

https://dspace.org/

The suitability of published neuropsychological test norms for urban black South African secondary school students

Schutte, Enid Mary

2014-03-24
http://hdl.handle.net10539/14261

Downloaded from a DSpace repository. https://dspace.org/

THE SUITABILITY OF PUBLISHED NEUROPSYCHOLOGICAL TEST NORMS FOR URBAN BLACK SOUTH AFRICAN SECONDARY SCHOOL STUDENTS

NAME OF STUDENT : ENID MARY SCHUTTE

Submitted in fulfilment of the requirements for the degree

M.Ed.(by dissertation)

SUPERVISOR : PROF. M. SKUY

FACULTY OF EDUCATION

DIVISION OF SPECIALISED EDUCATION

UNIVERSITY OF THE WITWATERSRAND

Degree awarded with distinction on 30 June 1998

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the following:

* Professor Mervyn Skuy, whose assiduous supervision managed my project from first sentence to concluding paragraph. His guidance and assistance has been invaluable;
* The staff and pupils of Anchor, Kwa-Ntsikana, Orlando West and Phfeni schools, without whom this study would not have been possible;
* The Multilateral Motor Vehicle Fund for their financial support;
* Abbott Laboratories for accommodating Part 1 of the study;
* Anita Painter for her support and encouragement;
* Diane Blades and Peter Fridjohn for their statistical assistance;
* Friends and family who unselfishly assisted, motivated and bore with me, throughout.

THE SUITABILITY OF PUBLISHED NEUROPSYCHOLOGICAL TEST NORMS FOR URBAN BLACK SOUTH AFRICAN SECONDARY SCHOOL STUDENTS

by

ENID SCHUTTE

ABSTRACT

Assessment is a central issue in neuropsychology. It assists in clarifying the initial diagnosis, in delineating areas of preserved function which may be exploited in rehabilitation and in determining the effects of therapeutic intervention objectively. In norm-referenced assessment an individual's performance is evaluated in terms of other people's performances. An important issue in this regard is the equivalency of the reference group and the testee in terms of such factors as educational opportunities, socio-cultural and economic background, demographic characteristics, sex and age. These factors are of particular relevance for the South African situation, where, dealing with the legacy of an apartheid system, equivalent acculturation across the diversities of society cannot be assumed. The diagnostic capacity of neuropsychological measuring instruments is based on a high degree of discriminant validity, and interpretation in the light of norms established for other groups may be misleading. The present study, which was conducted in two phases, questions the suitability of norms, usually derived from groups in other countries, and published for selected tests with a neuropsychological emphasis, for the assessment of black South African urban high school students. In Part I of the study 100 students, 20 from each standards 6 to 10 at a Soweto high school were assessed on subtests selected from the Individual Scale for African Language Speaking Pupils, Weschler Intelligence Scale for Children – Revised, the Rey-Osterreith Complex Figure Test, the Bender Gestalt Test, the Rey Auditory Verbal Learning Test, a Spatial Memory Task, the Trail-Making Test, the Wisconsin Card Sorting Test, the Stroop Colour-Word Test and the Draw-a-Person task. Results suggested that the acculturation variables lowered the measured performance for this group, compared to the North American and European standard. Thus, misdiagnosis could occur should the internationally published norm standards be implemented in the interpretation of an assessment conducted on a child from a milieu similar to that of the test group. Part II of the study focused on the establishment of a norm standard. An additional 152 Sowetan scholars between the ages of 13 and 15 years and in approximately their 8th year of formal schooling, were assessed on a similar test battery. It was concluded that investigations such as this one are needed, on an ongoing basis, for all sectors of South African society if the South African practitioner is to provide reliable neuropsychological assessment for the diversity of the South African populace.

TABLE OF CONTENTS

1 **INTRODUCTION** 1

2 **ANATOMICAL CORRELATES – A guide to localisation** 5

2.1 THE LURIA MODEL 6

2.2 THE CEREBRAL HEMISPHERES 7

2.3 FRONTAL LOBE 8

2.4 PARIETAL LOBE 9

2.5 OCCIPITAL LOBE 9

2.6 TEMPORAL LOBE 10

2.7 CONCLUSION 11

3 **FUNCTIONAL MANIFESTATIONS – The basis for assessment** 12

3.1 SENSORY FUNCTIONS 12

3.1.1 Auditory perceptual functioning 13

3.1.2 Tactile perceptual functioning 13

3.1.3 Visuo-spatial functioning 14

3.2 MOTOR FUNCTIONS 14

3.3 MEMORY 15

3.4 ATTENTION AND CONCENTRATION 16

3.5 LANGUAGE 18

3.5.1 Receptive language 19

3.5.2 Expressive language 19

3.6 PRE-FRONTAL EXECUTIVE ABILITIES 20

3.7 OTHER FACETS OF HIGHER COGNITIVE PROCESSING 22

3.7.1 Numerical skill 23

3.7.2 Reading and writing 24

3.8 Conclusion 25

4 **THE NEUROPSYCHOLOGICAL ASSESSMENT** 26

4.1 RELIABILITY AND VALIDITY 29

4.2 SELECTED PSYCHOMETRIC MEASURING INSTRUMENTS 31

4.2.1 The intelligence test batteries 31

4.2.1.1 Subtests derived from the Verbal scales 34

4.2.1.2 Su tests selected from the Non-verbal/Performance scales 37

4.2.2 Individually selected tests from other sources 38

4.2.2.1 Trail Making Test 38

4.2.2.2 The Goodenough-Harris drawing test 40

4.2.2.3 Rey Auditory Verbal Learning Test 41

4.2.2.4 Rey-Osterreith Complex Figure Test 42

4.2.2.5 Stroop Colour and Word Test 43

4.2.2.6 Wisconsin Card Sorting Test 43

4.2.2.7 Bender Gestalt Test 44

4.2.2.8 Spatial Memory Task 45

4.2.2.9 Oral Word Fluency 45

4.3 THE FINAL DIAGNOSIS 46

5 THE NORMATISATION ISSUES 48

5.1 SUBJECT VARIABLES – Assumptions of equivalence 48

5.1.1 Age 49

5.1.2 Gender 51

5.1.3 Language 52

5.1.4 Acculturation 55

5.1.4.1 Geographical location 57

5.1.4.2 Socio-economic factors 58

5.1.4.3 Education 59

5.1.4.4 Culture 61

5.2 SOCIO-CULTURAL ISSUES – The South African situation 63

5.3 CONCLUSION 65

6 THE STUDY 67

6.1 RATIONALE AND AIMS 67

6.2 HYPOTHESES 69

6.3 METHOD 69

6.3.1 Subject selection 70

6.3.1.1 Part I 70
6.3.1.2 Part II 70
6.3.2 Measuring instruments 71
6.3.2.1 Individual Scale for Xhosa-, Zulu-, Sotho-, Tswana-speaking pupils 71
6.3.2.2 Subtests from the Weschler Intelligence Scale for Children–Revised 72
6.3.2.3 Subtests from the Halstead-Reitan Neuropsychological Test Battery 72
6.3.2.4 Other cognitive measures 72
6.3.3 The assessment procedure 74
6.4 RESEARCH DESIGN AND STATISTICAL TECHNIQUES 77

7 RESULTS 81

7.1 PART ONE OF THE STUDY – The Exploratory Investigation 81
7.1.1 Background information 81
7.1.2 Psychometric Test Scores 87
7.1.2.1 Wechsler Intelligence Scale for Children – Revised (WISC-R) 87
7.1.2.2 Individual Scales For African Language Speaking Pupils (IS-A) 88
7.1.2.3 Trail Making Test (TMT) 88
7.1.2.4 Spatial Memory Task(SMT) 89
7.1.2.5 Rey Osterrieth Complex Figure Test (ROCFT) 89
7.1.2.6 Rey Auditory Verbal Learning Test (RAVLT) 90
7.1.2.7 Stroop Colour Word Test (SCWT) 91
7.1.2.8 Wisconsin Card Sorting Test (WCST) 91
7.1.2.9 Bender Gestalt Test (BGT) 92
7.1.2.10 Draw-A-Person (DAP) 93
7.1.3 The impact of subject variables on test performance 93
7.1.3.1 Gender 95
7.1.3.2 Age 96
7.1.3.3 Educational standard 98
7.1.3.4 Socio-economic standard 99
7.1.3.5 Language as an indicator of cultural affiliation 100
7.2 PART TWO OF THE STUDY – Establishing a norm standard 102
7.2.1 Biographical information 102
7.2.2 Psychometric test scores 103
7.2.3 Subject variables 105
7.3 PRESENT SOWETO DATA COMPARED TO TEST PERFORMANCES PREVIOUSLY REPORTED IN THE LITERATURE 108

8 DISCUSSION 111

8.1 AN INTERPRETATION OF THE FINDINGS – Observed trends 111

8.1.1 The suitability of the norms - Hypothesis I 111

8.1.1.1 Verbal functioning and related language considerations 112

8.1.1.2 Non-verbal testing 116

8.1.2 Socio-economic identifiers within the Soweto school system – Hypothesis II. 121

8.1.2.1 Domestic Circumstances 121

8.1.2.2 Educational Environment 122

8.1.2.3 Testee Orientation 122

8.1.3 Gender as a determinant of test performance –Hypothesis III 125

8.1.4 Chronological Age and Educational Exposure - Hypotheses IV and V 126

8.2 BROADER APPLICATION OF FINDINGS AND LIMITATIONS OF THE STUDY 129

8.3 SUGGESTIONS FOR FURTHER RESEARCH. 130

9 CONCLUSION 132

10 REFERENCES 134

11 APPENDICES

A A stylised map of the area 147

B A background questionnaire 150

C The procedures followed for the individually selected neuropsychological measures 154

D Data analysis according to age, educational standard and language 163

LIST OF TABLES

Table 1	Distribution of the sample by age	82
Table 2	Indicators of school performance within the initial test group	82
Table 3	Distribution of the initial sample by socio-economic level	84
Table 4	Distribution by language	85
Table 5	Distribution of the initial participants by gender	85
Table 6	Miscellaneous characteristics relevant to the initial test group	86
Table 7	The mean performance of the initial test group on the WISC-R subtest	87
Table 8	The mean performance of the initial test group on the IS-A subtests	88
Table 9	The mean performance of the initial group of testees on the TMT	89
Table 10	The mean performance of the initial Soweto sample on the ROCFT	89
Table 11	The mean performance of the initial test group on the RAVLT	90
Table 12	The performance of the initial Soweto sample on the SCWT	91
Table 13	The performance of the initial Soweto sample on the WCST	92
Table 14	The BGT scored in accordance with Pascal-Suttell and Koppitz criterion	92
Table 15	The mean performance of the initial test group on the DAP	93
Table 16	Analysis of variance dependent on gender	95
Table 17	Significant differences in performance between the older and younger subgroups	97
Table 18	An analysis of variance dependent on age	98
Table 19	An analysis of variance in test performance according to educational standard	99
Table 20	A comparison of the two extreme socio-economic sectors of Part 1	100
Table 21	Differences between the performance of the Zulu and Tswana speaking participants.	101
Table 22	Distribution by age of the norm sample	102
Table 23	Distribution by gender of the norm sample	103
Table 24	The mean performance of black urban scholars aged 13 to 15 years on the selected tests	104
Table 25	Significant differences in Male – Female Test performance	105
Table 26	Age as a contributing factor to variance in test performance	106
Table 27	A comparison of 13 and 15 year old participants on the IQ battery subtests	106
Table 28	A comparison of 13 and 15 year old participants on other psychometric measures	107
Table 29	A comparison of Hillbrow and Soweto std 6 pupils on various psychometric tests.	109
Table 30	RAVLT – Comparative local data	116
Table 31	Hillbrow and Soweto standard 10 pupils on the WCST	118
Table 32(a)	WISC-R raw scores analysed by educational standard	164
Table 32(b)	WISC-R scaled scores analysed by educational standard	164
Table 32©	WISC-R analysed by age	164
Table 32(d)	WISC-R analysed by language group	165
Table 33(a)	IS-A analysed by educational standard	165

Table 33(b)	IS-A analysed by age	165
Table 33©	IS-A analysed by language group	166
Table 34(a)	TMT analysed by educational standard	166
Table 34(b)	ROCFT analysed by educational standard	166
Table 34©	STROOP analysed by educational standard	166
Table 34(d)	SMT analysed by educational standard	166
Table 34(e)	RAVLT analysed by educational standard	167
Table 34(f)	BGT analysed by educational standard	167
Table 34(g)	DAP analysed by educational standard	167
Table 34(h)	WCST analysed by educational standard	167
Table 35(a)	TMT - analysis by age	168
Table 35(b)	ROCFT - analysis by age	168
Table 35©	SCWT - analysis by age	168
Table 35(d)	SMT - analysis by age	168
Table 35(e)	RAVLT - analysis by age	169
Table 35(f)	BGT - analysis by age	169
Table 35(g)	DAP - analysis by age	169
Table 35(f)	WCST - analysis by age	169

1 INTRODUCTION

An interest in brain-behaviour relations emerged in ancient Egypt and Greece, and physiological psychologists have always been strongly committed to research in this area. However, the greatest explosion of work in neuropsychology has only occurred in the last several decades. The many reasons for this upsurge include: the influence of technological advances in biomedicine such as single unit recordings; EEG spectral quantification; stimulus-related potentials; cerebral blood flow measures; computerised tomography and magnetic resonance imaging - all of which provide valid measures of cerebral function in relation to behaviour. Further, the greater understanding of functioning of neurotransmitters derived through the results of numerous psychopharmaceutical studies, new models of information processing, decision making, memory and other cognitive processes, provide new paradigms for research.

Neuropsychological impairment, which may eventuate due to genetic predisposition, a disruption in metabolic processes, physical assault or road traffic and other accidents, may have a profound impact upon quality of life of the individual. With a greater understanding of the brain-behavioural relationships, the medical and paramedical practitioners are better able to utilise the information provided by psychometric assessment in the rehabilitation process of neurologicaly impaired individuals. In addition, educators have recognised that only through the integration of behavioural, educational and neuropsychological knowledge can children be given the opportunity to maximise their potential. These interests, together with increased recognition by the legal professions of the importance of neuropsychological results as evidence in compensation cases, has led to the rapid development of clinical neuropsychology (Dennis et. al. 1991).

Neuropsychological assessment assists in both the diagnosis and treatment of the neurologically dysfunctional individual. The applications and the implications thereof, call for considerable responsibility on the part of the neuropsychologist practising in our multicultural, multi-language society, to develop and use valid and reliable assessment procedures.

The diagnostic capability of a neuropsychological instrument is derived from a high level of discriminant validity (Franzen, 1989). The external validity of a measure is threatened by doubts about the generalisability of its results to populations other than that from which its norms were derived. 'Even if a test is otherwise satisfactory, test scores may be misleading if the norms are inadequate' (Salvia and Ysseldyke, 1988).

A cultural group is a product of unique genetic, economic, social and familial factors. The thoughts and actions of individual members are modulated by specific cognitive codes and maps, the values and norms of appropriate behaviour, socio-economic conditions and educational opportunities. Previous research has shown that variables such as level of education, social class and rural/urban background strongly influence measured cognitive level (Wilson et.al., 1979).

In the United States of America, the use of published neuropsychological test norms for black adolescents has been found to lead to an unacceptably high number of misclassification errors (Knuckle and Campbell, 1984). A practical implication of cultural bias in cognitive assessment was highlighted in the case of Larry P. v. Wilson Riles (California's Superintendent of Public Instruction). In 1979 Judge Peckham ruled that Larry P. had been erroneously classified as mentally retarded as a result of established norms. Consequently, the California Supreme Court issued an order banning the use of all IQ tests for placing blacks in special education programmes (Brislin, 1990).

In South Africa, with its high incidence of learning disabilities, motor vehicle accidents and physical assaults, relative to other countries around the world, the critical need for valid neuropsychological assessment procedures is obvious. Given the black-white test score difference reported in both the international and local literature, cautions regarding the validity of measures developed and normatised for population groups other than that of the specific testee, cannot be ignored.

The uniqueness of the various sectors of the South African population growing up under an apartheid regime cannot be underestimated. To quote from Nelson Mandela's autobiography (1994, pg. 109) regarding the lot of an African in South Africa under the apartheid system "An African child

is born in an Africans Only hospital, taken home in an Africans Only bus, lives in an Africans Only area and attends an Africans Only school, if he attends school at all. When he grows up, he can hold Africans Only jobs, rent Africans Only houses in Africans Only townships, ride Africans Only trains and be stopped at any time of the day or night and be ordered to produce a pass, without which he can be arrested and thrown in jail. His life is circumscribed by racist laws and regulations that cripple his growth, dim his potential and stunt his life." Although laws enforcing this segregation of society have been lifted, the legacy of the past remains.

Given the unique nature of the stratification of South African society, one cannot automatically assume that what holds true for racial, socio-economic and gender differences in other countries, holds true for South Africa. Furthermore, norms gathered for one sector of South African society cannot summarily be accepted as appropriate for another sector of South African society. Acculturation variables may differ both inter- and intra- societally, dependent on the individual's primary identifiers (Khehla Shubane, Centre for Policy Studies – personal communication 1997). Age, educational, socio-economic, language, cultural and gender factors, may, or may not, exert the influence or carry the same weight as reported internationally.

It is imperative that neuropsychological processes not only remain cognisant of the historical legacy, but also keep pace with the on-going changes and directional developments in a rapidly changing society. All forms of normatisation, by definition, are necessarily circumscribed and specific.

Despite the extraordinary demands placed on the South African clinical practitioner, the validity of the neuropsychological procedures within the country remain uncertain. The primary issues in this dilemma arise from the lack of local research regarding the inherent construct and discriminant validities of the measuring instruments for local application. As Nell (1997) so aptly pointed out, a vicious circle develops; "without constructs, there are no norms, without norms ... the status of neuropsychological testing remains doubtful". It is evident that the circle must be broken.

The present study asks the question as to whether or not the interpretation of the neuropsychological test performance of an urban black South African high school pupil, based on the published neuropsychological test norms, would lead to a correct diagnosis. If this is not the case then the questions posed must be; 'Are the measuring instruments appropriate?' 'What norm standard should be used?' and, 'At what level can we assume equivalence for the various sub-sectors of South African society?' Although the need for cross-cultural psychologists to embark on the mammoth task of addressing both construct validity and normatisation is indisputable, given the pragmatic considerations and the immediate needs in the country for the close scrutiny of neuropsychological processes, as an interim measure, this particular study limits itself to the issue of normatisation.

Chapter 2 of the study provides an overview of the anatomical basis for neuropsychological inference. Chapter 3 summarises the functional correlates which the neuropsychologist is required to tap in the course of a neuropsychological assessment. With the emphasis on those measures which have been singled out for implementation in this specific study, Chapter 4 discusses the means whereby the quantifiable data can be assimilated for neuropsychological interpretation. Chapter 5 considers the issues which may impact on the interpretation of this data and focuses on the importance of these factors for the South African practitioner and hence, for this particular study. In Chapter 6 the methodology of the present study is presented. The findings of the study are then documented in Chapter 7 and discussed in Chapter 8. The conclusions are briefly summarised in Chapter 9.

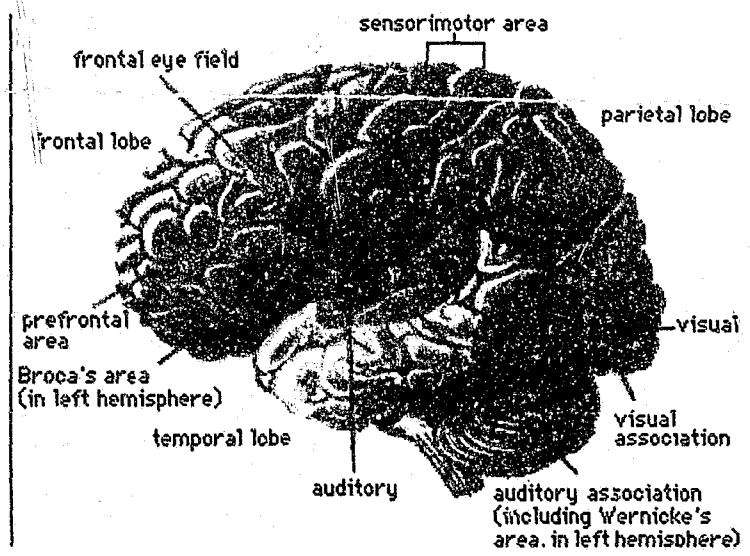
2 ANATOMICAL CORRELATES – A guide to localisation

2 ANATOMICAL CORRELATES – A guide to localisation

Clinical neuropsychology has its origins in the medical field. The earliest practitioners were physicians who were interested in the anatomical location of cerebral lesions in patients who exhibited behavioural abnormalities. Biomedical technology is now, ever increasingly, in a position to provide valid indices of the site and extent of brain pathology. Researchers in neuropsychology have capitalised on these anatomical insights in examining functional correlates.

Increased understanding of cerebral anatomy and physiology and the relationship between the medical and behavioural sciences had led to the development of a number conceptual paradigms in the field of neuropsychology.

Although in agreement that the various brain structures participate in different way and to different degrees in the execution of psychological functions, practicing neuropsychologists may prefer to interpret their findings according to a variety of differing principles.



The richness of Luria's qualitative approach to neuropsychology may provide a good overall view of brain functioning, however, in practice other neuropsychologists may prefer to interpret their quantitative findings in terms of such principles as; laterality, general versus focal effects and cortical versus sub-cortical functions. Localisation of function and disconnection of effects may also be employed in the logical process.

This overview of the anatomical correlates limits itself to a brief look at the functional system proposed by Luria (1970), the mechanisms of cerebral dominance and the contributions of the various anatomical lobes of the brain to functional operation. For a more detailed discussion of the behavioural geography of the brain, the reader is referred to Lezak (1995 pg. 45-96).

2.1 THE LURIA MODEL

Luria (1970) viewed the brain as a self-regulating functional system and conceptualised the working brain as organised into three major functional systems: the lower, posterior and frontal regions.

In the upper and lower parts of the brain-stem, including the thalamus, hypothalamus, midbrain and lower brain stem the reticular functioning plays an important role in maintaining wakefulness, memory organisation and attention. Injury to this area may manifest as a deterioration in alertness and vigilance, memory may become disorganised and variable, discrimination of stimuli may be impaired and the control of behaviour suffers.

The posterior part of the brain is concerned with the coding, analysis and storage of incoming sensory information of a visual, auditory, tactual and kinaesthetic nature. Injuries may manifest as restricted deficits for visual, tactile or auditory senses, or if the association areas are involved, the impairment of more complex processes.

The frontal region of the brain is involved in the formation of plans, intentions and programs for behaviour. Neuroanatomically linked to the reticular activating systems and other cortical and subcortical structures the frontal lobes play an important role in complex behavioural processes.

2.2 THE CEREBRAL HEMISPHERES

Functional assessment based on a left/right dichotomy, especially when considering higher mental or cognitive processes, is regarded as oversimplified because of the richness of inter- and intra-hemispheric connections. However, such a view should not be considered as negating evidence to suggest that each hemisphere is differentially specialised for certain forms of information processing.

Functional differences between the left and right hemispheres, not only at the level of the somatosensory and motor control (where each side of the body is primarily dependent on regions in the contralateral hemisphere of the brain), but also with regard to numerous perceptual and mnemonic functions have been described in the literature.

A synthesis of views suggests that, for the majority of individuals, the left hemisphere is considered to process information mainly in a phonic, sequential, analytic, propositional mode. It may have the specific function of analysing and executing series of discrete items in temporal arrangements. Language, because it depends heavily on such processing, would thus be served mainly by the left hemisphere.

The right hemisphere is considered predominantly to process information in a non-linguistic, holistic, synthetic manner. It has the specific function of synthesising and sustaining the gestalt representation of the environment without regard to the time dimension. Consequently such skills as the perception of form, of spatial relationships, and of some aspects of music, appear to be particularly dependent on the right hemisphere.

Although the pattern of hemispheric functional specialisation previously described occurs in the majority of individuals, this is not the case for everyone. Numerous studies of cognitive deficits in patients with brain damage, together with studies of right-left perceptual asymmetries on dichotic stimulation and tachistoscoptic tests in normal individuals, indicate that specialisation of the left hemisphere for linguistic functions is less frequent in left-handers than in right-handers. Additionally, when the above mentioned specialisation is present, it may be less complete, that is, more bihemispheric than in right handers.

Relevant to the South African situation where schooling for all has not been compulsory until most recent times, it has been reported that cultural variables can influence the brain's organisation of cognition (Ardila, 1995) and that the degree of lateralisation of language, for instance, can depend on literacy and verbal training histories.

2.3 FRONTAL LOBE

The area of the brain in front of the central fissure and above the lateral fissure is known as the frontal lobe. It is the largest structures of the human brain and is thought to be the seat of highest cognitive function. The literature abounds with references to the problems associated with frontal lobe damage, as it is implicated in an enormous range and complexity of behaviours from motor control to social behaviour. The clinical range of presentations may vary from paralysis and spasticity to asocial adynamia. The diversity of affective, cognitive and motivational changes which may follow frontal damage cannot be readily encompassed within or predicted by any given framework. Furthermore, changes in personality, mood and social behaviour may be difficult to gauge. When assessed using routine psychometric procedures, some individuals with frontal lobe dysfunction may appear cognitively intact. Assessment must attempt to identify and quantify cognitive impairments due to such factors as poor organisational abilities, planning, social judgement and cognitive flexibility (Crawford, Parker & Mc Kinlay, 1992).

2.4 PARIETAL LOBE

The parietal lobe is located immediately behind the central fissure. With the substantial neural connections between the parietal lobes and the hippocamus, particularly short-term or working memory functions are an attribute of the parietal lobes. Generally the parietal lobe concerns itself with synesthetic information processing, interpreting and integrating sensory inputs. The left parietal lobe integrates visual, auditory and tactile stimuli as they relate to language and is responsible for sequential analysis calculating and syntactical abilities. The right parietal lobe is involved in the integration of non-verbal perceptual stimuli, visual-spatial and tactual-spatial analysis and constructive abilities and body image integration (Parsons and Hart in Adams and Sutker (Eds.). 1984).

Bilateral parietal lobe damage may manifest in apraxia (inability to produce particular movements on command). Disorders such as alexia (inability to read) and agaphia (inability to write) have been associated with left parietal damage. The individual with right parietal damage may have difficulty integrating parts into a consistent whole due to perceptual deficits or demonstrate sensory neglect in restricted left sided awareness.

2.5 OCCIPITAL LOBE

The occipital lobe, which is responsible for visual information processing, is situated ventrally to the parietal lobe at the back of the head (Jordaan, Jordaan and Niewoudt, 1975). Lesions of the occipital lobes can produce blindness for parts of the visual field, however, more complex visual disorders relating to object and spatial perception may result when brain damage includes respectively either the temporal lobe or parietal lobe. A variety of agnosias and apraxias have been ascribed to parito-temporo-occipital dysfunctions. The association areas in the parieto-temporo-occipital juncture region are situated in front of the visual association areas and behind the primary sensory strip. They functionally comprehend cortical mediation for abilities associated with localisation, the abstract and complex intellectual functions of mathematical reasoning and logical propositions based on

visuospatial experiences (Obrzut, in Hynd and Obrzut (Eds.) 1981). An individual may, for example, be able to see letters, words or parts of symbols but be unable to synthesise them into a gestalt and, unable to attribute meaning, experience reading difficulties (Parsons and Hart, in Adams and Sutker (Eds.). 1984).

2.6 TEMPORAL LOBE

The temporal lobes, which are located below the Silvian fissure are, in addition to the higher order visual functions, responsible for auditory information processing as well as short term memory and emotion.

Regarding auditory processing, it appears as if the left temporal lobe permits the understanding of auditory language and verbal memory, and the right temporal lobe the understanding and interpreting of complex non-verbal material, distinguishing intonational and musical contours and topographic memory (Parsons and Hart in Adams and Sutker (Eds.). 1984). Left temporal damage (where this is the dominant side) may produce symptoms of Wernicke's aphasia, which, as opposed to Broca's aphasia which affects verbal output, involves disturbed speech comprehension (Makunga, 1988). Individuals with right temporal damage may suffer amusia and find themselves unable to recognise tones and rhythms.

Within the temporal lobes are structures that are part of the limbic system. This system is subcortical in nature and its structures mediate both memory and emotion. They direct the focus of attention and play a significant role in the determining the registration of perceptual input. The left hippocampus has been specifically linked to the recognition and recall of complex visual and auditory patterns, whereas anterograde and retrograde amnesia may manifest as a result of impaired functioning of the mammillary bodies and/or thalamus (Obrzut, in Hynd and Obrzut (Eds.) 1981). It is thus evident that, since the temporal lobes involve recall of memories, damage to either of the temporal lobes may result in memory deficits. Right sided involvement is characterised by a poor memory for pictures and other non-verbal material (Brooks, 1974) and left sided damage, a poor memory for verbal

information. Bilateral destruction can result in the loss of ability to learn anything other than new motor skills.

It may be of interest to note that schizophrenia has been associated with dominant temporal lobe dysfunction and affective disorders with the non-dominant temporal lobe dysfunction (Flor-Henry and Gruzelier, 1983).

2.7 CONCLUSION

Neuropsychology, in many ways, bridges the gap between the medical and behavioural sciences and researchers in both disciplines continue to contribute to the understanding of the integral relationship between functional deficits and their anatomical correlates. Although advances in biotechnology have greatly enhanced the physician's ability to localise brain lesion and predict general areas of dysfunction, the severity and extent of dysfunctional behaviours manifested by the individual vary. Therapeutic intervention is, therefore, often best guided by an in-depth evaluation of functional abilities. To quote Benton (1981) "symptoms must be viewed as expressions of disturbances in a system, not as direct expressions of focal loss of neuronal tissue".

3 FUNCTIONAL MANIFESTATIONS – THE BASIS FOR ASSESSMENT

The neuropsychologist works within the limitations of current neuroanatomical maps of function and directs the neuropsychological assessment at an understanding of memory, attention and concentration, visual spatial analysis and synthesis, motor and sensory abilities, language, numerical competence, general information processing or reasoning and the pre-frontal executive abilities. The thoroughness and accuracy of the assessment of various functional manifestations determines to a large extent how well the individual's problems are understood and the needs are met.

This chapter focuses on the above-mentioned functional constructs, which the neuropsychologist attempts to evaluate in the course of a neuropsychological assessment. The chapter also considers how these functional concepts relate to the anatomical constructs discussed previously and the process of psychometric evaluation discussed in chapter 4.

3.1 SENSORY FUNCTIONS

Highlighting the complexity of the sensory perceptual process, Lezak (1995) cites a number of studies focusing upon the many components of receptive function, sensory modalities and the sub-systems underlying these mechanisms. She encapsulates the essence of this complex function when she describes sensory reception as involving "an arousal process that triggers central registering, analysing, encoding and integrating activities" and then concludes that sensations are rarely experienced in isolation but rather "enter the neurobehavioural systems as perceptions already endowed with previously learned meaning".

Sensory competence, whether visual, auditory, olfactory or tactile, is dependent on the adequate functioning of the peripheral sense organ, the specific nerve tract and the brain. A reduced capacity for a specific sensory function may therefore reflect a dysfunction in any one of these areas. It is for this reason that peripheral acuity and transmission must be considered in a neuropsychological

evaluation of sensory perceptual skills before assumptions are made regarding cortical function. In the absence of peripheral damage these functional deficits raise the possibility of a post-central lesion (Gilandas et.al., 1984). In a simplified scenario, damage to the occipital lobe, traditionally referred to as the visual cortex, may result in cortical blindness. Poor speech-sound perception may be indicative of temporal lobe dysfunction. The parietal lobes, however, are concerned with the integration of auditory, tactile and visual input. Parietal lobe damage may therefore result in a spectrum of sensory deficits in the contralateral side of the body.

3.1.1 Auditory perceptual functioning

As adequate auditory-verbal perception is a prerequisite for satisfactory performance on many of the tasks presented in the course of a neuropsychological evaluation, significant defects may render themselves readily apparent. An individual with impaired auditory processing may demonstrate a significantly improved performance on visually, rather than verbally, presented tasks. However, it appears that the verbal and non-verbal elements of speech are functionally independent (Kimura, 1967). Defects in the recognition of speech in the absence of a hearing impairment may be indicative of a lesion involving the dominant hemisphere whereas impairment in non-verbal auditory perception such as music, indicate lesions in the non-dominant hemisphere (Milner, 1962). The Halstead-Reitan neuropsychological battery, for example, includes tests such as the Rhythm Test and the Speech Sounds Perception Test to examine these possibilities.

3.1.2 Tactile perceptual functioning

Tactile perceptual functioning may influence a broad range of more complex cognitive abilities such as motor, visuo-spatial, language and memory processes (Boll et.al., 1977). Disturbances of somatic sensation may be indicative of specific brain lesions and, according to Lezak (1995), tactile inattention most commonly results from right parietal damage. Tactile perceptual functioning tests, such as the Halstead-Reitan Tactual Performance Test, identify deficits in touch perception and are sensitive to parietal lobe damage. Stimuli may be administered unilaterally and bilaterally by touch to both hands and face.

3.1.3 Visuo-spatial functioning

Although there is some evidence that reduced levels of literacy may adversely influence the ability to interpret pictorial representation of three-dimensional figures, and even societal idiosycracies such as regular hunting, may enhance visual discriminatory and spatial skills (Ardila, 1995), ostensibly, visuo-spatial tests are less dependent on educational and cultural background than verbal tasks (Gilandas et.al., 1984).

Visuo-spatial functioning is a complex skill overlapping with cognitive and memory processes. Lezak (1983) reports that individuals with left hemisphere lesions may ignore the right side of a line when reading, whereas right hemisphere lesions may cause unilateral spatial neglect of the left side. This second group may also demonstrate more difficulty drawing familiar objects and geometric designs than would the individual with left hemisphere damage. A test such as the Rey Osterrieth Complex Figure Test (ROCFT) which, to a large extent, precludes verbal coding, is one of the measures used to tap visuo-spatial ability. An examination of technique, and a comparison between the copying and recall parts of the test may assist in differentiating between perceptual, visual memory and the higher planning functional components.

3.2 MOTOR FUNCTIONS

Although the quality of motor functioning is often used as an indicator of brain damage (Gilandas et.al., 1984), in many cases motor dysfunctions may relate to peripheral injury rather than organic brain damage. Such physical disorders may adversely affect the individual's ability to perform manipulative performance tests and must be considered before attributing poor performance on such tests to other cognitive factors.

The motor dysfunctions that are of concern to the neuropsychologist are those which occur despite an intact capacity for normal movement (Lezak, 1983). Impaired motor functioning is most likely to occur with pre-central lesions.

The evaluation of motor differences involves making an allowance for a better performance for the dominant hand relative to the non-dominant hand. If the dominant hand performs more poorly than the non-dominant hand on motor tasks this is suggestive of damage to the contralateral hemisphere. A qualitative analysis of the practical tasks employed in a neuropsychological assessment together with medical information and specific tests such as are offered in the Quick Neurological Screening Test (tandem walking, balance, eye-tracking, consecutive finger circles) and the Halstead-Reitan Neuropsychological Test Battery (lateral dominance assessment, the grip-strength and finger-tapping) may be of value in such instances.

3.3 MEMORY

Memory is a complex entity, involving a collection of interacting systems aimed at the storage and retrieval of information (Lezak, 1995). Firstly, the individual must attend to environmental stimuli. The stimulus is registered by the various sensory receptor organs and then, in most instances, held in sensory form until recognised as conforming to a pattern. Pattern recognition forms the bridge between sensory register and short term memory as incoming information is matched with previously learned information from long-term memory in order to convert the raw incoming stimuli into something meaningful. Although short-term memory is often thought of as merely a passive store for information before transfer into long-term memory, during cognitive tasks such as thinking, reasoning, mental arithmetic and reading comprehension, information is simultaneously held and manipulated in short term memory.

In order to demonstrate a functioning memory, the individual requires the ability for recall - either as automatic retrieval, via tracing associations to promote recollection, or on direct cues to 'jog' memory into recognition of the information. The efficacy of this system may be enhanced by rehearsal, organisation in terms of categories and associations, visual imagery and acoustic mnemonics. On the other hand, memory may be adversely affected by interference (which may either be retroactive, whereby old facts replaced by new, or proactive, whereby old facts interfere with the acquisition of new information), level of arousal and age.

In the course of a neuropsychological assessment numerous tactics may be employed in the assessment of memory function. Memory function may be differentiated according to the type of input presented and the specific way in which the material is presented. In this, the material presented to the testee may, or may not have an inherent logical sequential organisation and meaning, Both verbal (a story, word or number list) and visual (a series of pictures or following the copy trial of a visually presented design) tasks can be utilised. Dependent on instruction, incidental memory (through the inclusion of an unforewarned recall trail), purposeful (when the individual is instructed to commit the information to memory) and prompted (the provision of specific cues to 'jog' the memory) recall may be assessed.

Tests of memory span, for example digit-span (Weschler Intelligence Scale for Children - Revised; WISC-R) - as an indication of memory span for information that does not have a specific semantic meaning and a word span task as part of the Rey Auditory Verbal Learning Test (RAVLT) may be administered. A learning curve may be analysed for indications of strategy (RAVLT, Spatial Memory Task (SMT), Wisconsin Card Sorting Test (WCST)). Working memory may be taxed during administration of digits backwards and mental arithmetic tests. The effect of interference may be examined directly on tests such as the RAVLT, a test which also includes a recognition trial. Thirty to forty-five minute recall trails following many of the above-mentioned procedures may be included in an assessment to examine the efficacy of longer term recall.

3.4 ATTENTION AND CONCENTRATION

Attention and concentration may be thought of as the effort or energy required to perform cognitive tasks. The terms, attention and concentration, so often used either in conjunction or interchangeably, can be clearly differentiated if considered, in terms of immediate, overt and sustained, covert abilities.

Immediate attention refers to the ability to orient to a task. This observable aspect of attention entails placing sensory receptors, such as the eyes and ears, in a position to receive stimulation for the appropriate source. Dependent upon state of arousal, alertness, vigilance, amount of attention

available for information processing, sustained attention or concentration is the ability to maintain attention over time. Satisfactory cognitive performance relies heavily on selective attention or the ability to screen out unwanted stimulation and focus cognitive energy on the desired stimuli. As strategies employed to sample information from the environment form one of the foundation stones for so many other functions, even in the absence of marked intellectual deficits, inattention or even over-exclusive attention, may lead to poor or fluctuating level of performance.

Evidence that attention may become volatile after head injury (Wood, 1988) and that different brain lesions may selectively impair the individual's performance on tests of attention implies a functional anatomical system of attention (Mirsky, 1989 p84-86). However, research aimed at uncovering a specific biochemical basis or genetic-familial factors has failed to identify a single unifying theme and it appears possible that the childhood developmental disorder responsible for a specific learning difficulty may differ fundamentally from that seen following traumatic brain injury.

Many theories have been propounded to explain attentional function and a distinction can be made between structure and process. It is undeniable that developmental changes can be demonstrated on measures of selective attention (Ross, 1977) and that the electroencephalograms of many children with an attention deficit disorder demonstrate cortical immaturity rather than signs of focal damage. However, symptoms do not always disappear with the onset of puberty and in some cases may continue into adulthood (Henker and Whalen, 1989).

Attention deficit disorders are more commonly identified in boys than girls and, with the medial zones of the frontal lobes beingare involved in concentration, Luria suggested that voluntary attention was mediated via verbal processing or inner speech. However, as attentional difficulties may occur with right frontal lesions, this is probably not be an isolated critical factor of voluntary attention.

Possibly related to an under-arousal of the reticular substance in the brainstem, the intensity of disturbance in an attention deficit disorder is situation specific. In this regard, given equally attractive

alternative sensory input, Norman and Shallice have suggested a supervisory attentional system. Drawing on neuroanatomical evidence, a multi-component view of the complex modulatory and attentional systems which are necessary for problem solving is suggested by the diverse anatomical connections which the frontal lobes have with all other parts of the cerebrum (Stuss and Benson, 1986).

In conclusion, it is possible to view attention and concentration as skills which in the course of their acquisition have become differentiated from more biologically established abilities. The dissociation of these skills in some cases, indicates a degree of autonomy, however, their co-occurrence suggests that they may have a common developmental link.

3.5 LANGUAGE

Disorders of language are extremely handicapping since speech functions as a basic requirement for interpersonal relationships. A comprehensive evaluation of language requires an assessment of spontaneous speech, comprehension, ability to repeat spoken language, word finding, reading, writing and spelling. Gilandas et.al.(1984) suggest that the neuropsychologist be alert to any evidence of dysarthria (specific disorders of articulation wherein basic grammar and word choice is intact), dysprosody (interruption of speech melody) and specific dysphasic errors of grammar and word finding. Research into the neural basis for language and reading development is multifaceted and multidisciplinary in nature and, given the relevant environmental and experiential factors, involves age-appropriate measures of language, reading, attentional and frontal processes at various developmental levels. As mentioned in the previous chapter, language processing occurs mainly in Wernicke's area in the temporal lobe of the dominant hemisphere (i.e. in the majority of cases, the left temporal lobe) and language production in and around Broca's area in the frontal lobes.

3.5.1 Receptive language

When one listens to the spoken word it is necessary to process an exceptionally complex set of frequencies to make crucial distinction between similar patterns of sounds and to extract meaning from the utterance. In clinically tested normal hearing patients, the analysis of the sound pattern of words and processing for meaning, can break down selectively should the patient have specific cerebral lesions.

Patients with left hemisphere lesions may experience difficulty discriminating words but not necessarily discriminating tones whereas the converse is observed with right hemisphere lesions. Bilateral lesions of the temporal lobes may result in an impairment in the temporal resolution of acoustic signals manifesting as a partial cortical deafness (Brick et.al. 1985). Unilateral lesions of the left hemisphere, especially the left temporal lobe or Wernicke's area, may result in impaired vowel and consonant discrimination (Luria, 1976). Wernicke's dysphasia is primarily a disorder of comprehension and, although speech may be characterised by inappropriate word usage, the individual does retain an ability for speech.

In the majority of clinical cases, lesions affecting word comprehension are extensive or poorly localised. However, singular cases of selective impairment for animal-name comprehension have been associated with the lesions restricted to the superior temporal gyrus of the left temporal lobe and in cases of impaired comprehension of colour names, suggestive of poor visual associations, the left occipital lobe.

3.5.2 Expressive language

The average individual has little difficulty drawing from a bountiful lexicon in the course of spontaneous speech. Although occasional word finding difficulties may be noticed by anyone, they are far more commonly seen in those with acquired language disorders. In the course of a conversation, such individuals may pause frequently whilst searching for the appropriate word and then replace the target word with a generic term, an appropriate definition or explanation. In the course of the neuropsychological assessment in addition to the administration of specific

confrontation naming tasks it is important to monitor spontaneous speech as, grammar, word retrieval, language flow and neologisms, in the context of active conversation, may well pose a different set of problems for the aphasic than those which are assessed by the naming of visually presented objects (McCarthy and Warrington, 1990).

3.6 PRE-FRONTAL EXECUTIVE ABILITIES

The pre-frontal cortex occupies approximately one-third of the entire human cerebral cortex and does not mature until around 15 years of age (Stuss and Benson, 1986). As mentioned in the previous chapter (Section 2.3), frontal functions influence an enormous range and complexity of behaviours from motor control to social behaviour. The main function of the pre-frontal lobe appears to be some manner of manipulation of information stored elsewhere in the cerebral cortex and brain (Grafman, 1994). The critical factor appears to be the requirement for modulation and control of established cognitive skills in a problem solving situation rather than the primary intellectual difficulty of the task at hand. However, an organically based inability to plan, put into action and carry through with an appropriate course of action may prove debilitating to the individual with frontal lobe damage when the most basic essential ideas simply do not occur and they fail to modulate, monitor, evaluate, regulate or self-correct on-going behaviour (Kay and Lezak, 1990). These individuals find themselves in a position where they are unable to act independently and in a purposeful manner guided by their own self interest (Dywan et.al.1991).

Identification of frontal lobe damage can be difficult. When assessed using routine psychometric procedures, some individuals with frontal lobe dysfunction may appear cognitively intact. Normal scores on tests of psychometric intelligence do not mean that the individual's problem-solving activities are intact. Test batteries such as the Weschler Intelligence Test for Children-Revised (WISC-R) have multiple components and the required tasks can often be performed in a number of different ways. If the individual has some residual problem solving capabilities, or is only handicapped by one type of problem solving procedure, he/she may be able to compensate for his/her deficit in the formal context of a clinical assessment.

In a specific attempt to psychometrically evaluate executive abilities, the neuropsychologist may include a categorisation test such as the WCST or the slightly more time-consuming Halstead-Reitan Category Test, (should language proficiency variables permit this) tests of word fluency such as the Controlled Oral Word Association Test and other tests which are sensitive to frontal damage such as the WISC-R Picture Arrangement and Mazes subtests, the IS-A Blocks subtest and the Stroop in the test battery. Pre-frontal damage or dysfunction may lead to several kinds of characteristic errors in task performance including perseveration, embellishment and confabulation. Even where cognitive processes such as language, memory and mathematical ability are relatively intact, these types of errors may be responsible for the poor performance of patients with pre-frontal lesions on a number of tests. In order to effectively utilise psychometric intelligence the individual must be in a position to successfully employ organisational abilities, planning, social judgement and cognitive flexibility (Crawford, Parker & Mc Kinlay, 1992). Problems arising from an inability to reorganise established cognitive skills or change habits and thereby initiate non-habitual or novel patterns of behaviour may however be even more apparent in everyday life than on structured tests of intelligence.

The formal neuropsychological assessment procedure is highly structured and, as such, not conducive to eliciting the psychosocial deficits that so often characterise a frontal lobe dysfunction. In order to facilitate realistic goal-setting both vocationally and socially, the neuropsychologist must, in addition to attempts to psychometrically evaluate executive abilities, conduct a thorough investigation into the individual's capacity for independent daily functioning outside of the test situation. However, individuals with frontal lobe dysfunctions may be inclined to under-report symptoms or even claim to be in perfect health. Unreported by the client, changes in personality, mood and social behaviour may be difficult for the clinician to identify, based on psychometric evidence alone. However, these changes in character, mood or mental status may be obvious to those familiar with the individual pre-morbidly. The neuropsychologist may thus wish to seek collateral information via in-depth confidential interviews held with family members, friends and co-workers in their endeavour to assess the individual competence for activities of daily living, habits, sexual behaviour and personal interactions.

In conclusion, and with due consideration for the above, a note of caution should be sounded with regard to the assessment of pre-frontal function in children. Firstly, one needs to reiterate the opening statement of this section which alludes to the relatively late maturation of frontal lobe function as part of the normal developmental sequence, secondly one should focus on the specific validity of unstructured daily functioning against a backdrop of the expectations of the normal functioning child.

3.7 OTHER FACETS OF HIGHER COGNITIVE PROCESSING

The basic cognitive processes such as attention, language and memory, discussed earlier in this chapter, form the basic foundation for the development of higher intellectual skills. The pre-frontal executive skills ensure that these skills can be effective utilised. The ability to draw higher order inference requires that the individual is able to abstract the necessary information from the elements of the problem. To abstract is to go beyond the constellation of concrete physical properties of a single exemplar and to analyse how certain of its properties may be related to those of others. The ability to form abstract concepts has been tested using both verbal and non-verbal material, for example the Weschler Similarities subtest or a non-verbal sorting task. The formulation of strategy implies that the individual is able to generate a plan of action which is suitable for the problem at hand. In order to accomplish this the individual must be able to comprehend logical sequence and thereby anticipate the outcome of a series of steps.

Although it has been suggested (Teuber, 1964) that posterior lesions may be more debilitating to the intellect than frontal ones, these higher cognitive processes do not appear to be anatomically localised but rather diffusely represented in the cortex.

If we consider the basic scholastic skills such as reading, writing and arithmetic it is obvious that many of the functions that differentiate man from other animals are dependent on abstract thought and the cognitive understanding and manipulation of symbols. Intelligence tests are aimed at an assessment of an individual's overall capacity for intelligent behaviour - their capacity to understand

and cope with the world around them – dependent upon their ability to reason, ability to learn, ability to solve problems etc. (Wechsler, 1974). An intellectual assessment attempts to evaluate the individual's ability to form abstract concepts and solve problems by manipulating verbal and non-verbal symbols (Obrzut, in Hynd and Obrutz (Eds.), 1981).

As illustrated in the following discussion of the basic scholastic skills, the integrity of 'intelligence' as measured by these tests is dependent upon both the biological and environmental bases. A distinction can be made between functions based upon well-established systems or 'crystallised intelligence' and problems which require adaptation to the demands of unknown stimuli or new situations, 'fluid intelligence'.

3.7.1 Numerical skill

From an educational perspective, given an adequate attention span, memory and sequencing ability, with increased training in mathematical function, automaticity increases. Although only a small proportion of highly educated individuals may master the more advanced abstract mathematical concepts, basic arithmetical skills are routinely required for every-day modern life (Kaplan and Sadock, 1981). An individual's cache of arithmetic facts and procedures ranges from the most basic facts through to a rich and elaborate knowledge base dependent upon educational exposure. However, nearly 6% of the normal population can be expected to have symptoms of developmental dyscalculia - a structural disorder of mathematical abilities which has its origin in a genetic/ congenital disorder of those arts of the brain that are the direct anatomical physiological substrate of maturation of the mathematical abilities adequate for age, without a simultaneous disorder of general mental functions (Kaplan and Sadock, 1981). Calculation is a complex and multi-component skill which requires the individual to comprehend the elements of the calculation, compute a solution and retrieve the correct number word in order to offer an answer. It has been suggested that numeracy represents a specific category of semantic knowledge – a sub-domain which is analogous to other established knowledge bases (Maree, 1996). In some acalculic individuals, sub-categories of this system may be dysfunctional. Research has indicated that the posterior section of the left hemisphere is of particular importance for calculation (McCarthy and Warrington, 1991). The ability to read numbers appears to differ fundamentally from the ability to read words and letters, and alexic and

agraphic acalculias may be associated with lesions involving the left parietal lobe, and in particular the angular gyrus (McCarthy and Warrington, 1991).

3.7.2 Reading and writing

Developmentally there is a significant time-lag between the acquisition of spoken language and learning to read and write (Salvia and Ysseldyke,1988). Although there are only a very limited number of letters in the alphabet, these may computed and permuted into many thousands of meaningful words. With experience and training these complex visual patterns can be recognised extremely quickly by the fluent reader and (given the necessary motor control) written, utilising not only the correct letter formation but also the correct spelling and punctuation.

The above would then imply an educational basis for reading and writing skills, however, the selective impairment of these functions which may manifest as a consequence of certain cerebral lesions renders these skills of neuropsychological concern (Salvia and Ysseldyke, 1988). Neurolinguistic models of reading have typically been based on dual-route theories that propose indirect, phonological process based on knowledge of grapheme-phoneme correspondence rules and more direct orthographic process which accesses word specific knowledge (Huettner, 1994). Fluent reading is a multi-componential endeavour that involves processing linguistic information at the phonological, syntactic, lexical and discourse levels (Snyder and Downey, 1991). It also recruits a host of visual and conceptual-comprehension processes.

A breakdown in the complex information processing systems required for reading and writing manifests as dyslexia and/or dysgraphia (Sallice, 1988). More specifically, disorders affecting visual processing have been termed peripheral or visual word form dyslexia and those affecting the ability to derive sound or meaning from print, central dyslexia (Crawford, Parker and McKinlay 1992). Dependent upon the type of errors manifest, visual word form dyslexias can be sub-divided into spelling dyslexia, neglect dyslexia and attentional dyslexia (Warrington and Sallice, 1980). Lesions are poorly localised but in the majority of cases involve the posterior regions of the left hemisphere. Individuals with central dyslexias can be divided into two groups, depending on whether they read by

sound or sight, both deficits, however, again involve dysfunctions of the posterior structures of the brain, especially the temporal lobe (McCarthy and Warrington, 1990).

With regard to writing, the normal person is able to select and organise the movements necessary to write the letters of the alphabet and produce the appropriate letter form regardless of whether print or cursive script is being used. Lesions situated at the foot of the second frontal convolution may however leave the individual unable to write. Lesions of the parietal or parieto-occipital area may result in disproportionate difficulties in retrieving appropriate letter forms but a preserved ability to copy. Repetition of letter strokes and crowding of words on the right side of the page may be associated with more posterior lesion of the right hemisphere (Ellis, 1982).

3.8 CONCLUSION

It is apparent that human behaviour comprises a multitude of functions synchronised in process, governed by developmental profiles and based on anatomical integrity. Despite the high degree of specialisation within the human central nervous system, information processing and cognitive functioning requires complementary component operations to guide a unitary pattern of behaviour. In this endeavour, the individual must be in a position to pay adequate attention to appropriately perceived environmental stimuli, process this information systematically in the light of existing knowledge and execute an appropriate response. A break-down at any stage of this process leads to dysfunctional behaviour. Individuals impaired by dysfunctional cognitive strategies form the client base of the practising clinical neuropsychologist.

4 THE NEUROPSYCHOLOGICAL ASSESSMENT

Clinical assessment is concerned with identifying the individual's current level of overall functioning. Coleman et. al. (1980) define neuropsychological assessment as "the use of psychological tests that measure a subject's cognitive, perceptual and motor performance to determine the extent and locus of brain damage". The quality of the assessment dictates to a large extent how well a dysfunctional individual's problems are understood and his needs are met.

This chapter starts with a short discussion regarding the general approach to a neuropsychological assessment and goes on to discuss the specific tests implemented in the study in a little more detail.

Although the physiological structures discussed in the chapter 2 may not differ, the impact of functional disability resulting from damage in these areas may differ subjectively, between individuals. Few would argue that damage to the olfactory senses of an individual working in the perfume industry, may result in a more far reaching functional deficit (even where the post-traumatic level of functioning may still fall within the expected range for the general population), than would be the case for an individual less reliant on this particular sense. This individual's level of disability must therefore be measured relative to other individuals from similar backgrounds (i.e. those in the perfume industry who rely heavily on the olfactory ability). Similarly, it is important that the methods used to tap a specific function are appropriate for the individual being assessed; 'sprint times' would not offer a true indication of the athletic ability of a cross-country runner.

Historically, assessment and interpretation moved from reliance on subjective, internal, informal ideas of "correct" behaviour to a reliance on quantitative, objective, formal norms. These norms are based on the measurement of the same functions in numerous non-impaired individuals. It is rare nowadays to find a contemporary clinical neuropsychologist who does not use at least a few standardised tests (Franzen, 1989).

These tests produce numbers which can be interpreted to represent a skill level relevant to a particular ability. The scores relative to one skill can in turn be compared with the scores representing a different ability and a performance profile uncovered. It is clear that if these standardised tests are to be of diagnostic value to the clinician, it is of the utmost importance that the scores derived from them remain stable under unchanging conditions and prove themselves to be meaningfully related to some or other criterion. It is for this reason that such emphasis is placed on the reliability and the validity of the psychometric measuring instrument. Although references to these facets of psychometric assessment will be noted throughout this text, they will be given special attention in section 4.1 below.

Assessment may be based on either the administration of a flexible combination of independently developed measures selected from different sources and designed to tap specific functions or abilities, the administration of one of the recognised neuropsychological test batteries, or a combination of the two.

The disadvantage of selecting a battery of individual tests from different sources lies in the fact that an individual testee's performance is interpreted in the light of normative scores obtained by a number of different groups, usually with very different characteristics and conditions and occasions of testing. The exclusive administration of one of the recognised neuropsychological test batteries ensures that a wide range of testee abilities are measured against the performance of a single group of asymptomatic individuals. However, such a rigid battery may also tap abilities unrelated to a specific individuals problem but fail to adequately assess individually pertinent abilities.

Individual tests, although purportedly designed to measure specific abilities, are not exclusively open to the influence of single traits. The overlap and interdependence between the intellect/cognition (reason), emotions and motivation and classifications of scores into different modules may be to some extent artificial. Hypotheses formed on the basis of a single test score should not accepted without additional support from other sources, and without due consideration for the reliability and validity, and limitations of the test.

Specific test selection may be further influenced, not only by the specific nature of the dysfunction and the preferences of the clinician, but also the uniqueness of the client's milieu. In this regard Nell et.al. (1992, 1993) warn that "in developing country settings, the results of neuropsychological tests that have been well standardised in the west may be misleading unless the underlying validity issues that arise when a test developed in one culture is applied to another have been addressed". Psychological tests have no predetermined standards of success or failure. Each individual's performance is evaluated through comparison with that of others, on the same test (Anastasi, 1988). Careful consideration in acceptance of a specific standard of comparison for a specific testee (even for tests where normative data have been meticulously collected for the general population), is of critical importance in the neuropsychological assessment procedure. The available normative data may be misleading not only when applied to populations with geographic and ethnic differences as suggested by Nell (1997) but also when applied to specific groups within a population group. Spreen and Strauss (1991) illustrate this caution utilising the example of a boxer with concussion being assessed for motor skill or motor speed. Compared with the general population testing may lead to the erroneous conclusion that no deficit exists, compared with a population drawn specifically from a similar athletic community, the diagnosis may be somewhat different.

The level of general cognition, and relative strengths and weaknesses, determined by the individual's approach to and performance on a battery designed to give a differential profile of cognitive abilities is used in neuropsychological hypothesis formation. In this the reliability of the pattern of scores is important for confident interpretation.

Research has shown that variables such as age, sex, level of education and acculturation, socio-economic class, rural/urban background and race (Boone et.al., 1993; MacInnes et.al., 1983; Scarr, 1981), may be critical determinants of test performance. The appropriateness of the reference group yielding the norm-standard must therefore be carefully considered before any individual testee's performance can be utilised as a means of establishing a valid indication of brain damage (presence and localisation) and the effects thereof on their ability to effectively utilise their cognitive ability and function independently within a society. It is for this reason that it is important to ascertain a detailed

clinical and biographical background prior to selecting either the test battery or the norm standard to be used. Further, before any inferences are made on basis of the test performance, the practitioner may wish to establish laterality and, since the interpretation of the findings on so many of the individually selected neuropsychological measures is so dependent upon intellect, psychometric intelligence.

Given the legacy of the apartheid regime in South Africa, with its particular peculiarities, such as the "Dompass", Group Areas Act and segregated schooling, which effectively enforced separate development, one can not possibly expect equivalent acculturation across all sectors. Further, one must beware of making assumptions, based on findings associated with the cultural stratifications manifest in other countries, regarding a culture which has arisen out of legislation unique to this country.

A final diagnosis is based upon logico-deductive analysis of the meaningfulness of relationships within a measured profile. A thoughtless test selection or superficial analysis may result in misdiagnosis and mismanagement of the patient.

4.1 RELIABILITY AND VALIDITY

For the practising neuropsychologist to be able to draw on past experience when making a diagnosis they must be confident that, should a specific neuropsychological measure be administered to a specific individual at a different point in time and/or by a different clinician, neither the administrative procedure nor the scores produced would differ. In addition, to be of any significant value to patient management, the scores should be representative of the targeted function beyond limitation of the specific test items. Thus the term reliability may be used to refer to several different types of stability – temporal stability, internal stability and equivalence stability. Each type of reliability estimation is an attempt to assess the accuracy of the test. Although the ideal would be to have an error-free measure, in practice the observed score is composed of a true score and an error score (Salvia and Ysseldyke, 1988). The confidence with which a clinician can accept a recorded performance as a

true reflection of the measured trait is dependent upon the statistical computation of the reliability coefficient and thus the standard error of measurement of the test. A test score cannot be accredited as making a meaningful contribution to the understanding of an individual's neuropsychological profile unless it is replicable irrespective of test circumstances and generalisable to the broader spectrum of ability being assessed.

The other factor used to determine whether or not to include a specific measuring instrument in a neuropsychological assessment is that of test validity. With reference to a particular testee, in a particular setting, with a particular problem, the question is asked as to whether the test is capable of delivering the information for which it was originally intended (Salvia and Ysseldyke, 1988).

The degree of accuracy with which a clinician can make inferences and formulate hypotheses based on an individual's performance on a specific test, rests on a number of considerations. At the initial stage of test development the developer must clearly define the construct under examination. The examination of the relationship between the test and the underlying theory then becomes an ongoing process as the test is applied to other population groups and under other circumstances and possible improvements to the procedure are suggested. This may include the administration of the test to individuals with definable brain injuries, serial testing during recovery from brain injuries or predictions as to an individual's performance on similar tests. Given the specific circumstances of the assessment, the clinician must consider whether or not the test items adequately and appropriately tap the function for which the test was intended, thus the content validity. Criterion validity is based on the correlation (validity coefficient) between a test score and an external variable such as the performance on a similar test (concurrent validity) or a predicted behaviour (predictive validity). Both numerically and conceptually, the validity coefficient can be negatively affected by the degree of homogeneity of the sample and the limitations of poorly defined criteria (Franzen, 1989). The identification of the populations, the context, and the questions for which a particular measuring instrument is inappropriate is just as important as the identification of the populations, the context and the questions for which an instrument is appropriate. Threats to the internal validity of a test reflect design contamination that limits conclusions about treatment effects and threats to external validity reflect limitations on generalisability. The internal validity of a test may be threatened by

factors such as the uncontrolled effects of education, permorbid functioning, age, handedness, gender or socio-economic status; exposure to testing or test wiseness; fatigue, level of motivation and concentration; poor understanding of the underlying theory, unclear intent or the effect of irrelevant environmental or personal artefacts: Procedures which do not allow for the normal variability in a normal population; statistical artefacts arising from the implementation of inappropriate norms.

4.2 SELECTED PSYCHOMETRIC MEASURING INSTRUMENTS

The present study focuses on the suitability of published neuropsychological test norms for the diagnosis and management of black South African urban high school students. Since it is impossible to include all possibilities, a selection had to be made from the wide range of available psychometric measuring instruments. As one of the intentions of the present research was to test the validity of a previous and much debated (Murdoch et.al. 1997; Nell, 1997), study conducted by Murdoch et.al. (1994), test selection was to some extent predetermined. The final choice included subtests from local and internationally recognised test batteries together with a number of individually developed measures. Some of these measures had previously been implemented in South Africa in studies, whilst for others, local literature was sparse. All of the tests are recognised and the measures are commonly used in neuropsychological assessment.

4.2.1 The intelligence test batteries

Especially in the case of a culturally different and disadvantaged population, the dynamic assessment approach to cognitive functioning may offer a viable alternative to the more traditional psychometric assessment based on the Wechsler scales (Mervyn Skuy, Department of Specialised Education, University of the Witwatersrand – personal communication, 1998). However, despite the grumblings emanating from an awareness of the limitations and shortcomings of traditional psychometric assessment, the approach is sustained due to the wealth of research and published literature.

A survey of the literature suggests that a large proportion of the above-mentioned research emanates from societies with an acculturation norm typical of the Western intellectual heritage targeted by these intelligence tests (Kriegler and Skuy,1996). They warn that "the current repertoire of psychometric tests of general intelligence and special abilities are no more than proxies for scholastic attainment and Western acculturation" (pg. 115). The need for assessment outside of these societies has caused practitioners to question their conceptualisation of cognitive functioning and their approach to assessment. As with all other paradigm shifts, as measuring instruments such as Feurerstein's Learning Potential Assessment Device, Kaufman's ABC test and Das's Cognitive Assessment System gain popularity in the assessment of cognitive processes in culturally diverse societies, so the understanding of the potential and limitations of the approach will be reflected in the literature.

Although intelligence test batteries may be primarily directed at the determination of psychometric intelligence (a variable so often required for the valid interpretation of other neuropsychological measures), the various tasks from which they are composed correspond with issues relevant to subcortical, cortical and hemispheric specialisation functioning and for the neuropsychologist an analysis of the performance profile is of greater importance than the IQ score as such.

The Verbal Scale of intelligence test batteries offers insight into the sequential, analytic and logical processing associated with left hemispheric function, while the Non-Verbal (Practical or Performance) Scale aligns itself with the gestalt-like, holistic processing associated with the right hemisphere. The analysis of the performance profile does not, however, end with a simple split dependent on the verbal and practical performance scales. As discussed in the previous chapters, global behaviour is based on a multitude of factors, none of which operates in isolation. It is therefore important that the psychometric assessment is not limited to a simple quantitative procedure. This quantitative process must be backed by a qualitative analysis based on the way in which the individual testee approached the task. For example, a poor performance on a task such as the Weschler Intelligence Scale for Children – Revised (WISC-R) Coding subtest may have been due to poor concentration, poor motor speed, poor visual perception or an increased number of errors. Armed with the answers to both the quantitative question, "What scores were obtained?" and the

qualitative question as to "How?", the clinician is in a position to make an informed analysis of the resultant test profile on which to base his/her conclusions..

In the analysis of a specific individual's performance profile on the WISC-R, the practitioner could, for example, further sub-divide the non-verbal tasks according to those primarily dependent on right brain functioning (Picture Completion and Object Assembly) and those requiring the dynamic integration of the cognitive styles of the two hemispheres (Picture Arrangement, Block Design, Coding and Mazes) (Kaufman, 1979). Alternatively, the practitioner could distinguish between fronto-temporal successive processing (Picture Arrangement, Coding and Mazes) and the simultaneous mode of processing associated with occipito-parietal functioning (Picture Completion, Block Design and Object Assembly) (Das et.al., 1975).

Incorporating both the verbal and non-verbal subtests into a categorisation schema based on alternative modes of processing, Bannatyne (1974) suggested that verbal conceptualisation abilities could be quantified via performance on Similarities, Vocabulary and Comprehension subtests whilst the Information, Arithmetic and Vocabulary subtests could prove to be an indication of acquired knowledge. Sequencing skills could possibly be demonstrated on the Arithmetic, Digit Span and Coding subtests and spatial ability highlighted through performance on the Picture Completion, Block Design and Object Assembly subtests.

Although the WISC-R specifically is used in the above example, similar inferences can be made from other test batteries. [1].

Despite the fact that one of the purposes behind revising the WISC in the United States of America was the minimisation of racial bias, some practitioners may prefer to sacrifice the wealth of international literature in favour of a locally developed substitute, such as the Individual Scales for

---

[1] In Part 1 of the present study subtests from two different intelligence test batteries, the Weschler Intelligence Scale for Children - Revised (WISC-R) and the Individual Scales for African language (Zulu, Tswana and Northern-Sotho) speaking pupils (IS-A) were administered. However in Part 2 preference was given to the full WISC-R scale

African Language Speaking Pupils (IS-A). The IS-A was designed specifically for a black South African population to be administered in the vernacular as an objective aid in diagnosis and for the classification and guidance of black South African pupils (Landman,1991). This being the case, the advantage of such a selection is based both on language-, and norm group-, compatibility. However, considering the diversity of the South African population, a test selection based purely on the merit of home language may require caution. For some individuals, despite a common language factor, primary identifiers and geographical location may differ radically from those prevalent in schools in the former homelands and areas of the Republic of South Africa in which the particular language group predominates.

Irrespective of the test chosen, as discussed under section 4.3, the neuropsychological approach to the analysis does not differ. The measured psychometric profile will be examined in the light of the literature, intra- and inter-subject factors, background information as well as specific qualitative observations. The final diagnosis will be based on several neuropsychological methods of inference.

4.2.1.1 Subtests derived from the Verbal scales

It is suggested by Lezak (1983) that the Similarities subtest of the Wechsler tests is a measure of verbal concept formation which is virtually independent of any memory component (Lezak, 1983) and is unaffected by impulsiveness and social misjudgements. It is the one subtest least affected by the subject's social or educational background and is more sensitive to the effects of brain injury regardless of its localisation than the other verbal subtests included in the WISC-R.

On the other hand, in order to successfully answer questions on the Comprehension subtest, the testee must use common sense to draw on past experience, evaluate it, and verbalise the most effective solution. Responses reflect social and moral standards, the testee's level of comprehension and the range of information available to him (Landman, 1991). It is therefore possible that a significant difference between performance on these tests (Similarities and Comprehension) may prove to be a valid indicator of social, rather than purely, cognitive factors.

The IS-A Memory subtest measures attention to verbal input, and acquisition of and short-term recall for, meaningful material in the form of a short story presented in the vernacular. Although not included as part of the formalised procedure, this test can be administered to include both immediate, cued and longer-term recall of the information. This method of administration would then provide an indication of the testee's ability to acquire, encode and process relevant detail in a logical verbatim manner in short-term memory effectively enough to facilitate transfer to, retention in, and retrieval from long-term memory.

In addition to providing a measure of immediate memory, the Digit Span subtest requires the testee to hold and manipulate numerical information in working memory in order to recite information in reverse order. A large disparity between forward and reverse scores (total number of digits recalled forwards – total number of digits recalled backwards) may be an indicator of brain damage. Individuals with left hemisphere lesions perform poorly on both Digits Forwards and Backwards and those with right hemisphere lesions only on Digits Backwards (Weinberg, et.al., 1972). Performance on this subtest is sensitive to attentional factors and age, and possibly affected by the time of day (Baddley and Warrington, 1970).

Solutions to items on the Problems or Arithmetic subtests require mental-arithmetic. Similarly to the Digit Span subtest, performance may be adversely affected by poor immediate memory, concentration, concept manipulation or tracking (Lezak, 1983) but also by limited formal education, as they are fundamentally tests of mathematical skill. Correct answers depend on mental clarity in numerical manipulation and logical reasoning skills in the analysis of problems of a numerical nature (Matarazzo, 1972 in Landman, 1991). As stated in section 3.7.1 of the previous chapter, in the absence of a specific brain pathology, given an adequate attention span, memory and sequencing ability and a certain inherent potential, the ability to master increasing complex mathematical concepts increases with training. With regard to the formalised training of mathematical skills, although it is sometimes assumed that a reasonable correlation exists between the age of a student and the number of years of formal education, in a society where education is not compulsory this may not necessarily hold true. Effective daily functioning may frequently require simple addition and subtraction, but not division, multiplication or fractions. Why divide thirty six apples between four

children when it is more practical just to give them one each and, especially given the financial constraints of much of society, wait and see how many of them ask for another tomorrow.

Vocabulary tests are frequently used as an estimation of pre-traumatic functioning in cases of brain damage. Dependent on the specific test used, these subtests can either rely solely on receptive vocabulary (as is the case in the IS-A Vocabulary subtest where the individual has to associate a given word with one of a selection of four pictures) or both expressive and receptive language (as is the case in the WISC-R Vocabulary subtest where the individual is required to orally define a given word). Any individual who has ever tried to function in a linguistic environment other than their own is aware of the dysfunctionality that results when one is unable to communicate effectively. The complications associated with assessing language disorders in a multi-lingual society are obvious, as are the dangers of making unsubstantiated inferences regarding mother-tongue, language of education or the level of pre-traumatic functioning. However, given the importance of language as a functional manifestation of dominant left hemisphere functioning (see sections 3.5 and 3.7.2 of the previous chapter), language assessment never-the-less must remain an integral part of the neuropsychological assessment.

Another test which, like the Vocabulary and Arithmetical subtests, appears to rely heavily on learnt knowledge, is the WISC-R Information subtest in which learnt information retrieved from long term memory is verbalised. As suggested by the list of recommended WISC-R item substitutions for Canadian subjects (Violato 1986 in Spreen and Strauss, 1991, p 60), the relevance of the content for the group being tested is one of the more obvious areas of possible bias in a test such as this. Where the test was neither developed or normatised with regard for the specific educational syllabus, the item difficulty continuum may prove invalid. Given an appropriate standard of comparison however, of importance to a successful rehabilitation programme, the test may provide an indication of the richness of the home environment and available facilities. Except in the case of some very extreme cases, a test of this nature which was developed for individuals characterised by a specific geographical location and educational environment may prove to be of little value to the neuropsychological evaluation.

4.2.1.2 Subtests selected from the Non-verbal/Performance scales

Compared with many of the other subtests frequently incorporated into the Performance scale of an Intelligence test battery, successful performance on tests such as the Absurdities (IS-A) and the Picture Completion (WISC-R) subtests (both of which require visual recognition and analysis), is relatively independent of any major motor demands. Both tests require visual recognition and analysis. It thus appears that the IS-A Absurdities subtest incorporates many of the skills required for successful performance on the WISC-R Picture Arrangement subtest. However, it is possible that the Absurdities subtest introduces an additional component into the cognitive equation with regard to the level of concept formation and understanding required. In the case of the Absurdities subtest, the judgement is not based solely on the visual gestalt but, as is the case with the Picture Arrangement subtest discussed below (but without the cues of sequence), also requires a degree of social awareness.

Performance on the Picture Arrangement subtest requires comprehension and sequential integration of complex visual information and relies heavily on concept formation, perceptual organisation and social judgement and reasoning. As this depends on sensitivity to subtle information as well as to the sequencing of the story, right frontal or parietal and parieto-occipital damage may adversely affect performance. The apathy associated with frontal damage may for example prompt the patient to leave the pictures in order of presentation and offer this as a solution. Impaired planning and purposeful behaviour, and a tendency towards impulsiveness which are also frequent manifestations of frontal damage may further adversely affect performance on the mazes subtest.

Similar to the Block Design subtest, performance on the Object Assembly subtest provides an indication of right brain functioning where the individual is required to analyse and synthesise puzzle pieces. In cases where visuo-spatial problems can be excluded, poor performance on the Block design subtest may be due to the testee's failure to correct errors, an inability to formulate a suitable plan, or to the fact of attention to only a restricted part of the design, raising the possibility of frontal damage. With adequate visual-motor coordination, this test, as an estimate of non-verbal intelligence, relies on visual perception and organisation, spatial relationships, visual analysis and synthesis and logical reasoning skills.

The Coding subtest is based on the ability to channelise goal-directed energy in order to sustain prompt information processing and performance in a clerical type task. Lezak (1983) points out that this is a test of psychomotor performance in which motor persistence, sustained attention, response speed and visuomotor coordination play important roles. [2]

4.2.2 Individually selected tests from other sources

Based on the specific presentation of the clinical history the practitioner may decide to administer various tests from a number of sources. As hypotheses are formed in the course of the assessment ,so different components from the selected battery may be extended or discarded.

4.2.2.1 Trail Making Test (TMT)

Because of its brevity and simplicity of administration, the Trail Making Test (TMT) has become popular both as a screening and a diagnostic test of cognitive impairment. This originally formed part of the Army Individual Test Battery (1944) and, in addition to the other cognitive skills discussed below, requires motor speed and attention. It consists of Parts A and B, with a sample preceding the administration of each. In part A, the subject is required to sequentially join numbers scattered randomly over a page. In part B the subject repeats this procedure but with the additional requirement that every alternative connection be made to a letter in alphabetical order. Speed of performance in encouraged. Errors are immediately noted by the examiner and the subject is instructed to proceed from the point of error. In scoring the test according in the manner proposed by Reitan, errors count only in the increased time of performance and reliability therefore is based to some extent on aspects of speed relevant to the examiner's ability to spot errors and point them out and the speed with which the testee comprehends and corrects according to these instructions.

[2] In part 2 of the study those subtests forming part of the IS-A only were omitted from the battery and preference was given to the full WISC-R scale.

The test requires immediate recognition of the symbolic significance of numbers and letter, ability to scan the page continuously to identify the next number or letter in sequence, flexibility in integrating the numerical and alphabetical series, and ability to perform under time pressure. It is also a test of attention and concentration. Although the TMT may be administered as an index of visuomotor and visual conceptual tracking, the user is warned that the speed of execution may be affected by motor-slowing, incoordination, visual scanning difficulties, poor motivation or conceptual confusion (Lezak, 1976), and for this reason it is important that the test is interpreted from a qualitative viewpoint in addition to its quantitative usage in the diagnosis of neurological impairment to provide additional information regarding the testee.

Research has suggested that the two parts of the TMT may be differentially sensitive to impairment of the left and right hemispheres (Lezak, 1976). Comparing an individual's relative ability to perform on Part A, with his/her performance on Part B, individuals with left hemisphere dysfunctions demonstrate relatively poorer performance on Part B due to their inability to cope with the more complex processing required in this second part of the test. Individuals with right hemisphere dysfunctions, on the other hand, find it difficult to comprehend the spatial configuration of the material and the difference in performance between Parts A and B is thus less pronounced. Klonoff et.al. (1970) demonstrated test-retest correlations of 0.87 on part B of the TMT.

Boll and Reitan (1973) highlighted the significant correlation between performance on the TMT and IQ. Rosin and Levett (1989) stress that in the absence of standardised norms, cognisant of age, education and IQ differences, test results should be interpreted with caution.

With reference to the use of the TMT in a country such as South Africa, where literacy skills may be limited, Rosin and Levett (1989) stress that in the absence of appropriate norms, test results should be interpreted with caution.

4.2.2.2 The Goodenough-Harris drawing test

The draw-a-person test (DT) is an easily administered non-verbal test which appeals to children. Basically a test of visual-spatial ability, the testee's creation may be interpreted quantitatively (body proportion, accurate detail, ability to use shading and give expression to a drawn face), as an indicator of organic defect, mental age or intellectual ability, or projectively (inclusion of unusual detail, omission of usual detail and distortion), as an indicator of body-image and self-concept.

Richter et. al. (1989) suggest that the draw-a-person task is fundamentally different for local children than for their western counterparts and is unsuitable for evaluating the intellectual level of black South African children as firstly, scores based on the elaboration of detail tend to underestimate abilities, secondly, scores tend to level off around the age of 11 years and thirdly, they do not appear to correlate well with school performance.

Theoretically lack of detail, poor integration, noticeable shifting of parts, and inappropriate size or shape of the body parts can be associated with organic defects – the closer the involvement is to the occipital lobe, the greater the likelihood that the testee will display some of the more pronounced drawing disabilities associated with right hemispheric lesions (Obrzut, in Hynd and Obrzut (Eds.) 1981).

After examining a number of reliability studies (Harris, 1963; McGillgan, Yater and Hulsing, 1971; Scott,1981; Nagliera and Maxwell (1981); Dunn, 1967; Levy, 1971; Yater, Barclay and McGilligan, 1969; Struempfer, 1971) and validity studies (Joesting and Joesting, 1972; Dudek, Goldberg, Lester and Harris, 1969; Pihl and Nimrod, 1976, Watson, Felling and Maceachern, 1967), Franzen, (1989) concluded that although the Goodenough-Harris scoring system appears to demonstrate adequate reliability, validity is questionable, even for the population for which it was intended (Franzen, 1989). For black South African children in particular, many of the details credited in this scoring system, for example hair style, are obviously caucasian in nature.

4.2.2.3 Rey Auditory Verbal learning Test - Rey 1964

This test provides measures of immediate memory span, long term recall, recognition and susceptibility to interference. It also provides an opportunity to study the strategy used by the testee during a learning task. In an empirical evaluation of the different scores obtained on the Rey Auditory Verbal Learning Test (RAVLT), Vakil and Blachstein (1993) identified acquisition and retention as the basic constructs tapped by the RAVLT. Retention can then be further subdivided into storage and retrieval. Examining the performance of a group of 7 to 15 year olds, Forrester and Geffen (1991) found that although age did not effect acquisition rate, the shape of the learning curve, memory for the source of items or the proportion of items recalled on a long recall trial, the older children did demonstrate superior acquisition, retention, word span and retrieval efficiency. There is some evidence that performance on the RAVLT may relate to cognitive function (Query and Megran, 1980) especially verbal functions (Ryan et.al., 1986) but correlations with the Benton Visual Retention Test (Moses. 1986) suggest that these tests may not be purely modality specific. Possibly related to the fundamental difference between words and numbers (see section 3.7), despite expectations Talley (1986) found that performance on the RAVLT did not predict performance on Digits Forwards.

An examination of memory impairment requires the ability to detect poor memory function relative to some standard. In addition to the intellectual level and age factors discussed above, some (e.g. Spreen and Strauss, 1991), but not all (e.g. Forrester and Geffen, 1991), researchers have reported gender differences. The question is, therefore, whether the testee's level of memory function is commensurate with his/her age and IQ, and its answer, therefore, requires a test with satisfactory age and IQ norms.

The test was originally normed in 1964 on French-speaking subjects but has become popular with English-speaking neuropsychologists. It appears from the literature that, in many cases, the test is simply translated without any regard either for the frequency of the word in the language of translation, or for any other possibly relevant variables, and that the resultant version of the test is implemented clinically, without re-norming in the new language of administration. For this reason, and despite the fact the research into the use of the equivalent forms of the Auditory Verbal Learning

Test is not conclusive of equivalency (Franzen, 1989), individual performances are frequently interpreted according to the original test data.

Regarding the utility of the RAVLT in the clinical setting Mungas (1983) suggested that although delayed recall did not differentiate between his amnesiacs, head trauma victims, schizophrenics, nonpsychotic psychiatric patients and attention deficit disorders, their progressive performance over the initial five trials did. Following her research into the RAVLT, Lezak (1979) reported that although the scores of traumatically brain-injured individuals improved over time, a statistically significant practice effect was also noted in normal subject tested at 6 to 12 months intervals (Lezak, 1983).

4.2.2.4 Rey-Osterreith Complex Figure Test - Rey 1941; Osterreith 1944

This test requires the copying and immediate and delayed reproductions of a complex figure. The purpose of the test, which is based on visuospatial constructional ability and visual memory, is to reveal aspects of the testee's learning and recall strategy, as well as to elicit any perceptual deficits or difficulties that may be present in organising the response. Copying relies heavily on visual perception whereas freehand drawing relies in addition on representation from memory. A piecemeal approach to the copy adversely affects recall (Akshoomoff and Stiles, 1995). Various scoring methods have been proposed, with the aim of reflecting both qualitative and quantitative aspects of performance. Inter-rater reliability and internal consistency of the Lezak and Denman scoring systems were high. Considering the fact that Bennet-Levy (1984) showed that females did better than males and that scores were significantly correlated with age, the reliability of the scoring systems does not in itself relieve the practitioner of the responsibility of careful norm selection and interpretation of performance.

Regarding the usage of this test in the localisation of organic impairment, King (1981) showed that, although both groups with left and right brain damage made the same number of errors, individuals with left hemispheric problems were more likely to show simplification errors (omissions) whereas right hemisphere subjects were more likely to make distortion errors. Patients with posterior lesions

may demonstrate more difficulty with the spatial organisation of the figure, whilst those with frontal lesions are more likely to have difficulty planning their approach to the task.

4.2.2.5 Stroop Colour and Word Test – (SCWT: Stroop,1935)

This test developed from the observation (Cattell, 1886) that the naming of colour hues is always slower than the reading of colour names in literate adults. This test is based on stimuli having two sets of dimensions, colour and verbal meaning. The automaticity in word naming may improve greatly with practice and is associated with only one behavioural response, reading, whilst colour naming may be limited by an innate organic colour naming factor and does not have the same practice effect. These factors may be of significance when administering the test in a second language to a population with a lower literacy level, especially in South Africa where the vernacular does not offer single words for the names of colours such as blue.

With regard to localisation of organicity, it is probable that the left frontal area plays an important role in this form of focused attention (Holst and Vikki, 1988). In this regard, Perrett (1974) found a significantly greater performance deficit in frontally involved patients as opposed to those with damage in other areas on the Stroop test. When interpreting an individual's performance on the Stroop Colour Word Test (SCWT) , the practitioner must not ignore the fact that this test has been shown to be sensitive to gender differences and stress effects. Further, differences in performance on the SCWT may correlate with Verbal IQ (Franzen, 1989).

4.2.2.6 Wisconsin Card Sorting Test – (WCST: Grant and Berg, 1948)

Although it has been suggested (Franzen, 1989) that the Halstead Reitan Categories test may be a more sensitive measure, a test often used to detect frontal lobe dysfunction is the Wisconsin Card Sorting Test (WCST). The purpose of the test is to assess the ability to form abstract concepts and shift and maintain set. The cards differ in terms of number, colour and form of stimuli, and it may be predicted that non-verbal processes might be differentially involved, and that right frontal damage may be more disruptive than left. However, the task is complex and verbal mediation probably takes place. The selective effects of frontal lesions on WCST performance have been repeatedly confirmed

and a very poor performance is usually clinically significant. There are, however, exceptions, as some intellectually capable individuals (as assessed by university degree results) may fail the test and there is also at least one published report of an individual with dorsolateral frontal damage who showed superior performance on this test (Heck & Bryer, 1986).

As clearly indicated in a study conducted by MacInnes et.al. (1983) in which he calculated all 14 of the scores for the WCST and found that age correlated significantly with 12 and education with 10, practitioners utilising this measure should possibly take heed of the suggestion that an individual's performance on the WCST be interpreted within the context of patient gender, education and age (Boone et. al., 1993).

4.2.2.7 Bender Gestalt Test (BGT: Bender, 1938)

The Bender-Gestalt test consists of nine simple designs, each of which is presented to a subject to be copied on to a sheet of paper. The test can be used to demonstrate the tendency of the perceptual system to organise visual stimuli into a gestalt or configurational whole. For example, in the examination of constructional praxis, the BGT may be used in conjunction with the more cognitively dependent Block design subtest (discussed earlier) and other more motor dependent tests. Subjects with right parietal dysfunction may find it difficult to perform well on the BGT. The BGT has been used to estimate perceptual-motor development, intelligence, emotional disturbances, brain injury and the effects of convulsive therapy (Viljoen et.al. 1994).

Although the BGT has often been used as a screening mechanism for organic integrity, the accuracy of classifications and diagnoses based on the application of a single test is dubious. For example, Norton (1978) found that 33% of 598 individuals classed as normal on the Bender Gestalt Test (BGT) had abnormal objective neurological findings. The BGT loads heavily on visual-perceptual and fine-motor skills and may also be sensitive to receptive language skills (Franzen, 1989). Further, close relationships have been reported between performance on this test and the WISC Performance Scale IQ (Koppitz, 1960) in Viljoen et.al., 1994). However, not detracting from the usefulness of the test as part of a more extensive battery, as the test fails to tap such functions as reading

comprehension, arithmetic, memory or expressive speech skills, the usefulness of this test as a single screening test for organic integrity is thus limited.

The test has four major scoring systems. It is important to choose an appropriate normative reference in the interpretation of the BGT as the test has been found to be sensitive to factors such as sex, age, educational level and race, and misdiagnosis can occur when such factors are ignored (Adams et.al., 1982). Lacks (1984), for example, found that caucasian subjects performed better than blacks, and females better than males. In the South African situation Viljoen et.al. (1994) found significant discrepancies between the performance of their group of Zulu-speaking children and Koppitz's (1960) norm group and thus concluded that these foreign norms may be inappropriate for local use.

4.2.2.8 Spatial Memory Task

The Spatial Memory Task (SMT) was one of three tasks developed by Lhermitte and Signoret (1972) to distinguish between mamillo-thalamic and hippocampal amnesias. Since that time the Spatial Memory Task, Logical Memory Task and the Code Learning Task have proved useful in diagnosing cases of non-specific amnesia (Walsh, 1985). After being shown and instructed to learn the card placements, the testee is required to correctly position the cards from memory. Using a correction feed-back most subjects can correctly place all nine cards within six trials, however those with general amnesic syndromes seldom master the task even after twelve trials. Where all three tasks are employed, a response pattern can analysed and associated with different anatomical locations (Walsh, 1985).

4.2.2.9 Oral Word Fluency

The controlled Oral Word Association Test (Verbal Fluency) is part of the Multilingual Aphasia Examination (Benton and Hamsher, 1978) and has been shown to be sensitive to frontal lobe impairment (Perret, 1974). The purpose of the test is the spontaneous production of as many words as a given individual is capable (excluding names, numbers or the words with different endings) starting with a certain letter within a limited amount of time, namely one minute. The procedure is repeated using the letters 'F' then 'A' and then the letter 'S'. The score is the sum of the total

responses for each letter. The test does not measure verbal productivity in conversation or in continuous sentences.

As the test is to some extent dependent on basic spelling skills, specific pronunciation characteristics can adversely affect performance in a phonological speller, especially in the case of a young child where the test loads heavily on reading and writing abilities. Oral fluency is one of the latest prefrontal functions to mature. In adults the tests loads more heavily on verbal knowledge. Patients with right hemisphere lesions, in the absence of right frontal involvement, may demonstrate adequate performance on this test which is especially sensitive to bilateral and left frontal dysfunctions.

4.3 THE FINAL DIAGNOSIS

As mentioned previously, a final diagnosis is not based solely upon the assimilation of numbers derived from measuring instruments such as those described in section 4.2. Firstly, contingent upon those factors relevant to specific test reliabilities and validities discussed in section 4.1, the clinician must assess the dependability of the information procured by means of the quantitative assessment in a specific case. Then, with due consideration for collateral information derived from other sources, make a logico-deductive analysis of the meaningfulness of the relationships within the measured profile.

In order to formulate hypotheses, the clinician must not only be familiar with the literature relevant to a particular test but also be able to evaluate its significance given a specific testee. In this, it is important that the clinician is aware of the testee's experiential background and conduct a comparative evaluation of this, against that of the group on which the relevant research was conducted. Factors to be considered must include not only age, gender, educational opportunities, language, ethnic origin, culture and socio-economic standing (to be discussed in the following chapter), but also more specific personal factors such as state of health and physical well-being.

By way of illustration, the WISC-R Coding subtest which, as discussed in section 4.1, requires the dynamic integration of the cognitive styles of the two hemispheres and taps both fronto-temporal successive, and the occipito-parietal simultaneous processing. This test, based on the ability to channelise goal-directed energy in order to sustain prompt information processing and performance in a clerical type task, is a test of psychomotor performance in which motor persistence, sustained attention, response speed and visuomotor coordination play important roles. However, a poor score on this test, in itself, is meaningless. Firstly, if the testee was not an English speaking American, the norm standard may not have been an appropriate standard of comparison and the individual's performance may have been normal for his or her specific milieu. Secondly, if the performance could reliably be classified as below expectations, the clinician must examine the available information as to why. Did the testee complete only a limited number of items or make a large number of errors? If it was due to relatively few items being attempted, was this because of slow motor-execution or slow information-processing throughout? Was a retarded motor speed due to a physically based peripheral dysfunction or neurologically based inability? Was it perhaps because of fine motor co-ordination difficulties, a poor pencil grip, or were their fingers just cold? Did the testee demonstrate a good initial work pace but lack motor persistence and tire easily? Did the testee lack the energetic motivation necessary to ensure purposeful striving towards the set goal? Did the testee start slowly due to visuomotor coordination difficulties and speed up only once the symbol-digit pairs had been committed to memory? Was the testee easily distracted from the task at hand and as a result demonstrated a fluctuating work pace dependent upon the level of attention and concentration? If the poor score was due to a large number of errors, what type of errors were made? Were these due to poor visual acuity, visual perceptual ability or impulsivity?

All of the measures administered in the course of the neuropsychological assessment are scrutinised in a manner similar to that described above. Seen in the light of the testee's reported problems, clinical and developmental history and specific situation, hypotheses are then formed based on the results of two or more tests that measure common abilities or are influenced by the same non-cognitive factors.

5 THE NORMATISATION ISSUES

The measuring instruments used in a formal neuropsychological examination may vary from practitioner to practitioner and from client to client. However, as mentioned in the previous chapter, it is important that the numbers produced as an end result of the neuropsychological test administration, have both purpose and meaning for the specific testee. It is incumbent on both clinicians and researchers, not only to be aware of the specific applications of a test, but also to identify the limitations and shortcomings of any test battery and take steps to correct them (Knuckle and Campbell, 1984).

In the previous chapter it was noted that psychological tests have no predetermined standards of success or failure, and each individual's performance is evaluated through comparison with that of others on the same test (Anastasi, 1988); further, that the specific adoption of this standard of comparison is therefore a crucial factor in determining the validity of the neuropsychological assessment. As stated in chapter 1, the diagnostic capability of a neuropsychological instrument is derived from a high level of discriminant validity (Franzen, 1989). Further, external validity of a measure is threatened by doubts about the generalisability of its results to populations other than that from which its norms were derived. 'Even if a test is otherwise satisfactory, test scores may be misleading if the norms are inadequate' (Salvia and Ysseldyke, 1988).

5.1 SUBJECT VARIABLES – ASSUMPTIONS OF EQUIVALENCE

As can been seen in the summary below, the literature abounds with references to variables which may effectively threaten the assumption of equivalency of testees and the generalisability of findings in the neuropsychological situation. Group and gender differences in performance exist for many tests, suggesting that appropriate norms are necessary for interpretation. In this chapter, those variables which may threaten the external validity of a neuropsychological measuring instrument are discussed in more detail.

Some of the warnings relevant to the assumption of group equivalence mentioned in the previous chapter, include the suggestion that it may be wise to interpret findings on a test such as the Wisconsin Card Sorting Test (WCST) in the context of age, education (MacInnes et.al., 1983) and gender (Boone et.al., 1993). Interpretation of the Rey Osterreith Complex Figure Test (ROCFT) should remain cognisant of the possible influence of gender and age (Bennet-Levy, 1984). In order to avoid the pitfalls of misdiagnosis, the suitability of the normative reference utilised in the interpretation of the Bender Gestalt Test (BGT) must be evaluated in terms of sex, age, educational level, Performance IQ scores, race (Viljoen et.al., 1994) and even language proficiency (Franzen, 1989). For the Trail Making Test (TMT) the suitability of the normative reference utilised must be evaluated in terms of age, education and level of intelligence (Rosin and Levett, 1989). Performance on the Stroop Colour Word Test (SCWT) may be influenced by gender, stress levels and the general level of verbal intelligence (Franzen, 1989). Levels of intelligence (Query and Megran, 1983), particularly verbal intelligence (Ryan et.al., 1986), may also be important in the interpretation of performance on the Rey Auditory Verbal Learning Test (RAVLT). (Adams et.al., 1982).

5.1.1 Age

From a developmental perspective it is understandable that work in this area has concentrated on both the very old and very young population groups and that this variable has occasionally been disregarded in other groups. Developmental neuropsychology is concerned with specifying age-related changes in cognition as a function of both normal and aberrant changes in the brain. To predict how brain damage affects cognitive function in children, it is necessary to understand the time course of normal cognitive development. The age of the subject is a variable which significantly influences neuropsychological test performance (Gilandas et.al., 1984). A sense of mutual interdependence emerges between cognitive developmental psychology and developmental neuropsychology.

Human infants are born with the potential for social and cognitive development that allows them to become members of their society. Integral to the age factor is one of the fundamental issues of cross-cultural developmental research, universals in human cognition. The three cornerstones of cognitive-developmental theory are that patterns of cognitive-processing change with increasing age, that the most important changes are qualitative in nature, and that each such change results in more efficient (less context-dependent, less egocentric, more flexible) strategies for processing information (Lancy, 1983). A sense of mutual interdependence emerges between cognitive developmental psychology and developmental neuropsychology yet Viljoen et.al. (1994) found that both rural and urban Zulu-speaking participants in their study, demonstrated a slower progression to maturity and poorer performance on the Bender Gestalt Test (BGT) than reported for American subjects of similar age. On the subject of maturity, and relevant to the findings of Viljoen et.al. while some academics suggest that the frontal lobes do not reach maturity until the age of 15 years, others report that on the Wisconsin Card Sorting Test (WCST), a test specifically targeting frontal lobe function, maturity in test performance is achieved by the age of 12 years. Of importance to the South African practitioner, especially when working with tests of categorisation such as the WCST, is the observation that the developmental trend towards formal categorisation has been monitored consistently, only for Western children (Olson, 1976)

Bruner (1964) states that, in the process of cognitive development, language replaces visual imagery as the prime source of rules, structure and concepts for the child to represent and organise his world. Formal categories can be set against other types in terms of their relative reliance on language (more) and context (less). Formal categories are those in which certain attributes are extracted from to-be-compared items. A judgement of equivalence depends on the items sharing a relatively large (as compared to other items not judged to be equivalent) number of attributes.

As discussed above, with increasing age, qualitative changes in cognitive processing frequently result in more efficient strategies for processing information (Lancy, 1983). However, there are the occasional exceptions. In the process of establishing norms for the Wechsler Memory Scale (WMS) on subjects aged 10 to 14 years and 16 to 18 years, Ivinskis et. al., found that, although their younger subjects generally performed more poorly, on the Associative Learning subtest they tended

to demonstrate a superior performance. Cauthen (1977) administered the Weschler Memory Scale (WMS) to a group of over 60s and although he measured a generally poorer performance, the most pronounced related to Visual Reproduction. As individuals advance in age they may demonstrate a reduced immediate adaptive ability but excel on tasks based on the recall of stored information or past experience. Generally tasks requiring more complex cognitive skills show more pronounced age effects (Franzen, 1989).

Regarding prognosis for rehabilitation following brain damage, despite references to neuronal plasticity, the protective function of a young age and suggestions of an inverse correlation between age and recovery of function after brain damage (Heacon,1976), it appears that it is not that children are deficit free after brain injury but that different types and patterns of cognitive deficit are evident at different points in the life span (Heacon, 1976).

In South Africa, factors relating to chronological age are confounded by specific cohort factors due to our social politically changing environment. As laws were enforced and the struggle advanced so different groups were subjected to different influences and opportunities thus laying the foundation for specific acculturation factors.

5.1.2 Gender

Gender differences are found not only on measures relating to physical strength, but also in many other areas of neuropsychological functioning (for example as demonstrated in the gender differences reported on the WCST, ROCFT and SCWT discussed earlier). Based on converging evidence from the fields of cognition, neuropsychology and neuroanatomy, a number of theories supporting sex differences in cognitive competence, hemispheric specialisation and interhemispheric relationships have arisen. Evidence suggests that males are generally better at visuospatial and mathematical tasks, whereas females demonstrate a superiority for verbal fluency, perceptual speed and manual dexterity (Lezak, 1983; Maccoby and Jacklin, 1974). Thus, in the absence of sex related norms, the validity of the clinical interpretation of tests monitoring functions which may differ between the sexes must

remain doubtful (Gilandas et. al., 1984). Further, due to greater hemispheric specialisation in males and greater connectivity between the two hemispheres in females, the consequences of brain damage may also differ between the sexes. Brain damage in males was found to lead to greater functional asymmetry, especially in visuo-spatial skills and, after left cerebral trauma, more frequent and severe aphasias (McGlone and Kertesz, 1973).

5.1.3 Language

Numerous researchers have pointed to language as a confounding variable in cross-cultural psychology. Illustrating the influence of alternative language assessment, there is some evidence that alexias and agraphias are not completely equivalent in different writing systems and Ardila (1991) was able to highlight differences in reading errors when using a graphophonemic reading system (Spanish) as opposed to a partially logographic reading system (English). Generally, language usage differs according to cultural background and strongly correlates with the individual's educational level and must thus be taken into account when interpreting the results obtained on language tests.

Language is crucially important to the neuropsychological evaluation procedure, not only as an ability to be assessed in determining organic integrity, but also for the assessment of so many other cognitive abilities. The traditional indicators of the pre-morbid level of functioning are frequently language dependent and are, as such, suspect when implemented in a poly-lingual society. Limited linguistic communication may adversely effect test performance in other areas or even render it impossible to conduct a valid assessment of higher cognitive functions.

Neuropsychological assessment requires that the subject understand all test instructions fully. On practical items, deficient receptive language can be circumvented via the employment of demonstration, and understanding can be controlled to some extent on unscored practice items. On verbal items it is not as easy to ensure that the requirements of the test have been correctly understood.

Further complicating the assessment procedure is the fact that the South African practitioner has eleven official languages and numerous more dialects to contend with. Given that many practitioners are not fluent in all eleven official languages and that the majority of these practitioners rely heavily on measuring instruments developed and normatised in other countries, it is important that the language factor is not ignored.

One only has to contemplate a day in the life of a typical South African to see the reality of living in a country with eleven official languages. How often does one hear somebody use a term borrowed from another of the official languages even when a perfectly good equivalent exists in the language being spoken? A resident in a language specific rural area may for the most part, utilise his mother tongue in its purest form, but a child growing up in a multi-lingual urban area such as Soweto is exposed, frequently from birth, to numerous different linguistic inputs, and it is rare to find a school going child in this community who is not able to communicate with all of his class mates and neighbours irrespective of their specific language. On top of this social language mix, on entering into their years of formal schooling, this child has to cope with academic instruction in yet another language, English. Residents in the area have commented that the language mix is such, that a resident can almost certainly establish the residential area and age of another, purely on the form of language and colloquialisms used (Cyril Sadki, Psychological Services, Gauteng Department of Education. -personal communication 1996). In this way language may prove to be an indicator of other cultural variables.

Even when tests have been developed and normatised for use in the vernacular, given the multi-lingual nature of so many South African communities, certain problems may arise if the cultural mix of some communities is not accounted for. The linguistic level deemed appropriate for test construction may be more comprehensible to individuals resident in rural or culture/language specific areas than to those living in a linguistically and culturally mixed urban area. Due to the mixed linguistic input characteristic of South African life, language preference may be context specific; in other words, a culturally laden topic may be better understood in the vernacular, whereas an academic concept may be more appropriately presented in the language of instruction, usually English. For example, numerical or technical concepts and even some colours (e.g. blue) may be

more readily comprehended in English, whereas ideas based on traditional norms and values may be more easily expressed in the vernacular. For one unfamiliar with the African languages, the English derivation of many of the "modern" words incorporated into the Nguni group of languages is easily recognisable. On the other hand, the Afrikaner origins can often be more readily identified when listening to somebody speak Tswana or Sotho.

Operating within a poly-lingual framework complicates the language issues in that the use of a second non-favoured language or reliance on a translator may introduce unconsidered variables to the assessment. The educated translator may tend towards a pedantic linguistic style and the translation may lack linguistic equivalence with test instructions. A poor test adaptation/translation may make a test more difficult or easier and can change the validity of the scores in significant ways (Hambleton, 1994). If translation is used, strategies to improve its quality are available and must be implemented. For example, back translation and discussion of the meaning of the patients answers are realistic options.

Although Hirshoren et.al. (1977, in Franzen 1989) did not find the reliability coefficients for the WISC-R Performance subtests in a group of deaf children to differ significantly from those of the norm sample, the effect of administering tests in a second language, albeit contextually correct for the learning situation, is uncertain. Assessment in a second language or different dialect may be likened to visiting a foreign country - one may get by, but miss nuances, and often blunder. The clinician must carefully consider questions such as whether a poor score on the oral fluency test, for example, is due to a frontal lobe phenomenon or to a limited knowledge of the language? Is a weak performance on a verbal memory test due to solely to a memory deficit or the increased attentional levels required to function in an unfamiliar language?

A case in point is the Rey Auditory Verbal Learning Test (RAVLT), originally normed in 1964 on French-speaking subjects, which has subsequently become popular with English-speaking neuropsychologists and has in this country been translated into Zulu (Anderson and Matherson reported in Nell 1997). However, as research into the equivalency of the alternative English versions remains inconclusive (Franzen, M.D., 1989), the question is raised as to whether one can simply

translate this test for use in other language groups, or whether further investigation into factors such as the frequency of word occurrence in the intended language and standardisation is necessary.

Problems relating to neuropsychological assessment in South Africa are, however, not limited to the language factor. Internationally it has been demonstrated that cultural differences are not limited to verbal tests. Reising et.al.(1991) demonstrated that although the differences in verbal test performance between Moroccan, Turkish and Dutch children were comparatively larger, non-verbal tests such as Mazes and Hidden figures followed the same trend.

5.1.4 Acculturation

Each cultural group is a product of unique physiological and genetic factors, and social and familial influences. Thought and action are modulated by specific cognitive codes and maps, values and norms of appropriate behaviour, socio-economic conditions and educational opportunities. Individuals from low socio-economic backgrounds may experience a less stimulating environment than those from higher socio-economic condition and inadequate school facilities and lack of parental control and support are also more common in poor socio-economic circumstances. These conditions may individually or collectively affect people's development and psychological functioning (Brislin, 1990). Cultural influences affect the interpretation of items and in doing so possibly the reliability and validity of the measure. This may have serious consequences for the future, when programmes to develop scholastic potential and affirmative action policies are based on erroneous psychological inferences. It is because of this that Moalusi (1995) and Nzimande (1995) both question the validity of present testing in the South African context where testing has been in the hands of a dominating minority without considering the socio-political suppression of certain tested groups.

Familiarity with the test situation itself may demonstrate racial discrepancies. "In developed and highly psychologised nations the typical citizen is familiar with many test-taking practices. These include the desirability of optimum performance on ability tests or honest responses on psychological tests. However, for many persons in developing nations, since test taking is not part of the cultural

landscape expected test behaviours should not be assumed" (Lonner, 1985). As stated by Nell (1997), regarding the assessment of "subjects who are not "test wise", the first test performance may not be asymptote, but a point on the test acquisition curve for the ability in question".

Questions relating to acculturation differences, although possibly to some extent magnified, are not limited to the South African situation. In the United States of America, despite thorough attempts to reduce the effects of racial bias and to provide representative norms with regard to age, sex, race, geographical location, occupation of the head of the household and urban versus rural residence (Weschler, 1974), black/white differences have still been found on tests such as the Weschler Intelligence Scale for Children-Revised (WISC-R). In suggesting reasons for these differences, some proposed that the WISC-R is a culture fair instrument and that differences in performance reflect a genetically based difference in ability (Vance and Engin, 1978). Others suggest that the differences reflect bias in the test and that the WISC-R measures abilities and information to which Caucasian children are more likely to be exposed (Scarr, 1981; Oakland and Feigenbaum, 1979).

Although, Sattler and Gwynne (1982) found that, in the United States of America, the test performances, of black children were not impeded when the tests were administered by white examiners, this may, or may not, be the case in South Africa. The history of enforced separation may have given rise to aspects of inter-racial tensions which result in certain expectations and suspicions capable of exerting a specific influence within the test situation. It is also possible that the influence of this variable could differ among South Africans in different groups, dependent on how the individual being tested identifies him- or herself politically and racially.

These findings are particularly relevant for the rapidly changing South Africa society. Neuropsychologists have to cope with the legacy of apartheid, but are sometimes hesitant to accept cultural variation as a moderator of test scores (Nell, 1994). One cannot deny the sensitivity of the race issue and the positive connotations associated with the ideal that all South Africans are equal. In South Africa, however, it is undeniable that factors such as socio-economic standing, educational opportunity (even basic literacy) and geographical location have a tendency to be racially structured. As pointed out by Jooste (1995) one of the aims of the Reconstruction and Development Programme

(RDP) is the promotion of the quality, quantity and accessibility of mental health support and counselling services for all. It is therefore important, when working with individuals in a socially diverse society to consider the suitability of available norms, which may have been obtained from another population group, and the effect of this on the validity of the diagnosis and therapeutic approach. Certainly, this would be relevant to improving the quality of the mental health and counselling services to those groups previously denied ready access to them. In order to do this however, the clinician must accept the validity of variables such as geographical location, socio-economic status, education and culture, which may individually or collectively influence acculturation and affect people's development and psychological functioning.

5.1.4.1 Geographical location

As an indication of acculturation differences relative to geographical location, the Macro-Economic Research Group (1993) report that at the end of the apartheid era, African secondary school enrolments relative to population were highest in the Transvaal regions and lowest in the Transkei and KwaZulu-Natal areas, Ciskei, Boputhatswana, and the DET Cape regions. From an acculturation perspective, these regions can be further differentiated according to urban or rural location.

In their 1994 study, Viljoen et.al. found that although the progression to maturity did not differ for rural and urban participants, the urban group did on the whole, demonstrate a level of performance on the Bender Gestalt Test (BGT) superior to that of their rural counterparts. Both rural and urban participants in this study demonstrated a slower progression to maturity and poorer performance than reported for American subjects of similar age.

From a socio-cultural perspective, in an examination of the effect of participation in recreation activities, Sadki (personal communication -1995) uncovered distinct differences between university students from urban and rural backgrounds and concluded that acculturation variables between these groups of students registered at the University of the North must differ. Factors to

be considered in this regard include the availability of technology and amenities, common physical activities, family and community values and child rearing practices.

In addition, surveys have revealed that socio-economic standards vary in accordance with geographical area. In 1993 the Macro Economic Research Group wrote, "Black people living in rural areas in general have much lower incomes than black or, of course white people, in urban areas. The incomes earned by black women in rural areas, or by female-headed or female-dominated households are much lower than those earned by black men or by male dominated rural households". Children from urban townships such as Soweto and outlying rural areas in, for example, the Northern Province, do not apply the same standards of comparison in their classification of socio-economic standing (Cyril Sadki, personal communication - 1977). A child from a rural area may not own shoes and live in a traditional home without any modern conveniences but not consider himself as poor due to the family's ability to feed themselves off their lands. A township child without shoes or a radio is considered by his peers to be poor. The monetary income required to survive differs quite considerably for these two groups.

5.1.4.2 Socio-economic factors

Neurological function is influenced by a variety of environmental factors, which may, to a large extent, be economically dictated. Universally it has also been shown that both black and white groups from a lower socio-economic class have lower IQ scores on average than white middle class groups, probably because of cultural/environmental disadvantages (Scarr, 1981). Thus, neurological integrity appears to vary along a socio-economic gradient (Amante et. al., 1977) and as early as 1943, Biesheuvel found that after four years of age, children of low socio-economic status demonstrate an intellectual lag

In South Africa especially, socio-economic class is to a large extent racially mediated and in the opinion of Makunga (1988), a black person exposed to adverse environmental forces is less likely than whites to have access to opportunities which may ameliorate the situation. Although it is accepted that Makunga's writings date back to before the major political changes in the country,

because of their low socio-economic status, for the majority of the population the situation has not changed significantly.

Further, the focus group for the present study, high school students, spent a significant portion of their lives growing up under the old dispensation. Only in 1986 were textbooks nominally funded out of the state budget and by 1990/1991 they were in acute short supply. At that time approximately 20% of the black South African primary school teachers and 10% of the high school teachers were without the appropriate qualifications required for the job. Gordon (1986) concluded that family financial considerations and employment conditions have a greater influence on school drop-out than factors such as teacher upgrading and supply of books.

5.1.4.3 Education

As mentioned earlier, performance on tests such as the Wisconsin Card Sorting Test (WCST) and Trail Making Test (TMT) relies heavily on educational standard. In addition, Finlayson et.al., (1977) found education to be a confounding variable in all the Halstead Reitan subtests. Although some abilities (Speech Sounds Perception Test and the Seashore Rhythm Test) may be more susceptible than others to the effects of education (Vega and Parsons, 1967) the influence of education as a confounding variable in neuropsychological test performance cannot be ignored.

This is of particular relevance to South African, where, in 1953, the government of the time, passed the Bantu Education Act. At this time, the minister of Bantu education explained that education must train and teach people in accordance with their opportunities. In this, and the events that followed, the crisis of apartheid was reflected in, and was in part a product of the crisis in education. The schooling that was available to these cultural groups under the apartheid regime was heavily circumscribed and characterised by inequality of access and provision. Discrepancies in terms of per capita expenditure by racial group resulted in major discrepancies in educational standards.

Officialised by the Bantu Education Act, major discrepancies developed within the South African education systems and, until very recent political changes were implemented, neither curricula nor teaching standards were standardised across the 19 departments involved in education. For certain groups, structural factors interacted with other determinants to produce a particular type of teaching and resultant cognitive styles. Although some abilities may be more susceptible than others to the effects of education, the influence of education as a confounding variable in neuropsychological test performance cannot be ignored. Ostensibly, visuo-spatial tests are less dependent on educational and cultural background than verbal tasks, however, there is some evidence that reduced levels of literacy may adversely influence the ability to interpret pictorial representation of three-dimensional figures. With reference to the use of the Trail Making Test (TMT) in a country such as South Africa where literacy skills may be limited, Rosin and Levett (1989) stress that in the absence of appropriate norms, test results should be interpreted with caution. Seen from a South African perspective, it is interesting to note that cross-cultural studies have suggested that perceptual constancy may be more accurate in people with limited education and in non-western societies (Ardila, 1995). In South Africa, factors relating to chronological age are further confounded by specific cohort factors unique to our social politically changing environment. Until very recent political changes were implemented, school attendance was compulsory for "whites" and "coloureds" until the age of 16 years, and for "Indians" until age 15 but not for "black" children. For this reason, age, educational standard and ability do not demonstrate the level of correlation expected in situations where education is compulsory for certain ages.

Further complicating the educational issues in this country, neither curricula nor teaching standards were standardised across the 19 departments involved in education. The hierarchy of privilege across education departments is evident both in the small numbers of black South African children who reach senior classes, and in the time it takes them to complete the different phases of the school programme. In 1990 black South Africans accounted for 71% of the standard 10 Candidates, but only 49% of the passes and 35% of successful matriculants. Overall, about 40% of black South African children reach standard 10, less than half of these pass, and only about 10% reach the standard required for admission to higher education.

In 1982 Nyikana called for an improvement in educational variables such as teacher in-service training, in order to reduce repeater rates in schools. According to Donald (1991), structural factors such as the availability of resources, the qualifications of teachers, pupil-teacher ratios, language of instruction and curricular content have interacted with other determinants to produce a particular type of teaching. This emphasises child compliance, is heavily instrumental and requires rote learning, and the passive recall of information rather than the application of knowledge or analytic and creative problem-solving.

In addition to the language related educational problems mentioned earlier, and despite changes to the law, in practice significant differences between the educational facilities offered at rural farm schools, township schools and previously model 'C' schools still exist, and must be recognised by the neuropsychologist in the interpretation of an assessment. A measure of crystallised abilities focuses on intellectual functioning in tasks that require prior practice, education and acculturation. These requirements, together with other linguistic considerations are of particular relevance when these learned abilities, more often associated with tests on the Verbal Scale, are viewed in a South African context (van Eeden, 1992).

5.1.4.4 Culture

Even in a multi-cultural, multi-lingual country like South Africa, the theories taught, the procedures followed and the techniques inherited, and even the training programmes to introduce the profession of psychology, have their roots in specific values and attitudes. Significantly different educational and financial opportunity between races that existed previously has led to a situation in which the majority of the trained professionals belong to the previously dominating minority, while the majority of those requiring neuropsychological intervention belong to the previously disadvantaged majority.

Regarding cultural identification within the complexities of South African society, Shubane (1997, Centre for Policy Studies – personal communication) warns that the obvious visible trait

may not be the primary identifier. A child born of parents of differing languages may identify himself as 'a Sowetan' based on his peer group rather than 'a Zulu' based on mother-tongue. In the same way, a liberal black South African woman may identify her femininity in a very different way from her more traditional counterpart and as a result, adopt a different approach to life and develop different abilities. A black child born and raised in one of the traditionally white South African suburbs may merely see himself/herself as a South African child. Nevertheless, separate development policies did to a large extent artificially entrench cultural values in certain groups, especially those resident in the 'homelands', whilst for others resident in some of the townships cultural identification was artificially weakened though a 'divide and conquer' policy as the tribal groups were forced by circumstance to live in close proximity to each other.

With reference to the qualitative changes in cognitive-processing (Lancy, 1983), criteria for equivalence (Bruner, 1964) and formal classification (Olson, 1976), the results of a Nigerian study which examined these children's approach to a classification task highlight the extent to which specific test strategy may represent a culturally linked difference rather than a cognitive deficit. This group's initial classifications were according to criteria similar to those found by Luria (1979). They were however, well able to explain their classification strategy and when asked how less intelligent children would approach the same task were able to classify items according to the characteristics originally selected for this purpose. It is suggested that, despite the availability of alternative bases for equivalence, various aspects of culture selectively reinforce the use of one or another of them (Lancy, 1983). The unusually large number of individuals amongst the Kamba capable of eidetic imagery provides an indication of the importance of visual imagery in specific groups (Doob, 1965). Illustrating the complexity of cross-cultural research are suggestions that although the WISC-R Similarities subtest tests may be the one subtest least affected by the subject's social or educational background (Lezak, 1983), all other things being equal, the Westerner sees similarities where the non-Westerner sees differences (Olson, 1976) and many indigenous languages do not even have a specific linguistic equivalence for the word 'similar'.

Western first world culture te[illegible] conceptualise test performance in terms of competition, effective use of time and concentration (Miron, 1977, Lonner, 1985). However, many people when asked to describe 'a wise old man' will include a reference to long periods of contemplation in the search for answers. Some societies value youthful dynamism while others maintain a deep-seated respect and admiration of age and the associated value of experience. Adherence to one or other value system filter through into behaviours and thus into the neuropsychological evaluation.

5.2 SOCIO-CULTURAL ISSUES – THE SOUTH AFRICAN SITUATION

In cross-cultural assessment, two factors must be considered: the psychological processes and the cultural environment in which these take place. As documented in the previous chapter, both international and local literature acknowledge the impact of acculturation variables on neuropsychological test performance, and caution as to the possibility of misdiagnosis when this is not accounted for in a neuropsychological evaluation.

Cross-cultural research need not be restricted to comparisons of groups from different nations, but can also be extended to cultural or ethnic sub-populations within a single country. Cultural categorisations are thus not always limited to country or ethnic group, they also potentially include: the different age groups or cohorts; the genders with reference to specific roles, expectations or exposures; social classes in that they may adhere to different value systems; educational environments; occupational sphere and level; ideological or religious groups; and work organisations. As all of the above-mentioned characteristics may either singularly or collectively influence psychometric test performance, groupings for both clinical and research purposes must remain cognisant of all of these variables and the inherent interactions between them.

Given the unique nature of the stratification of South African society, one cannot automatically assume that what holds true for racial, socio-economic and gender differences in other countries, holds true for South Africa. Furthermore, norms gathered for one sector of South African society

cannot summarily be accepted as appropriate for another sector of South African society. Acculturation variables may differ both inter- and intra- societally, dependant on the individual's primary identifiers (Khehla Shubane, Centre for Policy Studies – personal communication 1997). South Africa is unique in that it has just recently emerged from a period of enforced socio-cultural segregation. Group differences have been politically moulded and manipulated on a racial basis. Although laws enforcing the separate development of societies have been lifted, the legacy of the past remains. Age, educational, socio-economic, language, cultural and gender factors, may, or may not, exert the same influence or carry the same weight as reported internationally.

Seen in the light of affirmative action policies and needs of previously disadvantaged communities, and given that test scores from culturally different groups are frequently used in decision making with respect to organisational or educational selection and placement, the question often arises as to whether, within different ethnic groups, the use of existing "Western tests", leads to correct conclusions, and whether it is justified to use uniform decision making procedures and equal norms.

As is the case for psychology in general, the neuropsychologist is faced with the task of upholding the profession in a rapidly changing society that is still dealing with the legacy of the apartheid regime. The diversity of this society is immense. Not only does the country have eleven official languages but it is dealing with the legacy of 19 different education systems. It is imperative that the assessment of neuropsychological processes not only remain cognisant of the historical legacy, but also keep pace with the on-going changes and directional developments in a rapidly changing society.

Given the legacy of the apartheid regime in South Africa, with its particular peculiarities, such as the "Dompass", Group Areas Act and segregated schooling, which effectively enforced separate development, one can not possibly expect equivalent acculturation across all sectors. Psychological tests have no predetermined standards of success or failure, each individual's performance is evaluated through comparison with that of others, on the same test (Anastasi, 1988). Further, one must beware of making assumptions, based on findings associated with the cultural stratifications manifest in other countries, regarding a culture which has arisen out of legislation unique to this country. In this regard, Nell et.al. (1992, 1993) warn that "in developing country settings, the results

of neuropsychological tests that have been well standardised in the west may be misleading unless the underlying validity issues that arise when a test developed in one culture is applied to another have been addressed". Richter et. al., 1989 suggest that the draw-a-man task is fundamentally different for local children than for their western counterparts and is unsuitable for evaluating the intellectual level of black South African children as firstly, scores based on the elaboration of detail tend to underestimate abilities, secondly scores tend to level off around the age of 11 years and thirdly they do not appear to correlate well with school performance. The test is further biased in that the scoring system credits numerous obviously caucasian features. As Nell (1997) so aptly pointed out "one of the primary issues in this dilemma arise from the lack of local research regarding the inherent construct and discriminant validities of the measuring instruments for local application... A vicious circle develops; without constructs, there are no norms, without norms ... the status of neuropsychological testing remains doubtful". In the light of the general literature, it is evident that in the interest of sound neuropsychological practise, the circle must be broken and it is to the credit of researchers such as Makunga; Anderson and MacPherson: Murdoch et.al.; Viljoen et.al.; Richter et.al; that attempts are being made to do so.

5.3 CONCLUSION

"When we compare a child's performance to a norm sample in order to predict future behaviour, we assume that the child has had an opportunity to acquire skills, concepts, or experiences comparable to the opportunities of the children in the norm sample. When we compare a child's performance to a norm sample in order to understand better that child's current level of functioning, we need assume only that the norm sample is representative of the population. The distinction between understanding current level of functioning and predicting future behaviour is part of the culture-fair testing controversy" (Salvia and Ysseldyke, 1988, p97). In South Africa, by virtue of the fact that we have only just emerged from a period of separate development, we cannot assume equal opportunities or acculturation for all population groups. Given the social diversity of the country a spectrum of factors such as language, socio-economic status, race, level of education must be considered carefully before making assumptions in norm-referenced assessment. Together these variables cast doubt on the generalisability of neuropsychological norms across all sectors of black South African society.

One way of dealing with this variability is through the use of local norms (Elliott and Bretzing, 1980). As stressed by Hambleton (1994) with regard to test adaptation that "validity must be compiled in each population where the instrument will be used".

6 THE STUDY

6.1 RATIONALE AND AIMS

Psychometric assessment is an essential tool in neuropsychology. It assists in elaborating, confirming or challenging the implications of a medical diagnosis of brain dysfunction. It also helps to delineate areas of preserved function which may be exploited in rehabilitation and to objectively determine the effects of therapeutic intervention.

As discussed in chapter 5, both international and local literature acknowledge the impact of acculturation variables on neuropsychological test performance, and caution as to the possibility of misdiagnosis when this is not accounted for in a neuropsychological evaluation. In norm-referenced assessment an individual's performance is evaluated in terms of other people's performances. An important issue in this regard is the equivalency of the reference group and the testee in terms of such factors as educational opportunities, socio-cultural and economic background, demographic characteristics, sex and age (see section 5.1). These factors are of particular relevance for the multi-cultural South African situation, where, dealing with the legacy of an apartheid system, equivalent acculturation across the diversities of society cannot be assumed (see section 5.2).

The diagnostic capacity of neuropsychological measuring instruments is based on a high degree of discriminant validity, and interpretation in the light of norms established for other groups may be misleading. The more obviously the testee's acculturation differs from those represented in the normative sample, the less valid and more biased the results become. Bearing in mind that one of the aims of the Reconstruction and Development Programme (RDP) is to promote the quality, quantity and accessibility of mental health support and counselling services to all, and that unsuitable norm standards could result in misdiagnosis and inappropriate treatment, it imperative that the question of appropriate local norms for all sectors of our South African society be addressed.

The thesis therefore addresses the issue of whether or not we can currently structure a correct diagnosis, based on norms gathered from other countries or even other sectors of South African society, to assess black South African urban high school students. Numerous studies (Makunga, 1988; Richter et.al., 1989; Murdoch et.al. 1994; Viljoen, 1996;) have concluded that black South Africans tend to produce test scores significantly lower than those reported for Western European or North American populations. However, very little appears in the literature comparing the various sub-sections of black South African society. The question then is raised within our society; over what data can we collapse norms, or, posing the alternative, at what level can we assume equivalence of group?

In the light of the above, the present study, which was also motivated by a much debated (Nell, 1997; Murdoch et.al.1997) exploratory study conducted on a group of black South African standard 6 [3] students attending a Gauteng, inner-city community college (Murdoch et.al.,1994), questioned not only the validity of Murdoch's findings, but also the suitability of other published test norms (often derived from groups in other countries), for the reliable interpretation of the abilities of black South African urban high school students. The mean test performances measured for the Soweto sample were tabulated and statistically compared to those of Murdoch's inner city sample and to the standards of performance published in the international literature.

With this in mind, the performance of a broad range of Soweto High School students was examined on a selection of tests which commonly constitute neuropsychological assessment batteries. This initial investigation served to explore the possible need for, and focus of, a more extensive investigation. Thereafter, with the need for norms established, a slightly larger and more stringently defined group was assessed on a similar battery of tests in order to determine more specifically the deviations from the published data for this specific group.

---

[3] At the time of testing educational levels in the participating schools were classified as Grade 1 and 2, followed by Standards 1 to 10. In 1998 this terminology was substituted with a classification according to grade. The twelve years of formal schooling are now referred to as Grades 1 through 12. The terminology which was in effect at the time of testing has not been substituted in this write-up.

The initial data were firstly compared with published norm standards and thereafter, given the possible mediating impact of the subject variables discussed in chapter 5, examined in accordance with some of the intra-group variables such as gender, language group, age, and educational standard. The questions addressed include that of whether the performance of individuals should be judged in terms of the same standard or in terms of that of individuals from a similar milieu, and whether the use of published norms from other populations leads to a valid classification and diagnosis in the assessment across the spectrum of South African testees.

6.2 HYPOTHESES

Hypothesis: I. Psychometric test norms published for other population groups are higher than those of urban black South African high school students.

II. There is no significant difference in neuropsychological test performance as a function of socio-economic status within the Soweto school system.

III. Neuropsychological test performance varies as a function of gender with direction dependent on the ability measured.

IV. There is a significant relationship between educational standard and neuropsychological test performance irrespective of age.

Alternatively

V. There is a significant relationship between age and neuropsychological test performance irrespective of educational level.

6.3 METHOD

Although Parts I and II of the present study adhered to similar methodologies, some important adaptations were implemented in Part II with regard to subject selection, measuring instruments and procedure. The specifics pertinent to each part of the study are discussed under the relevant sections below.

6.3.1 Subject selection

6.3.1.1 Part I

The initial investigation involved 100 participants recruited from a High School in Mzimhlope which draws pupils of varying languages from both the Orlando and Meadowlands areas of Soweto.

Both academically and socially, theories taught, techniques inherited and procedures followed, are so often based on the assumptions of ones own specific sector of society. Thus, cognisant of the fact that the norms of one sector can not unequivocally be imposed on another, an attempt was made to avoid predetermined criteria for the selection of participants in the initial stage of this study. The criterion for selection was restricted to, 'representative of a Soweto High School population'. To ensure that the sample covered the range of high school pupils the first 20 pupils to volunteer from each of standards 6 to 10 were assessed. Despite an expected age range of pre-teen to early 20s, age limits were not imposed. The equal numbers of male and female participants included in the initial test group was a factor of chance, as gender was not imposed as a criterion for participation. The group under investigation in the initial investigation therefore comprised a group of high school pupils, 20 from each of standards 6 to 10, attending Anchor Secondary School, Mzimhlophe, who perceive themselves and are perceived within their society as being representative of their milieu (see Chapter 8, Tables 1 and 2, for a detailed description of the resultant sample).

6.3.1.2 Part

Data for the second part of the study were collected from a group of 152 pupils attending Kwa-Ntsikana, Phefeni, Anchor and Orlando West High Schools, also located in the Orlando area of Soweto and drawing pupils from surrounding suburbs.

In Part II of the study, subject variables were more stringently controlled in that the test group was limited to standard 5-7 pupils, drawn from the total school population by the school staff according to the requirements of the study (i.e. age, gender and absence of head injury or epilepsy). This

ensured an equal number of healthy girls and boys between the ages of 13 and 15 years on which to base a norm sample (see Chapter 7, Tables 22 and 23 for a detailed description of the resultant sample).

6.3.2 Measuring instruments

Since the present study was based on a similar investigation conducted at a Hillbrow school (Murdoch et.al. 1994) initial test selection was to a large extent predetermined. The original study had been designed to include a variety of tests commonly used by both the South African and international practitioners.

The battery administered in the Part 1 of the study comprised the following;

A background questionnaire designed to elicit the information necessary for the computation of the socio economic ranking (SED)[4] as well as information of a medical, psychological, scholastic and social nature (See Appendix B).

6.3.2.1 Individual Scale for Xhosa-, Zulu-, Sotho-, Tswana-speaking pupils (IS-A)(Landman, 1991)

Comprehension

Problems

Blocks

Absurdities

Memory (inclusive of a longer term recall trial)

---

[4] Although the immense changes which have characterised South African society since the development of this scale (van den Berg, 1985) may have impacted on the validity of some of the items, given the uniqueness of South African socio-economic stratification, the range of scores is still considered to provide the clinician with an adequate indication of the intensity of non-racial environmental factors relevant to the variance in test performance (N. Claasen, HSRC – personal communication, 1997).

6.3.2.2 Subtests from the Weschler Intelligence Scale for Children–Revised (WISC-R) (Weschler, 1974)

Similarities
Arithmetic
Digit Span
Picture Arrangement
Mazes
Coding (inclusive of an immediate incidental recall trial)

6.3.2.3 Subtests from the Halstead-Reitan Neuropsychological Test Battery (HRNTB) (Reitan, 1979)

Trail-making Test (TMT - A and B), (Army Individual Test Battery, 1944)
Lateral Dominance Test, (LDT)

6.3.2.4 Other cognitive measures

Drawing Tasks (person, house, tree, bicycle and clock).
Rey-Osterrieth Complex Figure Test (ROCFT), (Rey, 1941; Osterrieth, 1944)
Rey Auditory Verbal Learning Test (RAVLT), (French version - Rey, 1964)
Stroop Colour Word Test (SCWT) (Stroop, 1935)
Wisconsin Card Sorting Test (WCST), (Grant and Berg, 1948)
Bender Gestalt Test (BGT), (Bender, 1946)
Spatial Memory Task (SMT), (Lhermitte and Signoret, 1972)

The above measures have been discussed in detail in chapter 4. It will be noted that, in addition to a number of commonly used neuropsychological tests covering a broad spectrum of abilities which were included for comparison with published norms, subtests from two different intelligence scales were included. Not only is IQ of importance in the selection of comparative norms but the subtests themselves, as well as an examination of the pattern of subtest scaled scores, have been shown to be useful contributors to the neuropsychological test battery.

Dependent on the language spoken, the Individual Scale for African Language Speaking Pupils (IS-A) has been normalised for black South African pupils up to the age of either 19 years 11 months or

15 years 11 months. Initially, in the case of intelligence scales, the inclusion of the abbreviated version of the IS-A was motivated by the need for a culturally and linguistically appropriate baseline measure of comparative intellectual ability. The selected subtests from the Weschler Intelligence Scale for Children - Revised (WISC-R) (only normatised for children up to the age of 16 years 11 months) served to provide a means of comparison both with an international standard and with the much debated results obtained by Murdoch et.al.(1994) in an ostensibly higher socio-economic group of black South African high school pupils. Notwithstanding the age issue, but rather focusing on content and the skill level of the group for whom the test was originally developed, both tests were considered appropriate for high school pupils. To avoid a practice effect, with the exception of the Problems/Arithmetic subtests, which are used for direct comparison, dissimilar subtests were selected from the two scales.

Where the intended age range for a specific test or version thereof might differ for different sectors of the group under investigation, that which would be appropriate for the majority was selected for blanket use.

The test battery administered to the second group of subjects was largely the same as for Part I, but differed in the following respect:

In Part II of the study, the emphasis was placed on the examination of the pattern of scaled score scatter. One of the advantages of administering a complete standardised battery is the fact that an individual testee's performance on tasks tapping a range of abilities is compared with that of the same group of asymptomatic individuals on a wide range of tasks. Thus, rather than administer subtests from two different intelligence scales, all twelve subtests from the WISC-R were included for examination, in preference to the ostensibly culturally and linguistically appropriate IS-A.

In addition, with due consideration for the fact that population is being educated (and is often assessed) in a language other than their mother tongue, the Vocabulary subtest of the WISC-R and a test of Oral Word Fluency (F.A.S.) were considered to be important indicators of language variables.

As education appeared to be one of the more influential subject variables, the WISC-R Information subtest added value to the selected battery as an indicator of the richness of learnt knowledge.

Group selection criteria enforced in the second part of the study facilitated the use of age appropriate versions of tests, and tests were scored in the manner previously described

6.3.3 The assessment procedure

Upon initiation of both parts of the study, both pupils and teachers were addressed; and the requirements of the project and the basics of test procedure were explained. Upon arrival in the testing situation, a preliminary discussion took place amongst all testees, in which students were given time to pose their own questions regarding the project.

In *Part I of the present study,* a self-administered biographical and clinical questionnaire was employed to gather the information required for assessment on the 22 items of the Socio-economic deprivation scale. The questionnaire also included questions regarding the student's health, schooling, home and family background, social habits and activities and future aspirations. Although the volunteer participants personally considered themselves to be 'normal' and representative of their milieu, this questionnaire served as a more concrete and objective indication of the specific characteristics and circumstances, and ensured that each participating individual was in good health and would generally be considered to be asymptomatic, with regard to severe neuropsychological impairment. Volunteers who answered in the affirmative to any of the questions regarding hospitalisations, head injuries, episodes of reduced consciousness (e.g. dizzy spells, fits, faints, blackouts), or headaches were required to complete an additional, individually-compiled, questionnaire, aimed specifically at eliciting more in-depth information relevant to these complaints.

With the cooperation of the school, and informed consent from the parents/guardians, a sample of 100 students (20 from each standard 6 to 10 at Anchor High, Soweto) from a relatively low but representative socio-economic background was initially assessed.

In the interests of optimum standardised test conditions, testing was not carried out at the school but rather at a suitable locale on the Abbott Laboratories premises in Aerton. This arrangement offered comfort, warmth and the minimum of distractions to the testee. In an attempt to minimise the effects of hunger and fatigue during the course of the morning, Abbott Laboratories provided tea and sandwiches and on completion of testing, a cooked lunch for all participants.

Four different volunteer subjects were individually tested each day. They were collected from the school and transported to the Abbott Laboratories offices. The journey from the school to the test locale provided the volunteers with the opportunity to discuss the project and, to some extent, familiarise themselves with the writer.

Individual testing of each of the 100 participants took a full morning in accordance with a test roster agreed upon by the relevant parties. Four psychometrists were involved in the administration of the selected batteries of tests to each individual subject on a rotating basis. All four of the test administrators had fully familiarised themselves with the selected test battery prior to the initiation of testing.

Two of the four test administrators were resident in the area from which the sample was drawn, and they were fluent in both English and the volunteers' mother tongue. These individuals therefore took responsibility for the administration of the selected subtests of the IS-A battery Verbal and Practical scales respectively. The remaining two psychometrists, respectively, administered the individually selected neuropsychological measures and those subtests selected from the WISC-R test battery.

As a result of this arrangement, the order of presentation of tests differed for individual participants. In this manner, problems associated with the assessment of subjects who are possibly not 'test wise' was not focussed on one specific subtest and the fatigue factor was spread amongst the tests..

In *Part II of the present study*, although the basic format of the assessment procedure remained unchanged, certain adaptations to the procedure were imposed. Due to practical considerations, the testing was conducted on the premises of the respective schools rather than at an outside location;'the 152 subjects were selected by the school staff according to the requirements of the study (i.e. age, gender and absence of head injury or epilepsy), and the biographical and clinical questionnaire was administered during the course of the assessment as part of the test battery.

As was the case during initial data collection, testing of each of the additional 152 participants on a similar (but not identical) battery of tests, took a full morning in accordance with a test roster agreed upon by the relevant parties. In this instance, nine psychology honours students (only one of whom was resident in the area from which the subjects were drawn) were trained on test procedure, and fully familiarised with all aspects of the administration and scoring of the battery of tests to be administered. Nine volunteer students were then individually assessed daily by these nine testers.

The direct influence of test administrator variables was minimised by rotating the tests to be administered amongst three groups of three test administrators. In a deviation from standard procedure the WISC-R test battery was split into two sections at subtest number 7, Vocabulary, and a third group of test administrators administered the other individually selected tasks. Some of the participants therefore completed the second half of the WISC-R battery before the first half and vise versa and some of them completed the other selected neuropsychological tasks prior to being faced with those from the WISC-R. In this way the effects of exposure to psychological testing and fatigue were distributed to some extent throughout the battery.

6.4 RESEARCH DESIGN AND STATISTICAL TECHNIQUES

In addition to the raw scores, scaled scores were also utilised as far as possible in the analysis of the Weschler Intelligence Scale for Children – Revised (WISC-R), the Individual Scale for African Language Speaking Pupils (IS-A) and the Goodenough Harris Drawing Test (GHDT). This was done for two reasons. Firstly, it was felt that conversion of raw scores to scaled scores to some extent offered an age correction factor to the WISC-R and IS-A data, and correction for both age and gender in the case of the GHDT. Secondly, comparisons were afforded with the existing norms on these tests. In the case of the IS-A, scaled scores offered an opportunity for direct comparison between the various language versions of the Verbal subtests. Raw scores alone were used in the case of other psychometric measures.

The Statistica (version 5.4 for Windows) computer software package was used in the statistical analysis of data.

The investigation was three-tiered. The first question posed was:

(i) Are the published norms suitable for this population?

To address Hypothesis I, and examine the suitability of published neuropsychological test norms for urban black South African secondary school students, means and standard deviations were calculated for all test scores obtained by the initial sample group. The mean test scores obtained by this group of Soweto students were then tabulated (Tables 7 to 15) so that they might by viewed in the light of norm scores published in the test manuals and other literature.

As an indication of whether or not the present group's test performance differed from that of a more culture/language specific group, the two predominant language groups, namely Zulu and Tswana were computed separately (see Tables 32d and Tables 33c - Appendix D) and compared via t-tests for independent samples (Table 21). Assumptions were based on the measured performances of these

two groups compared to the original standardisation data for the two language specific versions of the Individual Scale for African language speaking pupils. In addition, when possible, the test performance of this particular Soweto group on the various tests included in the present battery was viewed in the light of that of other groups of black South African high school students whose performances have been reported in the local literature (Viljoen et.al., 1994, Anderson and MacPherson in Nell 1997, Murdoch et.al., 1994).

The mean performances of the standard 6 participants in both Parts I and II of the Soweto sample were compared by means of t-tests with pooled variance with the performances measured for an inner-city sample of black South African standard 6 students and North American or European groups of similar age (Table 29).

The second question which addressed the intra-group variability within an urban black South African high school population was,

(ii) To what extent do subject variables affect 'equivalence'?

It was apparent from the literature that a number of variables, unrelated to organic pathology, may influence neuropsychological test performance. In order to examine the influence of variables such as gender, age, level of education, language, psychometric intelligence and socio-economic status on the particular black South African high school population represented by the initial Soweto sample, the group was subdivided according to these criterion, and comparisons were made.

A Pearson Product Moment Correlation was computed as an indication of confounding relationships between these variables and the extent to which these factors could be viewed in isolation.

Regarding Hypothesis II, an analysis of variance (ANOVA) was computed on the basis of the number of items on the Senio: South African Individual Scale – Revised Socio-Economic Depravation (SED) Scale to which a negative response was given. In addition, bearing in mind the

warning issued by Claasen (HSRC - Personal communication 1997) regarding the relevance of specific items for differing population groups, subjects were the categorised into three groups with relative socio-economic standing based on an SED score of 5 or lower (N=32), between 5 and 9 (N=40), and 9 and higher (N=28). The two extreme groups were compared via t-test for independent samples.

Gender issues relative to Hypothesis III were investigated via a comparison of the performance of the 50 male and 50 female participants on a t-test for independent samples.

Regarding Hypothesis IV, in addition to the individual computations relevant to the mean levels of performance for each individual age level in years (see Tables 32c, 33b and 35a-f - Appendix D), the significance of age as a variable of test performance was established on an analysis of variance (ANOVA). In view of the age range and resultant small cell sizes, t-tests for independent samples were employed to compare the performances of the 36 students aged 19 years and older to the 33 students aged 15 years and younger.

In order to investigate the possible influence of educational standard on test performance (Hypothesis V), the performances of the 20 participants from each standard 6 to 10 were individually computed (see Tables 32a-b, 33a and 34a-h - Appendix D) and the performances of the five groups classified according to educational standard (N=20), were subjected to an analysis of variance (ANOVA).

Intelligence Quotient as measured on the abbreviated form of the IS-A was utilised in an analysis of variance (ANOVA). The group was then classified into three categories according to the measured IQ score, 110 and above (N=33), 100 to 109 (N=36), and 99 and below (N=31) and the two extreme groups were compared using a t-test for independent samples.

Chance significances were minimised via strict interpretation of significance in adherence to Bonferroni's adjustment principle (adjusting the level of significance according to the number of comparisons involved). However, to aid interpretation, significance levels are reported in full throughout the discussion.

(iii) *The final step of the study was to establish a norm for one specific sector of this society.* This part of the study limited itself to age range 13-15 years and concentrated, for the most, on standard 6 students. The influence of extraneous subject variables such as age and education as variables within this narrow range, and gender were again examined and findings compared to those of the initial investigation. An explorative principal factor analysis was used to impart structure and determine factor loadings.

7 RESULTS

7.1 PART ONE OF THE STUDY – THE EXPLORATORY INVESTIGATION

Given the pragmatic considerations which drove this particular study, it was considered important to select students from a sample which is representative of the real, and in many instances, formidable difficulties which confront black urban high school students. Few criteria were therefore imposed on subject selection prior to testing.

7.1.1 Background information

It is important to note the characteristics of the test sample before examining the actual test performance.

In summary, 100 high school students between the ages of 12 years 0 months and 24 years 6 months were included in the study. In contrast with the twelve and a half year age span, the educational standard spanned only the five high school standards.

A characteristic which may differentiate a black South African school-going population, recently emerged from the apartheid era, from other population groups, is that this group may differ with regard to the age-educational expectation, in terms of the distribution of ages by standard. However, as indicated in Table 1, despite the inclusion of some exceptional cases (such as a 15 year old in matric, a 19 year old in standard 6 and a standard 9 group of a comparatively advanced age – see table 1), age and standard of education demonstrated a statistically very significant (r=0.7) correlation.

Table 1 -Distribution of the sample by age

	STANDARD				
	6	7	8	9	10
AGE	N				
<14	10	5	0	0	0
14	4	5	1	0	0
15	3	3	1	0	1
16	0	3	3	1	1
17	1	1	6	1	4
18	1	2	2	4	1
19	1	0	5	1	8
20	0	1	2	4	4
>20	0	0	0	9	1
Mean Age	14y5m	15y5m	17y11m	20y6m	18y11m
sd	2.11	1.86	1.52	2.10	1.71

As indicated in Table 2, a relatively high failure rate, comparative to other sectors of South African society was found.

Table 2 -Indicators of school performance within the initial test group.

	STANDARD				
	6	7	8	9	10
FAILURES	N				
0	14	13	3	4	7
1	2	5	9	4	7
2	1	1	2	2	4
3	2	0	2	3	1
4	1	0	0	0	0

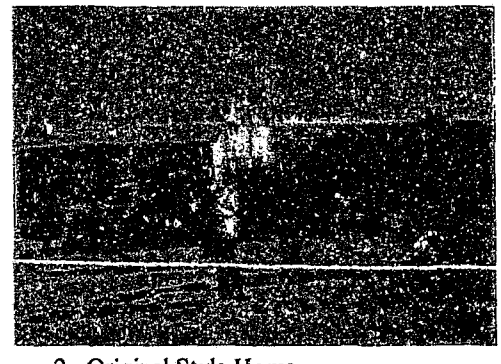
School failures tended to increase as the students progressed through their high school education. Between standards 6 and 10, faultless school progression halved, from 70% to 35% possibly merely as a factor of opportunity.

With regard to home circumstances, the average home comprised 4.5 rooms with 5.3 occupants living in a single abode.

The majority of the original residences built in the area comprised 4 roomed units made up of two bedrooms, a living-room and kitchen. Many changes have occurred since these homes were originally built and allocated and even since photographs of the area appeared in newspapers around the world during the 1976 Soweto riots. For the most, these dwellings have subsequently been electrified but do not offer hot running water or have the flush toilet located under the same roof as the main living quarters. Some of the homes are now occupied by third or even fourth generation family members, some have been upgraded beyond recognition (however, children resident in these homes usually travel to schools in other areas) and additional residents have moved into the area either dwelling in hostels or informal accommodation (i.e. squatter camps, back-yard shacks and other independent self-constructed shelters).



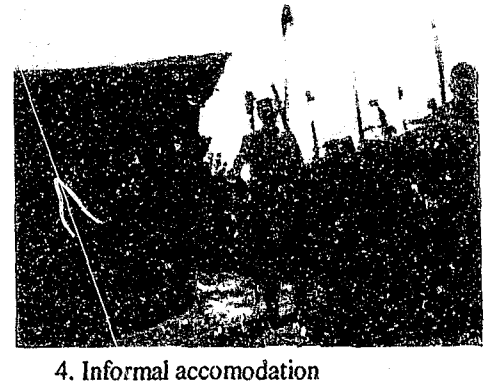
1. Upgrade



2. Original Style Home



3. Mzimhlope Hostel prior to upgrading



4. Informal accomodation

Given this broad socio-economic spectrum, information relevant to household facilities, sources of potential cognitive stimulation and parental attitudes, etc., were quantified using the Socio-Economic Deprivation Questionnaire (SED), a questionnaire specifically designed as an indicator of environmental factors which have been shown to correlate with, and explain part of the variance on, individual performance on the South African Individual Scales (van den Berg, 1985). The mean score obtained by this group of students suggests that this population group could be considered to representative of a moderately environmentally disadvantaged community. As Table 3 indicates, students answered in the negative to an average of 6.9 of the 22 potential items on the SED Scale (approximating an SED index of 5 on a scale of 0 to 10). Only 2 of the students included in the group would be considered by van den Berg (1985) to be non-environmentally disadvantaged.

Table 3 -Distribution of the initial sample by Socio-economic level

	STANDARD				
	6	7	8	9	10
SED Index		N			
Mean no	7.3	7.2	5.9	7.5	6.5
0	0	0	1	0	0
1	0	0	0	1	0
2	1	0	0	0	0
3	0	1	3	0	2
4	1	3	2	0	2
5	2	5	3	2	3
6	1	0	1	3	3
7	5	0	4	1	4
8	5	2	3	0	0
9	2	3	2	2	5
10	1	2	1	3	1
11	2	0	0	2	0
12	0	1	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	1	0	0	0

Socio-economic level, as quantified by the number of negative responses on the SED index, did not correlate significantly with any of the categorisation variables discussed above, i.e., educational standard, age or gender.

Soweto is a polyglot society, and students are therefore derived from a mix both of languages and cultures. Table 4 illustrates the distribution of the sample by language.

Table 4 -Distribution by language

	STANDARD				
	6	7	8	9	10
Language			N		
Zulu	5	8	11	7	3
Tswana	7	6	5	6	10
Southern Sotho	8	4	3	4	3
Northern Sotho		2		2	4
Xhosa				1	
Tsonga			1		

As can be seen, in total, 34 students reported Tswana as their mother tongue, 34 Zulu, 22 Southern-Sotho, 8 Northern-Sotho, 1 Xhosa and 1 Tsonga. Information regarding the student's mother tongue was relevant to the selection of the most appropriate version of the IS-A. With the exception of the Xhosa speaking student who by her own choice requested that the assessment be conducted in Zulu, where possible, the IS-A was administered in the testee's home language. In cases where the IS-A was not available in the mother-tongue, the student was given the choice of available languages. In this, all of the Southern-Sotho speaking students chose to be assessed on the Tswana version of the test and the Tsonga speaking student, on the Zulu version of the test.

Although the participants were not selected for gender, random selection did result in equal numbers of male and female participants, as given in Table 5.

Table 5 -Distribution of the initial participants by gender

	STANDARD				
	6	7	8	9	10
SEX			N		
M	6	7	10	8	19
F	14	13	10	12	1

The gender distribution was however skewed (see Figure 2); males showed a statistically significant tendency to load on the higher standards and females on the lower standards (r=0.38). The female group was therefore significantly younger than the male group (r=0.29) which served to confound data analysis.

In addition to the socio-economic indicators, a self-administered questionnaire included a number of questions regarding the participants' medical and developmental history and any therapeutic interventions received. Since the majority of the students included in the study reported being born in a hospital (for the most, Baragwanath) and indicated that they would attend one of the local clinics for on-going medical care or referral when necessary, the availability and accessibility of diagnostic and remedial resources, relative to the society in which these testees reside, had to be assumed. Since this questionnaire was attached to the parental consent form, it was also assumed that parental input regarding these details was readily available to students. With regard to some of the more pertinent questions included in this questionnaire, responses were as follows (Table 6):

Table 6 –Percentage affirmative responses regarding miscellaneous characteristics relevant to the initial test group

CHARACTERISTIC					
Smoking	Alcohol	Drugs	Hospitalisations	Head Injuries	Dizzy spells/fits/faints/blackouts
15	9	3	23	10	16

Additional questionnaires, requesting further detail from students who answered in the affirmative to any one of the latter three categories, or to the question regarding headaches, were subsequently distributed. Replies received suggested that two boys, one standard 10 and one standard 6 pupil, and two standard 6 girls should be excluded from the final analysis on medical grounds, and substituted with medically sound equivalents.

7.1.2 Psychometric Test Scores

As discussed in the previous chapter, the battery of psychometric tests administered were selected from a variety of sources. In accordance with Hypothesis I, the initial question posed regarding these measures was whether or not the psychological test norms published in the literature are suitable for the neuropsychological evaluation of black South African urban high school pupils. The scores obtained from the composite batteries and stand-alone measures are detailed in this section. [5]

7.1.2.1 Wechsler Intelligence Scale for Children – Revised (WISC-R)

The maximum age for which the WISC-R has been normatised is 16 years 11 months and 30 days, and only forty-two students included in the sample fell within this age group. The mean scores on standardisation of the WISC-R was 10. As demonstrated in the table below, scores measured for the initial test group in the present study were considerably lower. However, in a more recent comparison of black and white American subjects, by Reynolds and Jensen (1983), mean scores of between 9.51 and 8.13 were measured for the various subtests.

Table 7 The mean performance of the initial test group on the WISC-R subtest

WISC-R subtest	Mean Scaled Score	sd
Similarities	5.59	2.6
Arithmetic	6.08	2.4
Digit Span	7.08	2.7
Picture Arrangement	6.38	2.9
Mazes	7.84	3.3
Coding	6.12	3.0
Coding (short-term incidental recall-RAW)	7.83	

As can be seen, the performance of the present test sample was significantly below that of the original norm sample and even below that reported by Reynolds and Jensen for a black American population.

[5] Abbreviations of test names clarified in the body of the text will be utilised in the tables. The abbreviation sd will be used throughout to denote the standard deviation.

7.1.2.2 Individual Scales For African Language Speaking Pupils (IS-A)

The maximum age for which the individual Scale for Zulu speaking pupils (IS-Z) and the Individual Scale for Northern Sotho speaking pupils (IS-S) have been normatised is 19 years 11 months, and for the Individual Scale for Tswana speaking pupils (IS-T), 15 years 11 months. Only 57 of the testees included in Part I of this study fell within these respective age ranges. The advanced age and degree of urbanisation of the present group may account for the slightly elevated scaled scores obtained on some of the subtests. On standardisation on an ostensibly appropriate norm group, the mean score for the various subtests was 10. The results for the present sample on the IS-A are presented in Table 8 below.

Table 8 The mean performance of the initial test group on the IS-A subtests

IS-A subtest	Mean scaled score	sd
Blocks	10.47	2.84
Absu. ..ities	11.78	3.16
Comprehension	12.13	3.54
Problems	9.88	3.93
Memory	11.15	2.56
Memory (long-term recall-RAW)	18.91	

The mean IQ, as measured by the abbreviated version of the IS-A, was 103.35 - with a standard deviation of 13.92. The significantly higher scores obtained by the predominantly male matric group gave rise to a significant correlation between IQ and gender (r=0.39) and IQ and standard of education (r=0.36).

7.1.2.3 Trail Making Test (TMT)

Due to the age of the majority of the students, it was decided that the adult version of the Trail Making Test be employed throughout the study. Spreen and Strauss suggest that subject between the ages of 15 and 20 years require a mean of 23 seconds to complete Part A and 47 seconds to complete part B of the adult version of the TMT. As can be seen in Table 9 below the initial Soweto sample took considerably longer than suggested by Spreen and Strauss.

Table 9 The mean performance of the present group of testees on the Trail Making Test

Trail Making Test	Mean no. seconds	sd
Trails A	38.51	19.6
Trails B	85.72	40.3

Measured against the norm standard presented in Spreen and Strauss, it can be seen that the mean performance of the present group of testees fell on the 10th percentile for Part A and below the 10th percentile for Part B. The utilisation of this standard of comparison, derived from North American and European subjects, could very possibly lead to a misdiagnosis if applied to a black South African group.

7.1.2.4 Spatial Memory Task(SMT)

The test was discontinued once the subject could place all nine items successfully on a single trial or after 20 unsuccessful trials. Walsh (1985) suggests that subjects of normal intelligence will almost invariably reach a perfect score in 6 or less trials, and that patients with general amnesic syndromes will seldom reach criterion after even as many as 12 trials. The initial group of Soweto subjects took an average of 2.94 (sd=3.28) trials to achieve perfect placement.

7.1.2.5 Rey Osterrieth Complex Figure Test (ROCFT)

The mean copy score reported by Kolb & Whitshaw (1985) for a group of 12 year olds (the youngest age group included in the present group) was 30.21 (sd 6.69) and for the recall trial 23.20 (sd 6.38), while for a group of 16 to 30 year olds the scores were 35.1 (sd 1.5) and 22.7 (sd 7), respectively.

Table 10 The mean performance of the initial Soweto sample on the ROCFT

ROCFT	Mean Score	sd
copy trial	31.27	3.14
long term recall	19.39	5.99

The mean standard of the copies produced by this Soweto sample was comparable to that of the 12 to 13 year old American sample, however the reproduction of the same figure from memory 30-45 minutes later, was, by comparison, somewhat poorer and comparable with that of a 10 year old American sample. This fall-off in performance may to some extent be attributed to the copy strategy initially employed, as many of the present test group either began by drawing the overall contour without explicit differentiation of the central rectangle or with a subsection of, or detail attached to the central rectangle.

7.1.2.6 Rey Auditory Verbal Learning Test (RAVLT)

On a group of 13-16 year olds, Munsen (1987, in Spreen and Strauss, 1991 pg. 154) reported an increase from 6.8 (sd 1.7) words on Trial I, to 13.0 (sd 1.8) on Trial V. This group recalled a mean of 11.6 (sd 2.4) words after interference and was able correctly to recognise 14.3 (sd 1.1) of the target words amongst distracters. As can be seen in Table 11 below, consistently poorer recall resulted in the present group scoring a significant 8 words below the North American sample over the five learning trials.

Table 11 The mean performance of the initial test group on the RAVLT

RAVLT	Mean no. words	sd
List A-I	6.03	2.17
II	7.77	1.84
III	9.45	2.21
IV	10.37	2.17
V	11.12	1.81
List B	5.24	1.95
List A-after interference	9.65	2.23
No. recognition errors	2.79	4.24
List A-long term recall	10.10	2.15

Although it must be remembered that the present group of testees were not assessed in their mother tongue but rather in the language of formal scholastic instruction (namely, English), the total number of words recalled over the five learning trials was equal to, and not lower than, that recorded by Anderson and MacPherson (in Nell, 1997) on their group of 12-14 year olds when the test was administered in Zulu.

7.1.2.7 Stroop Colour Word Test (SCWT)

The test manual reports that, in young adults in the age group 16 to 44 years, the average number of words read in 45 seconds was 108, colours named, 80 and coloured-words 45. Above and below this age group, a correction factor is employed and the interference score should approximate zero. The scores obtained by the initial Soweto test group were accepted for statistical analysis without correction.

Table 12 The performance of the initial Soweto sample on the Stroop Colour Word Test

Stroop	Mean total	sd
No. of words read	85.84	14.4
No. of colours named	56.68	8.8
No. of coloured-words named	33.42	7.4
Predicted coloured-words	33.98	4.9
Interference Score	-0.55	6.2

As can be seen in Table 12 above although the present test group demonstrated a slower performance throughout this test, the interference score still approximated zero.

7.1.2.8 Wisconsin Card Sorting Test (WCST)

Robinson et.al. (1980) recorded means of 24.9 for error responses, 15.6 for perseverative responses, 12.6 for perseverative errors, 0.8 for failures to maintain set and a 69.2% conceptual level response in the group of 150 normal adults included in their sample. Chelune and Baer (1986) suggest that 12 year olds are capable of completing 5.7 (sd 0.95) categories, making an average of 12.3 (sd 16.94) perseverative errors. A mean of 0.7 (sd 0.68) failures to maintain set were recorded for their group. Despite the suggestion that by about 10 years of age, children's performances are similar to those of young adults can be seen in Table 13 below, with the exception of the ability to maintain set, the initial group of Soweto testees did not perform to the standard suggested in the literature.

Table 13 The performance of the initial Soweto sample on the WCST

WCST	Mean		sd
Correct	68.5	(55.8%)	13.3
Errors	55.5	(44.2%)	17.7
Categories	3.7		1.7
Perseverative responses	35.7	(28.3%)	20.4
Perseverative errors	30.6	(24.3%)	15.2
Conceptual level responses	52.0	(42.7%)	18.8
Failure to maintain set	0.8		1.0

The performance of the initial Soweto group can be likened to that of the 6 to 7 year old group included in Chelune and Baer's (1986) sample. The fact that the conceptual level score was below 50% suggests that the basic concept may have been unfamiliar to this particular group.

7.1.2.9 Bender Gestalt Test (BGT)

Using the Pascal-Suttell scoring system, the original normatization sample, comprising high school students between the ages of 15 and 19, scored a mean number of 19 errors (sd 9.4). Using the developmental scoring system, Koppitz provides normative data for children between the ages of 5 and 10 years and suggests that developmental maturity is reached by the age of 9 years. The 10 year olds in the Koppitz sample scored a mean of 1.6 errors. The performance of the initial group of Soweto testees was scored in accordance with both of the above mentioned profiles.

Table 14 The Bender Gestalt scored in accordance with Pascal-Suttell and the Koppitz developmental criterion

PASCAL-SUTTELL SCORING		KOPPITZ SCORING	
Mean number of errors	sd	Mean number errors	sd
31.25	23.32	1.06	1.60

Results presented in Table 14 above suggest that the present group of testees had reached developmental maturity scoring at a level similar to that of the 16 year old Zulu speaking students included in the Viljoen et.al. (1994) sample. However, viewed in the light of the 106 scorable characteristics identified by the Pascal-Suttell system and given the correlations reported between

measured performance on the BGT using this system and WAIS test scores, socio-economic variables and ethnic groupings, a different picture emerges, with the present sample scoring significantly below the reported norm.

7.1.2.10 Draw-A-Person (DAP)

Standardisation of this test by Harris was such as to effect a mean of 100 and sd of 15. The subject can achieve a maximum of 73 and 71 points on the Goodenough-Harris scale. However, as mentioned previously, a number of the features credited are caucasian in nature and previous studies conducted on black South African groups suggest that drawings produced by these children lack elaboration and detail.

Table 15 The mean performance of the initial test group on the DAP

Mean Raw Score	sd	Mean Standard Score	sd
34.71	11.43	83.17	17.91

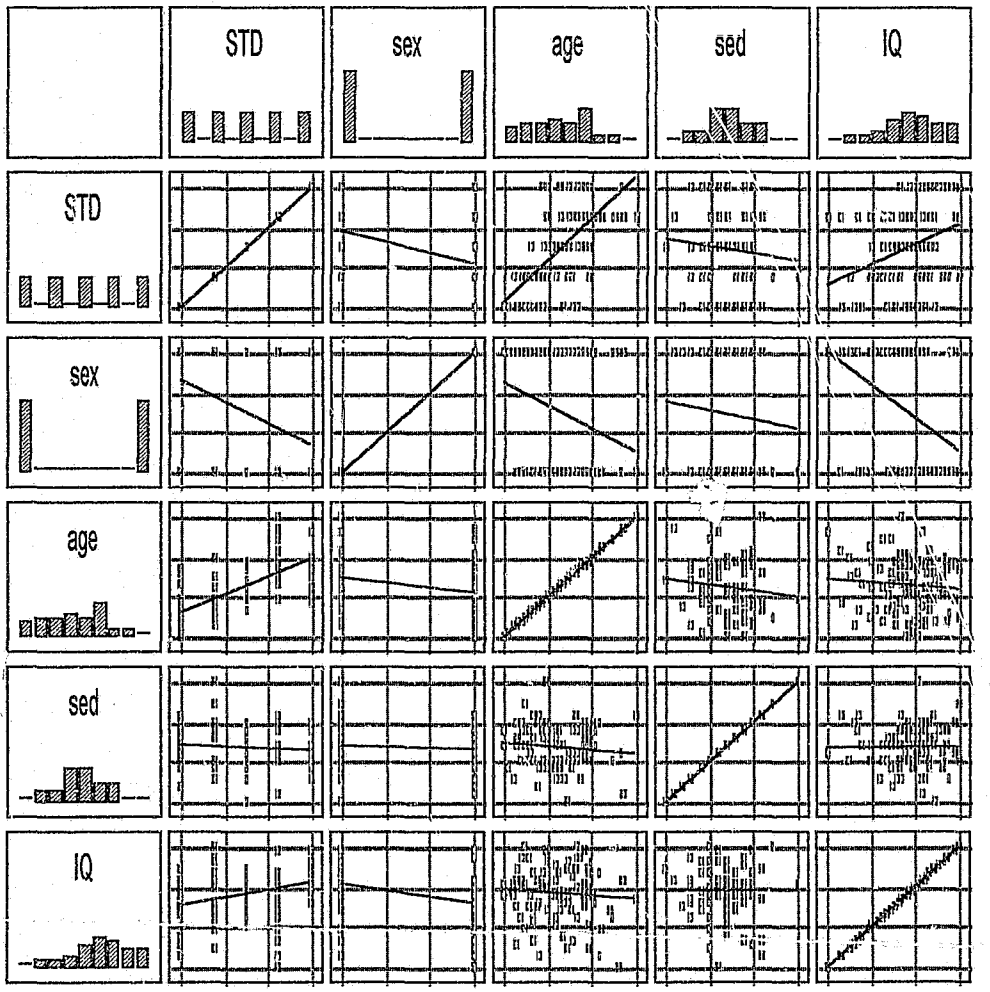
As can be seen in Table 15, drawings produced in the course of the present study confirm the previously reported trend for black South African children to score below the expectation of their American counterparts.

7.1.3 The impact of Subject Variables on test performance

As suggested in the preceding chapters, in the field of neuropsychological assessment, issues related to the role played by variables such as age, gender, educational opportunity, socio-economic standing and level of intelligence frequently arise. Before any inferences could be made regarding the impact that these variables might have had on the measured psychometric test performance of the present sample, it was important to examine the distribution of these variables within the sample and the correlations between them. With this in mind, Pearson's product moment correlations were computed for variable relevant to educational standard (STD), gender (sex), age, socio-economic standing (SED) and Intelligence Quotient (IQ). As can be seen in Figure 2, an understanding of the

relative influence of these factors on test performance was confounded by correlations between age, gender and educational level.

Figure 2 Correlations between subject variables for the initial test group



Educational standard correlated with gender (r=-0.38), age (r=0.70) and Intelligence Quotient (r=0.36) and gender was correlated with age (r=-0.30) and Intelligence Quotient (r=-0.40) at a 1% level of significance ($p<0.01$).

As discussed in the section 6.4 of the previous chapter, given the findings presented in section 7.1.2 above, an internal statistical analysis of the initial test data was conducted. This was done in accordance with Hypotheses II-V and the relevant subject variables depicted above. The large number of performance measures included in the analysis necessitated an adjustment of the effective p value so that inferences be based on stringent criteria of significance. However, as an indication of trend, p values are reported in full throughout the presentation of these findings.

7.1.3.1 Gender

As indicated in Figure 2 above, an understanding of the contribution made by gender to variance of scores measured for the initial Soweto sample was confounded by the skewed distribution of male and female participants in the sample. The male group was not only older but had also progressed further with regard to educational level. For this reason the data presented in Table 16 below cannot be accepted on face value but must be interpreted in the light of other contributions to the measured difference between the subgroups. However, further confirmation of some of the gender differences relevant to Hypothesis III is offered in Table 25. This table compares the performances of the male and female participants in Part II of the Soweto study.

Table 16 Analysis of Variance dependant on Gender

Psychometric Measure	Mean Score		t-value	F- score	p
	Male	Female			
Similarities (raw score)	13.6600	11.50000	2.20374	4.85645	.029884
Arithmetic (raw score)	11.5000	9.76000	3.27490	10.72499	.001462
Arithmetic (scaled score)	6.5600	5.60000	2.02190	4.08806	.045913
Comprehension (scaled score)	13.6200	10.64000	4.61103	21.26159	.000012
Block design (raw score)	12.0000	9.54000	3.22536	10.40296	.001715
Absurdities (raw score)	13.7400	10.68000	4.66424	21.75516	.000010
Absurdities (scaled scores)	12.6800	10.68000	3.68729	13.59613	.000372
IQ	109.3200	99.24490	3.84384	14.77508	.000216
Pascal-Suttell BGT	25.8163	35.60000	-1.89790	3.60201	.060683
Koppitz BGT	.6939	1.42000	-2.29363	5.26076	.023970
Draw-a-Person (raw score)	37.7200	31.65306	2.72337	7.41676	.007664
Draw-a-person (standard score)	89.5000	76.58333	3.80896	14.50816	.000246
Rey Osterreith Complex Figure	32.2716	30.27000	3.35171	11.23394	.001142
RAVLT (list A - trial I)	6.4400	5.62000	1.91312	3.66003	.059652
RAVLT (long term recall)	9.5918	10.61224	-2.40481	5.78313	.018038

The male participants in the initial Soweto sample out-performed their female counterparts with regard to constructional performance as measured by the drawing tasks Rey Osterreith Complex Figure, Bender Gestalt Test and Draw-a-Person. However, their performance may have been enhanced as a result of the number of males studying technical drawing as a school subject, the loading of male subjects in the higher school standards, and the tendency for them to form the older of the two groups.

On the WISC-R 25, females and 17 males fell within the range for which the test was normatised. The statistical significance of the male group performing better on the arithmetic subtest of the WISC-R was negated by the age correction offered when scaled scores rather than raw scores were compared. The same trend was observed for the Block Design subtest of the IS-A. On the Absurdities subtest of the same scale, both the raw scores and the scaled scores highlighted the tendency for the superior performance of the male group. This was once again, however, more pronounced with regard to the raw scores. The artefactual influence of the age factor must be considered, since only 23 of the males (compared to 34 of the females) fell within the age range for the various African language batteries. Raw scores on the comprehension subtest (which incidentally showed no significant difference for gender) could not be evaluated with any certainty due to the incompatibility of the test for the different language groups. Once again the significant difference between male and female scaled scores must be viewed in the light of the cumulative experience of the older and more educated male group. The differences measured between the groups on three of the four tests used to compute IQ naturally led to a significant difference on the IQ score.

7.1.3.2 Age

Although the Individual Scales for Zulu (IS-Z) and Southern Sotho (IS-S) speakers have been normatised for use on testees up to the age of 19 years 11 months; the WISC-R has not been normatised for individuals over the age of 16years 11 months; and the Individual Scale for Tswana speaking pupils (IS-T) for individuals over the age of 15 years 11 months. Cognisant of these facts, the participants in the initial Soweto study were subdivided into three age groups and comparisons (t-tests) made between the youngest (for whom all IQ batteries utilised had been normatised) and eldest (for whom there were no age-appropriate WISC-R or IS-T norms) of these (Table 17).

Table 17 Significant differences in performance between the older and younger subgroups in Part I.

Measuring Instrument	Mean Score		t-value	p
	<16years	>18years		
Rey Ostereith Complex Figure Test	30.3939	32.3056	-2.76091	.007429
Comprehension (scaled score)	13.2121	11.5278	2.07174	.042143
Similarities (raw score)	10.8182	14.1944	-2.98222	.003988
Coding (raw score)	41.9687	49.5000	-2.54701	.013204
Problems (raw score)	10.9091	15.0286	-4.82341	.000009
Absurdities (raw score)	11.0606	13.5278	-3.21613	.002002
Draw-a-Person (raw score)	36.8485	30.1111	2.73195	.008041
Draw -a-Person (standard score)	86.6061	76.9167	2.53278	.013665

Supporting acceptability of the implementation of the oldest available norm group, as indicated in Table 17 above, the impact of trend for the group 19 years and older (>18years; N=36), compared to the group 15 years and younger (<16 years; N=33) to obtain higher raw scores on the Similarities, Coding, Problems and Absurdities subtests, was negated by the age correction offered when scaled scores are compared. Although direct comparison of the raw scores obtained on the Comprehension subtest may have been compromised by the implementation of differing versions for the various language groups, no significant difference was observed. However, on conversion to scaled scores the younger group out-performed the older group. The performance differences recorded for the Draw-a-Person tasks may reflect the fundamentals of the test described by Richter et.al. in that the test does not appear to be an appropriate measure for older children.

Despite the small numbers included in each sub-group, means and standard deviations, for the measured performances on the test battery completed by the initial Soweto sample, were computed for the various age levels and included in Tables 32c, 33b and 35 (see Appendix D) and in Table 18, below, age was employed as the independent variable in an analysis of variance.

Table 18 An analysis of variance dependent on age

Psychometric Measure	F	p
WCST categories	1.948217	.039317
WCST %Perseverative responses	2.368300	.010979
WCST% Perseverative errors	1.936063	.040756
Koppitz BGT_	1.887818	.047172
Problems (raw score)	2.068736	.027580
Arithmetic (raw scores)	3.928867	.000082
Arithmetic (scaled scores)	2.098023	.025112
Mazes (scaled scores)	1.824056	.056578
Comprehension (scaled score)	5.006792	.000003

This analysis of variance computed for age suggests that frontal lobe functions, as measured by the Wisconsin Card Sorting Test and WISC-R Mazes subtests, are still maturing over the age range included in the initial Soweto sample, and that life experience is an important contributing factor to performance on the Comprehension subtest.

With reference to Table 18 above, if one considers the relatively large number of psychometric measures incorporated in the present study and adheres to a strict measure of significance according to Bonferroni's principle, an analysis of variance computed for age suggests that this is of little statistical significance. As can be seen, Hypothesis IV does not gain much support from the above statistical analysis, only the raw scores measured for the IS-A Problems subtest and the scaled scores for the IS-A Comprehension subtest demonstrated a statistically significant relationship with age.

7.1.3.3 Educational standard

In support of Hypothesis IV, the data suggests that by far the most important factor with regard to equivalent acculturation of groups is educational standard. As can be seen in Table 19 below, an analysis of the variance in test performance as a factor of educational standard suggests that 29 of the 58 measures examined are impacted upon by this variable. Even in the most exacting of scenarios, at least 12 of the measures must be considered to be significantly linked to educational level. Mean test scores and standard deviations for each of the 5 educational standards included in Part I of the study are tabulated in Appendix D.

Table 19 An analysis of variance in test performance according to educational standard

Test	F	p		F	p
Rey Osterreith Complex Figure	6.42690	.000127	Arithmetic (Scaled score)	3.47614	.010747
RAVLT List A Trial II	2.82261	.029163	Arithmetic (raw score)	19.52107	.000000
RAVLT List A Trial III	3.58904	.009043	Problems (raw score)	9.14557	.000003
RAVLT TOTAL I-V	2.61818	.039796	Comprehension (raw score)	4.83913	.001351
RAVLT List	3.15110	.017665	Comprehension (Scaled score)	9.81535	.000001
WCST %Perseverative Responses	2.92991	.024763	Story memory (raw score)	7.84732	.000017
WCST %Perseverative Errors	3.11118	.018776	Story memory (Scaled score)	2.95464	.023846
Stroop Words read	2.74742	.032766	long term story recall	8.15052	.000012
Stroop Predicted Coloured-Words	2.55328	.043986	Block Design (raw score)	6.59329	.000101
Similarities (raw score)	10.7360	.000000	Block Design (scaled score)	4.03911	.004569
Similarities (Scaled score)	4.47710	.002336	Absurdities (raw score)	8.84734	.000004
Digits Forwards	2.28797	.0655	Absurdities (scaled score)	5.81204	.000315
Digits (Raw Score)	2.83524	.028	Coding (Scaled score)	4.08960	.004231
Digits (Scaled Score)	2.67083	.036738	Coding (raw score)	9.47708	.000002
Picture Arrangement (raw score)	3.41715	.011761	IQ	5.34372	.000638

Given the age correction factor offered when raw scores are converted to scaled scores, it important to note that when variance in performance was analysed in accordance with education standard statistically significant effects were not limited to the raw scores, as was the case for the age analysis, but extended to the scaled scores obtained by the initial Soweto sample on the Similarities, Digit Series, Arithmetic, Coding, Comprehension, Story Memory, Block Design and Absurdities subtests. On the other hand, a number of measures possibly related to cortical maturity were of reduced significance when examined in relation to educational rather than age variables. Despite the correlation between age, gender and standard of education, education appears to have played the greatest role in performance on the Rey Osterreith Complex Figure Test, this may however, have been influenced by the number of years that some of the participating students have received formal instruction in technical drawing

7.1.3.4 Socio-economic status

In accordance with Hypothesis II, data was analysed with reference to socio-economic standing. An analysis of variance dependent on the individual's ranking on the Socio-Economic Deprivation

questionnaire (SED) suggested that this variable is of minimal significance within boundaries of the group included in the study. None of the computations demonstrated a statistically significant variance at the 1% level of significance. Given the large number of measures included in the analysis, trends suggested for the Rey Osterreith Complex Figure - recall (F=1.860958; p=0.048307), the Coding (raw score) (F=2.053561; p=0.026898 and the Draw-a-person (standard score) (F=1.847219; p=0.050595) must be viewed with extreme caution. With the exception of the draw-a-person task, they were not supported by the results of the t-tests discussed below.

Although the statistical significance of the socio-economic measure as a confounding variable did not differ, when the initial test group was categorised into three subgroups according to their ranking on the Socio-Economic Deprivation scale (SED) and the two extreme groups were compared by means of a t-test for independent samples, as can be seen in Table 20 below, the picture altered slightly.

Table 20 A comparison of the two extreme socio-economic (SE) sectors of the initial Soweto sample

	Mean			
Test	higher SE	lower SE	t-value	p
RAVLT (recognition)	3.7500	1.05000	2.64185	.010285
TMT Part_B	91.7949	71.3571	2.14347	.035823
Digits_Forward	6.2500	5.5714	2.16940	.033659
Draw-a-person	32.6154	38.6429	-2.05459	.043943
Draw-a-person	80.0769	89.2143	-1.98478	.051458

There was a tendency for the more socio-economically deprived to make fewer errors in recognition of the 15 target words of the RAVLT, complete trial B of the TMT in a shorter average time period, cope better with the draw-a-person test, but only cope with shorter strings of digits in forward recall. As mentioned above, these measured levels of significance are of doubtful importance.

7.1.3.5 Language as an indicator of cultural affiliation

The mean standard of education and level of socio-economic deprivation did not differ between the two language groups. Although the Zulu speaking group, tended to be a little older than the Tswana

speaking group, they did include slightly more female participants. Given that the content of the verbal items and the norm standards for non-verbal items differ for the Individual Scales for different African language speaking pupils, the performances of the two majority groups included in the initial Soweto sample were analysed separately and means and standard deviations of measured performance included in Appendix D (Tables 32d and 33c).

Comparisons of the raw scores recorded for the two language groups on the verbal sub-tests of the IS-A are rendered invalid due to the differences in the language versions of the measure, and comparisons made between scaled scores must be viewed in the light of the age ranges for which the test have been normatised. However, as can be seen in Table 21 below, t-test for independent samples revealed very little difference between the two language groups. The findings relevant to this statistical analysis are summarised in Table 21 below.

Table 21 Significant differences between the performance of the Zulu and Tswana speaking participants.

	Mean Score			
	Zulu	Tswana	t-value	p
WISC-R Arithmetic (raw)	9.8649	11.0909	-2.08727	.039691
WISC-R Arithmetic (Scaled)	5.1351	6.6909	-3.32413	.001284
WISC-R Picture Arrangement (Raw)	19.7297	23.4545	-2.03694	.044594
WISC-R Picture Arrangement (Scaled)	5.4595	6.9273	-2.39314	.018782
IS-A Comprehension (Raw)	33.1892	23.2545	10.04796	.000000
IS-A Comprehension (Scaled)	10.1351	13.2727	-4.47824	.000022
IS-A Problems (Raw)	13.9730	12.1481	2.10410	.038190
IS-A Absurdities (Scaled)	12.7027	10.9273	2.77748	.006666
Draw-a-person (Raw)	32.1389	36.6545	-1.95791	.053373
Draw-a-person (Scaled)	78.9143	86.1091	-1.94634	.054805
Rey Osterreith Complex Figure Recall	17.5000	20.4818	-2.36879	.020010
WCST % Perseverative Responses	.3252	.2605	1.93792	.055780

The most significant finding relates to the Comprehension subtest of the IS-A. This test draws on past experience with responses reflecting social and moral standards. The fact that the femininely biased older group did not out-perform the younger Tswana group may, to some extent, reflect either the age appropriateness of the norms or the specific conditions prevalent in the areas at the time that this test was developed.

7.2 PART TWO OF THE STUDY – ESTABLISHING A NORM STANDARD

As discussed earlier, the aim of Part II of this study was to establish a norm standard for one specific sector of the black urban high school populace. Given the findings of the exploratory phase of the study, Part II of the study concentrated on standard 6 students in the 13-15 year old age range. The influence of extraneous subject variables such as age and gender were again examined and findings compared with those of the initial investigation.

7.2.1 Biographical information

The additional 152 Soweto scholars assessed as part of the present study, were selected according to slightly more stringent criteria, the specific distributions of which can be seen in Tables 22 and 23 below. In summary, the group comprised 76 females (mean age 14 years 3 months; sd=0.95) and 76 males (mean age 14 years 4 months; sd=0.98) who were midway through standards 5, 6 or 7 at the time of testing.

Table 22 -Distribution by age of the norm sample

			STANDARD			
			5	6	7	TOTAL
	Mean Age		13.91	14.22	14.92	
		SD	1.78	0.92	0.53	
AGE				N		
<14	13.37	0.38	5	49	2	56
14	14.50	0.32	1	39	11	51
>14	15.36	0.33	3	31	11	45
TOTAL			9	119	24	152

In contrast with the male dominance reported for most other developing countries, the Macro-Economic Research Group (1993) reports that, for black South Africans, the male to female pupil ratio is fairly even. As has previously stated the present sample was selected to included equal

numbers of male and female participants (Table 23). The average number of rooms per home was 4.6, with 6.2 occupants living in a single abode.

Table 23 -Distribution by gender of the norm sample

	STANDARD		
	5	6	7
SEX		N	
Males	1	63	12
Females	8	56	12

In 1993 it was documented that black South African children spend an average of eleven years enrolled at school, but that the average attainment of black South African school leavers was standard 7, or nine years of formal schooling (Macroeconomic work group, 1993). In the present sample the percentage of school failures tended to increase with age. While only 21.4% of the 13 year old students had failed a school year, 50.9% of the 14 year olds and 53% of the 15 year olds had failed a school year.

7.2.2 Psychometric Test Scores

Since the test emphasis of the second half of this study was placed on the establishment of a norm standard and an examination of the pattern of scaled score scatter, preference was given to the full WISC-R battery over the abbreviated IS-A. As is recommended in the Canadian version of the WISC-R (Spreen and Strauss, 1991, pg. 60) certain items of this test battery were "South Africanised" in that units of measurement and geographically specific items were substituted with a local 'equivalent' for this group of testees. Although the initial item to be presented for the Information, Arithmetic and Vocabulary subtests differs for the different age groups included in this study, all children were treated as if they fell in the 11-13 year old age group. A test of Controlled Word Association (F.A.S.) was also included in the battery. Group selection criteria facilitated the use of age-appropriate versions of tests, which were scored in the manner previously described.

Results of the sample described above are presented in table 24.

Table 24 –The mean performance of black urban scholars aged 13 to 15 years on the selected tests

Psychometric Measure	Mean level of performance	Standard Deviation
WISC-R	Mean Scaled Score	
Information	4.66	2.33
Picture Completion	7.06	2.28
Similarities	4.89	2.32
Picture Arrangement	6.42	2.68
Arithmetic	6.01	2.20
Blocks	6.58	2.49
Vocabulary	2.85	1.64
Object Assembly	6.29	2.81
Comprehension	4.79	2.46
Coding	6.18	2.25
Digits	6.93	2.64
Mazes	7.60	2.90
Rey Osterreith Complex Figure	Mean Score	
copy trial	26.88	4.04
long term recall	18.00	5.39
Rey Auditory Verbal Learning	Mean no. words	
List A-I	5.36	2.11
List A-II	6.67	2.43
List A-III	8.21	2.96
List A-IV	9.59	3.10
List A-V	10.61	2.89
List A-after interference	9.47	2.97
List A-long term recall	10.11	2.98
Stroop Colour Word Test	Mean Score	
No. of words read	75.05	13.66
No. of colours named	52.83	8.70
No. of coloured-words named	29.20	6.37
Predicted coloured-words	30.76	4.63
Interference Score	-1.56	5.67
Wisconsin Card Sorting Test	Mean Score	
Correct	68.39	15.10
Errors	52.98	21.58
Categories	3.97	1.81
Perseverative responses	33.02	18.37
Perseverative errors	28.04	14.68
Conceptual level responses	52.89	19.81
Failure to maintain set	0.74	1.02
Koppitz Bender Gestalt Test	Mean Score	
Errors	2.18	1.95 [6]
Trail Making Test	Mean seconds	
Trails A (children)	29.77	17.33
Trails B (children)	50.30	33.19
Trails A (adults)	56.10	26.77
Trails B (adults)	110.58	52.54
Spatial Memory Task	Mean score [7]	
Mean no. trials to 3x perfect	2.63	2.20
Mean no. correct after 30-45 minutes	8.88	0.50
Controlled Oral Word Fluency	Mean no.words [8]	
Words starting with F	8.24	3.04
Words starting with A	4.17	2.03
Words starting with S	8.06	2.83

[6] The age appropriate version of this test was used throughout. The results are given firstly for the under 15 's (N-107 and thereafter for the over 15's (N=45)

[7] This test was administered as suggested by Murdoch et.al.(1995), with the trials terminating only after 3 sequential perfect placements or after 20 trials.

[8] Table 24 represents the actual number of words pronounced during each of the 60 second trials and has not been adjusted for age sex or educational level. Generally adjustments for male and female adult testees would differ (Gilandas et.al., 1984). The Raw scores obtained by the male and female groups in this sample did not differ significantly. The female group (who demonstrated a slightly larger standard deviation), averaged a grand total of 20.34 responses and the male group, 20.73. Even after the required adjustment both groups would therefore still fall below the 50th percentile (ie. males between 35-49 and females between 31-33).

7.2.3 Subject Variables

In order to clarify, and possibly verify, trends observed in the initial study with regard to the influence of subject variables, the performances of the male and female participants (76 of each gender) from this second stringently defined test group were compared via t-tests for independent samples (Table 25) and the influence of age was examined in an analysis of variance (Table 26).

Table 25 Significant differences in Male – Female Test performance

Psychometric Measure	Males	Females	t-value	p
Picture Completion (Scaled Score)	18.46596	17.37333	2.51409	.013004
Picture Completion (Raw Score)	7.53413	6.54667	2.72053	.007299
Similarities (Raw Score)	10.79927	9.17333	2.40589	.017367
Block Design (Raw Score)	28.05431	22.04000	3.80033	.000211
Block Design (Scaled Score)	7.32782	5.84000	3.81711	.000198
Object Assembly (Scaled Score)	20.05333	17.09333	3.48834	.000640
Object Assembly (Raw Score)	7.02667	5.54667	3.32358	.001120
Coding (Raw Score)	41.54234	44.16000	-2.02089	.045094
Coding (Scaled Score)	5.79396	6.56000	-2.11597	.036021
Mazes (Raw Score)	21.68315	19.17333	3.60336	.000458
Mazes (Scaled Score)	8.42405	6.81333	3.56120	.000497
Rey Osterreith Complex Figure (Copy)	27.53538	26.21897	2.06379	.040784
SCWT Words read	72.53405	77.68072	-2.35208	.019986
SCWT Colours named	50.70452	54.81119	-2.99555	.003213
SCWT Predicted Coloured Words	29.63071	31.86302	-3.03954	.002802
Koppitz Bender Gestalt Test	1.78326	2.59163	-2.63224	.009382

On the WISC-R battery, the boys obtained significantly higher scores than the girls on the Picture Completion, Block Design, Object Assembly and Mazes subtests. Although the girls tended to perform slightly better on the Coding subtest, this did not negate the influence of the other non-verbal tests, and the boys recorded higher performance IQ scores. On the BGT, the boys made less errors than the girls. Since the girls tended to be able to read more and name more colours within the time limit on the SCWT they demonstrated a significantly higher Predicted Colour/Word Score.

Table 26 Age as a contributing factor to variance in test performance

Psychometric Measure	F	p
Picture Completion(Scaled score)	2.853172	.017236
Similarities (Raw Score)	3.861340	.002562
Comprehension (Raw Score)	2.259269	.051475
Coding (Scaled Score)	5.590833	.000095

With regard to the WISC-R battery, as can be seen in Table 26, age as a variable made a statistically significant contribution to the variance of only the Raw-, but not the scaled- scores of the Similarities subtest, and the scaled- but not raw- scores of the Picture Completion and Coding subtests.

With reference to Table 27, it is interesting to note, given the equivalent educational standard of the group, when the test performance of the 13 year olds was compared to that of the 15 year olds, although mean raw scores did not differ, conversion to scaled scores resulted in a statistically significant advantage for the younger group relevant to performance on the Arithmetic, Information, Picture Completion, Mazes, Digit Series and Coding subtests. On the other hand, the age correction for the Similarities and Comprehension tests appeared appropriate as, despite that the older children achieved significantly higher raw scores, scaled scores did not differ significantly.

Table 27 A comparison of the performance of 13 and 15 year old participants on the IQ battery subtests

	Means			
	13 year olds	15 year olds	t	p
Similarities (Raw Score)	8.59530	11.1111	-3.10587	.002459
Comprehension (Raw Score)	12.41597	15.1681	-2.92869	.004216
Information (Scaled Score)	5.16374	3.9778	2.72685	.007552
Picture Completion (Scaled Score)	7.42316	6.1778	2.83177	.005598
Arithmetic (Scaled Score)	6.57942	5.6222	2.50751	.013769
Coding (Scaled Score)	6.90114	4.9333	4.49667	.000019
Digit Series (Scaled Score)	7.36605	6.3111	1.93556	.055746
Mazes (Scaled Score)	8.09128	6.8667	2.25590	.026255

The above differences on scaled scores resulted in the younger group being credited with a significantly higher Non-Verbal IQ and slightly higher Verbal IQ than the older group.

Although the findings discussed above may be interpreted as contributing corroborative evidence for Hypothesis IV, it is of course possible that this may be a true reflection of ability which led to the younger group reaching high school sooner. The possibility that the superior scores recorded for the younger group on the subtest discussed above is supported by the fact that 13 year olds made fewer errors on the Bender Gestalt Test (BGT), had better recall for the Rey Osterreith Complex Figure Test (ROCFT), took less trials to achieve consistent perfect placement on the Spatial Memory Task (SMT), and obtained better total word scores on the Rey Auditory Verbal Learning Test (RAVLT). However, refuting this possibility, when the performance of 15 year olds that had experienced school failures was compared with those who had not, significant differences were seen only on the WISC-R Information subtest at the 1% level of significance, the number of perseverative responses made on the WCST and the long term recall trial of the RAVLT at the 5% level of significance. Given the above, Hypothesis IV must be accepted

Table 28 A comparison of the performance of 13 and 15 year old participants on other psychometric measures

	Means			
	13 year olds	15 year olds	t	p
RAVLT (Total recall)	41.85835	37.6992	2.08480	.039635
RAVLT (After interference)	9.80618	8.2095	2.74311	.007213
RAVLT (Long term recall)	10.32200	8.9412	2.38100	.019159
Spatial Memory Task	2.19781	[illegible]	-2.81121	.005940
ROCFT_Recall	18.43038	16.4449	2.07436	.040615
Controlled Word Association - A	4.56753	3.7372	2.22364	.028422
Bender Gestalt (BGT)	1.92861	2.6972	-2.33651	.021460

When all of the children in the sample who had ever failed a school year were compared with all of those who had not, significant differences at the 5% level were again only observed on the WISC-R Information subtest, the RAVLT and the WCST.

7.3 PRESENT SOWETO DATA COMPARED TO TEST PERFORMANCES PREVIOUSLY REPORTED IN THE LITERATURE

The present study conducted on a specific milieu of Soweto high school students, in part, attempted to replicate a very similar investigation (Murdoch et.al..1994) undertaken on a group of black South African students attending a community college in Hillbrow. As the Murdoch study included only standard 6 students, only the standard 6 participants in the Soweto study were used in this comparison.

The mean age of the standard 6 pupils included in Part I of the present study was 14.38 years, the mean age of the standard 6 students participating in Part II of the Soweto study was 14.23 years and the mean age of the Hillbrow group assessed by Murdoch et.al. was 13.33 years. Where available, the American standard used was that against which a 13 year old's performance would be evaluated irrespective of educational level. The mean scores for these four groups are presented in table 27.

In order to assess the replicability of results and the suitability of the published norm standards, the performances of the above mentioned four groups were compared via t-tests with pooled variance. In this, all black South African standard 6 groups (Soweto I, Soweto II and Hillbrow) performed statistically very significantly ($p<0.01$) below the American standard on all measures listed in table 27 with the exception of the numbers of "Failures to Maintain Set" on the Wisconsin Card Sorting Test (WCST) and List B, the Interference words list, of the Rey Auditory Verbal Learning test (RAVLT). Although this did not hold true for the Soweto students, the Hillbrow group did not differ significantly from the American norm with regard to the number of words recalled on trial I of the RAVLT.

Statistically significant differences between performances of the two Soweto groups were seen only on the copy trial of the Rey Osterreith Complex Figure Test (ROCFT).

Table 29 - A Comparison of Hillbrow and Soweto std 6 pupils on various psychometric tests.

Psychometric measure	Soweto(1)	Soweto(2)	Hillbrow	American
WISC-R subtest (Scaled score)				
Similarities	4.3	4.79	4.92	10.0
Arithmetic	5.85	6.12	6.65	10.0
Digit Span	6.35	6.96	6.82	10.0
Picture Arrangement	5.95	6.46	7.55	10.0
Mazes	8.00	7.81	8.64	10.0
Coding	6.21	6.33	7.43	10.0
TRAIL-MAKING-TEST [9] (Time in seconds)				
Trails A	41.36	49.89	40.11	
Trails B	87.57	99.82	86.87	
ROCFT (Raw score compared to data gathered by Kolb and Whishaw, 1985))				
Copy Trial	29.3	26.77	25.0	32.63
Recall Trial	19.3	18.26	15.5	24.59
RAVLT (Number of words compared to data gathered by Munsen, 1987))				
I	6.0	5.48	6.08	6.8
II	6.9	6.72	8.14	9.5
III	8.1	8.43	9.84	11.4
IV	9.8	9.45	10.67	12.3
V	11.1	10.59	11.39	13.0
B	5.7		6.43	6.2
After interference	9.0	9.56	10.87	
Long term recall	9.8	10.07	10.90	
STROOP COLOUR-WORD TEST (No in 45 seconds compared to data reported in table II-B of the test manual)				
No. of words read	76.84	74.42	76.89	98
No. of colours named	53.47	52.98	51.63	73
No. of coloured-words named	30.21	29.34	28.34	40
Predicted coloured-words	31.37	30.73	30.77	42
Interference Score	1.16	1.38	-2.43	0
WISCONSIN CARD SORTING TEST (Card Placements compared to data gathered by Heaton, 1981)				
Correct	66.3 (53.2%)	68.7 (57.2%)	70.20 (57.4%)	
Errors	59.1 (46.7%)	53.2 (42.7%)	53.44 (42.5%)	28.2
Categories	3.4	3.97	3.91	5.2
Perseverative responses	33.2 (34.4%)	32.8 (26.4%)	32.82 (26.3%)	16.7
Perseverative errors	36.2 (28.6%)	27.9 (22.5%)	28.04 (22.4%)	16.7 (12.5%)
Conceptual level responses	51.8 (41.8%)	52.6 (44.3%)	54.37 (44.9%)	(66,7%)
SPATIAL MEMORY TASK	Number of Trials			
	4.05	2.50	4.97[10]	

[9] All comparisons were based on the adult version of the Trail Making Test. Only 30 of the Soweto 2 standard 6 pupils were thus included in this analysis

[10] In this instance, procedural differences are noted in that the testing of the Hillbrow group and the second Soweto group was continued until the subject demonstrated consistent perfect placement (i.e., 3 consecutive perfect scores) whereas testing was terminated on the initial group of Soweto subjects after the first perfect placement. By way of example, should an individual subject have placed 7 cards correctly on the first trial, 8 on the second trial and 9 on the third, but then made an error on the fourth trial, before perfectly placing the fifth sixth and seventh trials, then in the Hillbrow group the resultant score would have been 6, and in the Soweto group, 3. The initial group of 20 Soweto standard 6 pupils included one child who required 11 trials to complete the test, two required 10 trials and one 9 trials significantly raising the mean for the group, the median score for both groups of Soweto standard 6 pupils was however 2.0.

The mean level of performance recorded for the black South African students attending an inner city community college differed from the Soweto norm (part II) with regard to performance on the Trail Making Test (TMT), the ROCFT recall trial, the mid-learning trials (list A II-IV) and the Spatial Memory Task (SMT).

8 DISCUSSION

An abundance of studies point to the mediating effect of factors such as age, gender, language, geographical location, socio-cultural affiliation, educational opportunities and economic status on psychometric test performance. The more obviously the testee's acculturation differs from those represented in the normative sample, the less valid and more biased the results become. This is of particular relevance in the South African context where, up until very recent times, so many aspects of acculturation have, to a large extent, been legally enforced and racially bound. As a result, equivalent acculturation across the diversities of societies cannot be assumed.

With this in mind, the basic question around which the study revolved was whether or not published neuropsychological test norms were suitable for the assessment of urban black South African secondary school students. In Chapter 8 the findings of the study are discussed in terms of the hypotheses. Various theoretical and practical implications of the findings, and the resultant norms are considered, as are the study's limitations and areas for further research.

8.1 AN INTERPRETATION OF THE FINDINGS – OBSERVED TRENDS

It is evident from the results outlined in the previous chapter that differences in test performance do exist, both as a factor of within group variables and between the sample studied and those samples used to establish the published norms.

8.1.1 The suitability of the norms - Hypothesis I

At the outset it was hypothesised that norms published for other population groups are higher than those of urban black South African high school students. The Soweto students assessed in this study performed at a significantly poorer level than the respective foreign norm groups. For example, in

Part II of the study, the mean scaled scores obtained on the verbal subtests of the WISC-R ranged between 2.85 for Vocabulary and 6.01 for Arithmetic, the practical scores ranged between 6.18 for Coding and 7.6 for Mazes. Hypothesis I is thus supported. It is thus apparent that the published norms are unsuitable for use in the neuropsychological assessment of black urban high school students and can lead to misdiagnosis. Observations made during the course of the study suggest that the reason for this unsuitability is multifaceted.

8.1.1.1 Verbal functioning and related language considerations

In a multilingual society like Soweto, the importance of language factors cannot be over emphasised. In the neuropsychological context, language can be seen not only as an indicator of organic integrity, but also as a reflection of cultural affiliation. Perhaps, most importantly, it is a medium of assessment susceptible to the influence of a profusion of confounding variables which exist outside of the neuropsychological realm.

The exceptionally poor performance on many of the verbal tasks, together with the finding that intelligence, and more specifically, verbal conceptualisation, accounted for more than 18.5% of the variance in test scores in Part II of the study, further supports the argument that language must have a profound effect on test performance. It is obvious from the particularly low mean performance of the second group on the Vocabulary subtest of the WISC-R, that this test - which is so often used as an indicator of premorbid intelligence - cannot be used for this purpose in this group who are being raised in a multi-lingual environment and being educated in a language other than their mother tongue.

Contextual specificity in a multi-lingual society

Specifically within this urban group (but not necessarily within other, more language-specific areas of South Africa), teachers frequently complained of a high failure rate in the vernacular. This they attributed to the fact that children no longer spoke their mother-tongue in its pure form, due to the broad language mix of the society in which they live. The language issue is thus not a simplistic

binary issue of first and second language, or even, social and institutionalised communication. Conducted as it was within an educational setting, with the exception of the subtests from the Individual Scales for African Language Speaking Pupils (IS-A), assessment in the present study was conducted in the medium of scholastic instruction, namely English.

An interesting observation made during test administration was the contextually specific nature of language usage. This was demonstrated in the IS-A Problems subtest which was administered in the vernacular. On this test the subjects, who being taught through the medium of English, requested that the question was repeated in that language. In a similar vein, answers to certain items from the WISC-R Vocabulary subtest could be clearly linked to specific issues - the most obvious being the association of the word "Prevent" to the 'AIDS' or alternatively, the 'Planned Parenthood' campaigns.

The fact that the best performances on subtests from the WISC-R Verbal Scale were observed on the numerical tasks, may relate to the issue of contextual specificity for chosen language. Mathematical ability is to a large extent dependent on educational opportunity and these children are being educated in English. Therefore the language of presentation is appropriate for the subject matter. Furthermore, the expressive language required for answering these items is relatively limited and belongs to a closed set. There is a finite number of words within the vocabulary set and without synonym, thus, one is one and two is two. Despite the above, however, it must be remembered that performance on these test was still significantly "below average".

Cultural identification based on language

As mentioned earlier, the role of language is not limited to the problems associated with making neuropsychological inferences based on language ability. In a multi-lingual society, fraught with artefactual influences arising from non-organically based language factors, language also frequently serves as a readily available indicator of cultural affiliation. With regard to group identity, in South Africa, as is the case in the rest of the world, categorisation is frequently based on language and geographical location. English-speaking Canadians may be differentiated from French-speaking

Canadians or English-speaking South Africans. Given the ethnic groupings, geographical expanse, provincial divisions and languages represented within South African society, identifiers governing homogeneity of population groups may prove complex.

In order to examine factors relevant to language and geographical location, the data gathered for the initial Soweto group was classified according to language preference. The measured performances of these sub-groups of the Soweto population were compared to each other utilising t-tests for independent samples.

Within the initial Soweto sample, despite the fact that there was no statistically significant difference in the standard of education between the two language groups, the Zulu speaking group did have a slightly older mean age (13 months) than the Tswana speaking group. In addition, although the mean IQ levels did not differ significantly, the Zulu-speaking group did report twice as many school failures. These factors may have contributed to a weaker performance on the WISC-R Arithmetic subtest by the Zulu subjects when raw scores were converted to scaled scores.

The higher IS-A Comprehension scores obtained by the Tswana-speaking contingent of the initial test group (Table 21) possibly relates to the fact that this subtest differs for the different language groups, and norms are available only to a maximum age of 15 years 11 months.

The difference in performance between Tswana and Zulu groups on the Absurdities subtest is interesting to note since identical tests are administered to both groups. Despite the fact that the Tswana speaking contingent obtained a similar (slightly higher but not significantly so - Table 33c) mean raw score, norms provided by the HSRC led to a significantly (p=0,006) lower mean scaled score. This suggests that, whatever area-related differences led to this in the original normatisation, do not hold true for a culturally-mixed society being educated under a single educational system.

Language and the individually selected measures

Continuing the debate on influences of verbal/non-verbal test content, of the individually selected tests, the Oral Word Fluency Test (FAS), Rey Auditory Verbal Learning Test (RAVLT) and the Stroop Colour Word Test (SCWT) have the highest verbal content. Poor performance on the Oral Word Fluency Test, supported by findings on the Vocabulary subtest of the WISC-R, suggests that these students being educated in a second language may find themselves at a distinct disadvantage due to the availability of only a limited expressive and receptive lexicon.

It was originally hoped that the SCWT could be translated and used in some way to examine the relative interference of home language versus language of instruction. Translation of the colour blue into the vernacular, however, presented too formidable a stumbling block, so this was not done. Research has suggested (Chen, 1997) that the underlying mechanism of the Stroop interference effect is interactive or multiplicative, rather than stage-like or additive and that a time ratio of coloured-words named over the unambiguous colours named represents the more psychologically appropriate measure of effect.[11] Administered as the SCWT was, in English, although the absolute numbers were reduced interference score still approximated zero. The test was therefore considered to be a valid measure in this population group.

Considering this language issue, despite the warning by Franzen (1989) regarding the equivalency of alternative versions of the RAVLT, the findings of the present study were compared not only with the foreign norms and the local scores reported by Murdoch et.al., but also with those reported by Anderson and MacPherson in response to a Zulu translation of the test. Table 30 presents the total number of words recalled over trials I-V for the 13-15 year olds norms sample which comprised Part II of the present study, twenty-six 14-16 year olds included in Part I of the Soweto study, the thirty-three 14-16 year olds assessed by and Anderson and MacPherson and the forty-nine 11-16 year olds included in the Hillbrow group tested by Murdoch et.al.

[11] An exploratory factor analysis computed for the data gathered in Part II of the study suggests that Factor 3, accounting for 8.5% of the variance, is a speed factor. Speed of execution is reflected in the number of words read or colours named on the SCWT. On the other hand, Factor 6, loading on coloured-words, reflects susceptibility to interference.

Table 30 RAVLT – Comparative local data

	Soweto II	Soweto I	Murdoch	Anderson and MacPherson
	N=152	N=26	N=49	N=33
RAVLT Total Score (Trials I-V)	40.46	46.46	46.12	46.2

As can be seen, with the exception of Part II of the Soweto study the four groups studied produced almost identical results. It must be remembered Part II of the Soweto study did not include any 16 year old subjects. Also, the standard deviation measured in Part II of the Soweto study was 10.14 compared to the 6.9 of the Soweto I group. However, given the level of agreement characteristic of the other three groups the lower score obtained by the second Soweto group must be viewed with some caution. Nevertheless, all four of these black South African groups performed at a level significantly below the level of their American counterparts.

Observations regarding verbal functioning and related language considerations serve to highlight the potential problems inherent in assessment in a multilingual society. Within such a society, it is difficult to ascertain the covert equivalency of meaning between what is said and what is understood, even when, overtly, communication appears to be adequate. To repeat a previous assertion – 'one may get by but miss nuances and often blunder'. This takes on additional importance in the light of the influence exerted by verbal conceptualisation skills on the overall performance variance.

8.1.1.2 Non-verbal testing

The effect of acculturation variables on psychometric test performance is not limited to verbal testing. The exclusion of verbal items from a neuropsychological test battery does not, in itself, render the measure culture-free or culture-fair. As mentioned earlier, non-verbal tasks may require specific strategies and cognitive styles characteristic of one culture [illegible] another, and scoring systems developed for one group many introduce bias wh[illegible] istered to testees operating from a different frame of reference.

Drawing tests

Regarding those tests with limited verbal content, the most striking cultural bias was noted in the implementation of the Goodenough-Harris scoring system to the Draw-a-Person Task, where so many of the features credited are obviously Caucasian in nature. This was, however, not the only factor influencing performance. In accord with the findings of Richter et.al. (1989), who examined the drawings of a younger group of black urban children, the majority of the participants in the present study obtained scores well below that of their American counterparts. From a qualitative perspective, many immaturities were noted and representations generally lacked detail. Further study into the projective value of observations such as missing hands or feet and the likes might provide useful information but is beyond the scope of the present study. Of the other drawing tasks, bicycles tended to provoke comment to the effect that they were too difficult to draw, which is substantiated by the non-functional nature of the majority of the end products. Although not quantified, the number of tree drawings which include roots, and the number of transparent houses, appeared to be excessive and may warrant further investigation.

The Wisconsin Card Sorting Test

In agreement with the findings of Ardila, (1993) on his group of normal children between the ages of 5 and 12 years, the Soweto study did not find performance on the Wisconsin Card Sorting Test (WCST) to significantly correlate with gender or socio-economic level. Despite the fact that performance for the initial Soweto group did not correlate with educational standard, and the volumes of research undertaken in younger age groups (Paniak et.al 1996; Rosselli and Ardila, 1993; Riccio et.al, 1994; Grieve et.al., 1996), it has been suggested that this test should not be used on individuals with less than 12 years education (Nell,1997).

In the evaluation of the appropriateness of the norms and the usefulness of this test in a black South African population in their twelfth year of formal schooling, the performances of a group of 20 matriculants attending the community college from which Murdoch et.al. derived their Standard 6 group are tabulated below (Table 31) and compared with the matriculants from the initial Soweto test group.

Table 31 Hillbrow and Soweto standard 10 pupils on the Wisconsin Card Sorting Test

Hillbrow Standard 10 scholars		Soweto Standard 10 scholars		
	(N=27)		(N=20)	
	Mean	sd	Mean	sd
Correct	67.3	14.1	68.9	12.0
Errors	44.9	26.0	52.2	18.8
Categories	4.0	2.1	3.9	1.8
Perseverative responses	22.9	14.3	28.0	12.1
Perseverative errors	20.4	12.3	25.5	10.0
Failure to maintain set	1.2	1.6	0.8	0.8
Response to first category	27.5		13.8	

It is evident the Soweto matriculants, despite completing the first category, colour, sooner, made more errors, including perseverative errors and more perseverative responses in general. The Hillbrow group however, had more difficulty maintaining set. Compared to Murdoch's standard 6 group, many of the matriculants drawn from this inner-city community college had had the benefit of a number of years of private education. These standard 10 students achieved a mean level of 52.7% conceptual level responses compared to the 44.9% achieved by the standard 6 group drawn from the same school. In this they outperformed the township students tested during Part I of the present study. The standard 10 students attending a township school achieved a 44.6% conceptual level response and the standard 6 scholars, 41.8%. Nevertheless, performances recorded for all black South African groups remain considerably lower than the mean performance levels reported in the Heaton (1981).[12] An exploratory factor analysis performed on data gathered during Part II of the present Soweto study suggests that, Factor II, categorisation concepts, which accounted for 11.5% of the total variance, loads heavily on the WCST. The low percentage conceptual level responses recorded within both the Hillbrow and Soweto groups suggests that these populations had difficulty with the mental flexibility required to generate and discard categorisation strategies. The validity of the WCST for discerning organic impairment in such groups must thus be further investigated.

[12] Heaton reports a mean of 69.2% conceptual level responses for an adult norm group, with a mean age of 35.9years and an average of 13.9 years of formal education and 62.3% for subjects with less than 12 years formal education

During the normatisation of the WCST (Heaton, 1981), only 2% of the normal population obtained a perseverative response score greater than 46 and a cut-off of 18 was considered optimal for predicting brain damage. With regard to the present test group however, Heaton does suggest that some leeway (possibly increasing the impairment cut-off by five perseverative responses and thereby approximating the mean of the Hillbrow matriculants) could be given to high school dropouts.

Chelune and Baer (1986, in Spreen and Strauss, 1991) report rapid gains in the number of categories achieved and a significant reduction in the number of perseverative errors with advancing age. From their research they conclude that by about the age of 10 years, children do not perform significantly different from adults on the WCST.[13] The 12 year olds (the youngest age group included in the present study) successfully completed a mean number of 5.7 categories as opposed to the 4 categories completed by the black South African group. The number of perseverative errors made by the South African group was more comparable with their 6 and 7 year olds than with their twelve year olds, suggesting that culturally different categorisation strategies must not be disregarded in performance evaluation.

The Trail Making Test

The adult version of the TMT was administered to all participants in the initial Soweto group and to the forty-five 15 year old participants in the second Soweto group. Reitan suggests a cut-off score for Part A of between 39 and 40 seconds and for part B of between 91 and 92 seconds. Although the mean scores for most of the Soweto subgroups fell at or under the cut-off, the standard 6 participants did take longer to complete the task. Looking at the local literature, the findings for the adult version of the Trail Making Test appear to correlate more readily with those of Murdoch et.al. (1994) than with those of Anderson and MacPherson (reported in Nell,1997)[14]. Although the performance of the Soweto standard 10 students (see Table 34a - Appendix D) was similar to that measured by Anderson and MacPherson in their group of 14-16 year olds, the former group was

[13] It must be noted that the group of 105 children tested by Chelune and Baer ranged between the ages of 6 and 12 with only between 10 and 22 subjects in each age bracket. Relevant to the present discussion, they included only eleven 6 year olds and 10 twelve year olds.

[14] Murdoch et.al report a mean duration of 40.11 seconds for Trail A and 86.87 seconds for Trail B. Anderson and MacPherson report 34.03 seconds for Trail A and 76.09 seconds for Trail B on the Adult version of this test.

substantially older and more educated. Furthermore, the results reported in Murdoch et.al. may be somewhat accelerated due to an additional practice effect inherent in their research design. On the other hand, times recorded during Part II of the present study maybe somewhat inflated due to the comparative inexperience of the test administrators (see sections 4.2.2.1 and 6.3.3).

Looking at the children's version of the same test, which was administered to the 13 and 14 year olds included in Part II of the present study, findings are in agreement with increased times reported by Anderson and MacPherson, rather than faster times reported by Murdoch et.al.[15]

The Bender Gestalt Test

The strict age related trends demonstrated for performance on the Bender Gestalt Test (BGT) in the Zulu-speaking group assessed by Viljoen et.al. were not duplicated in the initial sample of the Soweto study (Table 35f). The mean error score obtained by the age controlled sample included in Part II of the Soweto study was higher (see Table 24) than that reported by Viljoen for the similar age groups drawn from an urban setting in KwaZulu-Natal.

The difference in performance of the present test group on the BGT when compared with results obtained by a Zulu-speaking group examined by Viljoen et.al (1994) may be attributed to a number of reasons. Firstly there were administrative differences between the studies. When administered as a group test, as was the case in the Viljoen study, errors arising from stimulus card rotations (2,5,7,11,13,22,25) are eliminated. Secondly, when one views the finding in the light of the Zulu/Tswana comparisons (Tables 21 and 33c) and considers that the Viljoen group was schooled in Natal rather than Transvaal it is possible that educational/cultural systems may have influenced performance. Finally it must be remembered that the Soweto group comprised a comparatively limited number of subjects at each age level.

---

[15] [15] Murdoch et.al report a mean duration of 18.91 seconds for Trail A and 38.91 seconds for Trail B. Anderson and MacPherson report 22.65 seconds for Trail A and 49.95 seconds for Trail B on the Adult version of this test.

As stated previously, the assumption of homogeneity of population does not end at broader classification based simply on race, language or country of residence. Assumptions of equivalence require multi-faceted analysis cognisant of age, gender, language, geographical location, socio-cultural affiliation, educational opportunities and economic status.

8.1.2 Socio-economic identifiers within the Soweto school system – Hypothesis II.

It was hypothesised that no significant difference in neuropsychological test performance exists as a function of those environmental factors identified by van den Berg (1984) as correlating with, and accounting for variance on, test performance, within the Soweto school system. Supporting the hypothesis, when *socio-economic circumstances* were quantified according to the Socio-economic deprivation scale (SED), and measured against test performance, the influence appeared (as was the case in the Murdoch et.al. 1994 study) to be minimal. Only a few specific measures - pertaining to the Rey Auditory Verbal Learning Test (RAVLT), the Trail Making Test (TMT), the Drawing Tasks (DT) and WISC-R digit recall test - demonstrated any correlative trends.

These findings appear to suggest that the range of socio-economic circumstances within a township school population are not so broad as to exert significant intra-group variance. In order to delineate the broader applicability of this finding, it was important to define the parameters of the present test population in terms of their domestic circumstances, educational environment and personal orientation towards the test situation.

8.1.2.1 Domestic Circumstances

A broad range of home situations were encountered, including hostel dwellers, children from squatter dwellings, children residing with relatives other than their parents, as well as children from economically viable families whose homes have been somewhat upgraded – through expansion - from the original 'match-box' houses. As indicated in sections 7.11 and 7.21, means computed suggest that five or six individuals occupy residences with between four and five rooms.

With regard to mobility and exposure, some families owned their own transport whereas others were, for the most, unable to even provide taxi fare for their children. Most families reported owning a television and almost all possessed at least a radio.

The majority of the parents were literate but the level of education varied from an incomplete basic primary school education to post-matric training. Family incomes varied from that obtained through irregular 'piece-work' or a grandparent's pension, to full-time parental employment. Generally incomes did not appear to exceed R3000 per month, the subjective value of which would be determined by the individuals own frame of reference.

8.1.2.2 Educational Environment

Given the influence of both the in- and out-of-school factors on repetition and survival in the school system (Gordon, 1986) and the present statistically based suggestion that educational factors played a significant role in acculturation it was important to examine the educational environment from which the sample was drawn. All of the participating schools – Orlando West, Phefeni, Anchor and Kwa-Ntsikana - were state schools, offering free education. They were all located within the Orlando area, but drew children not only from their own suburbs but also the surrounding suburbs. Despite minor qualitative differences between them, statistical comparisons suggest that test performance was not significantly affected by attendance at a specific school within the constraints of a culturally mixed urban township in this region. (see Appendix A for a stylised map of the area).

8.1.2.3 Testee Orientation

In all assessments, equivalence of experience, exposure and subjective evaluation of the assessment experience may artefactually influence test performance and must be evaluated for each individual case. As a basis for comparison the indicators of motivation, cooperation and test circumstances are discussed below.

With reference to motivation and cooperation, it may be relevant to note that children are often more accepting of the unknown when this can be approached hand-in-hand with their best friend. In this regard, the clinical situation may differ from the research environment in that the testee has, for whatever reason, been singled out and may be a reluctant participant. In addition, all of the testees participating in this study, did so voluntarily (with many of them being suspected of promptly signing their own consent forms so as not to be excluded from the study). In fact, a greater problem was the fact that not all students could be accommodated, rather than with subject recruitment. Thus although, a number of observations indicate that the majority these students are not necessarily 'test-wise', the situation did not appear to be perceived as aversive. Again the same can not always be said of the clinical situation. In the clinical situation, it is not only important to heed the caution posed regarding the assessment of subjects who are not "test wise" (Nell et.al. 1997) but also to consider their feeling about the testing procedure.

All of the students included in the present study had completed at least seven years of formal education under a system which, until recently, did not enforce compulsory education for black students. In itself, this suggests some degree of motivation, whether it be personal or enforced by parents or guardians.

The case of the student unable fully to develop his extraordinary artistic talent due to lack of basic facilities, indicates the extent to which the experiences of these students may differ from those of the published norm samples. In the particular instance of that student, he had never previously worked in colour – or even on a blank sheet of paper – so the procedures entailed by the Rey Osterreith Complex Figure Test and the Drawing Tasks were entirely unique in his experience. The heightened awareness and excitement generated by the test may have impacted upon its construct validity, in that it is possible that he may have become more absorbed in the colour, and this could have distracted from the primary purpose of the test, which is that of producing an adequate copy.

Other observations supporting the fact that participation in the first study meant that, for some students at least, the circumstances in which the testing took place may have been unfamiliar, include a comment made by one of the standard 9 pupils to the effect that (on entering the Abbot Laboratory

offices), he "never imagined being inside such a building"; a comment made by one of the fathers on a home visit that "he was honoured to have a white person visit"; the reaction of one of the matric students to the tertiary education selection procedure with regard to the unfamiliarity of the paperwork, the interview situation and the psychometric test battery; and, especially relevant for practical items with a motor component (e.g. puzzle piece manipulation), mannerisms prevalent whilst eating lunch.

Although testing of the second group of testees took place in surroundings that were familiar to them, the initial reception of the writer (and particularly the writer's young children) on visits made during the preparatory stage of the study, suggested that, possibly because of the racial difference, such visits to the school were not considered 'usual'.

Despite these initial reactions and idiosyncrasies, the students adapted well to the project. The testing took place amongst their class mates, among their peers, over an extended period of time. The students became familiar with the routine. Specific instructions restrained earlier testees from revealing test content to the later participants. However, those who had returned from being tested obviously interacted with their peers, in that those who could not be accommodated in the study were disappointed. In retrospect, since some student felt their exclusion was unfair and expressed a strong desire to participate in it, it can be inferred that the overall subjective interpretation of the experience by testees was that of a non-threatening and pleasant outing.

In South Africa, environmental and orientational factors similar to those encountered in both studies may frequently arise in the clinical test situation. It is evident that we cannot readily assume equivalence of experience, exposure and subjective evaluation of the assessment experience and it is obviously important for the practitioner to evaluate the influence of this for each individual case. This lack of equivalence of the assessment experience provides further support for the need to establish separate norms for this population.

8.1.3 Gender as a determinant of test performance –Hypothesis III

Supported by an abundance of references in the literature, it was hypothesised that certain abilities vary as a function of gender.

Although research suggests that males are generally better at mathematical tasks (Lezak, 1983), the nature of story problem subtests are such that they require that the individual utilise a range of abilities, such as memory and language, to facilitate the mental arithmetic required to solve the problem. Given the verbal components of the test content, and since arithmetical performance is to a large extent dependent on educational opportunity, it is understandable that, when the educational range of the sample was limited, as was the case in Part II, no statistically significant differences in gender performance were measured.

In Part I of the study, the boys were on average, a standard ahead of the girls, and 18 months older. The statistical significance of the differences measured for raw scores on tests such as the WISC-R Arithmetic and IS-A Block Design subtests was eliminated when conversion to scaled scores offered an age correction factor. Supported by the fact that in Part II, where gender was matched for age and educational standard, no statistically significant differences were measured for gender on the WISC-R Arithmetic subtest, the difference was attributed to the skewness of the sample. However, when the WISC-R Block design subtest was administered to the second group of testees, gender differences in favour of males were statistically significant for both raw and scaled scores. Given the supporting evidence measured for Part II, it is possible that, Block Design tasks are subject to a valid gender difference and that initial results were confounded by the discriminant validity of the test and related norms in the older age groups. A 19 year old Zulu speaker with a perfect score on this IS-A Block Design subtest is credited with a scaled score of only 14 whereas a 14 year old may be credited with a scaled score of 19; a scaled score of 10 for these two age group requires raw scores of 11 and 7, respectively.

The tendency amongst male testees for right hemispheric specialisation and enhanced ability for visuospatial tasks has also been reported by Lezak (1983) and Maccoby and Jacklin (1974). Within this study, this tendency was also supported by the measured performance on other Performance scale subtests of the WISC-R such as Object Assembly, Mazes and Picture Completion.

Further, regarding non-verbal tasks, in contradiction with the findings of Bennet-Levy (1984) males out-performed females on the ROCFT in the initial test group. Again, this initial finding may be somewhat misleading since research has demonstrated a correlation between age and performance on the ROCFT, and the trend was not replicated in the more carefully selected confirmatory group. As mentioned earlier, the fact that technical drawing was such a popular subject amongst the male group in the initial sample may have further confounded these results. Yet, in a similar task, when subjects had to copy 9 simple designs for the BGT, utilising the Koppitz developmental scoring system, males outperformed females in both the initial ($p=0.02$) and even more so in the second part of this study ($p=0.009$). This was in accordance with the findings of Viljoen et. al. (1994) ($p=0.02$). Unfortunately, Viljoen et.al. concluded that, since age correlated so highly with educational standard, and sex and geographical area accounted for less than 3 % of the total variance, they were warranted in reporting only age related norms and collapsing data across the other variables. For this reason, a detailed comparison of the two studies, with regard to the nature and direction of the gender differences in performance, could not be made.

The gender differences measured on tasks tapping these abilities take on added importance when one considers the emphasis placed on non-verbal tasks in a multi-lingual/multicultural society such as ours. Disregarding other factors, in the absence of gender specific norms the assumption that the elimination of verbal items renders a test battery culture-free or culture-fair could be misleading.

8.1.4 Chronological Age and Educational Exposure - Hypotheses IV and V

With regard to education and age, two alternative hypotheses were proposed relative to the respective influence exerted by the developmental events of adolescence and the number of years of

formal education.

Since pragmatic considerations were part of the rationale for this study, it was considered important to select students from a sample which is representative of the real, and in many instances, formidable difficulties which confront black urban high school students. The initial study therefore did not impose age restrictions and sampled students from all five levels of high school progression. As demonstrated in Table 1 in the previous chapter, although correlated, age and education do not demonstrate the level of parity evident in societies where school attendance is compulsory for certain age groups.

In many cases, school attendance may be dependent on financial rather than educational considerations. An individual child may either have started school early - since it provided financially viable day-care - or later than would normally be the case, due to the fact that the parents could not afford to send the child to school. As only one example amongst many which illustrate the range of idiosyncratic variables which may arise regarding this issue, one particular student in the present study was putting himself through school on the proceeds of his drug trading, and was older than the norm for his class due to the amount of time spent in the care of the correctional services rather than due to school failures.

In Murdoch et.al.'s (1994) exploratory study, the authors reported a consistent trend for their group of black South African students to produce lower scores on a battery of commonly used neuropsychological tests than those reported in Spreen and Strauss (1991) for their North American counterparts.

Given the highly politicised nature of the debates which ordinarily ensue when research discover differences between groups (as evidenced in neuropsychological studies, by ongoing debates regarding the interpretation of cultural differences), it not surprising that the report by Murdoch et.al. elicited comment. That study was criticised because of the broad age range of the participants. However, selection for participation in that particular study was based on educational criteria, not

age. Since education in South Africa, for this particular group, has not been compulsory until most recent times, the usual correlation between age and educational standard cannot be assumed.

The age range of the 20 Standard 6 pupils included in the first phase of this study was even broader than that reported by Murdoch et.al., and spanned between 12 years 0 months and 19 years 0 months as opposed to Murdoch's 11 to 16 years.. The mean age of 14 years 5 months (sd 2.1) was also higher than the 13 years 4 months reported for Murdoch's group.

The fact that the ages of the participating students did not necessarily demonstrate a direct parity with education may be of importance for South African norms (in cases where these are to be used in the neuropsychological assessment of individuals belonging to a milieu not governed by a compulsory education system) and the practitioner cannot readily adopt the assumption that grade related norms are superfluous because of the high correlation between age and education in the readily available school going groups (Viljoen et.al.,1994).

The ages of the second sample of 119 standard 6 pupils were more carefully controlled and included only 13, 14 and 15 year olds. A comparison of performances of the 13 and 15 year olds included in Part II of the study raises questions as to the validity of age based norms for abilities tapped by tests such as the WISC-R Information, Arithmetic, Digit Series, Picture Completion, Coding and Mazes subtests. On the other hand, as was the case in the original normatisation of the WISC-R, abilities tapped by the Comprehension and Similarities subtests, do appear to be age related. However, as mentioned in the previous chapter, the possibility of selection bias in the present analysis can not be disregarded. The superior performance of the younger participants on the Rey Auditory Verbal Leaning Test, Spatial Memory Task and Rey Osterreith Complex Figure Test recall trial may be taken to suggest that the younger participants had better memories and were there for in a better position to access previous knowledge required for response to test items.

On the age-controlled group (the second sample), age proved to exert a statistically significant influence only on Picture Completion, Coding and on singular measures within the RAVLT. This

comparison therefore offers support for the findings of Murdoch et.al.. In the examination of the validity of the findings, both groups of standard 6 pupils included in the present study were compared with Murdoch's standard 6 group (Table 21). On the whole, the test scores obtained in the present study were more compatible with those reported by Murdoch than with those reported in Spreen and Strauss. With the exception of the ROCFT, the students in this study obtained scores that were slightly lower than those reported by Murdoch et.al. In any case, data recorded on the SED scale suggests that the Soweto students were possibly derived from a lower socio-economic group and could avail themselves of different educational opportunities than those within the Murdoch study.

Given that the education system under the apartheid regime was flawed, and a number of, often idiosyncratic, factors were observed to exert an influence on student's scholastic progression, a wide distribution of age within any given standard was observed. The wide age range observed is clearly a socio-cultural rather than a developmental or educational factor and, as Nell (1997) notes, issues relative to the influence of developmental events of pre-puberty and mid-adolescence have to be borne in mind in any assessment, together with the number of years of formal education. However, given the peculiarities of the current South African situation, the resultant need for age/educationally stratified norms, remains cloudy. Thus both breakdowns are included in the appendices.

8.2 BROADER APPLICATION OF FINDINGS AND LIMITATIONS OF THE STUDY

Given the acculturation variables within black South African society, assumptions as to equivalence beyond the country's borders, even within Africa, cannot ever be assumed. The degree to which the Zimbabwean students assessed by Zindi (1994) out-performed the present test group on the WISC-R Verbal Scale highlights the need for caution when interpreting the performance of children from different language or cultural backgrounds.

Comparing the initial group in this study with the second sample, it is evident that the results for the group of 20 Soweto standard 6 students initially tested, were, to a large extent (especially when one

considers median rather than mean scores in the case of the SMT), replicated in the second phase of the research. The second phase of the research analysed the results of 119 standard 6 pupils. Given that the results for standard 6 students generated from the first phase were replicated in the second phase, one can tentatively suggest that the same may hold true for the other standards assessed in the initial group of Soweto students.

Statistical comparisons suggest that test performance was not significantly affected by attendance at a specific school or specific socio-economic standing within the constraints of a culturally mixed urban township in Gauteng, but that gender, age and especially education must not be ignored.

All of the students included in the present study had completed at least seven years of formal education. Although a number of observations indicate that some of these students at least are not necessarily 'test-wise', the presentiments were tempered due to the fact that testing took place amongst their class mates, among their peers, over an extended period of time. The students became familiar with the routine. The overall subjective interpretation of the experience by testees was positive. The clinical situation may differ from the research environment in that the testee has, for whatever reason, been singled out and may be a reluctant participant.

Although some of the intra-group variables examined may have led to statistically significant differences in performance, these are not necessarily large, and although interesting, and possibly relevant for the understanding of performance of specific individuals, do not unequivocally preclude collapsing norms over these variables for a black South African population.

8.3 SUGGESTIONS FOR FURTHER RESEARCH.

All forms of normatisation, by definition, are necessarily circumscribed and specific. Any interpretation which is based on norms gathered for a different epoch or derived from groups which may differ fundamentally from those from which the individual is derived, may be misleading. Given

the unique history of the country, the immense changes taking place and the diversity of contemporary society, these factors are of particular relevance within the current South African context. Test development and normatisation must continue on an ongoing basis.

The group under investigation encompassed only one very specific sector of the diverse South African society. They are drawn from an urban township community in Gauteng who received their education after the 1976 riots. This has numerous implications which may impede the generalisation of results to other groups. Norms for rural groups and norms for urban groups which are more culture/language specific may differ. It is also not known how functionally illiterate adults or even adults with the same level of education will perform on the test battery.

With due consideration for language issues and particularly the role played by verbal conceptualisation, further investigation is required to establish the appropriateness of the findings of the present study for black South Africans performing either significantly better or significantly worse on measures relating to language proficiency.

9 CONCLUSION

In dealing with the Black-White test score differences, some practitioners adhere to the biological standpoint and Rushton (1995 pg. 38) offers a summary of studies which have linked intelligence to brain size and reports the findings of numerous studies which have correlated head size with ethnic affiliation. Accordingly head size and psychological test performance is ranked from orientals who reportedly have the largest brains, through the caucasion groups to the black populations with the smallest brain sizes. In his discussion Rushton, refers to Passingham (1982, in Rushton,1995 pg36) who reasoned that "more intelligent children assessed by standardised IQ tests, learn faster than those less intelligent, and mammals with larger brains learn faster than those with smaller brains".

Another school of practitioners adopts an environmental philosophy to Black-White test score differences (Scarr, 1981), yet criticism has been levelled at those who adopt a colonial approach and interpret the performances of other cultural groups in terms of a deficit model thus implying a lack of cognitive competence (Nell, 1997), and Helms (1992) suggests a culturalist perspective as a more viable alternative to the interpretation of cognitive ability testing when the race or ethnicity of respondents is an issue.

"Basic cognitive processes are universal and cultural differences in cognition reside more in the situations to which particular cognitive processes are applied than in the existence of the process in one cultural group or another. Culture prescribes what should be learned and at what age. Consequently, different cultural environments lead to the development of different patterns of abilities" (Ardila, 1995).

Considering the implications of the "labels" that may be attributed on the basis of a psychometric assessment, some academics go so far as to unequivocally challenge the validity of a process which evolved under the auspices of a dominating minority. These views, however relevant for socio-

economic empowerment within the industrial spheres, may be considered short-sighted when viewed in the light of the need for improved mental health and counselling services advocated by the RDP.

Given the high incidence of road traffic accidents, assaults and specific learning difficulties prevalent in the country, and the important role played by neuropsychological assessment in diagnosis and rehabilitation of individuals suffering the consequences of these, it is imperative that previously socio-politically suppressed individuals are not denied access to valid neuropsychological assessment procedures.

It is true that, in South Africa, the general issues of black-white differences in psychological test performance are entrenched in, and complicated by, a politically motivated era of artificial cultural segregation enforced by the apartheid regime. However, as stated previously, the purpose of this study is not that of discussing what the results 'mean' in a generalist sense, but rather, what such differences could imply in terms of the potential for misdiagnosis.

It is evident from the results outlined in chapter 7 that significant differences exist between the sample studied and those samples used to establish the norm standard in other countries. The findings of the present study thus concur with those of other local studies (Murdoch et.al., 1994; Anderson and MacPherson, in Nell 1997; Viljoen, 1995; Makunga, 1988) in concluding that in order to avoid the pitfalls of misdiagnosis, the performance of a given testee must be interpreted in the light of the performance of those in his/her milieu.

10. REFERENCES

Adams, R.L., Boake, C. and Crain, C. 1982. Bias in neuropsychological test classification related to education, age and ethnicity. Journal of Consulting and Clinical Psychology, 50, 143-145.

Adams, H.E. and Sutker, P.B. (Eds.)., 1984, Comprehensive Handbook of Psychopathology. Plenum Press:New York

Akshoomoff, N.A. and Stiles, J. 1995. Developmental trends in visuospatial analysis and planning: Memory for a complex figure. Neuropsychology, 9(3) 378-389.

Amante, D., van Houten, V.W., Grieve, J.H., Bader, A. and Margules, H. 1977. Neuropsychological deficit, ethnicity and socio-economic status. Journal of Consulting and Clinical Psychology. 45, 524-535.

Anastasi, A. 1988. Psychological Testing. New York: Macmillan.

Ardila, A. 1991. Errors resemling semantic paralexias in Spanish speaking aphasics. Brain and Language. 41, 437-455.

Ardila, A., 1993. Developmental norms for the Wisconsin Card Sorting Test in 5 to 12 year old children. Clinical Neuropsychologist, 7 (2), 145-154.

Ardila, A., 1995. Directions in cross-cultural neuropsychology. Journal of Clinical and Experimental neuropsychology,. 17(1), 143-150.

Axelrod, B.N., Goldman, R.B. Heaton, R.K. and Curtiss, G. 1996. Discriminability of the Wisconsin Card Sorting Test using the standardisation sample. Journal of Clinical and Experimental Neuropsychology.18(3), 338-342.

Baddeley, A.D. 1976. The Psychology of Memory. New York : Basic Books.

Baddleley, A.D. and Warrington, E.K. 1970. Amnesia and the distinction between long and short term memory. Journal of Verbal Learning and Verbal Behaviour, 9, 176-189.

Bannatyne, A. 1974 . Diagnosis: A note on the recategorisation of the WISC-R scaled scores. Journal of Learning Disabilities. 7, 272-273.

Bender, L. 1946. Instructions for the use of the Visual Motor Gestalt Test. New York : American Orthopsychiatric Association.

Bennet-Levy, J. 1984. Determinants of performance on the Rey Osterrieth Complex Figure Test : An analysis and new technique for single case assessment. British Journal of Clinical Psychology, 23, 109-119.

Benton, A.L. 1981. Focal brain Damage and the concept of localisation of function. In Costa, L. and Spreen, O. (Eds.) Studies in Neuropsychology. New York : Oxford University Press.

Benton A.L. and Hamsher, K. 1978, Multilingual Aphasia Examination. Iowa City: University of Iowa

Biesheuwel, S. 1943. African intelligence. South African Institute for Race Relations: Johannesburg.

Boll, T.J., Berent, S. and Richards, H. 1977. Tactile-perceptual functioning as a factor in general psychological abilities. Perceptual Motor Skills. 44, 535-539.

Boll, T. and Reitan R.M. 1973. Effects of age on the Trail Making Test. Perceptual and Motor Skills. 36, 691-695.

Boone, K.B., Ghaffarian, S., Lesser, I.M., Hill-Gutierrez, E. and Berman N.G. 1993. Wisconsin Card Sorting Test performance in healthy, older adults: Relationship to age, sex, education and IQ. Journal of Clinical Psychology, 49 (1), 54-60.

Brick, J.F., Frost, J.L. Schochett, S.S., Gutman, L. and Crosby, T.W. 1985. Pure word deafness. C.T. localisation of the pathology. Neurology, 35, 441-442.

Brislin, R.W. 1990. Applied Cross-Cultural Psychology. California : Sage Publications

Brooks, D.N. 1974. Recognition memory and head injury. Journal of Neurology, Neurosurgery and Psychiatry. 37, 794-801.

Bruner, J.S. 1964. The course of cognitive growth. American Psychologist. 19, 1-15.

Cauthen, N.R. 1977. Extension of the Weschler Memory Scale norms to older age groups. Journal of Clinical Psychology. 33, 208-211.

Chelune G.J. and Baer, R.A. 1986. Developmental norms for the Wisconsin Card Sorting Test. Journal of Clinical and Experimental Neuropsychology. 8, 219-228.

Chen, J. 1997, How should the Stroop interference effect be measured? Further evidence from alternative versions of the Stroop Task. Perceptual and Motor Skills 84, 1123-1133.

Coleman, J.C., Butcher, J.N. and Carson, R.C. 1980. Abnormal Psychology and Modern Life. Scott, Foresman & Co. USA.

Crawford, J.R., Parker, D.M. and McKinlay, W.W. 1992. A Handbook of Neuropsychological Assessment. Hillsdal,NJ:Lawrence Erlbaum.

Das, J..P., Kirby, J.R. and Jarman, R.F. 1975. Simultaneous and successive process Journal of Educational Psychology, 65, 103-108.

Denman, S.B. 1987. Denman Neuropsychological Memory Scale : Norms. Chaleston, SC : Sidney B. Denman.

Dennis, M., Kaplan, E., Posner, M.I., Stein, D.G. and Thompson, R.F. 1991. Clinical Neuropsychology and Brain Funcion : Research, Measurement and Practice. edited by Thomas Boll and Brenda Bryant. American Psychological Association Inc. Washington.

Donald, D.R. 1991. Training needs in educational psychology for South African social and educational conditions. South African Journal of Psychology. 21 (1), 38-44.

Doob, l. 1965. Exploring eidetic imagery among the Kamba of Central Kenya, The Journal of Social Psychology. 67, 3-22.

Dywan, J., Kaplan, R. and Pirozzolo, F. 1991 Neuropsychology and the Law. New York: Springer.

Elliott, S.N. and Bretzing, B.H. 1980. Using and updating local norms. Psychology in the Schools. 17, 196-201.

Ellis, A.W. 1982. Spelling and writing (and reading and speaking). In A.W.Ellis (Ed.), Normality and pathology in cognitive function. New York: Academic Press.

Finlayson, M.A.J., Johnson, K.A. and Reitan A.M. 1977. Relationship of level of education to neuropsychological measures in brain-damaged and non-brain damaged adults. Journal of Consulting and Clinical Psychology. 45, 536-542.

Flor-Henry, P. and Gruzelier, J. 1983. Laterality of Psychopathology. New York : Elsevier

Forrester, G. and Geffen, G. 1991. Performance measures of 7 – 15 year old children on the Auditory Verbal Learning Test. Clinical Neuropsychology 5(4) 345-359.

Franzen, M.D. 1989. Reliability and Validity in Neuropsychological Assessment. Plenum Press:New York.

Gilandas, A., Touyz, S., Beumont, P.J.V. and Greenberg, H.P. 1984. Handbook of Neuropsychological Assessment. Orlando:Grune & Stratton.

Gordon, A. 1986. Educational constraints and their effect on the academic achievement of urban black children in South Africa. South African Journal of Education. 6 (1), 70-74.

Grafman, J., Sirigu, A. Spector, L. and Hendler, J. 1994. Damage to the prefrontal cortex leads to decomposition of structured event complexes. Journal of Head Trauma Rehabilitations. 8, 73-87.

Grafman, J., Passafiume, D. Faglioni, P. and Boller, F. 1982. Calculation disturbances in adults with focal hemisphere damage. Cortex. 18, 37-50

Grant, D.A. and Berg, E.A. 1948. A behavioural analysis of the degree of reinforcement and ease of shifting to new responses in a Weigl-type card sorting problem. Journal of Experimental Psychology. 38, 404-411.

Grieve, K.W., Williams, M.C., Haas, W.G and Littell. 1996. The role of attention in the Wisconsin Card Sorting Test performance. Archives of Clinical Neuropsychology. 11(3), 215-222.

Hambleton, R.K, 1994. Guidelines for adapting psychological tests: A progress report. Bulletin of the International Test Commmision. Vol 10, 3 229-244.

Heacan, H. 1976. Acquired aphasia in children and the ontogenesis of hemisphere functional specialization. Brain and Language, 3, 114-134.

Heaton, R.K. 1981. Wisconsin Card Sorting Test Manual. Odessa, FL: Psychological Assessment Resources.

Heck, E.T. and Bryer, J.B. 1986. Superior sorting and categorisation abilities in a case of bilateral frontal atrophy: An exception to the rule. Journal of Clinical and Experimental Neuropsychology, 8, 313-316.

Helms, J.E. 1992. Why is there no Study of Cultural Equivalence in standardised cognitive ability testing? American Psychologist, 9, 1083-1101.

Henker, B. and Whalen, C.K. 1989. Hyperactivity and Attention Deficits. American Psychologist, 44 (2), 216-223.

Heubrock, D. 1994. Standardised Auditory Verbal Learning: Preliminary German Auditory Verbal Learning Test norms for male and female population aged 18-26. 15(2) 65-76.

Holst, P. and Vikki, 1988. Effect of frontomedial lesions on lesions on performance on the Stroop Test and Word fluency tasks. Journal of Clinical and Experimental Neuropsychology. 10, 79-86.

Huettner, M.I.S. 1989. Neurological basis for language and reading. Learning and Individual Differences, 1, 407-421.

Hynd, G.W. and Obrzut, J.E.(Eds.). 1981. Neuropsychological Assessment and the School Aged Child: Issues and procedures. Grune & Stratton:New York.

Ivinskis, A., Allen, S. and Shaw, E. 1971. An extension of the Weschler Memory Scales to include lower age groups. Journal of Clinical Psychology. 4, 27, 354-357.

Joesting, J. and Joesting, R. 1972. Children's Quick Test, Picture Interpretation, and Goodenough Draw-a-Person scores. Psychological Reports, 30, 941-942.

Jooste, M. 1995. Towards the promotion of effective psychological assessment practices in a socially diverse society. Paper presented at the Congess on Psychometrics, Pretoria.

Jordaan, W.J., Jordaan, J.J. and Nieuwoudt, J.M. 1975 General Psychology: A Psychobiological Approach. McGraw-Hill:Johannesburg.

Kaplan, H.I. and Sadock, B.J. 1981. Modern synopsis of comprehensive textbook of psychiatry/III Third Edition. Williams and Wilkins: Baltimore.

Kaufman, A.S. 1979. Intelligent testing with the WISC-R. John Wiley & sons: New York.

Kay, T. and Lezak, M. 1990. The nature of head injury. In D.Corthell (Ed.) Traumatic brain injury and vocational rehabilitation. Menoomonie, WI:University of Wisconsin- Stout Research and Training Center.

Kimura, D. 1967. Functional asymmetry of the brain in dicotic listening. Cortex, 3, 163

King, M.C. 1981. Effects of non-focal brain dysfunction on visual memory. Journal of Clinical Psychology, 37, 638-643.

Klonoff, H and Low, M. 1970. Disordered brain functions in young children and early adolescents : Neuropsychological and Electroencephalographic correlates. I Reitan, R.M. and Danson, L.A. (Eds.) Clinical Neuropsychology ; Current status and applications. New York : John Wiley.

Knuckle, E.P and Campbell, A.L. 1984. Suitability of Neuropsychological Norms with Black Adolescents. Paper presented at the Annual meeting of the International Neuropsychology Society (12th, Houston, Texas).

Kolb and Whitshaw, 1985. Fundamentals of human Neuropsychology. New York:Freeman and Company.

Koppitz, E. 1960. The Bender Gestalt test for children: A normative study. Journal of Clinical Psychology, 16, 432-435.

Koppitz, E. 1975 The Bender Gestalt Test for Young Children. New York:Grune and Stratton.

Kriegler, S.M. and Skuy, M. 1996. Perspectives on psychological assessment in South African schools. In Engelbrecht, P., Kriegler, S.M. and Booysen, M.I. (Eds.) Perspectives on learning difficulties – International concerns and South African realities. Pretoria: van Schaik.

Lacks, P. 1984. Bender Gestalt Screening for Brain Dysfunction. New York: Wiley.

Lancy, D.F. 1983. Cross-Cultural Studies in Cognition and Mathematics. Academic Press: New York

Landman 1991. Manual for the Individual Scale for African language speaking pupils. Part 1 : Backgound and standardisation. HSRC: Pretoria.

Lezak, M.D. 1979. Recovery of memory and learning functions following traumatic brain injury. Cortex. 15, 63-70.

Lezak, M.D. 1983. Neuropsychological Assessment. Oxford: Oxford University Press.

Lezak, M.D. 1995. Neuropsychological Assessment. Oxford: Oxford University Press.

Lhermitte, F. and Signoret, J-L. 1972. Analyse neuropsychologigue et differenciation des syndromes amnesigues. Revue Neurologie. 126, 164-178. Translated in Walsh, K.W. 1985 Understanding Brain Damage – A primer of Neuropsychological evaluation. Churchill Livingstone: New York.

Lonner, W.J. 1985. Issues in testing and assessing in cross-cultural counseling. The Counseling Psychologist. 13, 599-614.

Luria, A.R. 1970. The functional organisation of the brain. Scientific American. 222, 66-78.

Luria, A.R. 1976. Basic problems in neurolinguistics. The Hague: Mouton.

Luria, A.R. 1979 Neuropsychology in the study of higher cortical function. In Christensen, A.L. Luria's neuropsychological investigation. Munksgaard:Copenhagen.

MacCoby, E.E. and Jacklin, C.N. 1974. Psychology of sex differences

MacInnes, W.D., Golden, C.J., McFadden, J.E. and Wilkening, G.N. 1983. Relationship between booklet Category Test and the Wisconsin Card Sorting Test. International Journal of Neuroscience, 21, 257-264.

Macro-Economic Work Group. 1993. Making Deocracy Work: A framework for Macroeconomic Policy in South Africa. Centre for Development Studies: South Africa

Makunga, N.V. 1988. The development of provisional norms for black South Africans on selected neuropsychological tests and their clinical validation Doctoral Dissertation : UNISA

Mandela, N. 1994. Long walk to freedom. London : Abacus

McCarthy, R.A. and Warrington, E.K. 1990. Cognitive Neuropsychology – A clinical introduction. London:Academic Press.

McGlone, J. and Kertesz, A. 1973. Sex differences in cerebral processing of visual-spatial tasks. Cortex. 9, 313-322.

Milner, B. 1962. Laterality effects in audition. In V.B. Mountcastle (Ed.) Interhemispheric relations and cerebral dominance. Baltimore: John HopkinsUniversity Press.

Miron, M. 1977. A validation study of a transferred group intelligence test. International Journal of Psychology. 12, 193-205.

Mirsky, A.F. 1989. The Neuropsychology of Attention: Elements of a Complex Behaviour. In Perecman, E.(Ed). Integrating Theory and Practice in Clinical Neuropsychology. Lawrence Erlbaum:New Jersey.

Moalusi, K.P. 1995. The natural and inherent equlity on the human scale of Africans with all other people: The quest for breaking the punitive gatekeeping technique. Paper presented at the Congess on Psychometrics, Pretoria.

Moses, J.A. 1986. Factor Structure of Benton's tests of Visual Retention, Visual Construction and Visual Form Discrimination. Archives of Clinical Neuropsychology, 7, 183-190.

Mungas, D. 1983. Differential sensitivity of specific parameters of the Rey Auditory Verbal Learning Test. Journal of Consulting and Clinical Psychology. 51, 848-855.

Murdoch, B.D., Fleming, J.H., Skuy, M. Painter, A., Schmidt, L. and Schutte, E.M. 1994. Neuropsychological performance of a group of selected asymptomatic black South African children. Pretoria:HSRC.

Murdoch, B.D., Fleming, J., Skuy, M., Painter, A. Schmidt, L. and Schutte, E.M. 1997. Comment on Victor Nell's article - `Science and politics meet at last'. South African Journal of Psychology. 27 (1), 50-52.

Nell, V. and Taylor, T. 1992. Bypassing culture: Performance process probes of neuropsychological assessment. Unisa Technical report, 92/2

Nell, V., Myers, J., Colvin, M. and Rees, D. 1993. Neuropsychological assessment of organic solvent effects in South Africa: test selection, adaptation, scoring and validation issues. Environmental Research, 63, 301-318.

Nell, V. 1994. Interpretation and misinterpretation of the South African Weschler-Bellevue Adult Intelligence Scale: a history and a prospectus. South African Journal of Psychology, 24 (2), 100-109.

Nell, V. 1997. Science and politics meet at last: the insurance industry and neuropsychological norms. South African Journal of Psychology. 27 (1), 43-49.

Norman, D.A. and Shallice, T. In Davidson, R.J., Schwartz, G.E. and Shapiro, D. (Eds.) Consciousness and self regulation (Vol 4) New York:Plenum.

Norton, J.C. 1978. The Trial Making Test and Bender Gestalt background interference procedure as screening devices. Journal of Clinical Psychology. 34, 916-922.

Nyikana, H. 1982. Pupil repetition in primary schools of Ciskei. Bloemfontein University of the Orange Free State.

Nzimande, B.Z. 1995 To test or not to test? Paper presented at Congress on Psychometrics, Pretoria.

Oakland, T. and Feigenbaum, D. 1979. Multiple sources of test bias on the WISC-R and Bender Gestalt test. Journal of Consulting and Clinical Psychology, 47, 968-974.

Obruzut, J.E., 1981. Psychological procedures with school-age children. In Hynd, G.W. and Obrzut, J.E.(Eds.). Neuropsychological Assessment and the School Aged Child: Issues and procedures. New York : Grune & Stratton:

Olson, D.R. 1976. Culture, technology and intellect. In Resnick, L.B. (Ed). The Nature of Intelligence. Erlbaum:Hillsdale

Osterreith, P.A. 1944. Le test de copie d'une figure complexe. Archives de Psychologie, 30, 206-356. Translated in Corwin, J. and Bylsma, F.W. 1993. The Clinical Psychologist, 7, 9-15.

Parsiak, C., Miller, H.B., Murphy, D. and Patterson, A.B. 1996. Canadian developmental norms for 9 – 14 year olds on the Wisconsin Card Sorting Test. Canadian Journal of Rehabilitation, 9(4) 233-237.

Pascal, G.R. and Suttell, B.J. 1951. The Bender Gestalt Test: quantification and validity for adults. New York:Grune and Stratton

Perret, E. 1974. The left frontal lobe of man and the supression of habitual responses in verbal categorical behaviour. Neuropsychologia, 12, 323-330.

Poulton, R.G. and Moffitt, T.E.. 1995. The Rey-Osterreith Complex Figure Test: Norms for young adolescents and an examination of validity. Archives of Clinical Neuropsychology. 10(1) 47-56.

Query, W.T. and Megran, J. 1980. Age related norms for a AVLT in a male patient population. Journal of Clinical Psychology, 39, 136-138.

Rapport, L.J., Charter, R.A., Dutra, R.L. and Farchione, T.J. 1997. Psychopmetric properties of the Rey-Osterreith complex figure: Lezak- Osterreith versus Denman scoring systems. Clinical Neuropsychologist, 11(1), 46-53.

Reitan, R.M.1979. Manual for the administration of Neuropsychological test batteries for adults and children. Tuscan, AZ : Reitan Neuropsychological Laboratory.

Rey, A. 1941. L'examen psychologique dans les cas d'encephalopatie. Archives de Psychologie. 28, 286- 340. In Lezak, M.D. 1995. Neuropsychological Assessment. Oxford: Oxford University Press.

Rey, A. 1964. L'exam clinique en psychologie. Paris : Presses Universtaires de France. In Lezak, M.D. 1995. Neuropsychological Assessment. Oxford: Oxford University Press.

Reynolds, L.R. and Jansen, A.R. 1983. WISC_R Subscale patterns of abilities of blacks and whites matched on full scale IQ. Journal of Educational Psychology, 75 (2), 207-214.

Riccio, C.A., Hall, J., Morgan, A. and Hynd, G.W. 1994. Executive function and the Wisconsin Card Sorting Test; Relationship with behavioural ratings and cognitive ability. Developmental Neuropsychology, 10(3) 215-229.

Richter, L.M., Griesel, R.D. and Wortley, M.E. 1989. The Draw-a-man test: A 50 year perspective on drawings done by black South African Children. South African Journal of Psychology, 19, 4, 191-198.

Robinson, A.L.,Heaton,R.K.,Lehman,R.A.W. and Stilson,D.W. 1980. The utility of the Wisconsin Card Sorting Test in detecting and localising frontal lobe lesions. Journal of Consulting and Clinical Psychology. 48, 605-614.

Rosin, J. and Levett, A. 1989. The trail making test : A review of research in children. South African Journal of Psychology, 19 (1), 6-12.

Ross, A.O. 1977. Learning Disability – The unrealised Potential. McGraw-Hill:New York

Rosselli, M. and Ardila, A. 1993.Developmental norms for the Wisconsin Card Sorting Test ini 5-12 year old children.Clinical Neuropsychologist, 7(2) 145-154.

Rushton, J.P. 1995. Race, Evolution and Behaviour –a life history perspective. Transaction Publishers:New Brunswick.

Ryan, J.J., Rosenburg, S.J. and Mittenberg, W. 1984. Factor Analysis of the Rey Auditory Verbal Learning Test. Journal of Clinical Psychology, 40, 785-787.

Ryan, J.J. and Schneider,J.A. 1986. Factor analysis of the Weschler Adult Intelligence Scale–Revised in a brain damaged sample. Journal of Clinical Psychology. 42, 962-964.

Salthouse, T.A., Fristone, N. and Rhee, S.H. 1996. How localised are age-related effects on neuropsychological measures? Neuropsychology, 10 (2) 272-285.

Salvia, J. and Ysseldyke, J.E. 1988. Assessment in Special and Remedial Education (4th Edition). Houghton Mifflin : Boston.

Sattler, J.M. and Gwynne, J. 1982. White Examiners do not impede the intelligence test performance of Black Children : To debunk a myth. Journal of Consulting and Clinical Psychology, 50, 196-208.

Scarr, S. 1981. IQ, Social Class and Individual Differences.

Shallice, T. 1988. From neuropsychology to mental structure. New York: Cambridge University Press.

Snyder, L.S. and Downey, D.M. 1991. The language reading relationship in normal and reading disabled children. Journal of Speech and Hearing Research, 34, 129-140.

Spreen, 0. and Strauss, E. 1991. A compedium of neuropsychological tests. New York: Oxford University Press.

Stuss, D.T. and Benson, D.F. 1986, The frontal lobes. New York:Raven.

Talley, J.L. 1986. Memory span in learning disabled children : Digit Span and the Rey Auditory Verbal Learning Test. Archives of Clinical Neuropsychology, 1, 315-322.

Teuber, H.L. 1964. The riddle of frontal lobe function in man. In Warren, J.M.and Akert, K. (Eds.) The frontal granular cortex and behaviour. New York: McGraw-Hill

Vakil, E and Blachstein, H. 1993. Rey Auditory Verbal Learning Test: Structure analysis. Journal of Clinical Psychology, 49 (6) 883-890.

Vance, H.B. and Engin, A. 1978. An analysis of the cognitive abilities of black childrens performance on the WISC-R. Journal of Clinical Psychology, 34, 452-456.

Van den Berg, A.R. 1985. Using the Junior South African Individual Scales for testees from South African population groups which were not included in the norm population. Pretoria: HSRC.

Van Eeden, R.1992. Training course for the Senior South African Individual Scale – Revised: Administration and interpretation. Pretoria:HSRC.

Vega, A. and Parsons, O.A. 1967. Cross validation of the Halstead Reitan tests for brain damage. Journal of Consulting Psychology. 31, 619-625.

Viljoen, G., Levett, A., Tredoux, C. and Anderson, S. 1994. Using the Bender Gestalt in South Africa: some normative data for Zulu-speaking children. South African Journal of Psychology, 24 (3), 145-151.

Walsh, K.W. 1985. Understanding Brain Damage – A primer of Neuropsychological evaluation. Churchill Livingstone: New York.

Warrington, E.K. and Shallice, 1980. Word-form dyslexia. Brain. 103, 99-112.

Weinberg,J., Diller, L., Gertsman, L. and Schulman, P. 1972. Digit Span in left and right hemiplegics. Journal of Clinical Psychology, 28, 361.

Weinstein, C.S., Kaplan, E., Casey, M.B.and Hurwitz, I. 1990 Delineation of female performance on the Rey-Osterreith Complex Figure. Neuropsychology, 4(2) 117-127.

Weschler, D. 1974. Manual for the Weschler Intelligence scale for Children - Revised. New York, Psychological corporation.

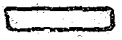
Wilson, Rosenbaum and Brown. 1979. The problem of pre-morbid intelligence in neuropsychological assessment of trauma severity. Journal of Clinical Neuropsychology, 1, 49-53.

Wood, R.L. 1988. Attention disordes in brain injury rehabilitation. Journal of Learning Disabilities, 21, 327-332.

Zindi, F. 1994. Differences in psychometric performance: Zimbabwe and England. The Psychologist, 1, 549-552.

APPENDIX A – A STYLISED MAP OF THE AREA

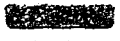
KEY TO MAPPING OF SOWETO SUBURBS

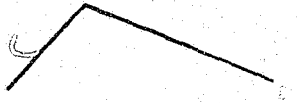

Small scheme housing

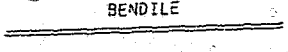

Developers' housing


Plot & Plan housing


Semi-detached housing


Multiple-unit housing

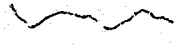

Suburb boundary

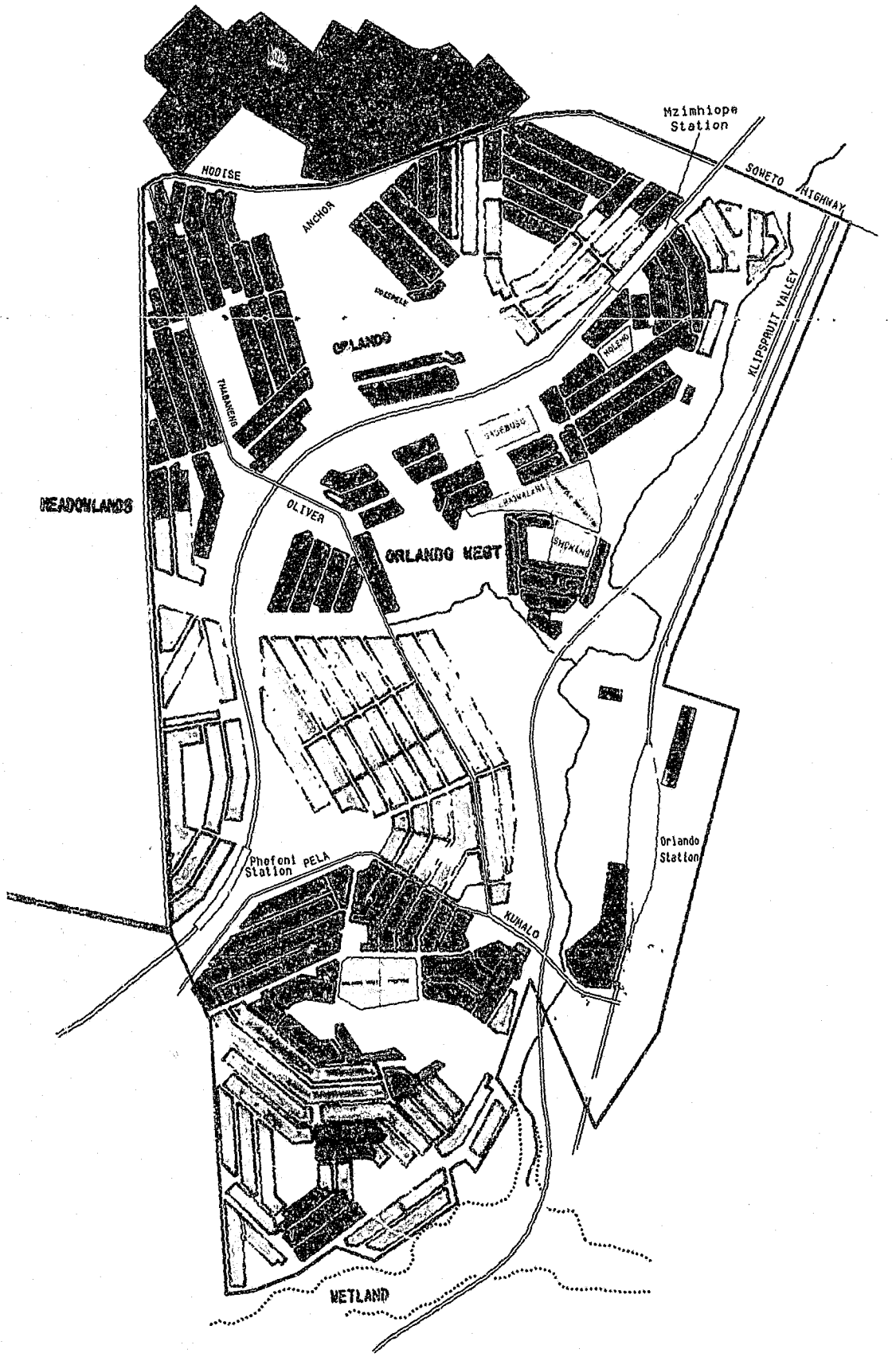


Main roads


Schools


Water towers


Streams


Mzimhiope
Station
SOWETO HIGHWAY
MODISE
ANCHOR
ORLANDO
KLIPSPRUIT VALLEY
THABANENG
MEADOWLANDS
OLIVER
ORLANDO WEST
Orlando
Station
Phefeni
Station
PELA
KUMALO
WETLAND

APPENDIX B - BACKGROUND QUESTIONNAIRE

Surname _____ First names _____

Sex _____ Date of birth _____

Home language _____ Present Standard _____

Home Address _____

If not at the above address, where do you live at present (address)? _____

Who else lives at the same address? _____

In the table below, fill in the details of yourself, your parents, your brothers and sisters, and any other family members (Grandparents, Aunts, Uncles, Cousins, etc.) or other persons (Lodgers) who share your home on a fairly permanent basis?

Name	Sex	Age	Relationship to yourself	Marital status	Highest educational qualification	Occupation and other relevant details Medical and psychological factors Are they presently employed? Where? Position held? Salary? Etc.

Does at least one of your parents hold a position in which a pension will be provided? _____

Can either of your parents drive? _____ Does your family own a motor-car? _____

Describe your home and household facilities:

Who owns the property? _____

How many rooms do you have in the main house? _____

What are they used for: (sittingroom, diningroom, kitchen, bedroom, bathroom, garage, etc.) _____

What outbuildings are available on the property? (e.g. Other dwellings, garage, bathroom, etc,) _____

Do you have a TV at home? _____ What television programmes do you watch regularly? _____

Do you have a radio at home? _____ What radio stations do you listen to regularly? _____

Do you have hot running water inside the main dwelling? (e.g. hot and cold, cold only, use an outside tap) _____

Do you have a flush toilet? _____ bathshower? _____ Are the toilet facilities inside or outside the main dwelling? _____

Do you have electricity? _____ a fridge? _____ What type of cooking facilities do you have? (e.g. electric, gas, coal, paraffin) _____

Eating habits (do you generally eat - breakfast) _____ the day) _____ (- in the evening) _____

Sleeping habits: What time do you usually go to bed? _____ and get up in the morning? _____

Do you sleep alone in your bedroom? _____ Do you have your own bed? _____

If not, what are the sleeping arrangements in your home (e.g. do you share your bedroom or your bed, or do you sleep on a mattress or in a room other than a bedroom?) _____

Would you estimate that there are more than 20 hardcover books in your home? _____

Do your parents read regularly (newspapers/magazines): _____

Do you regularly receive a birthday present from your parents? _____

Do you own toys, games or other personal goods worth in total more than R50? _____

Medical details

Where were you born (Area + hospital/home)?_____

Did your mother have any problems during pregnancy or delivery and were you a healthy baby? _____

Were there any developmental problems? (e.g. Did you learn to walk, talk, etc without problems at the normal age) _____

Do you smoke?_____drink alcohol?_____take drugs?_____exercise regularly?_____receive adequate medical care when necessary? ___

Do you usually receive your regular medical or dental treatment at the clinic ___ at the hospital ____ or do you consult a private practitioner? ____

Do you, or have you, ever suffered any serious illnesses? (please provide details) _____

Have you ever been hospitalised at any time? _____

If you have been in hospital when was this? ____ For how long were you there? ___ for what reason? ___ and what treatment did you receive? ___

Are you presently taking any regular medication? (give the names of the pills or medicines and the reason it is being used)_____

Have you ever suffered a head injury?_____ Were you unconscious?_____ For how long?_____ Did you require stitches?_____

Have you ever been involved in a motor vehicle accident?_____ Did you experience any related medical problems?_____

Have you ever been physically assaulted? _____Did you experience any related medical problems?_____

Have you ever suffered a sport injury? _____Did you experience any related medical problems? _____

Have you ever experienced any of the following? (please provide details i.e. describe exactly what and when)

Physical or mental abuse: _____

Epilepsy/Fits/faints/blackouts/dizzyspells: _____

Headaches: _____

Psychiatric problems (anxiety/depression etc.): _____

Specific learning difficulties, hyperactivity, concentration or attention problems: _____

Speech or hearing problems: _____Motor or tactile problems: _____

Have you ever received psychotherapy____, physiotherapy_____, occupational therapy_____, speech therapy____ or other forms of treatment?____

*Has any family member ever suffered from any of the above or from any related problems?(please specify):*_____

Have you or any of your family members been directly affected by the recent violence in our country?_____

Have you ever been in any trouble with the law:_____

Educational Background

In the table below fill in the names of all the schools (Nursery, Primary and Secondary) you have attended. (If you were a boarder mark with an asterisk *).

Name of school	Town	Date		Standards	Language	Reason for	Problems Experienced
		From	To		of instruction	leaving	

Best subject:_____Worst subject_____Most-liked subject_____Least liked subject_____

Do you enjoy school? _____ Do you like your teachers? _____ Do you get on well with your classmates?_____

Standards failed?_____Standards repeated?_____

What is your families attitude towards your schooling?_____

Who carries the financial burden of your schooling? _____Has your schooling ever been interrupted for any reason and why?_____

School subjects and symbols obtained in end of year examination in highest standard passed: (Standard?__ Position in class?__ Number of Students?

Subject	HG/SG	Mark/Symbol/comment/problems experienced	Subject	HG/SG	Mark/Symbol/comment/problems experienced

Author Schutte E M
Name of thesis The Suitability Of Published Neuropsychological Test Norms For Urban Black South African Secondary School Students Schutte E M 1998

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.