her performance in the experiment.

GENERAL SUMMARY

The results of the present study showed that, in the three categories, kanji was learned more readily than hiragana for both the experimental group and the control group. For verbal recall, the experimental group's performance showed greater extremes than that of the control group. This was also significant in the experiment for direction-orientation.

It was apparent that Subjects in both the pilot studies and the experimental situations utilised specific strategies to facilitate the retention and recall of information. Some covered cards with a hand, others closed their eyes, and some shuffled and re-sorted the cards after a very brief period of memorization. Contrary to expectations, the experimental group did not appear to take any longer to process the kanji. Some memorized them very rapidly. Both groups found the hiragana script more difficult to process and took longer to do so.

The composition of language is what makes one language differ from another. The English orthography has an alphabet of twenty-four letters comprising consonants and vowels. Groupings of these differ widely and do not always equate in sound as they appear in phonemes, for example, plough, cough, dough. Kana, on the other hand, are syllables that are perfectly regular, pronounced consistently and, therefore, are easier to process as the Subject in the Case Study has confirmed.

Whereas visual learning may be strong for some effects, it needs to be noted that, in situations where this is weak, another mode of learning needs to be added to effect learning, for example, an auditory, tactile, or kinaesthetic modality. For dyslexics, in particular, a combination of modes of learning may be necessary as well as being very effective.

Vernon (1984) points out that, in many cases, up until the late nineteenth century many children were raised in very practical families. Added to this, early childhood education still dwells on practical aspects and artistic activities. But, upon entry into primary school, the emphasis is more on left brain activities which are centred around

reading, writing, and mathematics. Somehow, alternative modalities need to be explored for those who show signs of not coping with traditional approaches to learning so that right brain (LH) deficits may be compensated through left brain (RH) strengths. For example, the wider use of typewriters, computers, ear-phones, audio-visual equipment and such which late twentieth century technology is producing so plentifully and which those with left brain (RH) strengths can utilise effectively. This is especially so if memory processes show deficits for these have an influence on learning as they interact dynamically with other cognitive processes (Gearheart, 1985). Those dyslexics who indicate good spatial ability may become very good at such things as chess, computer games, card games and geometry. In professions that require superior spatial ability, such as engineers and scientists, such students could do well.

It is tremendously important that those with reading difficulties make haste slowly so that no crucial step is overlooked in the developmental process. In this way, alternative modes will facilitate learning for those with dyslexia, taking the cue from cerebral hemispheric patterns of other nationalities, such as the Japanese, whose environments have fostered other learning styles.

Tsunoda's (1985) theory postulates that for Japanese, when the influence of an unknown language occurs, there is a switching mechanism at the subcortical level. This can be equated with the effect of a string of unknown syllables which has a warping action on the hemispheric patterns. Once this stimulus is removed the patterns return to normal again. His studies have shown that when a language environment is constant until almost nine years of age, no matter what the nationality, a second language learned after that time does not alter the lateralization pattern. It is important to note that switching mechanisms are involved with at least two types of organization, namely, the consonant-prevalent type of the Indo-European languages and the vowel-predominant type of Japanese and Polynesian languages. These two systems clearly need approaches to oral and written language skills in ways suited to their cerebral organization patterns. Tsunoda's concepts

are well worth further investigation, particularly in terms of vowel processing in relation to those who are hindered with dyslexia.

APPENDIX I

GLOSSARY OF TERMS

agrammatism: a form of dysphasia in which the power of grammatical and syntactical expression is lost; inability to learn grammar.

agraphia: inability to write; absence of power to express ideas in written form.

alexia: a loss of power to read: word-blindness.

anomalous dextral: an irregular right-handedness; one deviating from the rule of using a predominant right hand.

aphasia: inability to express thought in words, or inability to understand thought as expressed in the spoken or written words of others, by reason of some brain disease; without speech.

auditory perception: organizing and identifying what is heard through the ear.

calligraphy: handwriting; beautiful handwriting. (Gk. kallos, beauty. Kalligraphia).

contralateral: (pathway) A route relaying information from the right to the left hemisphere crossways and vice versa; relating to the opposite side.

decoding: an ability to understand what is expressed either verbally or visually.

dextral: right-handed.

dysgraphia: difficulty in writing and spelling; not as severe as agraphia.

dyslexia: difficulty in reading or in learning to read; difficulty in dealing with words, generally associated with dysgraphia.

dysphasia: difficulty with speech; inability to coordinate words and arrange them in correct order due to a lesion in the central nervous system.

familial: characteristic of a family.

Gestalt: form, shape, pattern, organised whole or unit. Perceived organized whole that is more than the sum of its parts, e.g., a melody as distinct from the separate notes of it (Concise Oxford Dictionary).

grapheme: smallest unit of sound which cannot be reduced further in a language, e.g., 'th' in 'thought', 'though'; 'a' in 'ate', 'at'.

hemispheric synergy: specialised actions requiring particular movements within either of the hemispheres of the brain.

intralogograph: within a logograph.

ipsilateral: (pathway) relaying of information along the same side of the brain; pertaining to one hemisphere.

kana: katakana and hiragana; phonograms.

Kanji: Chinese characters or logograms in the Japanese language.

kinaesthetic: sense of muscular effort in voluntary movement of body.

kinetic: of or due to motion; movement for its effect.

lateralization: one-sidedness, either left or right in reference to cerebral hemispheres.

logogram:) sign or character representing a word. These terms are used interchangeably with 'ideogram' and 'ideograph' in literature.

logograph:)

morpheme: word-structure.

morphology: how to form new words.

mutism: dumbness.

occipital lobe: area of the brain concerned with vision.

ontogenesis: history of the development of an organised being.

orthography: correct or conventional spelling.

paraphasia (verbal): semantic substitutions approaching jargon; a form of aphasia in which one word is substituted for another.

parietal lobe: area of the brain concerned with visual association.

perception: a process which organizes or interprets stimuli received through the senses.

perception of spatial relationships: the way in which two or more objects are perceived in relation to each other.

phoneme: unit of significant sound in a language, e.g., initial consonants.

phonemic paraphasia: substitutions of speech sounds in any one language.

phonological system: inventory of sounds in a language.

phonology: how to produce sounds and pronounce sentences.

Psycholinguistics: a combination of Psychology and Linguistics as a field of study which examines the total language process.

semantic: relating to meaning in language; the connotations of words.

semantic paralexia: semantic errors in reading single words orally.

sinistral: left-handed.

subcortex: the white matter of the brain which lies immediately beneath the cortex.

subcortical: lying underneath the cerebral cortex.

visual perception: identifying, organising, and interpreting what is received by the eye.

visuo-motor ability: an ability to perceive visuo-spatial materials, to perform relevant mental operations and to respond with hand movement for the final solution of the problem.

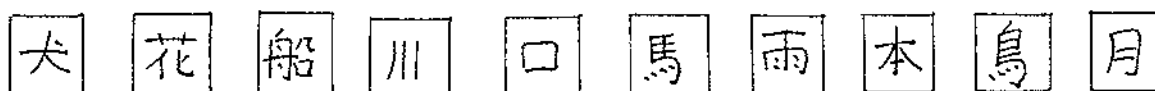
visuo-perceptual ability: an ability to perceive visuo-spatial materials and to perform relevant mental operations without the involvement of hand movement.

APPENDIX II (a)

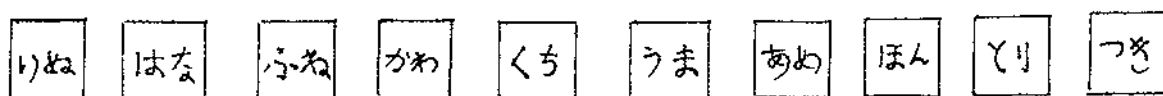
Experiments 1 and 2:

Stimulus cards and scriptsKanji script

dog flower boat river mouth horse rain book bird moon



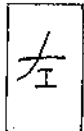
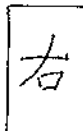
Stimulus cardsHiragana script

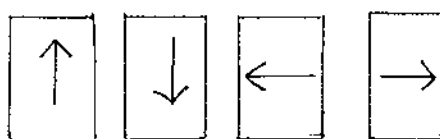
dog flower boat river mouth horse rain book bird moon


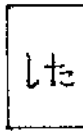
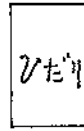
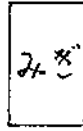


Experiment 3

kanji

up	down	left	right
			

Stimulus cardsHiragana script

up	down	left	right
			

APPENDIX II (b)

Test Instructions to Subjects

Before commencing:

In front of you is a row of ten picture cards. Look at each picture card and we will say the name together so that you know what each card represents.

Underneath each picture card is a card with a Japanese character written on it. This Japanese writing represents the word for the picture above it.

I will give you four minutes to memorize these card pairs. After four minutes the cards with Japanese characters will be shuffled and the picture cards will be changed around into a different order. You will be given another task activity until we are ready to begin the second part of the test.

Are there any questions? You may begin.

After the 5-minute interval task was completed:

Starting from the left side of your desk and moving toward the right, please place the picture cards in this order -- (Investigator dictates a random order for each subject to place the cards in a straight row.)

The cards with Japanese characters are now shuffled and are placed in one pile in front of each of you. You will be allowed three minutes to match the Japanese characters with their picture cards.

Are you ready? You may begin.

APPENDIX III

Pilot Study 1 (Age range = 10-26 years) (5 rows of cards)

		Number correct	
Larry (16)	H.	8	
	K.	3	
Rosemary (13)	H.	0	
	K.	3	
Rita (16)	H.	10	
	K.	10	
Shane (17)	H.	4	
	K.	10	
Michael (24)	H.	10	
	K.	10	
John (26)	H.	7	
	K.	8	
James (15)	H.	10	
	K.	10	
Audrey (13)	H.	10	
	K.	10	
Dick (10)	H.	5	
	K.	6	

In the results some cards were upside down.

All English and most of the Romanized script was accurate.

APPENDIX IV

Pilot Study 2 (3 minutes' memorizing, 3 minutes' recall)

Concrete nouns---

Ss Script dog flower boat river mouth horse rain book bird moon

Garry (10)	H.	*						*		3
	K.	*			*					2
Alan (11)	H.	*			*			*		3
	K.	*		*	*			*		5
Barry (10)	H.				*					1
	K.		*	*	*			*	*	5
Andy (10)	H.								*	1
	K.				*				*	2

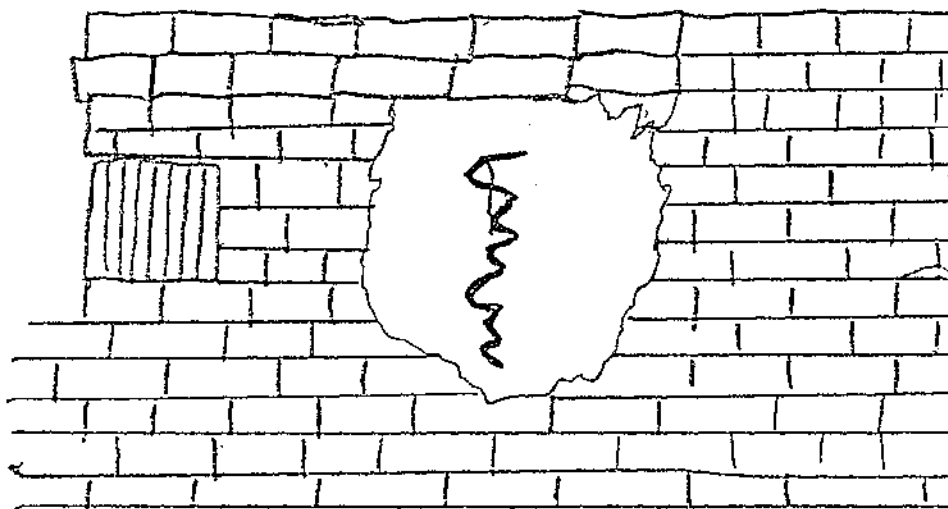
Directions---

		up	down	left	right	
Garry	H.	*		*		2
	K.		*		*	2
Alan	H.	*			*	2
	K.	*	*	*	*	4
Barry	H.					0
	K.					0
Andy	H.		*	*		2
	K.	*	*	*	*	4

APPENDIX V

Poem written by a dyslexic Subject

A Policemen is clear and fear
 And sticks up for the inersint one.
 There are bary to and from walls
 To put the crimals behind to have a tatic
 Police are big police are small but try
 to be the searist of all.
 blue blue uniforms give respect to all.



APPENDIX VI

Story written by a Dyslexic Subject

I was a skill full fighters my Quster
 was to brack the ~~eye~~ eye of erarick
 wick wood brack the spell that
 wood ~~releases~~ release the gold Dragon
 from the cave in the morten. I set
 off for the montan of misteres
 I star to climb. $\frac{1}{2}$ way up the montan
 there was a cave. outside the
 cave was a skion ~~that~~ with a ~~son~~ sword
 in ~~the~~ hand. I grad the ~~sword~~ sword
 I worked in to the cave. ^{in the cave, saw a Table.} on ~~the~~ a
 Table was the eye of erarick. a
 fire Bull shot out of the sword.
 eye of erarick exploed and to
 gold Draylon was release. the gold Draylon
 is the guide of the mo:inter

APPENDIX VII

Means and Standard Deviations on Related Samples for Two Groups of Subjects on verbal-learning tasks.

Test 1

Test Group (Dyslexia):

<u>Subjects</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	10	2	+8	64
b	8	6	+2	4
c	7	4	+3	9
d	7	4	+3	9
e	7	1	+6	36
f	7	4	+3	9
g	10	4	+6	36
h	5	0	+5	25
i	5	5	0	0
j	7	3	+4	16
10	73	33	$\Sigma D+40$	208

Control Group:

<u>Subject</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	10	10	0	0
b	6	3	+3	9
c	10	10	0	0
d	10	10	0	0
e	10	6	+4	16
f	10	10	0	0
g	8	3	+5	25
h	8	3	+5	25
i	3	2	+1	1
j	10	8	+2	4
10	85	65	$\Sigma D+20$	80

APPENDIX VIII

Test 1

SUMMARY TABLE FOR ANALYSIS OF VARIANCE

Source	df	SS	MS	F	
Script type	1	90	90	28.125	p < .001
Group	1	48.4	48.4	15.12	p < .001
Cells	—	148.4			
Group x Script	1	10	10	3.12	NS
Error (within)	36	115.2	3.2		

APPENDIX IX

Test 2

Means and Standard Deviations on Related Samples for Two Groups of Subjects on verbal-recall tasks.

Test Group (Dyslexia):

<u>Subject</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	5	4	+1	1
b	5	4	+1	1
c	4	1	+3	9
d	4	0	+4	16
e	5	0	+5	25
f	3	1	+2	4
g	5	2	+3	9
h	2	1	+1	1
i	3	1	+2	4
j	5	1	+4	16
10	41	15	$\Sigma D+26$	86

Control Group:

<u>Subject</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	3	3	0	0
b	3	0	+3	9
c	5	1	+4	16
d	2	2	0	0
e	3	2	+1	1
f	5	5	0	0
g	1	2	-1	1
h	5	5	0	0
i	3	1	+2	4
j	4	1	+3	9
10	34	22	$\Sigma D+12$	40

APPENDIX X

Test 2

SUMMARY TABLE FOR ANALYSIS OF VARIANCE

Source	df	SS	MS	F	
Script type	1	26.10	26.10	13.15	p < .001
Group	1	0	0		
Cells	-	41			
Group x script type	1	14.9	14.9	7.51	p < .01
Error (within)	36	71.4	1.983		

APPENDIX XI

Test 3

Means and Standard Deviations on Related Samples for two Groups of Subjects on direction-orientation tasks.

Test Group (Dyslexia):

<u>Subject</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	4	4	0	0
b	4	0	+4	16
c	2	2	0	0
d	4	4	0	0
e	2	1	+1	1
f	4	2	+2	4
g	2	1	+1	1
h	0	0	0	0
i	4	0	+4	16
j	4	0	+4	16
10	30	14	$\Sigma D+16$	54

Control Group:

<u>Subject</u>	<u>kanji</u>	<u>hiragana</u>	<u>D</u>	<u>D²</u>
a	2	2	0	0
b	0	2	-2	4
c	0	2	-2	4
d	2	3	-1	1
e	4	4	0	0
f	4	4	0	0
g	2	0	+2	4
h	4	4	0	0
i	2	0	+2	4
j	4	0	+4	16
10	24	21	$\Sigma D+3$	33

APPENDIX XII

Test 3

SUMMARY TABLE FOR ANALYSIS OF VARIANCE

<u>Source</u>	<u>df</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	
Script Type	1	3.03	3.03	1.23	NS
Group	1	0.03	0.03	0.01	NS
Cells	-	13.25			
Group x Script Type	1	10.19	10.19	4.142	p < .05
Error (within)	36	88.73	2.46		

APPENDIX XIII - Burt Reading Scores

For the Reading Difficulty Group, the Burt reading test showed the following scores:

Ss	<u>Burt Reading Test</u>	<u>Chronological Age</u>
A	9.10-10.04	14.00
B	No record	13.02
C	7.10--8.02	12.10
D	7.11--8.05	12.00
E	8.06--9.00	13.00
F	6.08--7.02	13.03
G	8.06--9.00	13.04
H	6.00--6.06	11.05
I	9.03--9.09	12.09
J	7.04--7.10	11.00

APPENDIX XIV - PAT Scores

The PAT Scores to determine how many children performed at two years or more below the level achieved by most children in the same age group.

For the Dyslexic Group these PAT scores were as follows:

Subjects	<u>P.A.T. Scores</u>					
	Study Skills.		Diagrams, maps, graphs.		Knowledge and use of Materials.	
	AP	CP	AP	CP	AP	CP
A	5	4	2	4	28	22
B	59	67	56	49	37	42
C	12	8	10	6	14	12
D	8	9	27	29	25	28
E	14	12	52	33	13	9
F	Not Tested					
G	0	0	52	33	22	18
H	13	8	30	24	4	1
I	21	16	13	9	11	10
J	Not Tested					

Although B's percentiles appear to be higher than the other Subjects', he does experience specific difficulties in reading and written skills. A sample of the latter may be seen in Appendix VI.

continued ?

See

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